HISTORY OF AGGREGATE MINING IN LESOTHO, 1967-2022: AN ASSESSMENT OF ENVIRONMENTAL IMPACTS

BY

ITHABELENG MOKOENA (200900603)

A DISSERTATION SUBMITTED TO THE DEPARTMENT OF HISTORICAL STUDIES, FACULTY OF HUMANITIES,

NATIONAL UNIVERSITY OF LESOTHO, ROMA,

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR THE AWARD OF A MASTER OF ARTS DEGREE IN AFRICAN HISTORY

JULY 2024

ABSTRACT

Owing to the ever-increasing importance, particularly in public and private construction, the global demand for aggregates has been increasing. The extraction of sand and gravel, however, has had adverse environmental consequences in the global south. In this light, this study examines the history of aggregate mining in Lesotho between 1967 and 2022. It explores the evolution of the policy framework that governed aggregate extraction and the socio-economic and environmental imperatives that shaped these policies. Moreover, the study examines the interface between state policy and communal responses and initiatives within an evolving socio-economic and environmental background. Using archival records and oral sources, this study will explore the intersection of economic and environmental issues as they shaped aggregate mining from a historical perspective. It draws from and seeks to join the growing historiographical conversations on the environmental history of Southern Africa and the imperatives, particularly those studies that unpack the link between economic development, rural livelihoods and environmental sustainability. In the main, this study argues that, notwithstanding the espousal of environmentally sensitive policies to govern the two industries over time, aggregate mining continued to have an adverse environmental impact due to an overriding need by communities to sustain their livelihoods, hence the proliferation of an illegal but thriving industry during the period under review.

DECLARATION

By submitting this thesis, I confirm that all the work presented is my original creation, that I hold the authorship rights, except where explicitly stated otherwise, and that I have not previously submitted this work, either in full or in part, for any other qualification.

Signature and Date

Ithabeleng Mokoena, (200900603)

CERTIFICATION

I certify that this dissertation entitled " History of Aggregate Mining in Lesotho, 1967-2022: An Assessment Of Environmental Impacts" has been duly completed by Ithabeleng Mokoena (200900603) of the Department of Historical Studies, Faculty of Humanities, National University of Lesotho, Roma.

Supervisor: Prof. Noah Echa Attah ……...…....……

Signature and Date

Head of Department: Dr Godfrey Hove …… ……

Signature and Date

External Examiner: …… ……..

Signature and Date

ACKNOWLEDGEMENTS

First and foremost, I would like to acknowledge the financial support provided by the History Project Research Grant and INET for my Master's research. I also want to extend my deep gratitude to my supervisor, Prof. Noah E. Attah, for his exceptional mentorship and inspiration throughout my dissertation and studies. His constructive criticism and meticulous attention to detail were instrumental in shaping my ideas. Writing this thesis would have been much more challenging without his unwavering support.

This research greatly benefitted from the insights of my respondents, who generously shared their thoughts and those of their organizations. I am deeply indebted to the officials and staff from various institutions who took the time to speak with me, without whom this research would not have been possible. I am also grateful to Chief Koenane Matsoso for allowing me to conduct research in his community and to the residents of Ha Tikoe for their warm welcome and assistance in obtaining essential information. My thanks also go to the respondents from Lesia, Ha Hoohlo, and other areas for contributing their knowledge to this study.

I would like to thank Dr. Joshua Chakawa, my MA in African History Lecturer, for his continuous support and engaging discussions that helped shape many ideas in this thesis. I am also grateful to Montseng Mapepesa, Rorisang Tsele, Ntefeleng Semuli, and Keratuoe Moqiti for their unwavering support, suggestions, and encouragement during challenging times. Additionally, I appreciate the staff members of the History Department at the National University of Lesotho for always being available to assist me. Special thanks to my MA in African History lecturers, including Dr Sean Maliehe, Dr Godfrey Hove, and Dr Nthabiseng Mokoena, for their valuable feedback during seminars and consultations.

I am thankful to my friends Theriso, Thato, and Halieo for their unnoticed but invaluable support. Lastly, I want to express my deepest gratitude to my family for their continuous financial, emotional, and spiritual support throughout my studies. My daughter, Bokang, was a constant source of inspiration despite my absence due to the demands of this dissertation. I owe you the world, Toto. To my mother, who took on the role of a mother to both me and my daughter, and who prayed for my well-being and success, I am profoundly grateful and will surely repay your kindness. I also extend my sincere thanks to other family members, especially Sutha and Makatleho Mokhali, for their sacrifices and support, as well as my mother's siblings, my aunt Fumane Motaung, and my uncles Simon Motaung for their constant generosity. I am also grateful to my brother Bakoena and my sister-in-law Malisemelo Mokoena for their emotional support throughout this thesis. May the Lord Almighty bless them abundantly. Despite all this support, I alone am responsible for any arguments, opinions, errors, omissions, and shortcomings in this thesis.

DEDICATION

With love to Bokang Mokoena, my precious daughter, and to my beloved mother, 'Mabakoena Mokoena, for her unwavering love and support.

LIST OF ABBREVIATIONS

ASM	Artisanal and Small-Scale Mining
BRICS	Brazil, Russia, India, China and South Africa
CWST	Community Water Shed Teams
D.M.R	Department of Mineral Resources
EIA	Environmental Impact Assessment
ESF	Environmental and Social Framework
GDP	Gross Domestic Product
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
IKS	Indigenous Knowledge Systems
LCN	Lesotho Council of NGOs
LEJAC	Lesotho Environmental Justice and Advocacy Centre
LHDA	Lesotho Highlands Development Authority
LLA	Lesotho Land Act
LMPS	Lesotho Mounted Police Services
MMA	Mines and Minerals Act
MPRDA	Mineral and Petroleum Resources Development Act
NGOs	Non-Governmental Organizations
NRED	Natural Resources and Environment Department
RISE	Relationships Inspiring Social Enterprise
TLB	Tractor Loader Backhoes

TRC	Transformation Resource Center
UNCLOS	United Nations Convention on the Law of the Sea
UNEP	United Nations Environment Programme
VWST	Village Water Shed Teams

LIST OF FIGURES

Table of Figures **Pages**

TABLE OF CONTENTS

Content **Pages**

Chapter One: Introduction

1.1 Background to the Study

In ancient times, sand as one of the major components is aggregates was used for different purposes including the polishing and sharpening of tools because of its abrasive texture. The most prolific use of sand gravel and crushed stone is in the construction industry where it is vital for almost every aspect of a building project. These soils are used in everything from cement and concrete to plastering, roofing grouting and paint and are also used to prevent flooding as it is put in bags. Sand on its own is essential for recreational purposes such as the creation of volleyball balls, and baseball courts. Gravel also falls under the aggregates umbrella. Lesotho still has gravel roads in every district and these roads require frequent maintenance to restore them to good condition. However, intensive rainfall often washes the gravel and gullies and potholes result. For this reason, gravel is one of the most sought-after resources on earth hauled in great quantities from river beds and together with sand soil; they are mostly used in construction. Their uses are interchangeable, and will also be under scrutiny in this research.

Crushed stone mining plays a vital role in infrastructure development and construction projects, providing the essential raw materials needed for building roads, bridges, and other structures. Crushed stone has a wide range of uses across various industries and applications due to its changeability, resilience, and availability in different sizes and compositions. These uses include the construction of roads where it provides a stable base that supports heavy loads and endures traffic wear and tear. Its uses extend to the production of concrete, as a drainage system and for landscaping purposes. One of the most significant uses of crushed stone is the control of erosion as it stabilizes the surface to withstand water run-offs. Worldwide, sand and gravel are considered amongst the most important natural resources and this is because of their importance to the global

economy generated through road construction and production of concrete for construction of various types of infrastructure. In construction, sand from rivers and coastlines is most desired because it effortlessly mixes with concrete thus fast-tracking the process of industrialization. In Lesotho, one of the richest citizens and the current Prime Minister, Hon. Ntsokoane S. Matekane started his wealth acquisition through sand extraction, before expanding his business interests into brick manufacturing in 1986, which ultimately led him to diversify his business through mining and selling sand. His businesses have since grown and are currently registered under Matekane Transport and Plant Hire (Pty) Ltd.

Owing to activities such as those highlighted in the paragraph above, it is clear that the harvesting of aggregates has been on the rise in Lesotho. Lack of data and poor accessibility of the few available data contributes to exacerbating these issues and impair evidence-based management efforts. For instance, in Lesotho. The Caledon/Mohokare Valley is a region along the Caledon/Mohokare River, a stream of Orage/Senqu River rising from the north-easterly Drakensberg/Maloti Mountains of Lesotho where these aggregates are mostly extracted from. Chatanga, Ntuli, Mugomeri, Keketsi and Chikowore add that the "Mohokare River is a major tributary of the Senqu Orange River which is also one of the most important river courses in southern Africa". In most cases in Lesotho, you will find that the brick moulding industries are fed by soil harvesting and gravel extraction and as it stands or has been observed, these industries are located beside rivers. This industry requires the use of sand mixed with clay to produce bricks that are used in the buildings. The Caledon/Mohokare River makes up a border between the Eastern Free State of South Africa and western Lesotho. Issues of the environment and livelihood sustainability cannot go unnoticed when sand mining and gravel extraction are mentioned.

1.2 Statement of the Problem

Although aggregate mining has been contributing to infrastructural development in Lesotho, its environmental effects have not been thoroughly evaluated, and the sector's historical history has not been thoroughly recorded. The sustainability of aggregate mining techniques in Lesotho is, therefore, called into question by this information gap, which also highlights issues related to social justice, the environment, and community livelihoods. Thus, this study aims to address how aggregate mining has evolved historically between 1967 and 2022 in Lesotho, and the environmental impacts of this evolution on the country's natural resources, local communities, and overall sustainable development. This research problem statement informs methods for ethical and ecologically acceptable mining practices by directing the investigation into the historical background, environmental effects, and sustainability of aggregate mining in Lesotho.

1.3 The aim and objectives

Aim

The study examines the environmental effects of aggregate mining in Lesotho between 1967 and 2022 through a thorough historical analysis. The study intends to give a detailed evaluation of how rural lives have been harmed, particularly through indiscriminate mining of sand, by focusing on the environmental effects of aggregate mining in Lesotho.

Objectives

The objectives of the study are to explore the historical evolution of aggregate mining in Lesotho, encompassing significant turning points, laws, and regulations; to identify and document the environmental impacts of aggregate mining in Lesotho, including effects on water, air, soil, and biodiversity; to assess the effectiveness of environmental policies and regulations in mitigating the impacts of aggregate mining; to contribute to the development of a comprehensive environmental

management plan for the aggregate mining sector in Lesotho. By achieving these objectives, the research hopes to offer a comprehensive grasp of the background and ecological effects of aggregate mining in Lesotho, as well as to contribute to the development of solutions for the industry's sustainable management.

1.4 Justification of the Study

This study is significant to the environmental history of Lesotho. There is a dearth of information regarding the effects of aggregate mining in Lesotho on the environment, especially when it comes to those effects. Lesotho's infrastructure has benefited from aggregate mining, so it is critical to comprehend the environmental effects of this industry such as water pollution, habitat destruction, and soil erosion, which need to be assessed and addressed. To inform future policy decisions and further the body of knowledge on aggregate mining practices in Lesotho, the study will assess the efficacy of the laws and regulations currently in place governing aggregate mining in the country. The study will emphasise the experiences of local communities and make sure their concerns are taken into consideration by looking at the social effects of aggregate mining. The results will impact aggregate mining operations in Africa, especially in nations with comparable environmental and socioeconomic backgrounds with Lesotho. In light of Lesotho's ongoing efforts to strike a balance between environmental preservation and economic growth, the study is very important. The study will incorporate elements from several academic fields, including economics, social science, environmental science, and policy studies, to provide a thorough grasp of the effects of aggregate mining.

1.5 Literature Review

Sand (and gravel and crushed stone) extraction remains the single most mined commodity by contractors and communities, be it on a legal route or illegal approach. To clearly understand the

concept of sand mining in its broadest view, it is of utmost importance to venture into various perspectives about sand mining/extraction, regionally and internationally to find a correlating theme about sand and gravel mining in Lesotho. Scholarly exploration of what sand mining is will be evident in this review. There will be a clear indication of the legal frameworks surrounding sand and gravel mining from different academic perspectives and also intellectual connotations on institutions involved in sand and gravel extraction activities. Thorough debates on the environmental impacts of sand mining will be discussed touching also on the socio-economic dimensions of this activity. Conclusions will be made on the long-seated hostilities relating to sand mining by emphasising its impacts on the environment and the responsibilities of different stakeholders.

Harvesting of sand (and gravel) from riverbeds or riverbanks for different activities inclusive of construction is regarded as river sand mining.[1] Origins of sand and gravel deposits are from numerous "geomorphological processes", inclusive of river channels, river flood plains, and glacial deposits.[2] Moving along the rivers of Lesotho, specifically, the Caledon River and Phuthiatsana River, it is evident through observation that sand mining has been and still is a regular activity that is mined through the use of heavy machinery in the case of large-scale extraction, while in the case of small-scale artisanal sand mining there is use of intermediate machinery like shovels and wheelbarrows. In Nigeria, sands are perceived as the most common and effortlessly

[1] Eline Rentier and Erik Cammeraat. "The environmental impacts of river sand mining." *Science of the Total Environment* 898, (2022): 155877

[2] Rose McKenney, Robert. Jacobson, and Robert Wertheimer. "Woody vegetation and channel morphogenesis in low-gradient, gravel-bed streams in the Ozark Plateaus, Missouri and Arkansas." *Geomorphology* 13, no. 1-4 (1995): 175-198.

extracted natural resource more than the extraction of renowned crude oil for it is inexpensive and existing in abundance.[3]

The uses of sand and gravel have evolved depending on the epoch under study and the growing need for sand and gravel universally has led/ is leading to social, environmental, and political issues that are now standard. In recent years it has been evident that sand is mostly extracted from rivers, but countries like Tanzania extracted underground sand which they called Kuluthum but due to the high demand for sand they had to shift to river sand mining.[4] Rentier and Cammeraat state that the uses of natural resources have intensified over the years due to Industrialization as it requires the use of cement which is combined with sand and gravel for construction purposes. They further add that rivers are the sources of sand and stones that bring sand and stones that are found to eventually "settle in lakes, the ocean and on river beds and banks" and these have historically been the basis for issues emanating from food security and conflict over land.[5] This simply means that the high demand for aggregate extraction has attracted illegal mining, community conflicts and environmental degradation. Urbanization and industrialization birthed the drastic harvesting of large quantities of sand and gravel from rivers and consequently have resulted in detrimental impacts on rivers.[6]

In Lesotho, sand mining is governed by the Ministry of Mines and Minerals and the Ministry of Local Government which regulate the activities surrounding the phenomenon. Similarly, in South

[3] Angela Oyilieze Akanwa. "River Sand Mining and Its Ecological Footprint at Odor River, Nigeria." *Agroecological Footprints Management for Sustainable Food System* (2021): 473-514.
[4] Christina Shitima and Bert Suykens. "Formalization of sand mining in Dar es Salaam, Tanzania." *Resources Policy* 82 (2023): 103589.
[5] Magnus Hatlebakk. "River sand mining as a livelihood activity: The case of Nepal." *The Extractive Industries and Society* 14 (2023): 101266.
[6] Zijian Ren, Meng Jiang, Dingjiang Chen, Yadong Yu, Fei Li, Ming Xu, Stefan Bringezu, and Bing Zhu, "Stocks and flows of sand, gravel, and crushed stone in China (1978–2018): Evidence of the peaking and structural transformation of supply and demand," *Resources, Conservation and Recycling* 180 (2022): 106173.

Africa, the Department of Mineral Resources (DMR) has governing power over the parameters of sand excavating. Furthermore, the Mineral and Petroleum Resources Development Act of 2002 (MPRDA) sets all mineral resources inclusive of natural sand and quarry under the custodianship of the South African state.[7] Shitima and Suykens explain that the formalizing of sand mining through laws and regulations in Tanzania enables artisanal sand miners to operate without being restricted and further supports and enables industrialists to safeguard and magnify their businesses to be more technologically advanced.[8] There usually are law enforcement and penalties for violating mining laws in different countries. Strict enforcement of laws is a necessity in sand and gravel extraction to daunt illegal miners from taking part in extraction activities as their actions could endanger resource management and sustainability in Akwa Ibom State, Nigeria.[9] The existence of laws implies that every individual who plans to extract sand is bound by law to apply for the right to mine and the acts set out a regulatory regime on the exploitation of the sand and gravel applied through the administrative bodies.

One other factor that is important to aspects of sand mining is regulations on the environment. These regulations control mitigation measures related to the use of the environment to avoid soil erosion, water pollution degradation and disruption of fauna and flora. In Nigeria, an Environmental Impact Assessment (EIA) is required once a mining site has been identified and explored to guarantee “environmental sustainability and illegalities”.[10] EIA is a regulatory body

[7] Romy Chevallier, "Illegal sand mining in South Africa." *SAIIA Policy Briefing* 2 (2014).
[8] Christina Shitima and Bert Suykens, "Formalization of sand mining in Dar es Salaam, Tanzania." *Resources Policy* 82 (2023): 103589.
[9] Abraham, C. M., K. Essien, E. U. Umoh, E. C. Umoh, L. E. Ehiremem, V. Akpan, and N. I. William. "Towards effective monitoring of sand mining sites and post management techniques in sand dredged environment of Akwa Ibom State, Nigeria." *Global Journal of Ecology* 6, no. 1 (2021): 092-099.
[10] Abraham, C. M., K. Essien, E. U. Umoh, E. C. Umoh, L. E. Ehiremem, V. Akpan, and N. I. William. "Towards effective monitoring of sand mining sites and post management techniques in sand dredged environment of Akwa Ibom State, Nigeria." *Global Journal of Ecology* 6, no. 1 (2021): 092-099.

that empowers the Minister of Environmental Affairs in South Africa to set out a system and requirements in the process of acquiring environmental approval to embark on sand and gravel extraction.[11] Miners, through EIA, are often required to protect natural resources and control environmental pollution and water quality control. However, Katz-Lavigne, Pandey, and Suykens contend that in the process of conducting EIA, some governments often lack tools meant to evaluate the environmental extremities of sand and gravel extraction which hinder the process of operation eventually leading to river erosions as some miners resort to illegal mining while in some cases states are inattentive to conduct EIA as is the case in South Africa.[12]

Furthermore, Lynggaard and Gallagher argue that as much as EIAs are mandatory for large-scale sand extraction, the regulations authorized are often either insufficient or inadequately enforced by "local authorities due to corruption, absence of monitoring, and/or lack of resources to prosecute offenders". Lynggaard and Gallagher further denote that the Artisanal and Small-Scale Mining (ASM) sector in Sierra Leone does not require EIAs thus making their laws and policies contradictory.[13] The effectiveness of EIA in Lesotho is seen more specifically in diamond mining as opposed to aggregates mining and this further exacerbates the extremities of the activity on the environment.

Land is a very significant factor in sand and gravel mining. Most countries have regulations on land use and the location of potential mining sites. Ordinances on the location of mining sites determine whether it is safe or not to start mining and factors like durability of the environment of the mine site, proximity to villages and the amount of sand available are mostly considered.

[11] Stewart Christopher Green, "The regulation of sand mining in South Africa." (2012).
[12] Sarah Katz-Lavigne, Saumya Pandey, and Bert Suykens, "Mapping global sand: extraction, research and policy options." (2022).
[13] Josefine Reimer Lynggard and Louise Gallagher. "Sand Policy Review 1: Sierra Leone."

Peduzzi states that the Convention on the Law of the Sea, 1982 (UNCLOS) created an awareness of the restrictions on certain locations and provided regulations stating rights and obligations on land use, site protection and sustainable development with regards to resource mining.[14] Mushonga adds that the Manyame River catchment area which has sand in abundance was opened for sand extraction and at the same time supplied sand to residents close by and to the city of Harare. He continues to assert that the river is located in a developing area that has a high demand for sand hence the Eyrecourt as a major sand extraction hotspot that the river runs close to is given governing attention by the state through its administrative institutions.[15] Determining aggregate mining sites requires for consideration of impacts on the ecosystem and residential areas nearby hence regulations are put to control mining rights and this is where the local government will be expected to protect the rights of communities in Lesotho.

Rules and regulations outlined by most authorities oblige sand miners to obtain permits or licenses from pertinent state institutions specifying the terms and conditions under which mining is expected to occur. Madyise articulates that in Zimbabwe, sand mining created a platform for the employment of youths who had licenses to mine.[16] Further research by Madyise adds that the Department of Mines expressed that revenue in Botswana is gained from sand and gravel through the Director of Mines from licensed companies.[17] In Morocco, the Ministry of Equipment became an overseer over rights hitherto held by the Ministry of the Interior, which included quarry licensing and control. Ameziane and Suykens however aver that licenses have become gradually

[14] Pascal Peduzzi, "Sand, rarer than one thinks." *Environmental Development* 11, no. 208-218 (2014): 682.
[15] Tafadzwa Mushonga, "The dynamics of Zimbabwe's sand mining frontier." *The Extractive Industries and Society* 12 (2022): 101123.
[16] Tariro Madyise, "Case studies of environmental impacts of sand mining and gravel extraction for urban development in Gaborone." PhD diss., University of South Africa, 2013.
[17] Tariro Madyise, "Case studies of environmental impacts of sand mining and gravel extraction for urban development in Gaborone." PhD diss., University of South Africa, 2013.

difficult to obtain considering investments made for the warranty.[18] In a meeting held at Manthabiseng Convention Centre in Maseru, Lesotho on August 16th, 2023 aggregate miners expressed their dissatisfaction with the issuing of mining licenses as it does not favour the extent of their capabilities. Sand extraction in Zimbabwe is regulated by section 140 (k) of the Environmental Management Act (Chapter 20:27) as read with Section 3 (1) of Statutory Instrument 7 of 2007 Environmental Management (Environmental Impact Assessment and Ecosystem Protection) Regulations [37, 38). The Water Act chapter 20:24 also touches on river sand extraction. Section 46 of the Water Act Chapter 20:24 details the application for a permit to conduct operations in a public stream. [19]

Most projects encourage and require local community engagement. The state through its regulatory stakeholders addresses sand mining related activities as perceptions of local communities and fears on use of their land are an integral part of the socio-economic factors that allow for resource management and development in states.[20] In Zambia, local chiefs are the link between the government and the community and are acknowledged as a governing body by the state as they handle matters over land disputes, land rights and community grievances. Chiefs are also supposed to act as a link between the community and the municipality's council.[21] Chindo explains that without community engagement, opposition may be encountered should the locals notice

[18] Lahcen Ameziane and Bert Suykens, "Political settlements and the historical development of sand governance in Morocco." *The Extractive Industries and Society* 14 (2023): 101245.
[19] George Manyumbu, and Jerie Steven, "An Assessment of Sand Extraction Environmental Externalities as a Source of Market Failure in Gweru District of Zimbabwe." *Am. Res. J. Humanit. Soc. Sci* 5 (2022): 37-53.
[20] Murtala Ibraheem Chindo, "Communities Perceived Socio-Economic Impacts of Oil Sands Extraction in Nigeria." *Human Geographies: Journal of Studies & Research in Human Geography* 5, no. 2 (2011).
[21] Erik Nilsson, "Socio-economic feasibility study for a proposed weir on the Magoye River, Zambia." (2012).

undesirable impacts on the milieu and their livelihoods as they are the ones who usually endure the destructive impacts of sand and gravel extraction.[22]

For the community to feel protected from potential conflicts, Hartati asserts that regulations are set up that liaison between the community and their environments and the mining companies in Indonesia where natural resources are available in abundance inclusive of sand. Furthermore, mining permits are legal on mining zones.[23] When states lack political will, they often fail to administer conflict between miners and communities as a result creating a rise in illegal sand and gravel mining as is the case with Nigeria's Niger Delta in oil extraction. [24] In instances of illegal sand mining, the community is bound to face problems of inability to meet basic needs and to carry out their communal role and also will fail to deal with environmental shocks and pressures.[25] This then means that for communities to benefit from sand mining at the same time conserving their environments there have to be licensing regulations.[26] It is of utmost importance to address findings on the governments' regulatory systems including that of Lesotho with regards to the legal framework to address ecological and community concerns.

Environmental impacts of river sand mining naturally affect both the local community surrounding land and the water stream. However, the extremities of the action depend on different aspects inclusive of the amount harvested, the type of sand (rough sand or fine sand) and how the extraction

[22] Murtala Ibraheem Chindo, "Communities Perceived Socio-Economic Impacts of Oil Sands Extraction in Nigeria." *Human Geographies: Journal of Studies & Research in Human Geography* 5, no. 2 (2011).
[23] Wahyuni Hartati, "Legal Protection for the Community Around the Sand Mining in Ijobalit Village, East Lombok Regency." In *IOP Conference Series: Earth and Environmental Science*, vol. 1175, no. 1, p. 012023. IOP Publishing, 2023.
[24] Abosede Ompwumi Babatunde, "Oil, Environmental Conflict and The Challenges of Sustainable Development in the Niger Delta." J*ournal of Peacebuilding & Development* 9, No. 2, (2014): p. 81
[25] Thoriqul Hag, Nuhfil Hanani, and Moh Khusaini. "Sustainable Environmental Recovery Policy: Redesigning Sand Mining Policy in Indonesia." *Journal of Law and Sustainable Development* 11, no. 7 (2023): e1311-e1311.
[26] Wahyuni Hartati, "Legal Protection for the Community Around the Sand Mining in Ijobalit Village, East Lombok Regency." In *IOP Conference Series: Earth and Environmental Science*, vol. 1175, no. 1, p. 012023. IOP Publishing, 2023.

is implemented.[27] Through the use of heavy machinery, river sand mining is suspected to result in oil leakages into rivers like the Senqu River where stakeholders are of the view that sand mining intensifies changes in river "morphology, water quality and hydrology".[28] Similarly, Nigeria's Niger Delta faces issues of oil spillages in oil extraction as the constant drilling on oil pits results in leakages especially when lorries are being loaded with extracted oils. [29] This entails that there is the likelihood of alteration in the shape and depth of waterways when extracting sand thus there are risks of flooding. Akankali *et al*., 2017, support that oil leakages from mining apparatus into river water also obstruct free transmission of air into rivers for the continued existence of "aerobic organisms".[30] The spills on rivers therefore contribute to the extreme impacts of sand mining on water resources and land.

In their study, Screebha and Padmalal note that although the need for sand and (gravel) has increased globally because of excessive economic growth and successive infrastructural activities, this activity has in many ways led to severe damage to river basin environments. Hill and Kleyhans realized that soil harvesting is a vital activity in South Africa however the process posed a threat to the environment as the process of extracting sand and gravel disrupts the natural environment. This disruption is evident in vegetation and ecosystems where mining is done near streambeds.[31] The River Sand Mining Management Guidelines state that one of the major causes of environmental degradation is stream mining where there is the removal of more sediments than

[27] Eline S. Rentier and Erik L. H. Cammeraat. "The Environmental Impacts of River Sand Mining." *Science of The Total Environment* 838 (2022).
[28] ORASECOM, 2014, Lesotho Action Plan for the Orange–Senqu River Basin. ORASECOM Report 004/2014, p.22
[29] Abosede Babatunde. "Environmental conflict and the politics of oil in the oil-bearing areas of Nigeria's Niger Delta." *Peace and Conflict Review* 5, no. 1 (2010)
[30] J. A. Akankali, A.S. Idongesit and P. E Patrick, "Effects of sand mining activities on water quality of Okoro Nsit stream, Nsit Atai local government area, Akwa Ibom state, Nigeria", International Journal of Development and Sustainability, Vol. 6, No. 7, pp. 451-462.
[31] Bruce L. Hill and Kleyhans. C.J, "Authorisation and Licencing of Sand Mining/Gravel Extraction, in terms of Impacts on the Instream and Riparian Habitats", *Journal of Mining Science*, Vol. 15, 1999.

the region's systems can replace.[32] Saviour also writes that during soil mining, the topsoil which plays a vital component in land reclamation is extremely damaged as it is not extracted independently and this leads to further erosion of soils.[33]

Coakley writes that artisanal miners produced small amounts of clay, crushed stone sand and gravel for domestic consumption.[34] These materials were extracted from the river thus creating a strong dependence on them which could later impact the river water by decreasing the supply and at the same time contaminating the water. Gyamfi, Appiah-Adjei and Adjei further explain that the run-offs or rather sewages and mine waste from these artisan miners in Kokoteasua, a community in Ghana are directly disposed to the environment without being treated prior.[35] This activity has the potential to damage the soil and contaminate the water resources that the general surrounding public relies on for their daily water needs.

The most important effects of sand mining on the physical environment include the widening and lowering of the riverbed. Unsustainable sand mining could result in the collapse of riverbanks and deepen the river beds. The National Climate policy states that in Lesotho soil mining or rather soil harvesting together with overstocking and overgrazing creates a loss of viable agricultural and range lands thus resulting in land degradation. This phenomenon is worsened by poor land management as responsible sectors fail to follow environmental conservation policies.[36] In

[32] River Sand Mining Management Guideline. Ministry of natural resources and environment. Department of irrigation and drainage. Malaysia.
[33] Saviour Naveen. "Environmental impact of soil and sand mining: a review." *International Journal of Science, Environment and Technology* 1, no. 3 (2012)
[34] Coakley, George J. "The Mineral Industries of Lesotho and Swaziland." *US Geological Survey Minerals Information* (2002)
[35] Gyamfi, Ebenezer, Emmanuel Kwame Appiah-Adjei, and Kwaku Amaning Adjei. "Potential heavy metal pollution of soil and water resources from artisanal mining in Kokoteasua, Ghana." *Groundwater for Sustainable Development* 8 (2019).

[36] Ministry of Energy and meteriology, Lesotho. National Climate Change Policy, 2017.

Mensah's study, he discovered respondents being sand miners and non-sand miners were aware of the hazardous impacts of sand extraction on land. More than 55 per cent of the respondents were concerned more about coastal erosion while others, through thorough investigation, noted their concerns on loss of agricultural land, loss of beaches for recreational purposes and landing sites for canoes.[37]

Harvesting of Sand and gravel is normally done along and in rivers which are considered the most prone to environmental destructions. Rivers are home to diverse ecosystems and environmental marvels that include wetlands and dunes to name a few. This then poses a threat to both vegetation and wildlife found in and around rivers especially when extraction is done excessively without monitoring. In India, zones that are populated with birds become threatened by sand and gravel mining activities as the natural environment gets destroyed and some birds depend on preserved habitats. The adversarial effects of sand mining are further intensified when developed cities allow for recreational activities along rivers without proper regulatory laws especially those that deal with climate change.[38] Dredging of sand and gravel often generates noise that disrupts the nesting of birds.[39] Dredging allows for materials to pollute the rivers when they are washed away during rainy seasons which impacts the aquatic habitats. [40] Aggregates are often extracted by the rivers in Lesotho and the country is prone to rain, these excavation sites are bound to wash away dredged materials back into rivers thus destroying fish and other organisms found in rivers.

---

[37] Mensah, John Victor. "Causes and effects of coastal sand mining in Ghana." *Singapore Journal of Tropical Geography* 18, no. 1 (1997).

[38] Bombay Natural History Society and Awaaz Foundation, India, Convention on Biological Diversity, Effects of sand mining on biodiversity, 2014

[39] Ashraf Aqeel Muhammad, Muhammad Aqeel Ashraf, Mohd Jamil Maah Mohd. Jamil Maah, Ismail Yusoff Ismail Yusoff, Abdul Wajid Abdul Wajid, and Karamat Mahmood Karamat Mahmood. "Sand mining effects, causes and concerns: a case study from Bestari Jaya, Selangor, Peninsular Malaysia." (2011): 1216-1231.

[40] Abosede Babatunde. "Environmental conflict and the politics of oil in the oil-bearing areas of Nigeria's Niger Delta." *Peace and Conflict Review* 5, no. 1 (2010): 1-13.

There are physical impacts which are a result of mining from stream beds causing alteration of channel slope and changes in channel morphology. Water quality impacts are caused by sand mining and dredging activities, reducing water quality for downstream users and increasing treatment costs. Again, excessive extraction of soil leads to excavation, destruction of ecosystems, and exposure of buried pipelines. In some cases, there is a depletion of water resources leading to flood shortages and hardship for people.[41] The Quick Scope Review paper explains that soil mining interferes with various ecological courses like "macroinvertebrate drift", municipal organizations and food web dynamics.[42] The paper continues its report that biological impacts connected with sand mining (and gravel) together with environmental migration of ecosystems in and around rivers and with the direct disruptions of mining activities affected the quality of land.[43] This clearly shows that river sand mining often involves the removal of large quantities of sand, and can disrupt the natural habitat of aquatic flora and fauna when extraction is in large quantities leading to loss of biodiversity and damage to ecosystems.

Issues emanating from illegal river sand mining include land degradation in Zimbabwe. It contaminates rivers that are a source base for drinking water supplied to cities.[44] Land loss is one of the common impacts of sand mining which is evident in North Central Nigeria. This land is usually used for farming and grazing.[45] In Limpopo South Africa, studies have shown that river sand harvesting causes severe impacts on agricultural land and vegetation thus lowering the

[41] Christo Odeyemi. "Analysing Impact of Sand Mining in Ekiti State, Nigeria Using GIS for Sustainable Development", *World Journal of Research and Review* 6, No. 2, (2018): Pp 26-31
[42] Lois Koehnken, and Max Rintoul. "Impacts of sand mining on ecosystem structure, process and biodiversity in rivers." *World Wildlife Fund International* 159 (2018).
[43] Lois Koehnken, and Max Rintoul. "Impacts of sand mining on ecosystem structure, process and biodiversity in rivers." *World Wildlife Fund International* 159 (2018).
[44]George, Manyumbu, and Jerie Steven. "An Assessment of Sand Extraction Environmental Externalities as a Source of Market Failure in Gweru District of Zimbabwe." *Am. Res. J. Humanit. Soc. Sci* 5 (2022): 37-53.
[45] T. A. Ako., "Environmental Effects of Sand and Gravel Mining on Land and Soil in Luku, Minna, Niger State, North Central Nigeria", *Journal of Geosciences and Geomatics*, Vol. 2, No. 2, 2014, pp. 42-49

economic attainment through agriculture.[46] Ako stipulates that pits are formed and water is often stored in them adding to the loss of flora and damage to land, birthing conflicts over land, loss of biodiversity and air contamination.[47] To summarize land loss, Sand mining affects the availability and quality of land as there can occur landslides and water resources may be limited thus prohibiting growth in the agricultural sector.

In Botswana, the EIA department was faced with challenges emanating from sand mining that included disruption of existing land uses, probability of interference of water supply during works and unwanted sediments bred from construction activities.[48] There has been an indication that sand mining continuously births negative environmental effects depending on the extent and intensity at which extraction takes place. For instance, Muiruri *et al*., 2020 say that the consequences of the dry-pit mining method in Kenya include lowering the sandy water bench, contamination of water held by the sand as well as altering river channel dimensions. Contrary, "bar skimming yields the least negative environmental effects if done in a controlled way".[49] Tarire Madyise notes that there has been a significant increase in soil mining (sand and gravel) and this follows a boom in the construction industry as most developed and developing countries' main objective lies in reaching urbanisation.[50] In the process of achieving urban growth, sand and gravel are extracted at an alarming rate as they are needed for the construction of modern and durable structures. Alui, Akoteyon and Soladoye add that soil mining supports urban growth by providing necessary

[46] Amponsah-Dacosta, Francis, and Humphrey Mathada. "Study of sand mining and related environmental problems along the Nzhelele River in Limpopo Province of South Africa." *Mine Water and Circular Economy, Finland* (2017).
[47] T. A. Ako., "Environmental Effects of Sand and Gravel Mining on Land and Soil in Luku, Minna, Niger State, North Central Nigeria", *Journal of Geosciences and Geomatics*, Vol. 2, No. 2, 2014, pp. 42-49
[48] Lebogang Peggy Makaba. "Effectiveness of the strategic environmental assessment process in Botswana." PhD diss., North-West University, 2014.
[49] Phillip Gathogo Muiruri, Joy A. Obando, and Ishmail O. Mahiri. "Morphologic response of a river channel to sand mining in river Tyaa, Kitui County, Kenya." *Journal of Environmental & Earth Sciences* 2, no. 2 (2020): 12-18. P. G.
[50] Madyise, Tariro. "Case studies of environmental impacts of sand mining and gravel extraction for urban development in Gaborone." PhD diss., University of South Africa, 2013.

aggregate materials like sand and gravel for urban real estate and the construction sectors.[51] This indicates that sand mining is of great importance as there is a massive reliance on sand as a major resource in the formation of concrete used for building.

Sand mining activities have directly and indirectly obstructed the socio-economic and environmental aspects of communities. Conversely, Mngeni states that local communities in Botswana often seek employment in sand mining to secure their livelihoods from money received from selling sand. He further explains that most chiefs and the locals tend to put their fields on the market to sell to mining companies as the income received from the sales ensures the sustainability of their livelihoods. Consequently, the availability of mining resources advocates for an increase in the demand for aggregates which are meant for construction at the same time threatening the environment.[52] In issues relating to livelihoods, the River Sand Mining Management Guideline in Malaysia states that problems emanating from sand mining include bad quality of air from dust particles. Dust concentrations are hazardous to health issues that exacerbate respiratory disorders such as asthma and irritate of lungs and bronchial passages.[53]

However, issues of air quality in Nigeria emanate from the use of gas flaring in the oil mining industry which is harmful to the environment[54] but this serves as an example of how mining affects the atmosphere. Inhaling sand particles also causes coughing and breathlessness in societies thus posing a risk to their health as is the case with communities around the Tikoe region in Maseru

[51] Ibrahim Rotimi Aliu, Isaiah Sewanu Akoteyon, and Olayemi Soladoye. "Sustaining urbanization while undermining sustainability: the socio-environmental characterization of coastal sand mining in Lagos Nigeria." *GeoJournal* 87, no. 6 (2022): 5265-5285.
[52] Asabonga C. M Mngeni, Chris M. Musampa and Motebang Dominic Vincent Nakin. "The effects of sand mining on rural communities." *WIT Transactions on Ecology and the Environment* 210 (2017).
[53] River Sand Mining Management Guideline. Ministry of natural resources and environment. Department of irrigation and drainage. Malaysia.
[54] Abosede Omowumi Babatunde. "Environmental Insecurity and Poverty in the Niger Delta." *African Conflict & Peacebuilding Review (ACPR)* 7, no. 2 (2017).

where gravel is extracted. Mkhando says that sand is used in various projects inclusive of land reclamation, and the construction of roads and buildings and these projects tend to have socio-economic benefits. Some of the most essential aspects of sand mining include reinforcement of buildings when "mixed with cement and concrete; plastering; mixing with concrete when making foundations; and moulding bricks"[55] or building of homes for domestic purposes or for businesses which brings income to villagers. Local populations build contemporary and resilient houses at affordable prices because of the availability of sand. Mkhando further states that sand mining is also important as it allows for job creation.

This activity creates employment for all age groups with the young employed as sand labourers while the adults operate heavy vehicles.[56] Households that are proximate to the rivers where sand is extracted engage in sand businesses and end up combining sand mining with agricultural production, while construction companies engaging in sand mining end up offering permanent employment opportunities to local communities.[57] Nalule is of the same view that economically, sand mining in African states contributes to government acquisition of revenue and creates employment of a significant number of people.[58] However, excessive sand mining in Lesotho can lead to detrimental environmental degradation which in turn can result in long-term economic costs with states trying to combat the impacts caused by unsustainable sand mining activities. Ultimately, the views of other scholars on sand mining create a platform to discover a more detailed interpretation of the effects of sand mining and how it affects communities and the

[55] S. S. Zubir and C. A. Brebbia., eds, *The sustainable city VIII (2 volume set): urban regeneration and sustainability*. Vol. 179. WIT Press, 2013.
[56] Zwoitwa Makhado and Thembela Kepe. "Crafting a livelihood: local-level trade in mats and baskets in Pondoland, South Africa." *Development Southern Africa* 23, no. 4 (2006): 497-509.
[57]Magnus Hatlebakk. "River sand mining as a livelihood activity: The case of Nepal." *The Extractive Industries and Society* 14 (2023): 101266.
[58] Victoria R. Nalule. *Mining and the Law in Africa: Exploring the social and environmental impacts*. Springer Nature, 2019.

environment. There is a distinctive analysis of their perspectives but in the end it all results in environmental degradation. This, however, shows us a thin line when it comes to issues of the socio-economic impacts of sand mining and gravel extraction and how they aggravate environmental issues.

1.6 Methodology

In an attempt to gather information on sand and gravel extraction, this study mostly adopted a qualitative research design and incorporated different research methods that helped to respond to the objectives of the study. Reliance was put on documented evidence being archival sources. The use of archival sources enabled the retrieval of guiding principles that made it possible for sand mining and gravel extraction to take place. For this research to be more articulate, it relied on documentary evidence like government documents, newspapers, environment reports, laws and policies on mining.

In this study, there is also a strong use of oral history which is the recollections and eyewitness accounts about events which occurred during the lifetime of the informants.[59] The nature of this study required interviews to be conducted to source information from mining companies, communities, government ministries, Non-governmental Organisations, and International Organizations. Interviews constitute oral sources as they enable the researcher to draw more information and reach a strong conclusion by comparing of data gathered. However, objectivist historians normally mistrust oral materials as historical evidence, pointing out "the unreliability of

[59] Jan M. Vansina, Jan M. *Oral tradition as history*. Univ of Wisconsin Press, 1985.

memory, the contextual effects of interviews, and the risk of manipulation or bias".[60] Furthermore, this study adopted the use of observations in support of the oral visits to mining sites.

To build more on the discussion about sand mining and gravel extraction, this study will look into the use of secondary sources like published books, articles, papers and dissertations. These works will enable the researcher to identify gaps in sand mining and gravel extraction history thus giving direction to the study. Secondary sources illuminate how knowledge about a phenomenon has changed within the field and subsequently highlight what has already been done in that particular field.

1.6 Structure of the Study

This study will be divided into 6 chapters and these chapters will have sub-sections. The first chapter will be introducing the study followed by the background, statement of the problem, aim, objectives and justification. In the very same chapter, there will be a review of existing literature on sand mining and gravel extraction, the chapter will further entail the methodology to be adopted and the structure of the study. Chapter 2 will give a detailed history of the mining legal frameworks creating an emphasis on how the study at hand has evolved. This is where policies and regulations of aggregate mining in Lesotho will be interpreted in detail.

To comprehend the concept of sand mining and gravel extraction, chapter 3 thoroughly details the activities of mining in Lesotho rooting out the historical nature of mining events on the environment. Furthermore, this chapter looks at the role played by mining associations in Lesotho and how they engaged with the government and communities. Due to the rapid increase in demand for sand and gravel, there has been a rise in damages to the environment hence the fourth chapter

[60] Lisa Klopfer. "Oral history and archives in the new South Africa: Methodological issues." *Archivaria* (2001): 100-125.

ventures into the environmental impacts of sand mining in Lesotho. It comprises the factors that emanate from the ongoing mining activities in the country. In this chapter, there will be an analysis of information to show the extent to which sand mining and gravel extraction have affected the health of the ecosystems and people but also the level of environmental degradation on a broader view.

Chapter 5 explores the role of stakeholders involved in the sand mining. It looks into the measures taken by these stakeholders and the extent to which their engagement has brought calamity towards sand mining issues. It will further build more on the discussions and research on sand mining and its environmental impacts touching greatly on mitigation measures that have taken place throughout the period of study. Chapter 6 will conclude this study relating the major discussions developed throughout the study and the trajectory that ought to have taken place. In this concluding chapter, there will be an assessment and synthesis of key findings from each chapter including limitations of the methodologies used.

Chapter Two: Policies and Regulations of Sand Mining in Lesotho

2.1 The Constitution and Sand Mining in Lesotho

In Lesotho, sand miners are required to align themselves with the laws that govern their operations. The country's legal framework on mining generally attempts to align the mining industry to guidelines that allow for economic growth while adhering to environmental sustainability. Sand mining requires adherence to existing laws to avoid breaches that might negatively impact people and their environments.[1] These laws also enable accountability in aggregated extraction and ensure sustainable mining activities. Laws guiding sand mining are important to regulating environmental conservation, community safety and economic development. This is against the background that aggregate mining, without doubt, results in environmental depletion and degradation. It was partly for this reason that the Earth Summit was held in Rio de Janeiro in 1992 to provide guidelines for the sustainability of the environment in the face of environmental exploitation.[2] Mining laws, therefore, require companies to ensure the preservation of the environment and adhere to social responsibility for national development. The mining laws in Lesotho are thus, guided by conservation as an "overarching goal of sustainability of the environment for economic development, environmental health and social equity".[3]

The legal framework on mining in Lesotho is important, especially with aggregate mining as it balances the extremities of its effects in the country. When companies are well informed about the laws that govern their activities, it allows for adopting long-term practices that have fewer impacts

[1] Cook, Susan. "Community management of mineral resources: The case of the Royal Bafokeng Nation." *Journal of the Southern African Institute of Mining and Metallurgy* 113, no. 1 (2013): 61-66.
[2] Slavko Vekoslav Šolar, Deborah J. Shields, and H. William Langer. "Important features of sustainable aggregate resource management." *Geologija* 47, no. 1 (2004): 99-108.
[3] Slavko Vekoslav Šolar, Deborah J. Shields, and H. William Langer. "Important features of sustainable aggregate resource management." *Geologija* 47, no. 1 (2004): 99-108.

on the land. Aggregates miners and communities need to understand the concept of good governance about mining as it affects the environment. The unregulated environmental and financial costs of aggregate mining are aggravated by feeble control. This is also the case with BRICS countries.[4] Sand and gravel are a reasonably priced resource, which are crucial for urbanisation, food security and industrialisation and thus there is a high demand for these aggregates spawning hefty revenues.[5] Conversely, the impacts on the environment are not considered when evaluating the prices of mining where the communities are left to deal with the negative impacts of mining. This chapter will bring to light the specific laws and regulations on mining in Lesotho and interpret them to accommodate my study on aggregate mining.

The Constitution of Lesotho comprises obligatory laws that oversee extraction activities and the extent to which mining companies comply with the said laws. Chapter 9, Section 107 of the Constitution of Lesotho (Commencement) Order 1993 states that the land and all mineral privileges are bestowed upon the Kingdom of Lesotho and its citizens.[6] This means that the commencement of surveys and mining can only be done through concessions articulated by the government of Lesotho. In most countries, international organisations often constitute laws requiring member states to conform to issues relating to land use, environmental impact assessments, and rehabilitation of mined-out areas. Effective regulations help balance economic benefits with environmental protection. For example, the World Bank states that countries of the world should align themselves with redefining their roles in mining in a way that governments

[4] Javeed Ahmad Ganie and Mohammad Younus Bhat. "Sand mining in BRICS economies: Tragedy of the commons or fortune in the making?." *Journal of Cleaner Production* 434 (2024): 140122.
[5] Javeed Ahmad Ganie and Mohammad Younus Bhat. "Sand mining in BRICS economies: Tragedy of the commons or fortune in the making?." *Journal of Cleaner Production* 434 (2024): 140122.
[6] Constitution of Lesotho, Chapter 9, Section 107, number 36 Protection of the environment

should focus on acquiring sustainable capital flows to develop the mining industries by strengthening mining rights.

To comply with the above international guidelines, Lesotho must ensure that its aggregate mining industry operates in a way that is both economically viable and environmentally sustainable. The country needs to establish clear mining rights to attract long-term investment in this sector. Additionally, these guidelines emphasize the importance of drawing sustainable capital flows to manage aggregate resources responsibly, preventing over-extraction and environmental damage. This involves implementing regulations specifically for aggregate mining. It further states that member states should advance and strengthen their tools and expertise concerning the preservation of the environment (transboundary and local) and community involvement in mining projects and their impacts.[7]

Chapter 9, Section 107 of the Constitution of Lesotho states that there must be protection of the land, to safeguard and enrich the environment. It further explains that the protection of the environment allows for both present and future generations to benefit from it. This section, thus, guarantees a sustainable environment for the "health and well-being" of Basotho.[8] Aggregate mining involves the use of the environment and thus affects everything that is found in the environment. Aggregate miners are forced by the law to follow sustainable extraction practices by registering for an Environmental Impact Assessment before they can begin the process of extraction. Before independence, land allocation in Lesotho favoured men over women.[9] The

[7] World Bank. "Environmental and Social Management Framework for Lesotho." World Bank, last modified April 2020.https://documents1.worldbank.org/curated/en/148841588144549881/text/Environmental-and-Social-Management-Framework-for-Lesotho.txt

[8] Constitution of Lesotho, Chapter 9, Section 107, number 36 Protection of the environment

[9] Paul Kishindo, Elizabeth Eldredge, and Marc Epprecht. *Women, land and agriculture in Lesotho*. No. 4-6. Institute of Southern African Studies, National University of Lesotho, 1993.

allocation of land was done by traditional chiefs who were delegated power by the King. The customary land reform entailed that the chiefs had supremacy over all administration and apportionment of land and were also empowered to revoke land ownership where they deemed fit.[10] Section 107 of Chapter 9 further declares that short of biases, any form of land allocation made and that existed before the commencement of the 1967 Constitution, remains in ownership of such individual for as long as he complies with the notion that the Basotho Nation is bestowed with all land in Lesotho.[11] This law enables women to take part in aggregate mining since they are allowed to own land making it easy for them to invest in aggregate mining.[12] Women are also involved in aggregate mining and this was enabled by the 1993 Constitution Order.

The legal frameworks in Lesotho, inclusive of the constitution, state that all land is bestowed upon the Kingdom of Lesotho and so all mining (inclusive of aggregates mining) can only take place following the appropriate permission by the Lesotho Government.[13] There also attests that land is entrusted to citizens of Lesotho[14] which indicates that Basotho are to be given first preference in land ownership and how it is used. However, most aggregate miners are in constant fights with the government where they claim that sand, gravel and crushed stone extraction projects are given to international businesses whereas the priority in such businesses has to be given to Basotho miners. In the case of the extraction of the Polihali dam, small-scale miners from Mokhotlong were

[10] Moses Daemane "Problems of land tenure system in Lesotho since post-independence: challenging perspectives for sustainable development in land administration and management." *Journal of Sustainable Development in Africa* 14, no. 8 (2012): 164-175.
[11] Constitution of Lesotho
[12] Interview with Hycinth Maime of Mphatlalatsane Construction on 03 April 2024
[13]LEX Africa. "Lesotho Mining 2022," LEX Africa 2023.. https://lexafrica.com/wp-content/uploads/2023/01/Lesotho-Mining-2022.pdf
[14] Liteboho Tlebere, "An inquiry into the mining industry of Lesotho." PhD diss., National University of Lesotho, 2023.

promised to be given priority in the supply of aggregates but the mining contract was given to Morali Crushers Stone which they believe is operated silently by international personnel. [15]

Section 108, chapter 9 of the Constitution of Lesotho states that the King has supremacy in the distribution of land "in trust for Basotho Nation".[16] Number 2 of section 108 adds that the King's power over land is intended to be implemented in line with the Constitution and the laws surrounding mining. As much as land is allocated in this regard, it can also be repealed if it does not meet the terms of the authorities involved.[17] If the extraction of aggregates seems to be negatively impacting the community or there is a breach of the permit, the miner's licence can be revoked by the King or responsible ministries. The Tikoe Mines had its licence revoked and operations had to stop because they were in breach of their licence.[18]

2.2 Regulatory Laws and sand mining

The Mining Rights Act number 43 of 1967[19] provides that qualified persons who have undergone the EIA process on their designated site and have a mining license can prospect and extract minerals, including sand, gravel and crushed stones in Lesotho.[20] As is with the Constitution of Lesotho, the Mining Rights Act of 1967 states that rights to ownership of resources are bestowed in the Kingdom of Lesotho. The Act further states that for prospecting and extracting to take place, miners should respect the laws of the appropriate authorities. [21]The license holder is then able to prospect and mine on the designated area for aggregates following the conditions specified upon receipt of the license which includes ensuring safe excavation practices during prospecting

[15] Interview with Thabang Mokoqo on 16 March 2024
[16] Constitution of Lesotho, Chapter 9, Section 108,
[17] Constitution of Lesotho, Chapter 9, Section 108. Number 2.
[18] Interview with Lerotholi of Tikoe Mine on 09 February 2024
[19] Mining Rights Act 1967
[20] Mining Rights Act 1967, Act 43
[21] Mining Rights Act 1967

operations to meet the reasonable approval of the Commissioner and the Authority, and taking all necessary precautions to safeguard the safety, welfare, and health of employees involved in prospecting activities.[22] This is similar to the administration of mining rights in Botswana, which, however, has a broader legal framework. The control and assessment in the mining of natural resources apply to quarrying activities, thus adding to the development of the country.[23]

In the case where land is vacant from ownership in Lesotho, a lease is given to anyone who wishes to start excavations within a specified timeframe agreed upon by the lease or license holder and responsible authorities. Not only does the miner adhere to the time specified but also to the rights and fees for prospecting grant for aggregates which is Fifty Thousand Maloti (M50000,00) and the mining lease which amounts to One Hundred Thousand Maloti (M10000,00).[24]. For countries like Nigeria, it is of utmost importance to acquire a mining license provided by the Nigerian Mining Cadastre Office.[25] When it comes to issues with the environment it is well known that the state needs to play a pivotal role through good governance in mining activities, decreasing pollution, restoration of quarries and enforcing compliance with state laws.

Furthermore, the Mining Rights Act 1967 states that where land has been leased for mining, compensation ought to be made to landowners where there are agricultural damages. Although the Act does not touch on issues of the environment, the Department of Mines and Geology provides for general environmental issues incurred from large-scale mining.[26] When it comes to issues with the environment it is well known that the state needs to play a pivotal role through good governance

[22] Mining Rights Act 1967
[23] Lin Cassidy, *CBNRM and legal rights to resources in Botswana*. Vol. 4. IUCN Botswana, 2000.
[24] Lesotho Government Gazette, Vol. 66, NO. 16, 2021
[25] Selina Kudzai Zhuwarara, "The potential of digitisation in enhancing regulation and sustainability in the artisanal and small-scale mining (Asm) sector in Zambia, Nigeria, and Ghana." In *Mining Law and Governance in Africa*, pp. 193-217. Routledge, 2023.
[26] Mining Rights Act 1967

in mining activities, decreasing pollution, restoration of quarries and enforcing compliance with state laws.

Aggregate mining often renders certain areas uninhabitable due to the extremities of the activity such as the threat of displacements. Often at times when mining takes place, issues such as disruption of human settlements and residents forced to vacate to other areas.[27] In China, the mining laws and regulations that foster displacements are legally binding as resettlements birth socio-economic costs and disruption of environmental setups. Furthermore, the Land Administration Law of the People's Republic of China provides for provisions in the appropriation of land clearly articulating that resettlement compensations, cover the basic needs of residents. However, it is sometimes overshadowed by a lack of transparency and competence when compensations are carried out.[28] The extremities of crushed stone extraction in the Tikoe region have raised a need for some community members who reside close to the mine to vacate their houses. However, these residents are still waiting for compensation packages before they can move.[29]

In 2005, the Ministry of Mining was primarily tasked with overseeing the management of the mining law and was assisted by the Commissioner of Mines. Furthermore, the Mining Board also governs mining regulations by the MMA.[30] This is similar to Zimbabwe, where the Ministry of Mines and Mining Development is a pivotal protagonist in the execution of the country's mining

[27] Jafaru Adam Musah and Bjorn H. Barkarson. "Assessment of sociological and ecological impacts of sand and gravel mining: A case study of East Gonja District (Ghana) and Gunnarsholt (Iceland)." *Final Project, Land Restoration Training Programme, Keldnaholt* 112 (2009).
[28] Matthew Erie, "China's (post-) socialist property rights regime: Assessing the impact of the property law on illegal land takings." *Hong Kong LJ* 37 (2007): 919.
[29] Interview with Habofanoe of Ha Tikoe on 06 February 2024
[30] LEX Africa. "Lesotho Mining 2022." LEX Africa, January 2023. https://lexafrica.com/wp-content/uploads/2023/01/Lesotho-Mining-2022.pdf

activities.[31] This indicates that the Ministry of Mining assists in developing and executing comprehensive mining policies by collaborating with different stakeholders like aggregate mining companies, environmental organisations and residents affected by aggregate mining. Similarly, the Ministry ensures that aggregate excavations comply with the set laws to endorse economic growth by ensuring that local communities benefit from aggregate mining activities through the creation of jobs, development of infrastructure and Corporate Social Responsibility. The Ministry of Mining in Lesotho is crucial in making sure that aggregate mining is sustainable and supports economic growth. By developing thorough policies, establishing strict regulatory frameworks, and actively monitoring and enforcing these regulations, the Ministry ensures that mining positively impacts the economy while protecting environmental and social interests.

The Mines and Minerals Act of 2005 was to "repeal and replace" the Mining Rights Act of 1967. This Act entails comparative guidelines over the assessment and utilization of natural resources, in this case, aggregates by providing thorough strategies for assessing and using aggregates. Furthermore, the Act mandates detailed exploration, environmental assessments, and sustainable mining practices; it ensures that aggregate mining contributes positively to economic growth while safeguarding the environment and promoting social responsibility. It continues to necessitate issues related to the fortification of the environment and how water resources are utilized. Countries like Botswana and Chile have a strong legal framework that provides for and guarantees transparency and impartiality in mining.[32] The 2005 Act sought to implement ecological mining practices that allow for environmental conservation through a reduction in radiation and ensuring that natural resources are exploited sustainably. The ownership of aggregates is declared in this

[31] Mines and Minerals Act 2005

[32]LEX Africa. "Lesotho Mining 2022." LEX Africa, January 2023. https://lexafrica.com/wp-content/uploads/2023/01/Lesotho-Mining-2022.pdf

Act and as such, all rights about ownership of these resources are dependent on the Act. Within this Act, constraints are evident when attaining rights to mine aggregates and these include a prospecting licence and a mining lease [33] The Minister of Mining is responsible for granting permission for mining. The issuance of permits allows the government to monitor compliance with the regulations.[34]

The Mines and Minerals Act created the office of the Commissioner for the Mining Board, which assesses the regulations guiding the extraction of aggregates. The regulatory policies within the Act prescribe that the Mining Board carry out all the consultative functions, including aggregate mining.[35] The 2005 Act, stipulates the preservation and protection of the environment through compliance with Environmental Impact Assessment (EIA).[36] This also encompasses conditions relating to the environment like rehabilitation of the quarries and economic development by the mining lease holder in compliance with the ecological requirements.[37]

2.3 Environmental Law and Sand Mining

Environmental laws were thought necessary by governments, including those of Lesotho, to regulate the extremes of human activity on the environment. Human activity affects not just the environment but also natural resources and public health.[38] Environmental laws are primarily designed to prevent pollution of the environment, safeguard natural resources, and encourage

[33] Mines and Minerals Act 2005
[34] Mines and Minerals Act 2005
[35] Mines and Minerals Act 2005
[36] Liteboho Tlebere, "An inquiry into the mining industry of Lesotho." PhD diss., National University of Lesotho, 2023.
[37] Liteboho Tlebere, "An inquiry into the mining industry of Lesotho." PhD diss., National University of Lesotho, 2023.
[38] Bell, Stuart, Donald McGillivray, and Ole Pedersen. *Environmental law*. Oxford University Press, USA, 2013.

sustainable development. Aggregate mining is one of the problems that give rise to environmental problems for which legislation must be implemented.[39]

The Environment Act of 2001, which was repealed in 2008 provides for environmental management in Lesotho.[40] The law typically imparts knowledge on sustainable resource use through conservation efforts. Because aggregate is so highly sought after in Lesotho for construction, conservation efforts may involve controlled extraction, preventing environmental damage, and preventing the extinction of particular species. The Act also established some organisations, such as the Environmental Tribunal, the National Environment Fund, the Lesotho Environment Authority, and the National Environment Council which resolve conflicts involving companies, communities, and the government related to aggregate mining and also ensure that mining operations adhere to environmental protection laws. They also oversee the process of conducting EIAs for proposed projects.[41] It includes rules that are covered in depth in the Environment Act 2008, which was created to achieve environmental control and safeguarding while also conserving and responsibly using Lesotho's natural resources.[42]

The 2008 Environmental Act spelt out the administration of the environment and the establishment of the National Environment Council. The roles of the Council as entailed in the Act are to implement the tasks in section 8 of the Act which include promoting the integration of environmental considerations in all aspects of socio-economic planning.[43] The laws ensure that aggregate mining in Lesotho is carried out in a proper manner and in compliance with

[39] Tracy-Lynn Humby. "'One environmental system': aligning the laws on the environmental management of mining in South Africa." *Journal of Energy & Natural Resources Law* 33, no. 2 (2015): 110-130.
[40] "Environmental Policies." Government of Lesotho. Accessed June 11, 2024. info@environment.gov.ls
[41] Environment Act 2001
[42] Environment Act 2008
[43] Environment Act 2008

environmental law. Environmental regulations often involve penalties for non-compliance, and regulatory bodies are responsible for ensuring compliance with environmental guidelines. The Environment Act 2008 states that a fine of not less than Five Thousand Maloti will be paid as a penalty when there has been emission of excessive noise during aggregate mining operations and failure to do so will subject them to two years imprisonment or both prison and payment of fine.[44] Compliance with these laws allows governing bodies to monitor and reduce the environmental impact of aggregate mining, addressing issues related to climate change and degradation. Compliance with these laws allows governing bodies to monitor and reduce the environmental impact of sand mining, addressing issues related to climate change and degradation.

The Environmental Act of 2008 includes that Environment Impact Assessment or Strategic Environmental Assessment should be undertaken and this will be discussed in Section 2.6 of this chapter. However, it is important to mention that the Director is liable for evaluating all environmental assessments.[45] Before projects like sand mining can start, most states need environmental impact assessments. These evaluations determine how much the environment will be impacted, enabling responsible authorities to make appropriate operational decisions. The Act further states that the Director and his Ministry shall create criteria for pollution attributes.[46] This means that the quality of water, air, noise and harmful substances is entrusted to the director and his team and their role is to minimize and/or prevent pollution caused by aggregate mining at all costs. The Ministry through the Director's orders sets out the limits to which the environment is to be disturbed and enforces penalties on those who do not comply with the said regulations.[47]

[44] Environment Act 2008, Section 42, subsection 2
[45] Environment Act 2008
[46] Environment Act of 2008
[47] Environment Act 10 of 2008.

Interpreting the Act with regards to sand and gravel mining, it clearly shows that for such projects to take place there has to be safeguarding of "rivers, river banks or wetlands".[48] It calls for proper management of these areas and where necessary calls for businesses to apply for a waste license.

2.4 Environmental Impact Assessment (EIA)

The Environmental Impact Assessment is a division within the Ministry of Environment that was established to establish ethics and regulation at the same time manage the extent to which the Environmental Management Plans are confirmed. It enables environmental and socio-economic sustainable development through the assessment of the Environmental Impact Statements of Projects and also endorses projects that submit to the set regulations.[49] Environment Impact Assessment (EIA) appraises the possibility of environmental impacts emanating from proposed projects like sand mining before operation can take place. This process is primarily intended to guarantee that governing bodies and stakeholders are conversant with the environmental consequences, which include aggregate mining. This allows for the prospection of mitigation measures of impacts that may arise from aggregate mining. The EIA division in Lesotho is administered by currently "one Principal Environment Officer, one Senior Environment Officer and two Environment Officers.[50]

The Environmental Impact Assessment is a division within the Ministry of Environment that was established to establish ethics and regulation at the same time manage the extent to which the Environmental Management Plans are conformed with. It enables environmental and socio-economic sustainable development through the assessment of the Environmental Impact

[48] Environment Act 10 of 2001.
[49]"Environmental Policies." Government of Lesotho. Accessed June 11, 2024. info@environment.gov.ls
[50] Lipolelo Makhele, and Roseanne Diab. "Evolution of environmental impact assessment in a small developing country: a review of Lesotho case studies from 1980 to 1999." *Impact Assessment and Project Appraisal* 19, no. 1 (2001): 9-18.

Statements of Projects and also endorses projects that submit to the set regulations.[51] Environment Impact Assessment (EIA) appraises the possibility of environmental impacts emanating from proposed projects like sand mining before operation can take place. This process is primarily intended to guarantee that governing bodies and stakeholders are conversant with the environmental consequences, which include aggregate mining. This allows for the prospection of mitigation measures of impacts that may arise from aggregate mining. The EIA division in Lesotho is administered by currently "one Principal Environment Officer, one Senior Environment Officer and two Environment Officers."[52]

In the 1930s and 1940s, the British Colonial administration introduced several ways to assess and manage environmental impacts in Lesotho, many of which are still in use today. As a result, there were attempts to adopt EIA in Lesotho. These techniques include the implementation of conservation by local communities through law enforcement. The EIA not only assesses the negative implications on the environment but also the positive outcome of proposed mining.[53] The Environmental Act, which became the nation's environmental legal framework was approved and put into effect in 2008.[54] One project that influences the environment is sand mining, and the Environmental Act requires the EIA to approve its implementation. Additionally, the Act stipulates compliance with regulations about sand mining activities.[55] The Lesotho Environment Act ensures the protection of wildlife during aggregate mining, mandates Environmental Impact Assessments (EIA) for mining activities of specified sizes, regulates emissions into water and land, protects

[51]"Environmental Policies." Government of Lesotho. Accessed June 11, 2024. info@environment.gov.ls
[52] "Environmental Policies." Government of Lesotho. Accessed June 11, 2024. info@environment.gov.ls
[53] Setenane Nkopane. "An evaluation of environmental impact assessment procedure in the Lesotho Highlands Water Project: Phase 1." (1997).
[54] Environment Act 10 of 2008.
[55] Environment Act 2008, Section 113, Subsection 2

degraded areas, manages rivers, and controls noise pollution.[56] These regulations further include adherence to specific regulations for aggregate mining activities. This involves securing the necessary permits, following environmental protection guidelines, performing impact assessments, and taking steps to reduce ecological harm. The Act's goal is to promote sustainable practices, safeguard natural resources, and lessen the negative environmental impacts of aggregate mining.

Power is vested in the Minister of Environment to issue EIA guidelines about sand mining projects and mining in general. The Director of the Department of Environmental Affairs is tasked with creating guidelines for conducting environmental impact assessments (EIAs) on aggregate mining.[57] There are some limitations in the EIA regulations as contained in the 2008 Environment Act as most miners who solely focus on sand mining entail that these regulations are close to impossible to adhere to as most of them do not have enough capital that enable them to conduct EIA[58]. However, even though the EIA Regulations are still yet to be formally conceded, the extraction of aggregates continues to take place.[59]

Screening is one of the major components required in the EIA process.[60] The purpose of screening in aggregate mining is to safeguard the environment. It ensures that the potentially harmful effects of aggregate mining undergo a detailed impact assessment, helping to protect natural resources, biodiversity, and community health.[61] Furthermore, most countries inclusive of Lesotho require

[56] Environment Act 2008, Section 113, Subsection 2
[57] Amandus Thabang Tapole. "The environmental impact assessment (EIA) under the Lesotho Environment Act No. 10 of 2008: a comparative analysis with the South African EIA regime." PhD diss., 2011.
[58] Meeting for aggregate miners at 'Manthabiseng Convention Center on 16 August 2023
[59] Rantlo, Tiisetso John. "Environmental impact assessment legislation in Lesotho, Swaziland and South Africa." PhD diss., North-West University (South Africa), Potchefstroom Campus, 2015.
[60] Setenane Nkopane. "An evaluation of environmental impact assessment procedure in the Lesotho Highlands Water Project: Phase 1." (1997).
[61] Tiisetso John Rantlo. "Environmental impact assessment legislation in Lesotho, Swaziland and South Africa." PhD diss., North-West University (South Africa), Potchefstroom Campus, 2015.

determinants on the dimensions and setting of the mining project.[62] This will determine the impacts of the project, in this case, aggregate mining. Talime argues that screening is centred on project activities that have potential negative ecological impacts.[63] These activities include crushed stone mining whose operations birth environmental issues like generation of dust and damage to residential settlements. Screening during the implementation of EIA is a necessity in sustainable development as it ensures that sand and gravel extraction projects are environmentally feasible at the same time identifying and lessening the negative impacts of aggregate mining early in the design stage.

The Draft EIA Regulations, 2006[64] states that for a mining project to take place there has to be the implementation of scoping. This is another important component required in the process of EIA. Scoping explains the major environmental concerns coupled with studying possible impacts.[65] Scoping establishes the parameters and type of mining project like aggregate mining, as well as the geographic restrictions and alternatives to consider in the event of any unfavourable effects caused by activities like crushed stone mining.[66] Talime adds that scoping warrants that the process of EIA focuses solely on the important effects of aggregate mining and allows for time and financial management.[67] The scoping phase is necessary for making sure that EIA address issues that threaten the environment be it explosives and/or drillings done by machinery to extract sand and stone. EIA in Lesotho requires data to be collected and analyzed from the environment

[62] Louise Zdanow and Natasha van de Haar. "Botanical Screening Assessment for Proposed Sand Mining At Southern Home Farm Along The Mtwalume River, Kwazulu Natal." (2016).
[63] L. A. Talime., "A critical review of the quality of Environmental impact assessment reports in Lesotho." (2011).
[64] Draft EIA Regulations, 2006
[65] Peter Morris and Riki Therivel, eds. *Methods of environmental impact assessment*. Vol. 2. Taylor & Francis, 2001.
[66] Tim Snell and Richard Cowell. "Scoping in environmental impact assessment: balancing precaution and efficiency?" *Environmental Impact Assessment Review* 26, no. 4 (2006): 359-376.
[67] L. A. Talime., "A critical review of the quality of environmental impact assessment reports in Lesotho." (2011).

regardless of its conditions.[68] It provides for the establishment of a baseline, which will serve as a reference for impacts that may occur in the future.[69] The evaluation of potential sand mining impacts on the environment is done through an assessment of the proposed site.[70] It requires thorough consideration of the effects of sand mining and also cumulative effects like degradation of water sources. The EIA in sand mining accounts for possible synergies either from government or private institutions.

Central to EIA is planning towards combating impacts emanating from sand and gravel extraction where a management plan is established.[71] These mitigation measures are usually developed with a special concentration on community participation. The public inclusive of stakeholders is involved in making decisions about how their land is utilized.[72] The TRC[73] and Renoka[74] advocate for the inclusion of the community when it comes to aggregate mining and these institutions believe involving the community and stakeholders in the decision-making process allows for diverse ideas which safeguard sustainable development thus improving the implementation of EIA. Further elaboration on these institutions will be discussed in Chapter 5 of this dissertation. Moreover, the Environmental Impact Statement in Lesotho sought to formulate a comprehensive report which informs stakeholders of the findings obtained during the EIA.[75]

[68]Patric Gwimbi, Palesa Lebese, and Kamohelo Kanono. "Mainstreaming health impact assessments in environmental impact statements into planning obligations in post dam construction in Metolong, Lesotho: A qualitative investigation." *Heliyon* 6, no. 7 (2020).
[69] Tchakounteu, Mitrance Sorelle. "A Critical review of EIA report quality in Lesotho." (2021).
[70] B. B. Matandare, T.M. Takura., "Impacts of Mining Operations on Water Resources and Ecosystems: The Case of Letseng Diamonds in Lesotho."
[71] Malahalli Vandana, Shiekha E. John, K. Maya, Syam Sunny, and D. Padmalal. "Environmental impact assessment (EIA) of hard rock quarrying in a tropical river basin—study from the SW India." *Environmental monitoring and assessment* 192 (2020): 1-18.
[72] Limpho Letsela, Andre Pelser, and Maitland Seaman. "A participatory sustainability assessment process for biodiversity conservation in Lesotho." *Journal of Environmental Assessment Policy and Management* 12, no. 02 (2010): 107-129.
[73] Interview with Limpho, legal advisor of TRC on 09 April 2024
[74] Interview with Malisema Fako of Renoka on 08 April 2024
[75] L.A. Talime., "A critical review of the quality of environmental impact assessment reports in Lesotho." (2011).

2.5 The Land Act and Sand Mining

In 1979, the Lesotho Land Act of 1979 was enacted.[76] The Act updated and concurrently incorporated all existing land laws to allow for land redistribution.[77] Land redistribution allows for rectifying inequalities associated with the circulation of land and this is usually evident in the restructuring of aggregate mining land and that of peasants thus allowing for equity and economic development.[78] In Lesotho, the Matebeleng community are conflicting with the mining company where they feel that the company has appropriated their agricultural land and this calls for the redistribution of land after the decisions have been made on who the rightful owners of the site are.[79] The Act amended the regulations that addressed land issues through awarding land titles and allowed for land conflict management. The Act declared some areas essential for development, making them distinct from those allocated for agricultural purposes. The Land Regulations Act 1980 was meant to indicate clearly the roles played by different officials in the redistribution of land and also address issues on registration and charges to land development and license holding. The Act of 1980 further provided for reimbursement of communities affected by development projects that require them to relocate from their homes.[80] The Land (Amendment) Order, 1986 (No.27 of 1986) revised the 1979 Land Act where modifications were made regarding the Minister being empowered to withhold consent and award leases for development purposes.[81] The Minister administered compensation issues where loss or damage was incurred by the leaseholder.

[76] Land Act of 1979
[77] Act NO. 17 of Land Act of 1979
[78] Washington Mushore and Khatija Bibi Khan. "Mining the Truth: Representation of Land and Land Redistribution in Zimbabwe in the Daily News." *Commonwealth Youth & Development* 18, no. 2 (2020).
[79]Interview with Matsuinyane Tsuinyane of Ha Tikoe on 06 February 2024
[80] Land Regulations Act 1980
[81] Land Order (Amendment) of 1986. No 27.

The Land Act of 2010 replaced the 1979 Act and emphasized land apportionment and administration.[82] The LLA 2010 sought to address the management and protection of natural resources for future generations to benefit by creating a balanced approach to land and resource management that prioritizes both current and future needs, ensuring that aggregates like sand and gravel remain available and viable for generations to come. In aggregate extraction, the Act regulates how extraction takes place at the same time safeguarding natural resources inclusive of aggregates. The administration of the Land Act requires the inauguration of the legal framework surrounding aggregate extraction through license provision, revenue services and environmental safety by establishing tools for the sustainable management of forests, water bodies, and wildlife habitats just to name a few. This could also include setting quotas for resource extraction and implementing conservation measures when undertaking aggregate mining. These efforts aim to encourage sustainable land use practices and responsible environmental management.

The LLA 2010 Land regulates mining activities like aggregate extraction where communities are affected and are to be compensated. The responsible state bodies liaise between the sand mining companies and communities to avoid conflict. In most cases, compensation becomes mandatory where land use rights are violated and where there is environmental degradation through mandating legal and regulatory systems that safeguard land use rights and address environmental degradation brought about by aggregate mining. These systems define the criteria for compensation, detail the processes for assessing and providing it, and offer means for affected individuals to seek redress. The 2010 Land Act provided for the ecological use of land while at the same time respecting the rights of landowners and residents. This allows for social and economic

[82] Land Act 2010

growth.[83] The 2010 Land Act also covers the management of water resources. It also focuses on how flora and fauna are affected by the activities on land, closely looking into archaeological and paleontological remains before any development (inclusive of aggregates mining) can take place on land in Lesotho.[84]

2.6 Local Government Law and Sand Mining

Globally, local government Acts or laws stipulate the structures in which state authorities function, especially in the field of sand mining. [85] The role of local government in mining (sand and gravel) is to provide a guide to the operations of sand mining. The local authorities also outline the conditions for sand mining as may be contained in the permits. These conditions may apply to the locations, technologies that are to be used on the site and timeframe of the mining project.[86] This proves that the relationship between sand mining and local governments is of utmost importance as they regulate frameworks that govern sand mining activities.

The Local Government Act 2008 grants powers to different personnel by existing laws in Lesotho. For example, it empowers the Minister to form community, rural, urban and municipal Councils for distinctive administration. These Councils function as organized administrations. The municipality of Maseru is the governing authority for matters about sand and gravel mining, however, each district has a Council where sand mining-related matters are discussed.[87] The Act plays an important role in Lesotho as it requires for undertaking of EIA before the extraction of sand can take place.[88] This enables local government officials to understand the potential

[83] Land Act 2010
[84] Land Act 2010
[85] Melissa Elizabeth Mark, "The Governance of Global Sand Mining." Master's thesis, University of Waterloo, 2021.
[86] Saviour Naveen. "Environmental impact of soil and sand mining: a review." *International Journal of Science, Environment and Technology* 1, no. 3 (2012).
[87] Aggregates miners meeting at ‘Manthabiseng Convention Centre, August 2023.
[88] Aggregates miners meeting at ‘Manthabiseng Convention Centre, August 2023.

environmental effects of sand mining, enabling them to make well-informed decisions about both environmental protection and economic growth. Moreover, the Act states that local authorities are granted powers over issues like sand and stone mining while at the same time protecting the environment.[89] Since the Community Councils are in charge of making sure companies follow the law, they are also in charge of managing sand harvesting operations.[90] The employees of the Community Councils are required to visit the sites regularly to examine and monitor the effects that sand and gravel mining has on the environment and water resources.

Local Government Act 2008 to rectify issues relating to the composition of councils including taking steps to guarantee that local councils accurately mirror the communities they serve. This includes modifying the number of council members or adjusting electoral district boundaries to align more closely with demographic shifts and uphold equitable representation making boundaries on areas affected by aggregate mining more accurate. The Act further makes provisions for the reclamation and rehabilitation of quarries. This means that sand mining companies are regulated to restore mined areas after mining is completed. Quarries are frequently left open after operations are finished. To lessen the effects of sand mining, local governments support refilling quarries, recovering habitats through vegetation, and managing water resources.[91] Like many other local government Acts around the world, the Local Government Act 2008 in Lesotho provides for the engagement and rights of the communities.[92] According to the Act, communities can express their concerns about the way sand mining corporations exploit their land. The local government Act provides for "pitso" community discussions, during which locals are informed about the

[89] Local Government Act 1996, Second Schedule
[90] Hoolo Nyane,. "Assignment of functions to local authorities in Lesotho." *Commonwealth Journal of Local Governance* 19 (2016): 58-74.
[91] Saviour Naveen. "Environmental impact of soil and sand mining: a review." *International Journal of Science, Environment and Technology* 1, no. 3 (2012).
[92] Local government Act 2008

potential effects of mining operations on their lives and can file complaints with the appropriate authorities.[93]

Furthermore, an international framework is relevant when it comes to the regulation of aggregate mining by local government actions. International laws on local governments and sand mining assist in setting up criteria and aims that allow for sustainable development in the management of natural resources by local governments by promoting the sustainable management and utilization of aggregates. They also aim to conserve resources and advocate for the sustainable use of sand mining activities.[94] This therefore leads to the role of local governments being combined with legal rules and enforcement instruments in sand mining.[95] However, the Ministry of Local Government and Chieftainship does not clearly show the responsibilities of authorities over policy formulation. This ambiguity often creates conflicts between sand miners and residents.[96] Furthermore, Lesotho's local governments have not yet established regulations about the monitoring of sand mining, capable of ensuring job prospects.[97]

[93] See "Sandra Wallman, "Lesotho's pitso: Traditional meetings in a modern setting." *Canadian Journal of African Studies/La Revue canadienne des études africaines* 2, no. 2 (1968): 167-174."
[94] Melissa Elizabeth Mark, "The Governance of Global Sand Mining." Master's thesis, University of Waterloo, 2021.
[95] Melissa Elizabeth Mark, "The Governance of Global Sand Mining." Master's thesis, University of Waterloo, 2021.
[96] R Leduka, M. Ntaote, and N. Takalimane. "Land governance in Lesotho." In *Land Governance in Southern Africa Symposium*. 2019.
[97] Ignatius Matete Naha, "Full decentralisation of powers, resources and functions in the Kingdom of Lesotho: an evaluation from a developmental local government perspective." PhD diss., Stellenbosch: Stellenbosch University, 2015.

Chapter Three: Aggregate Mining

3.1 River Sand Mining

Sand mining is a type of aggregate mining. The extraction of raw materials used in the construction industry is regarded as aggregate mining. In this umbrella, we find river sand mining, gravel mining and crushed stone mining, which are major components in the production of construction materials and are also used in the construction process. These aggregates, including sand, played a pivotal role in infrastructural development in Lesotho and the maintenance of those builds and roads. The periods of 1980-2023 marked a key phase in the usage of sand and gravel in Lesotho due to the excess need for urban improvement in the country. The process of sand mining varied depending on the reason behind the extraction. For centuries surface mining was at the core of aggregate mining as it comprised removing soil from the surface to get access to aggregate underneath. Most common in Lesotho was river sand mining where sand and gravel were mined from river beds. Sand miners played a pivotal role in the economic growth of the country as they provided raw materials used in infrastructural projects. The need for aggregates required extraction to take place at a high rate to meet construction needs. The high demand for aggregates allowed for the employment of residents. When the market needed sand, the miners were prompted to hire more manpower to source the resource in high quantities. The local economy was supported via the supply chain. When trucks were working in Thaba Bosiu along the river, the miners usually hired residents to serve as labourers in the process of acquiring sand. As the demand for sand and gravel grew, miners adopted the use of heavy machinery that made extraction more efficient and also in high

quantities.[1] Sand mining was important to countries as it shaped itself as the backbone of construction and infrastructure which will clearly be articulated in this chapter.

River sand mining over time became a process that was practised globally and was extracted from river beds and banks. Global economies had for centuries depended on sand for making concrete and paving. Similarly, Basotho used sand in their builds for shelter and later upgraded to using sand as a base for paving their walls mixing with cow dung. They extracted the sand using shovels from the rivers with shallow waters that the chiefs and community councils had designated for residents to extract from as they were the governing bodies. For gathering the sand, they used basins that they could carry on their heads or the backs of donkeys then transporting the sand to the villages. This process enabled residents to pave their houses and design the houses the way they saw fit. The manual extraction of sand was labour intensive even though it did little to no damage to the environment.

Manual extraction of sand was and still is mostly practised by developing communities through the use of simple tools like wheelbarrows and shovels. The communities often practised rotational mining where the residents mined at a designated part of the river, then later allowed it to gather enough sand moving on to another section of the river that was still in the sand. [2] Furthermore, sand was also used in crafting beads. Although many crafters had different ways of making beads, some residents especially women handcrafted beads from mixing sand with clay and later on selling the beads to get income for the household. [3] This then suggests that river sand was essential in socio-economic development and the rate at which the extraction was done was on a small scale.

[1] Interview with Thabang Moqoko, Chairman of Concrete and Aggregates Association of Lesotho, Maseru, 20th March, 2024
[2] Interview with Mathato Monts'I, resident of Lesia Ha Thetsane, 09th Frbruary, 2024.
[3] Interview with Mahlape Letsie, resident of Ha Hoohlo, Maseru, 10th February, 2024

As Lesotho developed its infrastructure, it saw the need to improve on technologies used in the extraction of river sand. These methods were tailored depending on the scale at which mining was meant to take place. On intermediate-scale operations, miners globally started using dredgers and pontoons to extract sand from rivers and river beds. This method vacuumed the sand from the river beds using pipes and the sand is then transported to shore to be loaded on trucks.

However, Lesotho used Tractor Loader Backhoes (TLB) to extract sand from rivers. The TLB was placed in the shallow waters of the Mohokare River and Phuthiatsana River. The load was then offloaded on the shore before being loaded on and transported by trucks to the depot. This technique enabled the sand to be extracted in larger quantities from the river. Apart from the usage of TLBs, large-scale miners often used excavators to mine sand from rivers. Excavators were placed in the middle of the river where they scooped up sand from the river and the load was then placed on land where they were placed in stockpiles to eliminate moisture from the sand. There were seasons when river sand mining in Lesotho was halted due to weather patterns faced by the country. Along the Mohokare River, most miners halted operations as mining in the river was not advisable during rainy seasons. [4] Miners were unable to extract sand in the river when the water levels were high making them lose out on business for two to three weeks depending on the rate of the rainfall. [5] When the Mohokare River was full, it became impossible for anyone to cross over let alone start an operation and it tended to wash away everything it came across. The Makhaleng River was a source of sand for construction purposes as was the case with Phuthiatsana River.[6]

[4]Interview with Thabang Moqoko, 20 March, 2024
[5] Pascalinah Kabi, The Hidden Environment Toll of Sand Mining on Mohokare, @uncencorednews.com, 2023
[6] Interview with Tebello Naha, Ha Hoohlo, on 10th February, 2024

3.1.1 Rough Sand Mining

Rough sand in Lesotho was extracted from the rivers together with fine sand. It played a pivotal role in the construction and sometimes in land reclamation. [7] This sand was regarded as rough solely based on its texture or rather its unprocessed nature. The manual harvesting of sand before the introduction of heavy equipment was labour-intensive but had little impact on the environment. Miners together with the local chiefs served a site that they saw had enough sand to be extracted. After special consideration and mutual understanding, the chiefs then permitted miners to undertake their activity and it usually covered a small area. To access the sand, the use of shovels and spades was at the core. Miners excavated from the shallow water and then gradually advanced to dig from the deeper waters. They dug sand in sections and steadily to avoid fatigue. When others dug through the water, others collected the sand in buckets and also loaded the sand on wheelbarrows. They made sure not to overload the containers so that it eases the transportation process. The sand from the river was then sifted on land along the river to separate large particles and small particles. This process produced rough sand which was needed by the miner. From the rough sand sifted, tractors and wheelbarrows were used to transport it to the site where it was be used. Rough sand after extraction was kept away from moisture and any other pollutant that could reduce the quality of the sand.[8]

As economies improved, and the demand for rough sand escalated, miners were faced with the task of upgrading their technologies in the extraction business. This was where the use of heavy machinery and equipment was required for extraction and transportation. Bulldozers and TLBs were used to remove the topsoil creating access to the resource. The processes of harvesting rough

[7] Berry M. Lehane., Gaudine Christophe, and J. A. Schneider. "Scale effects on tension capacity for rough piles buried in dense sand." *Géotechnique,* Vol. 55, No. 10, pp. 709-719,2005.
[8] Interview with Matseliso Ranooe, Ha Hoohlo, Maseru, 10th February, 2024.

sand required an excavator to be placed in the middle of the rivers to dig out sand in large quantities and the sand was loaded on trucks for processing at the processing site. Impurities were removed from the sand through screening and sifting. This helped the miners classify the rough sand into smaller even bits. At the depot, sand was stored in piles while waiting to be sold. It was however important to consider the environmental implications of sand mining. [9]

3.1.2 Fine Sand Mining

Fine sand is derived from river sand mining where fine grain sands are obtained. Fine sand is mostly sought after as it serves in the making of concrete and is used in plastering. [10] Developed countries like Spain and Italy used fine sand to make glass and to produce electronics with silicon chips.[11] After the extraction of sand from rivers, the sand was sifted and classified into different piles. Most Basotho for years purchased fine sand as it helped in the construction of their residential houses, and its size, shape and purity make it perfect for buildings. Small-scale miners used manual sifting methods where they poured sand through the mesh sifter allowing small particles to fall through and leaving large particles to remain behind. These piles were then placed at the depot for sale. Often sand extracted from rivers was mixed with materials like gravel and fine sand was derived from sifting through a tilted screen where fine sand fell through gravity separation.

The introduction of cement in Lesotho in the 80s brought about a high rate of fine sand mining because of the high demand for the construction of buildings. As the demand for fine sand grew, there was a need for the use of professional tools to separate sediments. Large-scale miners adopted

[9] Interview with Thabang Mokoqo, 20 March 2024.
[10] Joe Willis, Neil Coleman, and Wilbert Ellis. "Laboratory study of the transport of fine sand." *Journal of the Hydraulics Division* 98, no. 3 (1972): 489-501.
[11] Dieter Brems, Patrick Degryse, Femke Hasendoncks, Domingo Gimeno, Alberta Silvestri, Elvira Vassilieva, Steven Luypaers, and Johan Honings. "Western Mediterranean sand deposits as a raw material for Roman glass production." *Journal of Archaeological Science* 39, no. 9 (2012): 2897-2907.

the use of vibrating screens to obtain fine sand proficiently.[12] Miners and contractors in Lesotho had a high preference for river fine sand because it was highly used in most construction projects in the country because of its purity making builds sturdy and immaculate.[13] Several stream beds near the Emmaus mission and on the road to Qaba were sources of clean sand for use in cement building materials.[14] Extracting sand was an important factor used in different sectors and the techniques used varied depending on the scale it was harvested on and also conditional to the location of the resource.

3.2 Gravel Mining

The extraction of gravel mining was practised for centuries for road construction. It was extracted from the surface. Most roads in Lesotho were made out of gravel especially those in remote areas. This allowed for travel to be convenient for people to access basic services. Gravel was also one aggregate that had been harvested in great quantities in Lesotho and globally in the period of this study. In the extraction of gravel, sand deposits were evident and the two were sifted and separated depending on the uses. Before operation, miners were bound to strip off top soils and clear the vegetation on land to access the gravel deposits. This was done on open pits where excavators, TLBs and loaders were used to extract the resource.[15] Initially, Lesotho roads were constructed using gravel extracted using simple tools like shovels, spades, chisels and hammers. Miners who mined on a small scale would dig into the surface to uncover the gravel deposits using a peak. Once the gravel was exposed, they then used shovels and chisel to loosen the gravel.

[12] Interview with Thabo Moiketsi, Scalo Construction Company, Maseru. 16th March 2024
[13] Pascalinah Kabi, The Hidden Environment Toll of Sand Mining on Mohokare, @uncencorednews.com, 2023
[14] UNDP, Technical Report: Geology and Mineral Resources of Lesotho, 1984
[15] Interview with Thabo Moiketsi, 16 March, 2024

Basotho used indigenous knowledge systems to uncover rocks in open pits which minimized the impact on the environment by systematically digging through the rocks to avoid the crumbling of the site being excavated. After excavation was completed, miners used sifters to single out gravel apart from large rocks. Through this sifter separation, fragments of rocks and dirt became evident creating quality gravel to be distinguished. The sifter was manually operated by two people holding at each end while other persons deposited the resources on the sifter allowing smaller particles to pass through. Once they dug out and sifted the gravel, they used spades to load the resource on wheelbarrows or on tractors which were used to transport it to the designated area of construction.[16] With the advent of industrial development and infrastructural growth, the high demand for gravel forced miners to transition from basic mining methods to mechanized methods which required the use of heavy machinery to extract gravel.

Accessing gravel deposits was also done through river dredging and underwater mining. This is where gravel was extracted from the bottom of rivers and sometimes on a larger scale in deeper waters. This process was effective in accessing high-quality gravel and requires special equipment as the practice was a bit more complex. It has however been recorded that in Lesotho, gravel deposits were limited in rivers. Gravel hawass been visible in subdued locations that were prone to erosion. [17] In Lesotho gravel was mostly extracted from Mountains. The use of heavy machinery was required as mountain rocks were hard to break down. Basotho miners drilled through the rocks to excavate the gravel and also used excavators and bulldozers in the process. Although not regular with artisanal sand miners, big companies were known to use explosives in extracting gravel from

[16] Interview with Matseliso Ranooe, 10 February, 2024
[17] F. Jaggie, UNDP report on Project Lesotho 73-021-exploration for minerals, Phase 2, *Department of mines and Geology*, 1981.

mountains. The gravel was then transported to depots for refinement. This is where impurities found in gravel were separated depending on the grade. This was done through screening and washing.[18]

3.3 Quarry Mining

"Quarry"[19] mining encompasses the extraction of sand, gravel, stone and other raw materials from the earth. The sizes of quarry sites differ depending on the activity ranging from small to large. Where miners were extracting for commercial purposes, these pits were often massive as operations required large quantities of output. Often where crushed stone and minerals were extracted, the quarry tended to be large. Their role in the development of a country was primarily to supply raw materials for construction purposes even though without proper management these pits had adverse environmental impacts. About this study, quarry mining entails the harvesting of sand, gravel and crushed stone from the ground which were essential for the construction of buildings, roads and bridges.

Quarrying in Lesotho involved the allocation of a site that wemt through the EIA process before it was permitted to start operations. Along the Mohokare River at the Arrival Center, a site was selected before extraction could take place and a mining license was issued. Site selection determined the quantity of the material required and how it was to boost the economy once it was been extracted. When the miner was permitted to start work on the site, they starterd clearing a path to access the resource from the river by placing their plant in the river and making piles of sand which were later processed to yield various sizes and grades of the sand. River Sand Quarries located at the extraction site of sand, usually along the riverbed. This is where sand

[18] Interview with Lerotholi Ts'ella, Manager at TRS Company, Maseru, 06th February, 2024

[19] Quarry is simply defined by the oxford dictionary as a large open pit site where natural resources like sand, gravel and stone are extracted from or have been harvested from. Some miners often relate quarry to the actual process of extracting raw materials from the surface.

was extracted and processed with the use of simple tools or as was evident from the 60s, the use of heavy machinery like excavators.[20]

Figure 1: Sand quarry along Mohokare River

Crushed Stone quarries involved the extraction of large rocks from the earth through the use of heavy machinery and explosives to access crushed smaller pieces and/or aggregates. This activity was done to obtain the stone for sales purposes. A more detailed description of the process of crushed stone will be included in section 4.5 below. In these quarries, rocks were blasted with explosives to unearth the material which was processed through crushers and screens where they were later sorted into different sizes. Demand for stone determined the size of the pit operated on and in this case, concerns over the environment and the community determined the operations of these mines. Where the community was not satisfied, the operation stopped.[21]

[20] Interview with Thabang Moqoko, Chairman of Concrete and Aggregates Association of Lesotho, Maseru, 20th March, 2024
[21] Interview with Lerotholi Ts'ella, Manager at TRS Company, Maseru, 06th February, 2024

Figure 2: Crushed Stone quarry mine along Phuthiatsana River

Regulatory bodies like the Ministry of Environment and the Ministry of Mining regulated that all mining companies undergo a rehabilitation process after extraction was completed. These included filling the extraction area and replanting vegetation. This allowed the site to regain its natural façade as much as possible.[22] However, quarries had environmental considerations that needed to be looked into and these will be discussed in detail in Chapter 4. Significantly, quarries played a minor role in the development of the community as residents were sometimes employed to work on these quarries. However, only a limited number of residents got absorbed by these mining companies as their operations required more machines than human labour.[23] Furthermore, the machines used in these mines required qualified personnel to operate them and the residents did not hold such qualifications thus eliminating them from job opportunities.[24] The role these mining companies played in the economy was mediocre. However, its biggest role stemed from

[22] Interview with Ishmael Khalema , Geologist at Ministry of Mining, Maseru, 30th November, 2023
[23] Montoeli A. Rantlo, "The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija." *Merit Research Journals*, *Vol. 7, no. 8* (2019).
[24] Interview with Lerotholi Ts'ella, Manager at TRS Compnay, Maseru, 06th February, 2024

the provision of materials for construction and infrastructure in the country even though there was no balance between the environmental impacts and economic growth.

3.4 Crushed Stone Mining

The rivers of Lesotho were a home for Crushed stone mining. The river that was most prominent for crushed stone mining in Maseru was the Phuthiatsana River which crosses along the Tikoe village.[25] Phuthiatsana River is a small river in Lesotho that feeds the Metolong dam and flows through the northwestern parts of the Mountain Kingdom of Lesotho. This river was an important source of water for local communities that live nearby.[26] Crushed stone mining was an activity that encompassed the extraction of rock from the earth's surface.[27] The purpose of extracting crushed stone was to acquire aggregates that are necessary for construction. This industry has existed in Lesotho for decades and one prominent aggregate company that drew from this river was the Tikoe River Stone Mining Company which extracted an unknown amount of stone as it has existed since late 2012.[28] A more detailed description of crushed stone mining will be evident.

In Lesotho, the 1980s saw a boost in the aggregates mining industry with one of the pioneering Crusher Stone Companies being the Morali Crusher located in Maseru Morija. This company was founded in 1981 to develop infrastructure while at the same time improving communities and safeguarding the environment it operated within.[29] There were factors involved in the advent of

[25] Motlatsi Maliehe and Deogratias Mulungu. "Assessment of water availability for competing uses using SWAT and WEAP in South Phuthiatsana catchment, Lesotho." *Physics and Chemistry of the Earth, Parts A/B/C* 100 (2017): 305-316.
[26] Thabang Sekamane, W. A. J. Nel, Tracey McKay, and Henry Bikwibili Tantoh. "Community perceptions of the social impacts of the Metolong Dam and Reservoir in Lesotho." *Land Use Policy* 125 (2023): 106495.
[27] Eyo C. Ukpong., "Environmental impact of aggregate mining of crush rock industry in Akamkpa local government area of cross river state." *Nigerian journal of technology,* Vol.31, No. 2, 2012.
[28] Motlatsi Maliehe and Deogratias Mulungu, "Assessment of water availability for competing uses using SWAT and WEAP in South Phuthiatsana catchment, Lesotho." *Physics and Chemistry of the Earth, Parts A/B/C* 100 (2017): p.311
[29] Moradi Crushers. "Home." Moradi Crushers. Accessed April 13, 2024.http://moradicrushers.co.ls?

crushed stone mining. These included the preparation of the mining site. Crashed stone mining required miners to undergo planning and surveillance of the site. Rightfully, the vegetation and topsoil from the site were supposed to be removed from the ground and preserved to be used in the future when the mining companies apply reclamation processes. In Lesotho, most mining companies underwent EIA to determine the extremities of the activity. When extracting, it was known that the rock extracted to make crushed stone was always harvested from quarries and crushed into different proportions subjective to what it will later be used for.

The extraction of Crushed Stone in Lesotho was done through drilling of the rocks.[30] The drilling process encompassed forming holes in the ground where there were rocks and filling those rocks with explosives.[31] Miners further inserted explosives in the holes blasting the rocks from the surface[32] thus creating smaller pieces that were easy to manage.[33] Furthermore, once the blasting was done, excavation resumed from the loosened rock through the use of heavy machinery.[34] The heavy machinery that was utilized in extracting rocks after blasts are loaders (TLB) bulldozers which eased loading on the trucks and then transfered the necessary rocks to the crushing site.[35] The process of crushing stone extracted from rock particles required miners to screen and wash the rocks. The reason behind screening and washing was to determine the size of the rocks and their uses at the same time reducing the dust particles produced during the crushing process of the rocks. The crushed was then transported to the depot where it was kept to be sold to consumers.

[30] Interview with Marets'elisitsoe Lekhooa .Office Manager at TRS company, Maseru, 06th February 2024
[31]Eyo C. Ukpong., "Environmental impact of aggregate mining of crush rock industry in Akamkpa local government area of cross river state." *Nigerian journal of technology,* Vol. 31, No. 2, 2012
[32] Interview with Marets'elisitsoe Lekhooa, Maseru 06 February 2024
[33] Interview with Thabang Moqoko, 20 March, 2024
[34] Interview with Marets'elisitsoe Lekhooa, Maseru, 06 February 2024
[35] Interview with Marets'elisitsoe Lekhooa, Maseru, 06 February 2024

Before the use of heavy machinery, the miners gathered women from the villages to crush stones. This manual crashing of stone was done through the use of simple tools like chisels and hammers. The stone was crushed into smaller pieces depending on the desired texture. To retrieve the best quality, the miners then used a sifter to sieve the stone to attain different samples of stone and this was done after the stone was cleaned with river water. This activity was done along the river banks where they could access water which assisted in managing dust particles from the rocks. To get the tiniest pieces from the stone, the women used "ts'iloane"[36] to break down the stone. Through this method, residents were able to cater for their needs as they were paid after this process.[37] The crushed stone was then transported to the villages where it was either used or sold for landscaping or for building houses using wheelbarrows or tractors depending on the quantity extracted.

The Tikoe mines are located very close to the villages of Ha Tikoe and Ha Ramorakane. The mine brought about infrastructural development in these communities. A road made from the crashed stone extracted from the mine was constructed that enable villagers to travel. The village did not have water before the mine went into operation but as it stands, the village draws water that was brought by the mine. Furthermore, after the mine started operation in 2012, the village was electrified and this came as a Social Responsibility of the mines.[38] Equally, the Morija crushed stone mine was one of the mines that brought about infrastructural development to its community. Through the mine, there was electrification in the village and there was the connection of running water.[39] However, some community members dispute the fact that these improvements

[36] Ts'iloane is a small stone used for milling in households to turn maize into maize meal, "Interview with Matseliso Ranooe, Village Nurse, Ha Hoohlo, 10 February, 2024."
[37] Interview with Thabang Mokoqo, 20 March, 2024
[38] Interview with Lerotholi Ts'ella, 6 February, 2024.
[39] Montoeli A. Rantlo, "The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija." *Merit Research Journals, Vol. 7, no. 8* (2019).

were brought about by the mines. The community of Tikoe Mine indicated that these developments were brought about by the local government council[40] while in Morija government councils indicated that these developments were part and parcel of the government policies.[41]

3.5 Sand Mining Associations

Within sand mining, there was involvement by associations which oversee mining practices. These various associations endorse sustainable activities in sand mining and extend to ensure miners conformed to the regulations stipulated in Lesotho. Furthermore, these associations promoted proper research for sand mining activity to take off smoothly. Often, many of these associations embody the welfare of the sand mining industry and environmental conservation as a result they can be international, national or local. The role of associations was extremely crucial as they further liaison between the community and the miners, further having an advisory input in market dynamics. In the context of sand mining, there were different types of associations including industrial, environmental, community and regulatory groups that specialized depending on their role while others embody all these factors.

The sand mining industry in Lesotho currently operates with one association the Concrete and Aggregate Association of Lesotho which started operations by law in 2023. Before the association, miners often grouped themselves to voice out their grievances but these complaints were seldom taken into account as they had no law to stand on. The law that governed operations of sand miners were not responsive to the needs of the miners hence the need for them to form this association. The role of the association was to set regulatory frameworks that governed aggregate miners and their

[40] Interview with Habofanoe , Ha Tikoe, 06th February, 2024.
[41]Montoeli A. Rantlo, "The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija." *Merit Research Journals*, *Vol. 7, no. 8* (2019).

operations and to review laws set for the miners by the government of Lesotho. The role of the mining industry was to institute the best mining practices that correlated with the standard of the aggregate industry to attain a balance between economic growth and environmental protection. As much as the association advocated for advantageous regulations, it also wished to address issues relating to responsible mining. The association created awareness of policies presented by the government and also has representations in aggregate mining sittings by the government. In these meetings, the miners' representation addressed issues that determine the development of the industry and the role it played in the economy while also voicing out the challenges it faces.[42] On the 16th of August at 'The Manthabiseng Convention Centre, a meeting was called to address issues relating to aggregate miners.

According to the report by the newspaper, the meeting was an initiative by the Ministries of Natural Resources, Local government and the Prime Minister's office[43] however, the meeting was orchestrated by the Concrete and Aggregates Association of Lesotho. Through this event, the association sought to create a platform for Basotho in the industry and those who wish to start operations to voice out their concerns and also have an insight into how the regulations work. [44] In this meeting, miners shared information on their operations and challenges with the government and got an insight into the laws that govern their operations. The role of the association was not only limited to overseeing operations but extended to ensuring that compliance was met by members of the association. When it came to penalties for misconduct, the association had no issue presented to its offices and was aware of grievances that were made as a result of the operations of other miners.

[42] Interview with Thabamg Mokoqo,, 20 March, 2024
[43]The Post Newspaper. "Mine has gone rogue, say villagers." 16 November, 2021
[44] Interview with Thabang Mokoqo, 20 March, 2024

The association faced challenges from illegal miners. Illegal miners tended to operate on sites that were set for other miners thus creating conflict between them and communities and licensed miners. Illegal miners opted to operate unlawfully because of their inability to meet the set regulations by the government and their desire to meet the high demand for sand as they were bound to lose revenue if they opted out of operation. This then created environmental degradation and loss of revenue for the government as there were no records of such incomes. The role of the association was to negotiate on behalf of miners with the community council/associations on a way they can relate with each other to combat the adversarial impacts of sand mining. They further served as conflict managers to create a safe work relationship between the two parties. Furthermore, this association like many others served as a channel between all three bodies the miners, the communities and the government of Lesotho. Through this liaison, the association promoted justifiable mining practices which met the socio-economic and environmental concerns. Nevertheless, the association could not singlehandedly address the effectiveness of policies but could only influence the governing bodies to include some of their ideas. The rate at which the association was effective depended on the capacity it held to balance economic development and environmental sustainability.[45] International associations like the National Stone Sand and Gravel Association addressed the environmental impacts of sand mining and further advocates for a review of regulations that governed the activity also looking at the extent to which mitigation was enforced.[46]

[45] Interview with Thabang Mokoqo, 20 March, 2024
[46] NSSGA. "Home." National Stone, Sand & Gravel Association. Accessed July 11, 2024. https://www.nssga.org/

Chapter Four: Environmental Impacts of Aggregate Mining

4.1 Aggregate Mining and Farmlands

It has been shown in various researches that sand as an aggregate extracted from the surface hurts land use and productivity. The identified scope of sand mining remains biased towards the socio-economic benefits of developing Lesotho. The mining of sand was carried out using an open-cast method using heavy machinery and trucks, heavily impacting the ground in the process. This inevitably caused a range of impacts on the physical environment in the site area. While being a generic and uncontrived term, 'physical environment' referred to the earth's landscape and the natural processes by which features were created, according to the Natural Resources and Environment Department (NRED).[1] This included the atmospheric system, weather, landforms, vegetation, and animal life. Impacts were characterized as either being positive or negative and as having short or long-term effects. This was important as an understanding of the timing of impacts helped in effectively planning strategies to avoid or ameliorate harmful effects, and was also used as a comparative tool between the predicted impact and actual impact after observation. Due to an abstract understanding of the complexity and interactions of environmental systems, the prediction of long-term impacts will be in most cases a general hypothesis.

Agriculture was a very important aspect in the development of Lesotho and most countries because it provided a platform for economic production. Agriculture was for centuries remained the backbone of the economic development of Lesotho through the provision of food and raw materials and at the same time was been prone to environmental impacts. This research focuses on the impact of aggregate mining on agricultural land. There were various methods of

[1] Andrew Goudie *Human impact on the natural environment*. John Wiley & Sons, 2018.

extracting aggregates from the surface and these included the use of heavy machinery to open pits, as was mentioned in Chapter 3. Sand as a type of aggregate was extracted for many centuries and up to the present day, it is still being done on either a large or small scale. The extraction of aggregate the Earth was a very profitable activity and was also considered very valuable because it was a resource that was very useful to human needs.[2] This activity had serious consequences for the environment, and in the long term, it affected the economy.

Sand mining activities as mentioned in Chapter 3 included removing top soils and vegetation from the ground which resulted in soil erosion. When the vegetation on land is removed, the fertility of farmland is reduced as manure is washed away which makes it less suitable.[3] In most instances, it was well known that farmlands in Lesotho comprised Indigenous vegetation like seruoe, leshoabe, and hloenya, these were lost when mining started operation rendering the land useless for sustaining the basic needs of communities. The flora along the route where heavy machinery and trucks drove through was threatened as these trucks killed vegetation for they constantly drove along the route making it impossible for the regrowth of these plants. The road leading to the Mohokare River where trucks accessed sand at Lesia was once filled with vegetation. However, through the mining activities, vegetation was no longer evident in this area. During heavy rainfall, the soil got washed away without hindrance as the topsoil and vegetation was removed.[4] Sand mining along the rivers creates a loss of agricultural land.[5] Land to Basotho was the most essential resource since the creation of the Basotho nation. However, mining activities along the Thaba Bosiu River resulted in the loss of land as mining activities tended to

[2] Carvalho, Fernando P. "Mining industry and sustainable development: time for change." *Food and Energy security* 6, no. 2 (2017): 61-77.
[3] Interview with Matseliso Ranooe on 10 February 2024
[4] Interview with Mathato Monts'i, Lesia, 06 February2024
[5] Eline S. Rentier and Erik L. H. Cammeraat, "The Environmental Impacts of River Sand Mining," *Science of The Total Environment* 838 (2022).

result in farm slides as the rivers widened due to mining activities. The loss of agricultural land affected some residents as food production decreased thus affecting residents' ability to sustain their lives.[6] Not only was agricultural land affected by sand mining but also businesses situated along the rivers. Businesses along the Mohokare River in Florida lost most of their land due to suspicions of river sand mining activities which continued to widen the size of the river.

Agricultural production required the presence of groundwater for output to be profitable.[7] Sand mining, however, altered the balance of water in some fields as they depended heavily on water to attain cash crops. The depletion of groundwater due to sand mining activities made irrigation impossible thus hindering agricultural production. It was evident that along the Mohokare River, sand mining activities invited littering which resulted in water contamination as these pollutants were washed away into the river during heavy rainfall. Livestock and crop production from the South African side of the river had the potential to be affected by the polluted water. Also, oil leakages from machinery used as excavators leaked into the river water affecting durability in fertilizing agricultural land. [8] This led to reduced crop yields and in some cases, though not recorded lead to health problems for both farmers and consumers.

[6] Interview with Thabang Mokoqo, 20 March 2024
[7] Thandiwe Annastacia Mpala, and Mulala Danny Simatele. "Climate-smart agricultural practices among rural farmers in Masvingo district of Zimbabwe: perspectives on the mitigation strategies to drought and water scarcity for improved crop production." *Frontiers in Sustainable Food Systems* 7 (2024): 1298908.
[8] Interview with Malisemelo Fako, 11th April, 2024

Figure 3: Renoka raises concern over oil leakages in rivers

Furthermore, activities by The Southern Sky mine in Nazareth posed hazardous impacts on both the community and their animals. The grazing land for their animals was degraded making it impossible for their animals to feed from these pastures.[9] Aggregate mining sometimes disturbed ecosystems and habitats which resulted in loss of biodiversity. Equally, agrarian land near mining sites experienced degenerations in pollinator populations and soil fertility, all of which were essential for maintaining healthy crop yields. This created a shortage of crops for feeding animals. The disturbance of natural drainage systems caused by aggregate mining and in some countries resulted in flooding.[10] These floods drowned crops making it difficult for them to grow. Furthermore, sand mining operations caused waterlogging in neighbouring farmlands ultimately reducing agricultural productivity. Although no report was made in Lesotho, there were high risks that without proper management, aggregate mining may end up creating such issues for the country's agricultural sector. In agriculture, the extraction of crushed stone degraded the

[9] Liapeng Raliengoane, "Qoo visits Nazareth community over quarry grievances", Informative Newspaper, 18 May, 2021

[10] Selasi Kofi Attipoe, "An assessment of flood mitigation measures in Accra, Ghana." PhD diss., 2015.

quality of air for farmlands near the Phuthiatsane River. Airborne impurities settled on yields weakening the process of photosynthesis and eventually decreasing crop production.[11] Generally, the increasing impacts of aggregate mining on agricultural land were severe as this activity threatened food security and livelihoods extending to failure to achieve environmental sustainability in Lesotho.

4.2 Water Resources and Ecosystem

Water resources are natural environments that provide water that assists in the everyday activities of people. These sources are rivers, reservoirs, and springs that store water for drinking, agricultural production, and environmental protection.[12] The management of these sources were of great importance as it guaranteed long-term use for the development of growing communities.[13] The management of water resources in sand mining lay in the implementation of policies and regulations that sought to maintain the good quality of water and allowed for fair access to water for business and personal use.[14] Sand mining in Lesotho was extracted from rivers and this phenomenon affected water resources in different ways. When dealing with water resources, it was inevitable to separate it from the ecosystem. Ecosystems were communities of plants, animals, water, and soil to mention a few, that interacted together within the environment. Plants and animals survived on water resources and soil and water were found in water resources. Human activities, such as sand mining and pollution were deemed as factors that were most prominent in the disruption of ecosystems and the quality of water resources. Sand mining activities continuously disrupted the flow of water in the rivers of Lesotho. This led to the loss

[11] Interview with Puleng Makotoko from Temong on 05 May 2024
[12] Interview with Malisemelo Fako, 11 April, 2024
[13] Norbert Edomah, "Rural electrification in Africa: a case study of Yebu community solar minigrid." *Environmental Research: Infrastructure and Sustainability* 2, no. 4 (2022): 045001.
[14] Interview with Malisemelo Fako, 11 April, 2024

of water quality. Sand mining disrupted water flow and led to sedimentation, affecting water quality by increasing the dirt found in water due to pollutants thus reducing the oxygen levels in water. This is where one found that in most sand mining sites, there was little to no life and this water was not ideal for drinking and agricultural purposes. Sand mining activities suffocated aquatic life because of this sedimentation. Because water lost its clear colour, light did not pass through to feed the water ecosystems and this killed many organisms while others migrated to clearer waters. Furthermore, the submerged vegetation which relied on light for growth was unable to develop because of the increased levels of turbidity.[15]

Furthermore, the removal of sand from riverbeds altered the flow of water. Miners often extract the sand until there was no soil left to meet the demands for sand and this indeed affected river flows. Extreme mining activities depleted groundwater reserves. Communities were usually at the end of the harsh outcomes of mining activities as they lacked drinking water and water for irrigation purposes. Moreover, the loss of soil lefts nothing to trap water, and soil during heavy rain falls as the water eroded even the little soil.[16] This then increased the risks of flooding which often had adverse impacts as bridges and roads were destroyed due to the force of the water. [17] In rivers where mining was most dominant like the Mohokare River and Phuthiatsana Rivers, fishermen left these areas because there were no fish available for them. Because sand mining involves removing large quantities of soil, this destroyed habitats for fauna and flora. When the water lost its quality, it also lost recreational benefits and the traditional practices in rivers were affected especially for traditional healers.[18]

[15] Interview with Dr. Tshuma, Lecturer, Department of Geography at National University of Lesotho
[16] Interview with Thabang Mokoqo, 20 March 2024
[17] Interview with Dr. Tshuma, Lecturer, Department of Geography form National University of Lesotho
[18] Interview with Mathato Mont'si, 16 March 2024

In Morija, water was for a very long time a significant resource for residents. This is because water was in the domestic upholding of households at the same time in their agricultural practices which they accessed from the river which the Moradi Crashers mine operated along.[19] Most miners and community members conflicted over water resources as residents averred that mining activities diluted their springs while others dried up due to changes in water flows emanating from sand mining. Miners contended that they did not find any water resources within these communities, that instead they availed water to the community as part of their social responsibility.[20] Sand mining wielded significant pressure on water resources and ecosystems. The relationship between sand mining and water sources highlighted the importance of sustainable management of this activity to safeguard water and ecosystems at the same time ensuring that these natural resources were available for decades. Sand mining not only disturbed the river flows but extented to conflict over boundaries in rivers. The measurement of sand mining boundaries between RSA and Lesotho through the Mohokare River sparked concerns over the sand restrictions. Most illegal miners went over the mining confines and extracted sand on the site designated as a South African site. The boundaries of sand mining were not measured right in the middle of the river to determine the South African and Lesotho sides but through sections. When mining was done on the portion of the river designated for RSA conflict was bound to arise for both countries.[21]

4.3 Soil Erosion and Degradation

The removal of soil from one place to another is soil erosion. This removal of soil is through

[19] Montoeli A Rantlo. The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija," Merit Research Journals 7, no. 8 (2019): 91-97.
[20] Interview with Marets'elisitse on 06 February 2024
[21] Interview with Thabang Mokoqo, 20 March 2024
[22] Kate Showers, "Soil erosion in the kingdom of Lesotho and development of historical environmental impact assessment." *Ecological Applications* 6, no. 2 (1996): 653-664.

water and activities by humans in the environment.[22] Sand harvesting activities exacerbated the process of soil erosion which in turn produced extreme consequences. As mentioned in 4.2, sand mining altered the natural flow of rivers and this led to increased erosion in the Mohokare River and that of adjacent land. This not only led to loss of land but extended to loss of property where some yields from land were also lost.[23] For countries like Sri Lanka, mining activities resulted in landslides. When the landscapes were altered, slopes were eroded when there were heavy rains as the sand that strengthened the land was removed in large quantities. Similarly, sand mining required the removal of vegetation for extraction to commence and this made the land prone to erosion as vegetation meant to bind the soil was removed making the area prone to landslides.[24]

Mining operations degraded the environment as unwanted materials were dumped on rivers and as the land became overburdened with pollutants it resulted in slides where these materials were deposited into rivers ultimately reducing the quality of water.[25] The Mohokare riverbank was prone to littering and garbage was disposed around this area and this was happening for years. [26] This happened because sand mining activities opened a route for people to dump garbage along the river. When miners started operations, they opened a road that made it easier for them to access the river and usually these areas were located where people would barely access. But with the new roads being carved, people tended to dump their waste at these sites or even in the river. The picture below shows the state in which the Mohokare river banks are degraded in the Bambatha area. When there were heavy rainfalls, the waste was washed away into the river further degrading the Caledon River.

[23] Interview with Mahola Moiketsi on 06 February 2024
[24] Chandra B. Dissanayake., and M. S. Rupasinghe. "Environmental impact of mining, erosion and sedimentation in Sri Lanka." *International journal of environmental studies,* Vol. 51, no. 1, 35-50, 1996.
[25] Interview with Lehlohonolo Ramarou, Lerotholi Polytechnic on 17 February 2024
[26] Interview with Fumane Hoohlo, Ha Hoohlo, 15 February 2024

The extreme rainfall events evident globally are products of climate change. Aggregate mining intensified these occurrences as it decreased the ability of the surface to absorb water and increased runoff. These runoffs had severe implications like reduced agricultural productivity, infertile soil sedimentation of water bodies, and landslides in countries like Sri Lanka.[27] Dunes are natural fences that combat soil erosion along rivers. The harvesting of sand in rivers weakened these barriers making rivers prone to soil erosion eventually leading to riverbank erosion.[28]

Sand was always a very important component to sediment transportation in the Caledon River, not only in rivers but also in residential areas. The excessive harvesting of sand leds to changes in erosion as it disturbed the balance of sediment. Furthermore, in some rivers like Motubatsana situated in Boleka in the Mafeteng District, residents usually drew water from the rivers during dry seasons when their springs had burnt out. They dug through the sand in the rivers to access water that was filtered by the sand and they used the water for household purposes like

[27] Renuka N. Silva., "Integrated Plant Nutrition Systems Modules for Major Crops and Cropping Systems in Sri Lanka." *Integrated Plant Nutrition System Modules for Major Crops and Cropping Systems in South Asia,* Vol. 176, 2019.
[28] Interview with Lehlohonolo Ramarou from Lerotholi Polytechnic on 17 February 2024

washing laundry and sometimes drinking.[29] However, sand mining activities degraded and washed away the sand limiting the sand that filtered the water. Extreme sand mining from riverbeds depleted groundwater reserves like in springs, resulting in limited water supply for household purposes like drinking and irrigation purposes, especially in places where groundwater was an important source of water.[30]

These activities further altered the river habitats as this disrupted the flora and fauna that depended on these rivers for survival. Southern Sky, a Chinese-owned company, began excavating stones at Ha Ntsi in 2002. Approximately 173 houses were affected by the hazards caused by the quarrying activities.[31] Sand mining can lead to negative social impacts on communities, such as causing distress for people from their homes and land, causing those who rely on natural resources to lose their livelihoods, triggering conflicts over resource access and ownership, and exploiting vulnerable groups, including children and migrant labourers, within the industry.

4.4 Aggregate Mining and Health

Aggregate mining has sprung various environmental issues that have been seen on a global basis. These detrimental effects of sand mining were inclusive of health impacts which were impossible to separate when talking about the environment in Lesotho. These health impacts not only affected those employed within the mines but extented to affect communities nearby. Health implications brought about by aggregate mines were lung and kidney-related problems and others which will be thoroughly explained. While sand mining benefits many industries

[29] Interview with Moeketsi Ranooe of Boleka, Mafeteng on 18 April 2024
[30] Interview with Fumane Hoohlo on 15 February 2024
[31] Liapeng Raliengoane, "Qoo visits Nazareth community over quarry grievances" Informative Newspaper, 18 May 2021

within Lesotho, its health impacts were extreme. Aggregate mining activities generally produced a lot of dust which resulted in respiratory illnesses like asthma, bronchitis, and tuberculosis.[32]

Tikoe communities complained about the health implications emanating from the mine. A female employee of the mine who resided in the Tikoe region was infected with tuberculosis which was a result of the mining activities and eventually lost her life. Furthermore, one member of the community was struggling with asthma sickness which was suspected to come from the movement of loader trucks passing by his yard causing a lot of dust and in turn affected his lungs.[33] The inhalation of crystalline silica dust affected the respiratory system and this dust was said to have been present in sand.[34] The sieving of sand and stone particles released dust that was inhaled by workers especially when they did not follow safety guidelines. Furthermore, a community of Morija asserted that community members had complaints about illnesses like excessive coughing and other respiratory ailments even though they could not subject these diseases as a result of mining activities as only a medical practitioner could confirm these suspicions.[35]

Notwithstanding the implications of sand mining on the air quality, these impacts were evident in noise pollution. Sand mining required the use of heavy advanced machinery like excavators, and TLBs, and extended to the use of explosives in the case of crushed stone and gravel extractions. Noise pollution led to hearing loss and for others stress due to sleepless nights from the

[32] Pascalina Chanda-Kapata,"Public health and mining in East and Southern Africa: A desk review of the evidence." *Zambia Ministry of Health with Training and Research Support Centre in the Regional Network for Equity in Health in East and Southern Africa (EQUINET). EQUINET DISCUSSION PAPER* 121 (2020).
[33] Interview with Ntate Habofanoe of Ha Tikoe, 06 February 2024
[34] Jeffrey Feda, "Biological effects of inhaled hydraulic fracturing sand dust. I. Scope of the investigation." *Toxicology and applied pharmacology* 409 (2020): 115329.
[35] Montoeli A Rantlo. The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of
.

prolonged noise. The Tikoe community stated that the noise started from the minute the alarm that warned of the coming of explosives goes off. This created panic attacks for some community members as the anxiety from the knowledge that the deafening sound of explosives was underway.[36] Sand miners extracted sand from the early hours when communities were still resting and the movement of trucks past the Lesia community that collected sand from the Mohokare Rivers created noise for them.[37] The Matebeleng community further attested to the fact that noise coming from the Tikoe Crushers Stone Mine damaged their hearing.[38]

Aggregate mining disrupted the natural balance of ecosystems and impacted water quality. The disturbance of riverbeds increased sedimentation, altered aquatic habitats and contaminated water sources with pollutants and sediments. Residents of Morija, living near the Morali Stone Mine and Crushers, reported that while water bodies appeared unchanged, they were polluted, particularly by dust from mining blasts. The contamination caused animal diseases and deaths, and adversely affectes agricultural productivity and forcing the community to stop using river water.[39] This shows that the disruption of ecosystems caused by sand mining can indirectly affect human health by impacting biodiversity, fisheries, and other natural resources that communities rely on for their livelihoods and well-being. Regulations on the rehabilitation of quarries in Lesotho were not enforced after mining sites closed. As mentioned in Chapter 3, sand mining flooded and deepened rivers and this threatened the safety of community members. These may have caused animals or residents to drown in these pits if not developed. On 02 October 2024,

[36] Interview with Ntate Habofanoe, 06 February 2024
[37] Interview with 'Mathato Montsi, 09 February 2024
[38] The Post Newspaper. "Mine has gone rogue, say villagers." 16 November, 2021
[39] Montoeli A Rantlo. The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija, " Merit Research Journals 7, no. 8 (2019): 91-97

.

the LMPS underwent a search party for two children aged Fourteen (14) and Nine (9) who drowned in the Qoqolosing dam in Leribe that was formed from the abandoned quarry pit.[40]

Picture by: Lesotho Mounted Police Services

The health impacts of sand mining may not have medical records presented but it was clear from correlating these impacts with other countries that they had adverse implications on the health of communities. The ailments that occurred within communities due to the suspected mining activities had the potential to harm their financial resources as they travelled to doctors seeking medical attention. Health implications created unproductiveness in communities as residents became unable to engage in developmental activities that alleviated them from a poverty-stricken community.

[40] Lesotho Mounted Police report on Facebook on 03 October 2022

4.5 Aggregate Mining and Residential Settlements

More often than not, aggregate mining companies are situated near villages, or on route to access sand, passes through villages. For this research, these settlements are not only limited to structural settlements but extend to political and socio-economic settlements encompassing how the community relates with the different stakeholders involved in sand mining. Sand mining relations matter most because they deal with the livelihoods of communities and the development of the economy of Lesotho through commoditizing this activity. Human activity influences an area from a natural to a humanized environment and correlates the socioeconomic status of the people and type of habitat. This is important because, in most aggregate mining cases in Lesotho, there are detrimental effects on marginalized societies living in rural areas changing the quality of their surroundings.

A residential settlement can be defined as an inhabited place whose boundaries are fixed by a legal or customary agreement, and this includes the occupied area associated with the site.[41] Settlements are the outcome of various overlapping economic, social, and political processes. Settled communities can be very open to outside influences and innovation, often acting as agents of change for the surrounding area.[42] Resource use in settled areas is established and often increases as populations grow and people become increasingly dependent. They are the focal point of the cultural and economic identity of communities on a widening array of material goods. This can lead to increased rates of resource extraction. Settlements are closely tied to governance and the presence of formal or informal government at various levels. This has important implications for

[41] Cherry Leonardi and Martina Santschi. *Dividing Communities in South Sudan and Northern Uganda: boundary disputes and land governance*. Rift Valley Institute, 2016.
[42] Christopher Marquis and Julie Battilana. "Acting globally but thinking locally? The enduring influence of local communities on organizations." *Research in organizational behavior* 29 (2009): 283-302.

the distribution of costs and benefits of resource use and for how changes in resource availability are managed.

Aggregates were crucial to the economic, spiritual, and cultural survival of Basotho and included the viability of settlement sites. However, this often masked inequitable distributions of costs and benefits, often with the environmental impact being borne by the communities living near sand mining sites. The process of extracting aggregates from the surface, especially in the case of crushed stone resulted in dust and noise pollution that impacts communities. The Tikoe village experienced dust sieving of stone from the mining site also the constant movement of trucks along the village to access the aggregate.[43] This dust affected washed laundry that was hung outside of homes to dry as it made them dirty again.[44] Similarly, the residents of this area were faced with too much noise emanating from the mining site as the machinery and explosives used to extract the stone were extremely loud. This not only affected residents but also their animals as the noise became an irritation and disturbed their sleeping patterns and harmony.[45] Residents of Ha Ntsi in Thaba Bosiu were also affected by the noise that came from the Southern Sky mine which posed a threat to their peace and that of their animals.[46] Aggregate mining made it impossible for residents to enjoy their stay in their houses and they were constantly stressed by what to expect and nursing their illnesses from the dust.

When choosing a site to build on, the residents of Lesia were hoping for a harmonious environment where there was no traffic congestion. However, the constant movement of heavy machinery and trucks used to access the Mohokare River where aggregate was extracted, increased movement

[43] Interview with ntate Habofanoe, on 06 February 2024
[44] The Reporter. "Quarry Mine Pollution Uproar." 25 March, 2019
[45] Interview with Ntate Habofanoe, on 06 February 2024
[46] Liapeng Raliengoane," Qoo visits Nazareth community over quarry grievances", Informative Newspaper, 18 May 2021

on the road and made it risky for residents to move about freely due to the fear of accidents that may occur. The congestion on these roads also made homeowners who sought healthier lifestyles unable to go for walks or jogging along those roads thus reducing the quality of their lives.[47] As has been observed through conducting interviews at Ha Tikoe, the continuous movement of trucks along the village made moving around the village stressful as there were fears of being run over. The stress extended to worries over trucks losing control and crashing into residential settlements.

As mentioned in section 4.3, aggregate mining causes water pollution. The presence of the Tikoe River Stones Pty Ltd mining activities contaminated the village water streams and this affected the availability of clean water for residential use. This forced villages to rely on water pumped by the mine yet it was the one that made water unavailable in the first place. Furthermore, aggregate mining altered landscapes due to the extraction that took place. Mining processes required the use of a great amount of water as it suppressed dust, and this sometimes led to the depletion of groundwater resources thus affecting the availability of water meant for residential and agricultural use.[48] Residents feared that complimentary to the loss of clean water, aggregate mining reduced the value of property either for sale or for rental as residential sites lose their aestheticism.[49] Buyers and renters are drawn to an area to stay based on the amenities available in the area and the overall view of the area. Where aggregate mining is involved, potential buyers and renters were turned away by the unavailability of water, and electricity and also by the harmony in the area which often aggregate mining did not offer.

Furthermore, the most controversial impacts of aggregate mining in Lesotho lay in residential

[47] Interview with Mopeli from Lesia on 07 February 2024
[48] Interview with Marets'elisitsoe on 06 February 2024
[49] Interview with Habofanoe on 06 February 2024

damages. The vibrations from blasting and the constant movement of heavy trucks along the road that passed through villages caused structural damage to nearby residential buildings. The Tikoe village is very close to the mining site so residents' houses were affected by the blasts from the mine as these blasts resulted in cracks and shifts in the foundations of houses. In 2019, blasts from the mine Tikoe created a shift in the foundation of the house where an object can be inserted between the wall and the floor.[50] Furthermore, Masowe 3 residents grieved that the Tikoe mine operations created cracks in their walls and windows and that their houses were gradually giving into the blasts.[51] These damages to property due to aggregate mining required repairs from homeowners which in turn become costly further hindering their progress economically as they were constantly fixing the damages.

Picture: Structure affected by aggregate mining at Ha Tikoe

Furthermore, Semphuroaneng communities in Morija also claimed that the Morali Crushers

[50] Interview with Habofanoe on 06 February 2024
[51]'Marafaele Mohloboli, "Thabane dragged into quarry mine, residents clash", Lesotho Times, 06 September 2019

stone mine disrupted their lives as their houses were continuously patched to stop them from cracking and this was done without much success as blasts are frequent.[52] Ha Ntsi communities in Nazareth also had similar cries over aggregate mines. They indicated that it was disheartening watching their houses which have fallen while others have cracked walls and their windows broken.[53] The impacts of aggregate mining lay in the fact that it caused community disruption. Mining activities near residential areas often created conflict among community members. This was evident when some members of the community were compensated while others were looked over. The chief was often the one caught between the community and the mining company as he faced backlash from the community.[54] Some community members claimed that funds from the mining companies that were meant for community development were embezzled by community councils and did not respond to resuscitating the shelters.[55] When funds are not used accordingly, the mining company becomes at risk of facing allegations of not complying with its social responsibility. Some members of the community claimed that aggregate mining impacts prevailed because government officials were involved in the ownership of these mining companies so their grievances were not responded to.[56]

Lesotho is a country that is still in touch with its traditional lifestyle. Its landscapes are said to still be untouched. However, the activities of aggregate mining play a huge role in the loss of cultural sites. The landscapes and cultural sites of Lesotho form the roots of traditional practices and sand extraction in rivers disrupts these sites as some are sacred areas. Aggregate mining in this regard undermines the heritage of residents and also weakens cultural identity. Furthermore, the rivers

[52] The Reporter. “Quarry Mine Pollution Uproar.” 25 March, 2019
[53]Liapeng Raliengoane , “Qoo visits Nazareth community over quarry grievances”, Informative Newspaper, 18 May, 2021
[54] Interview with Chief Koenane Matsoso, Ha Tikoe on 06 February 2024
[55] The Reporter. “Quarry Mine Pollution Uproar.” 25 March, 2019
[56] Interview with Mosito, Masowe 3, 06 February 2024

and mountains of Lesotho were known to be a prayer ground for Basotho. As a traditional society, Basotho were very much in tune with their spiritual beliefs, and extraction of aggregate from these sites vandalized their natural landscapes thus resulting in loss of spiritual connections of residents.[57] This was seen in the case where a traditional doctor had his sacred prayer site in the river where he prayed to his ancestors for healing strength. This was then disrupted by sand mining activity around this area.

Indigenous knowledge system[58] was at the core of traditional societies and this system was not foreign to Lesotho. "A distinctive feature of indigenous responses to dispossession and environmental degradation is the claim of "culture loss."[59] This is simply explained in that traditional practices were usually passed down to younger generations verbally based on the indigenous knowledge of the environment and the natural resources found within the surface. Aggregate mining altered ecosystems thus causing a decline in local knowledge and further making traditional practices unsustainable.

[57] Interview with Matseliso Ranooe, 10 February 2024
[58] Indigenous knowledge systems (IKS) are rich, multifaceted bodies of information and practices that are rooted in cultural and historical frameworks also encompassing environmental contexts. IKS are created and kept to be passed down from one generation to the other by local communities. See. *Jacob Mapara "Indigenous knowledge systems in Zimbabwe: Juxtaposing postcolonial theory." Journal of Pan African Studies 3, no. 1 (2009).*
[59] Qian Zhu. *River-Sand Mining: An Ethnography of Resource Conflict in China*. Vol. 45. Brill, 2022.

Chapter Five: Responses of Stakeholders to the Environmental Impacts

5.1 Government Interventions

The government of Lesotho implemented various measures to regulate and support the aggregate mining industry due to its importance to the economy and infrastructure development. These measures included legislative frameworks and regulatory bodies. The main legislation governing mining activities in Lesotho, including aggregate mining, was the Mining and Minerals Act 2005. This act specified the requirements for obtaining mining licenses, which included having an adequate prospecting program that made proper provisions for environmental protection. Additionally, it outlined the responsibilities of mining companies to ensure safe excavations during their prospecting operations to the satisfaction of the commissioner and the authority.[1]

The Government of Lesotho emphasized environmental considerations in mining projects. Before any project began, a comprehensive Environmental Impact Assessment (EIA) was required, which included an environmental plan for sand miners. This assessment identified potential environmental impacts and proposed mitigation measures. Lesotho implemented several laws to safeguard the environment, such as the Environment Act 2008, which required the sustainable use of natural resources and environmental protection. Sand mining, a form of aggregate mining, can cause water pollution; therefore, the government, along with stakeholders like ReNOKA, started working on enforcing regulations to prevent contamination of water bodies.[2] Additionally, companies were to use water efficiently and ensure their activities did not impact the water supply for local communities. Aggregate mining operations produced dust that affected air quality, so the government enforced regulations to control dust emissions by using water sprays

[1] Mines and Minerals Act 2005.
[2] Interview with Mme Malisema Fako, Engineer at ReNOKA, Maseru, 24th April 2024

and other dust suppression methods. The Tikoe mine started spraying water on the road three times a day to combat dust emissions.[3]

The government supported community engagement in areas affected by aggregate mining. They recommended that mining companies hold regular meetings with the community to explain their projects and gather feedback. However, the Ha Tsiame community reported that mining companies rarely held these meetings, and this issue persisted because the government did not monitor the frequency of these gatherings.[4] This then did not allow the community to voice out their distresses. It prohibited them from asking pressing questions and advice on the operations of the mine.[5] Furthermore, the government advised that the aggregate mining companies take priority to hire the community surrounding the mining site while at the same time providing training and employment opportunities.[6] The community was given priority when there was a vacant space available but when there was no qualified individual in the community, they sought labour outside the village.[7]

In addition to creating employment, the government's role in aggregate mining included generating revenue through taxes, royalties, and licensing fees. These funds were essential for national development projects and included a rehabilitation budget. Aggregate mining also supported infrastructure projects within Lesotho, including road construction, building projects, and other civil engineering works. The availability of local aggregates helps lower construction costs and fostered economic growth.[8] The concrete used for the road leading from the Tikoe bus

[3] Interview with Marets'elisitsoe, Tikoe River Stone Mine, Ha Tikoe, 06th February 2024.
[4] Interview with Chief Koenane Matsoso, Ha Tikoe, 06th February 2024
[5] Interview with Habofanoe, Ha Tikoe, 06th February 2024
[6] Interview with Thabang Nkoko, Ministry of Mining, Maseru, November 2023
[7] Interview with Marets'elisitsooe, Tikoes Mine, Ha Tikoe, 06th February 2024
[8] Moeketsi Boniface Matli, "The social impacts of a large development project: the Lesotho Highlands Water Project." (2005).

stop to the village was taken from the mine and the resources used in the construction belonged to the mine. However, the residents argued that the road only led to the mining site and did not serve all members of the community.[9] Moreover, the presence of the mine introduced water sources within the Tikoe region.[10] The government encouraged community engagement in aggregate mining to promote cooperation, ensuring that mining activities benefit local communities while reducing negative effects. Prioritizing open communication, social responsibility, and environmental stewardship allowed mining companies to cultivate constructive relationships with the communities in their environment.

The government encountered difficulties with illegal mining operations, resulting in environmental harm and revenue loss. Initially, sand miners operated without registering with the Ministry of Environment, extracting sand from rivers. However, following a meeting at the Manthabiseng Convention Centre, the Ministry conducted inspections to locate sand miners and urged them to undergo an Environmental Impact Assessment (EIA) or develop an environmental plan, particularly for small-scale operations.[11] These efforts were made to enhance monitoring and enforcement to curb illegal operations and the environmental impacts of aggregate mining. The government of Lesotho was pivotal in overseeing and promoting the aggregate mining sector. By implementing laws, regulatory frameworks, environmental safeguards, and community involvement, the government sought to ensure that mining operations contribute positively to national development while mitigating adverse environmental effects. Ongoing enhancements in regulations and sustainable mining practices were crucial for the industry's sustained advancement.

[9] Interview with Mme Makhele, Ha Tsiame, 06th February 2024
[10] Interview with Marets'elisitsie, Tikoe Mine, Ha tikoe, 06th February 2024
[11] Interview with Lipalesa Malebese, Environmentalist, Maseru, 21st June 2024

The Ministry of Environment together with the Ministry of Natural Resource shut down operations of the Tikoe Mine as their operations were not conducive to the environment and the community of Matebeleng, Ha Tsiame and Masowe 3. The Department of Environment conducted inspections at the mine, leading to its shutdown due to concerns about fly rocks potentially landing in the river, as well as vibrations, loud noises, and dust emissions during blasting. Additionally, the project significantly altered the site's natural drainage patterns and underground water systems. They also noted that dust and noise from the mine negatively affected residents, their properties, and the overall environment. They emphasized that the environmental and health impacts of aggregate mining had serious negative consequences especially if not addressed. [12] The mine later on got conditional clearance to start operations.

Similarly, the Mining Engineer at the Department of Mines stated that his department conducted regular inspections of the mine and recommended that the mine use water to reduce the dust generated by the quarry. This came about because of grievances from the Semphuroaneng community affected by the Moradi Crushers Mine. They argued that the mine should have at least warned them before blasting so they could prepare. They added that the explosive sound caused panic among young children, the elderly, and their domestic animals. Moradi Mine caused numerous problems for residents by failing to notify them in advance about the blasting. Some residents, although lacking a confirmed case of Tuberculosis linked to the mine, suspected that their children working there might contract it due to their proximity to the operations.[13]

The government of Lesotho through the Ministries of Natural Resource and the Ministry of Local Government introduced a policy to decentralize the running of the aggregate mining

[12] Interview with Marets'elisitsoe, Office Assistant at Tikoe River Stone, Ha Tikoe, 06th February 2024.
[13] The Reporter. "Quarry Mine Pollution Uproar." 25 March, 2019

industry. This was said at the meeting held on 6th August 2023 by the Minister of Natural Resource Hon. Mohlomi Moleko. The policy gave the local government ministry full power to administer the aggregate mining in Lesotho. [14] This came about because of the local councils complaining about the limited role they play in enforcing the law for miners to adhere to which created conflict between them and the villagers. However, this policy was met with opposition from the aggregate association where they felt that the policy was made without their involvement and that they wished for the government to go back to the drawing book to include them in policy- making decisions.[15] Moreover, the Water Affairs department felt that they needed to be given priority over the running of aggregate mining as their activities affected their department mostly since they dealt with water and soil issues in the country.[16]

5.2 Responses from the Communities

Communities in Lesotho impacted by aggregate mining exhibit diverse reactions based on the scale and intensity of the mining operations, along with the effectiveness of government and corporate interventions. Their responses typically revolved around environmental, social, and economic consequences. These communities voiced concerns over environmental damage and social displacement, while also advocating for improved economic prospects and sustainable practices. To address these concerns and ensure that mining activities benefited local populations, it is essential to engage with communities effectively, provide fair compensation, and adhere to environmental and social regulations.

[14] Meeting for aggregate miners.
[15] Interview with Thabang Mokoqo, Chairman of Concrete and Aggregates Association of Lesotho, Maseru, 20 March 2024
[16] Interview with Ntate Ramarou, Officer at Water Affairs, Ha Ramarothole, 21 June, 2024

Mining communities mobilized through protests and strikes to highlight their concerns and called for intervention from both authorities and mining companies. These efforts encompassed peaceful demonstrations as well as potentially disruptive actions such as road blockades. The Lesotho aggregate mining sector witnessed conflict between contractors of the Lesotho Highlands Development Authority (LHDA) and directors of Poone Diamonds, a mining company operating near the confluence of Khubelu and Senqu rivers in Mokhotlong. The dispute revolved around issues of sand supply and access around the Polihali Dam area. Poone Diamonds officials were in disagreement with LHDA contractors over the refusal to purchase sand extracted at the Polihali Dam site from Poone Diamonds, as well as disputes over the use of an access road. Tensions escalated to the point where contractors blocked the road, preventing Poone Diamonds from accessing the river. Despite attempts to mediate by LHDA, no resolution was achieved. The LHDA informed Poone Diamonds that neither the authority nor its contractors was going to procure sand from their operations.[17]

In addition, residents of Masowe 3 protested against the Tikoe mine's blasting activities, which had damaged their homes. They blocked the main access road with rocks. Thetsane police officers eventually dispersed the protesters and escorted them, along with their area chief, Koenane Matsoso, to a meeting with the mine's director, Lefa Monaheng, at the company's offices. The actions of the community forced the governments to enforce stricter regulations and oversight of mining activities which in some cases resulted in halting mining operations. They also partnered with environmental NGOs like ReNOKA to raise awareness of their concerns about aggregate mining. Partnering with environmental organizations allowed communities to

[17]Pascalinah Kabi, "Fights saddle Polihali Dam project", Lesotho Time, 25th September, 2019

acquire technical expertise on aggregate mining, legal support, and expanded networks for their advocacy initiatives.

Communities pursued legal action to halt mining operations or wanted compensation for damages. This involved filing lawsuits, seeking injunctions, or appealing to regulatory bodies. Often, they turned to NGOs such as TRC for legal expertise and counsel. The Ha Ntsi community highlighted that they reached out to the TRC to help facilitate discussions with the LHDA regarding compensation for houses damaged by LHDA operations. During these discussions, a new Asian- controlled company called Southern Sky began quarry operations without the permission of the local chief, Thamae Thamae. Despite multiple efforts by the chief to get Southern Sky's management to inspect the houses damaged by the LHDA's quarry activities, they ignored him and continued their operations. Additionally, they backed out of creating a coordinating committee with community members to address the socio-economic and environmental impacts of the quarry, which included health issues from dust emissions. The community also wrote to the Prime Minister for intervention but received no response. Subsequently, they sought a court order to halt Southern Sky's quarry operations until all social and environmental concerns were addressed. The residents also demanded that Southern Sky invest in development projects in Ha Ntsi as compensation for the profits made from selling crushed stones from the quarry.[18]

Raising awareness about the effects of aggregate mining is crucial. Communities used media campaigns, social media, and public forums to inform others about their situation and gather support. Masowe 3 community called out to newspapers to cover and publish their stories for

[18] Thabo Thakalekoala," Lesotho Highland Development Project Quarry is a Menace to the Ha Ntsi Community", International rivers, 14th November, 2002

responsible stakeholders to take into consideration the environmental hurdles they are facing due to aggregate mining activities. The Ha Mpeke community presented their case on the impact Moradi Crushers Mining operations had on their environment to the Natural Resource Social Cluster. This propelled the mining company to have a meeting with residents to discuss grievances and a way forward. Also, the Natural Resource Social Cluster ordered Moradi Crushers to present their EIA documents before the committee to prove that they were operating by the regulations.[19]

The Likotsi community made frequent visits to the chief to lay down their grievances about the operations of the operations of the Tikoe River Stone mine and the impacts on their houses.[20] The chief tried to intervene between the mine and the community by presenting the community's complaints to the mine management. However, the mine was slow in responding to the issues presented and did not meet the grievances of all the affected households which put pressure on the chief who was accused of favoritism by some community members. The intervention by the chief made the mine management fix the affected houses while others were replaced as they were destroyed by the explosives from the mine. Some houses were patched with concrete mixture to strengthen the structure while other community members were waiting for their complaints to be responded to.[21]

5.3 Interventions of International Organizations

The United Nations Environment Programme (UNEP) was actively addressing the environmental impacts of aggregate mining. It published reports and guidelines to encourage sustainable mining practices. The 2019 UNEP report, "Sand and Sustainability: Finding New

[19] Lena, "Moradi Crushers instructed to communicate with Mpeke Community", 11th April 2022
[20] Interview with Mamots'eoa Makhele, Ha Tikoe, 06th February 2024
[21] Interview with Chief Kuenane Matsoso, of Ha Tikoe, on 06 February 2024

Solutions for Environmental Governance of Global Sand Resources," highlighted the necessity for improved governance and regulation of sand and aggregate mining to reduce environmental harm.[22] UNEP also focused on various environmental concerns related to aggregate mining in Lesotho, stressing the importance of sustainable methods to prevent environmental degradation. Aggregate mining, which involves the extraction of sand, gravel, and crushed stone, is vital for construction but can lead to significant environmental challenges if not properly managed.

The UNEP's comprehensive framework for sustainable resource management underscored the importance of responsible mining practices to mitigate environmental impact and advance sustainability goals. The organization emphasized that mining operations should minimize harm to ecosystems, ensure the sustainable utilization of resources, and address social and economic effects on local communities. In Nigeria, a key among UNEP's recommendations was the incorporation of rigorous environmental impact assessments (EIAs) before commencing mining projects. [23] These assessments were crucial for evaluating potential impacts on biodiversity, water resources, and soil quality, and for implementing strategies to mitigate any adverse effects in Lesotho. UNEP also advocated for the restoration of mined areas to their natural conditions after extraction, which contributed to preserving biodiversity and preventing lasting environmental harm.

Moreover, UNEP advocated for the implementation of advanced technologies and methodologies aimed at minimizing the environmental impact of mining activities.[24] These efforts encompassed

[22] Louise Gallagher and Pascal Peduzzi. "Sand and sustainability: Finding new solutions for environmental governance of global sand resources." (2019).
[23] Allan Ingelson and Chilenye Nwapi. "Environmental impact assessment process for oil, gas and mining projects in Nigeria: A critical analysis." *Law Env't & Dev. J.* 10 (2014): 1.
[24] Gavin Hilson, and Barbara Murck. "Sustainable development in the mining industry: clarifying the corporate perspective." *Resources policy* 26, no. 4 (2000): 227-238.

adopting energy-efficient procedures, recycling water employed during mining operations, and establishing of effective waste management systems to prevent pollution. UNEP's initiatives in Lesotho were integral to its broader commitment to promoting sustainable development and enhancing environmental governance within the area. [25] This organization worked in partnership with local governments, communities, and various stakeholders to formulate policies and frameworks that encouraged sustainable mining practices, thereby facilitating economic growth and advancement.

Another institution involved in aggregate mining is the World Bank which provided funding and technical assistance for projects aimed at enhancing the sustainability and regulation of aggregate mining.[26] It aided countries in developing policies and regulatory frameworks to ensure mining activities did not harm the environment or local communities. The World Bank's Environmental and Social Framework (ESF) established standards for environmental and social performance that member countries must adhere to in mining projects. In Indian states like Maharashtra and Madhya Pradesh, the World Bank supported initiatives focused on sustainable aggregate mining.[27] For Lesotho's aggregate mining sector, these projects typically involved collaboration with state governments, local authorities, and communities. With sufficient funding, rehabilitation measures in Lesotho can effectively mitigate the impacts of aggregate mining.

The Ramsar Convention is a global agreement focused on the preservation and sustainable utilization of wetlands. Established in 1971 in Ramsar, Iran, it was embraced by numerous nations around the world. Lesotho is a participant in the Ramsar Convention, pledging to conserve

[25] Interview with Dr Doreen Tshuma, Lecture, National University of Lesotho,
[26] Kendra Dupuy. "Community development requirements in mining laws." *The Extractive Industries and Society* 1, no. 2 (2014): 200-215.
[27] Anand Teltumbde, "Natural resources policies of the Government of Maharashtra: An analytical review." (2007).

and manage its wetlands sustainably. The Convention strived to safeguard wetlands, frequently endangered by sand mining activities, by offering guidelines and frameworks for their sustainable use. Extracting sand from surfaces destabilized riverbeds and coastal regions, resulting in greater erosion and the loss of vegetation that helped stabilize these areas. [28] Managing a Ramsar site required cooperation among governments, communities affected by sand mining and conservation organizations to mitigate the impacts of sand mining. In this context, community-led monitoring programs were established to track the effects of sand mining and ensure adherence to regulations.

In Uganda, initiatives are underway to rehabilitate wetlands damaged by sand mining, such as Lake Nabugabo. These restoration projects involved replanting vegetation, stabilizing riverbanks, and re-establishing the lake's natural hydrological patterns.[29] Similarly, the Ramsar Convention's role in Lesotho included the restoration of rivers fed by wetlands. Additionally, the Ramsar Convention promoted the creation and enforcement of policies to regulate sand mining in and around wetlands. These policies typically included restrictions on mining sites, limits on extraction volumes, and requirements for environmental impact assessments (EIAs). The Ramsar Convention was essential in mitigating the impacts of sand mining on wetlands by offering a framework for their conservation and sustainable management.[30]

5.4 Interventions of Non-Governmental Organizations

Non-Governmental Organizations (NGOs) were crucial in tackling the complex challenges of

[28] David Farrier and Linda Tucker, "Wise use of wetlands under the Ramsar Convention: a challenge for meaningful implementation of international law", *Journal of Environmental Law,* Vol. 12, no. 1, 2000.
[29] Ministry of Water and Environment, "The Lake Nabugabo Wetland System Ramsar Site Management Plan",2017-2027, The Republic of Uganda, 16th June, 2017.
[30] David Farrier and Linda Tucker, "Wise use of wetlands under the Ramsar Convention: a challenge for meaningful implementation of international law", *Journal of Environmental Law,* Vol. 12, no. 1, 2000.

aggregate mining. They advocated for sustainable and fair mining practices, aiming to balance economic growth with environmental protection and social justice. NGOs were involved in various activities such as community outreach, policy advocacy, environmental conservation, and promoting corporate accountability. By collaborating with local communities, government agencies, and international bodies, NGOs worked to reduce the negative impacts of aggregate mining, protect human rights, and ensure long-term ecological health. Their efforts were essential in creating a mining sector that values both people and the environment.

In Lesotho, there are three major catchments[31] that ReNOKA works with. These catchments include Senqu, Makhaleng and Mohokare which form part of this study. These catchments were filled by different sub-catchments and micro-catchments where sand aggregate mining was most evident. ReNOKA "raises awareness about environmental impacts of aggregate mining by organizing workshops and campaigns to educate communities and different stakeholders involved in aggregate mining about sustainable mining practices". Similarly, the Lesotho Environmental Justice and Advocacy Centre (LEJAC) frequently participated in community education campaigns to highlight the ecological risks associated with aggregate mining activities.

ReNOKA established the Village Water Shed Teams (VWST) and Community Water Shed Teams (CWST) which worked closely with the organization to sort aggregate mining issues. The VWS teams included small groups within different villages that are affected by activities taking place in the micro-catchments. These villages were said to be major contributors to the use of the

[31] A catchment is an area that collects and then drains water from the highlands, it is the area from which all runoff for a particular point or water resource state originates. The catchment is considered to be the most basic unit in the management of land and water resources for water supply. A catchment or water supply management area encompasses an area from which water is collected over the land surface and from which it may be obtained for treatment and distribution. See, "Fabienne Barataud, Christine Aubry, Alexander Wezel, and Patrick Mundler. "Management of drinking water catchment areas in cooperation with agriculture and the specific role of organic farming. Experiences from Germany and France." Land use policy, Vol. 36, 2014."

environment. Within the VWST, ReNOKA helped these residents to come up with suitable uses for their environment; “it works directly with local communities affected by mining operations to ensure their voices are heard in decision-making processes. This organization further helped communities to understand their rights and provide platforms for them to express their concerns and demands on their environment.” In the same way, NGOs like the Lesotho Council of NGOs (LCN) facilitated community meetings and dialogues between mining companies, government authorities, and residents to come up with just decisions. Through ReNOKA, communities already on the radar were introduced to agricultural initiatives, small-scale entrepreneurship programs, or eco-tourism projects to diversify local economies by getting funding from mining companies to uplift their communities through Corporate Social Responsibility initiatives. Aggregate miners improved infrastructure thus attracting more business within villages that contributed to the economy.

From the VWST, two representatives in each village were chosen to be a member of the CWST where they implemented projects that promoted alternative livelihoods and sustainable development in mining-affected areas. These projects aimed to reduce the community's dependency on mining and mitigate its adverse impacts. In these initiatives, ReNOKA oversaw the activities and provided funding to these communities where a mining company aims to extract sand from the village. The sub-catchment the miner wished to extract sand from belongs to the community so they had to meet with the CWST to come up with decisions on how to use harvesting of aggregates from their rivers to benefit the community. The role of ReNOKA extended to sensitizing different members of the community to work together when it comes to sand mining.

They held workshops for these teams to educate them on how they can use sand, for example, through RISE they teach communities how to use sandbags to build structures combat soil erosion and fill in dongas.[32] Relationships Inspiring Social Enterprise (RISE) is a non-profit social enterprise registered in both the United States and Lesotho. It was established after seven years of work in Southern and Eastern Africa and witnessing the challenges faced by under-resourced local social entrepreneurs in rural and semi-rural areas. It leveraged its professionalism by connecting vulnerable communities in Lesotho to essential resources like sand. These resources included technical and soft skills training in the uses of sand as is the case in Lithabaneng where a structure was built out of sand bags. It engaged directly with individuals and their communities in a comprehensive manner and created training programs and solutions that addressed local needs and promoted economic development through the extraction of sand.[33]

ReNOKA influenced aggregate miners to play a role in the land and water issues of Lesotho especially since their activities were on the environment. They swayed the aggregate miners to give back to the communities while they take from their land by buying seeds, fertilizers and infrastructural development. They also swayed miners to play a role in the protection and preservation of land and water. The miners were influenced to fund community initiatives on environment rehabilitation since the Mohokare River catchment, a tributary of the powerful Orange-Senqu River, unfortunately, shared the fate of many rivers globally, having become polluted with plastic and other waste.[34] ReNOKA advocated for post-mining restoration efforts that were inclusive of soil stabilization, reforestation, and wetland creation.

The Transformation Resource Center (TRC) in Lesotho is an organization dedicated to advocacy

[32] Interview with Malisema Fako, Engineer at ReNOKA, 24th April 2024
[33] Interview with Likonelo Mothobi, Maseru, 26th April 2024
[34] Pascalinah Kabi, "The hidden Environment Toll of Sand Mining on Mohokare", Uncensored News, October, 2023

and research, concentrating on social justice, human rights, and sustainable development. Since its inception in 1979, the TRC aimed to empower communities, enhance transparency, and shape policies for positive change. It was notably active in tackling issues related to land use, environmental conservation, and the effects of aggregate mining. The TRC called for comprehensive research on sand mining issues to address environmental degradation and health problems resulting from aggregate mining activities. The organization examined the effects of aggregate mining on water sources, soil quality, and ecosystems. It investigated the health impacts on communities living near mining sites due to the operations of aggregate mining companies. Additionally, the TRC evaluated whether these mining activities contributed sustainably and equitably to local and national economies.

TRC engaged and empowered communities affected by mining operations so that their voices were heard in decision-making. It collaborated directly with local communities impacted by mining operations to ensure their voices are included in decision-making processes. They assisted communities in understanding their environmental rights, offering platforms for expressing concerns and demands while highlighting the potential impacts of sand mining.[35] Similar to the operations of TRC, the Lesotho Council of NGOs also organized community meetings and discussions between mining companies, government authorities, and the community.[36] Moreover, TRC received complaints from the Tikoe Community on the operations of the Tikoe Riverstone Mine and advised them to form a community council which the organization was to work directly with to combat their problems.

The TRC advocated for more strict environmental regulations and enforcement measures to ensure

[35]Transformation Resource Center. "Home" Transformation Resource Center. Accessed June 12, 2024. https://www.trc.org.ls/.
[36]Interview with Mme Limpho, Legal Officer, Maseru, 23rd April, 2024.

mining companies follow sustainable practices. Additionally, they offered legal assistance to communities wishing to contest detrimental mining operations. They availed their legal personnel to assist the residents of affected areas to negotiate with aggregate mining companies and pursue compensation for damages incurred. In the case of the Ha Mpeke community that was aggrieved by operations of the Morija Crushers Stone mine, TRC offered legal advice on measures to be taken for the mine to answer before the government on issues relating to their environment being harmed by activities of the mine. TRC trained the community members on proper legal conduct when presenting their cases to the government. Furthermore, TRC educated community leaders to advocate for their rights and engage in decision-making processes concerning aggregate mining through *lipitso*.[37]

The TRC was active in shaping policy by working with the ministries of mining and environment to advocate for regulations that safeguard communities impacted by aggregate mining and their surroundings. They were involved in the policy-making for the decentralization policy where the Ministry of Mining was relinquishing power to oversee mining operations to the Ministry of Local Government. However, this policy is yet to be finalized.[38] Additionally, they partnered with other NGOs and international organizations like Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) to enhance advocacy efforts and draw global attention to sand mining to water resources management in Lesotho.

Moreover, TRC tackled the challenges of land displacement caused by aggregate mining. This activity, involving the extraction of soil, sand, gravel, and rock for construction, frequently displaced communities, reduced agricultural land, and harmed the environment. The process

[37]Interview with Mme Limpho, Legal Officer, Maseru, 23rd April, 2024.
[38] Meeting for aggregate miners held at Manthabiseng convention Centre on 16 August 2023

destroyed habitats, decreased arable land, and caused social upheaval as people were compelled to move. To mitigate these effects and safeguard affected communities and ecosystems, effective regulations and sustainable practices were essential. The involvement of TRC with Moradi Crushers Stone led to them coercing the mine to present their EIA documents to show whether the mine was complying with the law on mining as its operations destroyed buildings and degraded the environment. As part of its mandate, TRC advocated for transparency and accountability from aggregate mining companies concerning environmental and social responsibility.

However, these NGOs faced several challenges. Most communities were reluctant to engage in the VWST and CWST due to internal conflicts, making collaboration difficult and combating sand-related issues impossible. ReNOKA struggled to encourage the community to work together. Additionally, NGOs encountered resistance from government entities and aggregate mining corporations when pushing for stricter regulations and improved mining practices. They also struggled to ensure that environmental and social regulations were effectively enforced due to financial constraints and political clashes within the community. Non-Governmental Organizations (NGOs) were essential in mitigating the environmental and social impacts of aggregate mining in Lesotho. They were key advocates for sustainable and fair mining practices, working to balance economic development with human rights and environmental protection. Their initiatives typically involved advocacy, community engagement, environmental conservation, and policy influence. Overall, NGOs' efforts in Lesotho's aggregate mining sector were multifaceted, aiming to harmonize economic growth with environmental sustainability and social justice. Their work was vital in promoting sustainable mining practices and safeguarding the rights and well-being of affected communities.

Chapter Six: Summary and Conclusion

6.1 Summary

This study has assessed the dynamics of aggregate mining in Lesotho, focusing on the environmental impacts and discussing the legal frameworks governing aggregated mining. It has explored and discussed the regulations and policies governing aggregate mining in Lesotho, along with the measures taken to mitigate its impacts. The Constitution of Lesotho serves as the fundamental law of the nation, establishing principles for governance, human rights, and the rule of law. Although it does not specifically reference aggregate mining, it includes provisions concerning natural resource management, environmental protection, and land rights.[1] Despite the absence of clear mention of aggregate mining, the Constitution provides a legal and ethical framework that shapes mining legislation. Compliance with these laws ensures that mining activities, including aggregate mining, are conducted responsibly and sustainably.

Aggregate mining in the country is governed by several significant legislative acts and policies, such as the Mines and Minerals Act of 2005, which aims to promote sustainable development, protect the environment, and ensure responsible management of aggregate resources.[2] Moreover, the regulation of aggregate mining is intricately linked with the Local Government Law of Lesotho, which forms part of a broader framework encompassing environmental, land, and mineral resource legislation, as detailed in chapter two of this dissertation.[3] The Land Use Act in Lesotho in regulating and managing land resources, including aggregate mining is pivotal in this study.[4] A comprehensive understanding of the Land Use Act and its implications for aggregate mining is

[1] Constitution of Lesotho, Order No. 16 of 1993
[2] Mines and Minerals Act, ACT 4, 2005.
[3] Local Government Law, Act 41, Vol, XL11, 1997.
[4] Land Act 2010

crucial for promoting sustainable land management and mitigating conflicts arising from competing land uses.

The regulations governing aggregate mining also encompass Lesotho's Environmental law, which plays a critical role in overseeing the sustainable conduct of such activities, aiming to minimize their environmental impact.[5] These laws seek to strike a balance between the economic benefits of aggregate mining and environmental sustainability by promoting responsible mining practices, advocating for the adoption of environmentally friendly technologies, and ensuring that mining operations contribute to sustainable social and economic development while safeguarding the environment. Additionally, the Environmental Impact Assessment (EIA) process is pivotal in the regulation of aggregate mining in Lesotho, ensuring that mining activities adhere to environmental sustainability standards.[6]

The evolving landscape of aggregate mining highlights the widespread use of river sand in construction and various industrial applications. It outlines the historical shift in sand extraction practices from the 1960s to 2022, underscoring its pivotal role in development while also raising significant environmental and social concerns, similar to gravel extraction. Gravel mining, essential for construction and infrastructure projects, also serves diverse industrial needs.[7] Similarly, the extraction of crushed stone has evolved from small-scale operations using basic tools to the introduction of heavy machinery in the late 1980s, pioneered by Moradi Crushers Stone and subsequent mining enterprises.[8] Aggregate mining significantly affects water resources and

[5] Environment Act, ACT 10, 2008.
[6] Lipolelo Mokhehle, and Roseanne Diab. "Evolution of environmental impact assessment in a small developing country: a review of Lesotho case studies from 1980 to 1999." *Impact Assessment and Project Appraisal* 19, no. 1 (2001): 9-18.
[7] Interview with Moshe Sekoboto, Maseru, 16th March, 2024.
[8] Moradi Crushers. “Home.” Moradi Crushers, accessed June 30, 2024. http://moradicrushers.co.ls?

ecosystems, particularly when operations are near or within water bodies like the Mohokare or Phuthiatsane Rivers.[9]

These activities also contribute to soil erosion and degradation, raising substantial environmental concerns associated with aggregate mining.[10] While essential for economic growth, the impact on soil quality, ecosystems, and human health underscores the importance of adopting responsible mining practices and effective environmental management strategies. Aggregate mining also has profound effects on nearby residential settlements such as in the Ha Tikoe community. The continuous blasting and frequent movement of heavy trucks in their village have caused shifts in housing foundations and cracks in windows.[11] However, the current government intervention has not fully addressed the grievances of communities like Ha Tikoe, particularly in terms of adequately informing and involving them in decision-making processes.[12]

6.2 Conclusion

The study revealed the environmental effects of sand mining in Maseru, and Lesotho, examining similar cases in districts like Berea and Mokhotlong. Achieving a balance between aggregate mining and farmland preservation demands thoughtful planning, robust regulation, and active engagement with stakeholders. Sustainable land use practices, including reclamation and mitigation measures, are crucial to reducing environmental impacts and ensuring the enduring viability of both the aggregate mining and agricultural sectors. Collaborative initiatives involving governments, industry stakeholders, and local communities are essential for achieving this equilibrium and advancing sustainable development goals.

[9] Interview with Malisemelo Fako, Engineer, Maseru, 11th April, 2024
[10] Interview with Lehlohonolo Ramarou, Builder, Maseru, 17th February, 2024
[11] Marafaele Mohloboli, "Thabane dragged into quarry mine, residents clash", Lesotho Times, 06th September, 2019
[12] Interview with Sebabatso Mosito, Self-employed, Masowe 3, 06 February 2024

Effective management of water resources and ecosystems in aggregate mining necessitates proactive planning, rigorous regulatory oversight, and collaboration among industry, government, and local communities. Through the adoption of sustainable practices, mitigation of environmental impacts, and prioritization of ecosystem health, mining operations can reduce their impact on water resources and contribute to lasting environmental stewardship. Moreover, addressing soil erosion and degradation in aggregate mining demands a proactive approach that integrates environmental stewardship into mining practices. By implementing robust erosion control measures, planning for reclamation, adhering to regulatory standards, and engaging stakeholders, mining companies can minimize their environmental footprint and promote sustainable land use practices. Continuous monitoring and adaptive management are crucial to ensure long-term soil health and ecosystem resilience in mined areas.

River sand mining presents a multifaceted challenge that demands a balanced approach to navigate the trade-offs between economic progress and environmental conservation. Enforcing stringent regulations, advocating sustainable methodologies, and exploring substitute resources are essential to mitigating adverse effects associated with this practice. Similarly, gravel mining, crucial for construction and infrastructure, also introduces considerable environmental and social complexities. Achieving a harmonious balance between economic advantages and environmental sustainability necessitates effective oversight, responsible mining techniques, and the exploration of alternative materials such as reuse and rehabilitation technologies. Sustainable management strategies and community involvement play pivotal roles in alleviating detrimental impacts and fostering enduring environmental stewardship.

Quarries are vital for supplying essential materials for construction and industry, yet require responsible management to minimize environmental and social impacts. Effective regulation,

responsible mining practices, and community engagement are crucial for striking a balance between economic benefits and environmental sustainability. Embracing sustainable methods and exploring alternative materials can further decrease the industry's environmental footprint and encourage lasting environmental stewardship. Aggregate mining associations play a pivotal role in advocating for the industry, promoting sustainable practices, providing industry data and research, and fostering collaboration among stakeholders in policy-making and operational activities within the aggregate mining sector.

Finally, achieving a balance between the economic advantages of aggregate mining and the welfare of nearby residents demands careful planning, regulatory oversight, and proactive measures to mitigate potential adverse impacts on residential areas. The Government of Lesotho aims to harmonize the economic benefits of aggregate mining with the preservation of environmental and social well-being, necessitating collaboration among government bodies, industry stakeholders, and affected communities to achieve sustainable development goals. Community responses to aggregate mining reflect a complex interaction of environmental, social, economic, and governance elements. Effective engagement, transparent communication, and proactive steps to address environmental concerns can facilitate more constructive relationships between mining enterprises and affected communities.

Bibliography

Oral Interviews

Names	Occupation	Age	Place	Date
Fako Malisema	Engineer	-	Maseru	08 April, 2024
Habofanoe Habofanoe	Pensioner	62	Ha Tsiame, Ha Tikoe	16 February, 2024
Hoohlo Fumane	Hair Dresser	45	Ha Hoohlo, Maseru	10 February, 2024
Khalema Ishmael	Geologist	-	Maseru	30 November, 2023
Lekhooa Maretselisitsoe	Office Manager at TRS	-	Ha Tikoe, Maseru	06 February, 2024
Letsie Mahlape	Self-employed	42	Ha Hoohlo, Maseru	10 February, 2024
Maime Hycinth	Miner	42	Maseru	03 April, 2024
Makhele Mamotseoa	Pensioner	72	Ha Tsiame, Ha Tikoe	06 February, 2024
Makotoko Puleng	Ministry of Agriculture Officer	-	Maseru	05 May, 2024
Malebese Lipalesa	Environmentalist	-	Maseru	21 June, 2024
Matsoso Koenane	Chief	-	Ha Tikoe, Maseru	06 February, 2024
Mme Limpho	Legal Advisor	-	Maseru	09 April, 2024
Moiketsi Mahola	Self Employed	54	Ha Ts'iame, Ha Tikoe	06 February, 2024
Montsi Mathato	Self Employed	53	Lesia, Ha Thetsane	07 February, 2024
Mopeli Lekhotla	Entrepreneur	34	Lesia, Ha Thetsane	07 February, 2024
Moqoko Thabang	Miner	-	Maseru	20 March 2024

Moshe Sekoboto	Miner	-	Maseru	06 March, 2024
Mosito Sebabatso	Self Employed	49	Masowe 3	06 February, 2024
Mothobi Likonelo	Volunteer at RISE	27	Lithabaneng, Maseru	26 April, 2024
Naha Tebello	Self Employed	62	Ha Hoohlo, Maseru	10 February, 2024
Nkoko Thabang	Engineer	-	Maseru	08 November, 2023
Ramarou Lehlohonolo	Builder	32	Maseru	17 February, 2024
Ramarou Ramarou	Officer at Water Affairs	-	Ha Ramarothole, Mafeteng	21 June, 2024
Ranooe Mats'eliso	Village Nurse	58	Ha Hoohlo, Maseru	10 February, 2024
Ranooe Moeketsi	Councilor	56	Boleka, Mafeteng	18 April, 2024
Ts'ella Lerotholi	Manager at TRS	36	Ha Tikoe, Maseru	06 February, 2024
Tshuma Doreen	Lecturer	-	Roma, Maseru	27 May, 2024
Tsuinyane Matsuinyane	Pensioner	76	Ha Tsiame, Ha Tikoe	06 February, 2024

Archival Materials

Cassidy, Lin. *CBNRM and legal rights to resources in Botswana*. Vol. 4. IUCN Botswana, 2000.

Chevallier, Romy. "Illegal sand mining in South Africa." *SAIIA Policy Briefing* 2 (2014).

DID. "River sand mining management guideline." (2009): 1-50.

Lesotho Highlands Development Authority. *Lesotho Highlands Water Project, Phase 1B: Draft Environmental Action Plan*. Lesotho Highlands Development Authority, 1997.

Ministry of Energy and Meteorology, Lesotho. National Climate Change Policy, 2017.

Ministry of Water and Environment, "The Lake Nabugabo Wetland System Ramsar Site Management Plan",2017-2027, The Republic of Uganda, 16th June, 2017

Mokuku, Chaba. *Lesotho: Second State of the Environment Report, 2002*. National Environment Secretariat, Ministry of Tourism, Environment & Culture, Government of Lesotho, 2004.

Nkopane, Setenane. "An evaluation of environmental impact assessment procedure in the Lesotho Highlands Water Project: Phase 1." (1997).

ORASECOM, 2014, Lesotho Action Plan for the Orange–Senqu River Basin. ORASECOM Report 004/2014.

Sekamane, Thabang, W. A. J. Nel, Tracey J. McKay, and Henry Bikwibili Tantoh. "Community perceptions of the social impacts of the Metolong Dam and Reservoir in Lesotho." *Land Use Policy* 125 (2023).

Shitima, Christina, and Bert Suykens. "Formalization of sand mining in Dar es Salaam, Tanzania." *Resources Policy* 82 (2023).

Tchakounteu, Mitrance Sorelle. "A Critical review of EIA report quality in Lesotho." (2021).

World Health Organization. *Guidelines for drinking-water quality*. World Health Organization, 2002.

Journal Articles

Akankali, J.A., Idongesit A.S. and Patrick, P.E., "Effects of sand mining activities on water quality of Okoro Nsit stream, Nsit Atai local government area, Akwa Ibom state, Nigeria", *International Journal of Development and Sustainability*, Vol. 6, No. 7, 2017.

Akanwa, Angela Oyilieze. "River Sand Mining and Its Ecological Footprint at Odor River, Nigeria." *Agroecological Footprints Management for Sustainable Food System* (2021): 473-514.

Ako T. A., “Environmental Effects of Sand and Gravel Mining on Land and Soil in Luku, Minna, Niger State, North Central Nigeria”, *Journal of Geosciences and Geomatics*, Vol. 2, No. 2, 2014.

Aliu, Ibrahim Rotimi, Isaiah Sewanu Akoteyon, and Olayemi Soladoye. "Sustaining urbanization while undermining sustainability: the socio-environmental characterization of coastal sand mining in Lagos Nigeria." *GeoJournal* 87, no. 6 (2022): 5265-5285.

Ameziane, Lahcen, and Bert Suykens. "Political settlements and the historical development of sand governance in Morocco." *The Extractive Industries and Society* 14 (2023).

Atejioye, Adekunle Adegoke and Chris Adebola Odeyemi. "Analysing impact of sand mining in Ekiti State, Nigeria using GIS for sustainable development." *World Journal of Research and Review*, Vol. 6, No. 2, 2018.

Babatunde, Abosede Omowumi. "Environmental Insecurity and Poverty in the Niger Delta." *African Conflict & Peacebuilding Review (ACPR)* 7, no. 2 (2017).

Babatunde, Abosede Omowumi. "Local perspectives on food security in Nigeria's Niger delta." *The Extractive Industries and Society* 7, no. 3 (2020): 931-939.

Babatunde, Abosede Omowumi. "Oil, environmental conflict and the challenges of sustainable development in the Niger Delta." *Journal of Peacebuilding & Development* 9, no. 2 (2014): 77-82.

Babatunde, Abosede. "Environmental conflict and the politics of oil in the oil-bearing areas of Nigeria’s Niger Delta." *Peace and Conflict Review* 5, no. 1 (2010): 1-13.

*Barataud, Fabienne, Christine Aubry, Alexander Wezel, and Patrick Mundler. "*Management of drinking water catchment areas in cooperation with agriculture and the specific role of organic farming. Experiences from Germany and France*." Land use policy, Vol. 36, 2014*

Bombay Natural History Society and Awaaz Foundation, India. *Convention on Biological Diversity: Effects of Sand Mining on Biodiversity*. 2014

Brems, Dieter, Patrick Degryse, Femke Hasendoncks, Domingo Gimeno, Alberta Silvestri, Elvira Vassilieva, Steven Luypaers, and Johan Honings. "Western Mediterranean sand deposits as a raw material for Roman glass production." *Journal of Archaeological Science* 39, no. 9 (2012): 2897-2907.

Carvalho, Fernando P. "Mining industry and sustainable development: time for change." *Food and Energy Security* 6, no. 2 (2017): 61-77.

Chatanga, Peter, Victor Ntuli, Eltony Mugomeri, Tumo Keketsi, and Noel VT Chikowore. "Situational analysis of physico-chemical, biochemical and microbiological quality of water along Mohokare River, Lesotho." *The Egyptian Journal of Aquatic Research* 45, no. 1 (2019): 45-51.

Chindo, Murtala Ibraheem. "Communities Perceived Socio-Economic Impacts of Oil Sands Extraction in Nigeria." *Human Geographies: Journal of Studies & Research in Human Geography* 5, no. 2 (2011).

Cook, Susan. "Community management of mineral resources: The case of the Royal Bafokeng Nation." *Journal of the Southern African Institute of Mining and Metallurgy* 113, no. 1 (2013): 61-66.

Coplan, David B. "Unconquered territory: narrating the Caledon Valley." *Journal of African Cultural Studies* 13, no. 2 (2000): 185-206.

Daemane, Moses. "Problems of land tenure system in Lesotho since post-independence: challenging perspectives for sustainable development in land administration and management." *Journal of Sustainable Development in Africa* 14, no. 8 (2012): 164-175.

Dissanayake, Chandra B., and M. S. Rupasinghe. "Environmental Impact of Mining, Erosion and Sedimentation in Sri Lanka." *International Journal of Environmental Studies* 51, no. 1 (1996): 35-50.

Dupuy Kendra. "Community development requirements in mining laws." *The Extractive Industries and Society* 1, no. 2 (2014): 200-215.

Edomah, Norbert. "Rural electrification in Africa: a case study of Yebu community solar mini-grid." *Environmental Research: Infrastructure and Sustainability* 2, no. 4 (2022): 045001.

Erie, Matthew S. "China's (post-) socialist property rights regime: Assessing the impact of the property law on illegal land takings." *Hong Kong LJ* 37 (2007): 919.

Farrier David and Linda Tucker, "Wise use of wetlands under the Ramsar Convention: a challenge for meaningful implementation of international law", *Journal of Environmental Law,* Vol. 12, no. 1, 2000.

Fedan, Jeffrey S. "Biological effects of inhaled hydraulic fracturing sand dust. I. Scope of the investigation." *Toxicology and applied pharmacology* 409 (2020): 115329.

Ganie, Javeed Ahmad and Mohammad Younus Bhat, "Sand mining in BRICS economies: Tragedy of the commons or fortune in the making?." *Journal of Cleaner Production* 434 (2024): 140122.

George, Manyumbu, and Jerie Steven. "An Assessment of Sand Extraction Environmental Externalities as a Source of Market Failure in Gweru District of Zimbabwe." *Am. Res. J. Humanit. Soc. Sci* 5 (2022): 37-53.

Gwimbi, Patrick, Palesa Lebese, and Kamohelo Kanono. "Mainstreaming health impact assessments in environmental impact statements into planning obligations in post dam construction in Metolong, Lesotho: A qualitative investigation." *Heliyon* 6, no. 7 (2020).

Gyamfi, Ebenezer, Emmanuel Kwame Appiah-Adjei, and Kwaku Amaning Adjei. "Potential heavy metal pollution of soil and water resources from artisanal mining in Kokoteasua, Ghana." *Groundwater for Sustainable Development* 8 (2019): 450-456.

Haq, Thoriqul, Nuhfil Hanani, and Moh Khusaini. "Sustainable Environmental Recovery Policy: Redesigning Sand Mining Policy in Indonesia." *Journal of Law and Sustainable Development* 11, no. 7 (2023): e1311-e1311.

Hartati, Wahjuni. "Legal Protection for the Community Around the Sand Mining In Ijobalit Village, East Lombok Regency." *Earth and Environmental Science*, Vol. 140, No. 1, 2018.

Hatlebakk, Magnus. "River sand mining as a livelihood activity: The case of Nepal." *The Extractive Industries and Society* 14 (2023): 101266.

Hill. L Bruce and Kleyhans. C.J, "Authorisation and Licencing of Sand Mining/Gravel Extraction, in Terms of Impacts on the Instream and Riparian Habitats", *Journal of Mining Science*, Vol. 15, 1999.

Hilson Gavin, and Barbara Murck. "Sustainable development in the mining industry: clarifying the corporate perspective." *Resources policy* 26, no. 4 (2000): 227-238.

Humby, Tracy-Lynn. "'One environmental system': aligning the laws on the environmental management of mining in South Africa." *Journal of Energy & Natural Resources Law* 33, no. 2 (2015): 110-130.

Hunt, Julian, Alexandros Lingos, Johannes Platje, Lara Werncke Vieira, Markus Will, and Marius Dan Gavriletea. "The unsustainable use of sand: reporting on a global problem." *Sustainability* 13, no. 6 (2021): 1-16.

Ingelson, Allan, and Chilenye Nwapi. "Environmental impact assessment process for oil, gas and mining projects in Nigeria: A critical analysis." *Law, Environment & Development Journal* 10 (2014): 1.

Klopfer, Lisa. "Oral history and archives in the new South Africa: Methodological issues." *Archivaria* (2001): 100-125.

Koehnken, Lois, and Max Rintoul. "Impacts of sand mining on ecosystem structure, process and biodiversity in rivers." *World Wildlife Fund International* 159 (2018).

Leal Filho, Walter, Julian Hunt, Alexandros Lingos, Johannes Platje, Lara Werncke Vieira, Markus Will, and Marius Dan Gavriletea. "The unsustainable use of sand: Reporting on a global problem." *Sustainability* 13, no. 6 (2021): 3356.

Letsela, Limpho, Andre Pelser, and Maitland Seaman. "A participatory sustainability assessment process for biodiversity conservation in Lesotho." *Journal of Environmental Assessment Policy and Management* 12, no. 02 (2010): 107-129.

Makhado, Zwoitwa, and Thembela Kepe. "Crafting a livelihood: local-level trade in mats and baskets in Pondoland, South Africa." *Development Southern Africa* 23, no. 4 (2006): 497-509.

Mapara, Jacob. "Indigenous knowledge systems in Zimbabwe: Juxtaposing postcolonial theory." *Journal of Pan African Studies* 3, no. 1 (2009).

Marquis, Christopher, and Julie Battilana. "Acting globally but thinking locally? The enduring influence of local communities on organizations." *Research in organizational behaviour* 29 (2009): 283-302.

McKenney, Rose, Robert B. Jacobson, and Robert C. Wertheimer. "Woody vegetation and channel morphogenesis in low-gradient, gravel-bed streams in the Ozark Plateaus, Missouri and Arkansas." *Geomorphology* 13, no. 1-4 (1995): 175-198.

Mensah, John Victor. "Causes and effects of coastal sand mining in Ghana." *Singapore Journal of Tropical Geography* 18, no. 1 (1997): 69-88.

Mngeni, C. M Asabonga, Chris M. Musampa and Motebang Dominic Vincent Nakin. "The effects of sand mining on rural communities." *WIT Transactions on Ecology and the Environment* 210 (2017): 443-453.

Mokhehle, Lipolelo, and Roseanne Diab. "Evolution of environmental impact assessment in a small developing country: a review of Lesotho case studies from 1980 to 1999." *Impact Assessment and Project Appraisal* 19, no. 1 (2001): 9-18.

Morley, John Rupert Myers, Yves Plancherel, and Pablo Brito-Parada. "A Database for the Stocks and Flows of Sand and Gravel." *Resources* 11, no. 8 (2022): 72.

Muiruri, Philip Gathogo, Joy A. Obando, and Ishmail O. Mahiri. "Morphologic response of a river channel to sand mining in river Tyaa, Kitui County, Kenya." *Journal of Environmental & Earth Sciences* 2, no. 2 (2020): 12-18.

Mushonga, Tafadzwa. "The dynamics of Zimbabwe's sand mining frontier." *The Extractive Industries and Society* 12 (2022): 101123.

Mushore, Washington, and Khatija Bibi Khan. "Mining the Truth: Representation of Land and Land Redistribution in Zimbabwe in the Daily News." *Commonwealth Youth & Development* 18, no. 2 (2020).

Nnatuanya, Felix O. "Political Ecology of Sand Mining in Awka, South East Nigeria." *SAU JOURNAL OF MANAGEMENT AND SOCIAL SCIENCES* 6, no. 1 (2021): 253-264.

Nyane, Hoolo. "Assignment of functions to local authorities in Lesotho." *Commonwealth Journal of Local Governance* 19 (2016): 58-74

Odeyemi, Christo. “Analysing Impact of Sand Mining in Ekiti State, Nigeria Using GIS for Sustainable Development”, *World Journal of Research and Review*, Vol. 6, No. 2, 2018, Pages 26-31.

Peduzzi, Pascal. "Sand, rarer than one thinks." *Environmental Development* 11, no. 208-218 (2014): 682.

Rantlo, A. Montoeli. "The Social Impact of Mining Activities on Surrounding Communities in Lesotho: Case of Morija Stone Mine and Crushers in Morija." *Merit Research Journals, Vol. 7, no. 8* (2019).

Saviour Naveen. "Environmental impact of soil and sand mining: a review." *International Journal of Science, Environment and Technology* 1, no. 3 (2012).

Showers, Kate B. "Soil erosion in the kingdom of Lesotho and development of historical environmental impact assessment." *Ecological Applications* 6, no. 2 (1996).

Silva, Renuka N. "Integrated Plant Nutrition Systems Modules for Major Crops and Cropping Systems in Sri Lanka." In *Integrated Plant Nutrition System Modules for Major Crops and Cropping Systems in South Asia*, vol. 176, 2019

Snell, Tim, and Richard Cowell. "Scoping in environmental impact assessment: balancing precaution and efficiency?." *Environmental Impact Assessment Review* 26, no. 4 (2006): 359-376.

Šolar, Slavko Vekoslav, Deborah J. Shields, and H. William Langer. "Important features of sustainable aggregate resource management." *Geologija* 47, no. 1 (2004).

Sreebha, Sreedharan, and Damodaran Padmalal. "Environmental impact assessment of sand mining from the small catchment rivers in the southwestern coast of India: a case study." *Environmental Management* 47 (2011).

Vandana, Molahalli., Shiekha John, K. Maya, Syam Sunny, and D. Padmalal. "Environmental impact assessment (EIA) of hard rock quarrying in a tropical river basin—a study from the SW India." *Environmental monitoring and assessment* 192 (2020).

Wallman, Sandra. "Lesotho's pitso: Traditional meetings in a modern setting." *Canadian Journal of African Studies/La Revue canadienne des études africaines* 2, no. 2 (1968).

Willis, Joe Neil Coleman and Wilbert Ellis. "Laboratory study of the transport of fine sand." *Journal of the Hydraulics Division* 98, no. 3 (1972).

Book and Chapters in Books

Amponsah-Dacosta, Francis, and Humphrey Mathada. "Study of sand mining and related environmental problems along the Nzhelele River in Limpopo Province of South Africa." *Mine Water and Circular Economy, Finland* (2017).

Bell, Stuart, Donald McGillivray, and Ole Pedersen. *Environmental law*. Oxford University Press, USA, 2013.

Coakley, George J. "The Mineral Industries of Lesotho and Swaziland." *US Geological Survey Minerals Information* (2002): 19-1.

Gallagher, Louise, and Pascal Peduzzi. "Sand and sustainability: Finding new solutions for environmental governance of global sand resources." (2019).

Goudie, Andrew S. *Human impact on the natural environment*. John Wiley & Sons, 2018.

Green, Stewart Christopher. "The regulation of sand mining in South Africa." (2012).

Katz-Lavigne, Sarah, Saumya Pandey, and Bert Suykens. "Mapping global sand: extraction, research and policy options." (2022).

Kishindo, Paul, Elizabeth Eldredge, and Marc Epprecht. *Women, land and agriculture in Lesotho*. No. 4-6. Institute of Southern African Studies, National University of Lesotho, 1993.

Leonardi, Cherry, and Martina Santschi. *Dividing Communities in South Sudan and Northern Uganda: boundary disputes and land governance*. Rift Valley Institute, 2016.

Lynggaard, Josefine Reimer, and Louise Gallagher. "Sand Policy Review 1: Sierra Leone."

Maliehe, Motlatsi, and Deogratias MM Mulungu. "Assessment of water availability for competing uses using SWAT and WEAP in South Phuthiatsana catchment, Lesotho." *Physics and Chemistry of the Earth, Parts A/B/C* 100 (2017): 305-316.

Matli, Moeketsi Boniface. "The social impacts of a large development project: the Lesotho Highlands Water Project." (2005).

Morris, Peter, and Riki Therivel, eds. *Methods of environmental impact assessment*. Vol. 2. Taylor & Francis, 2001.

Mpala, Thandiwe Annastacia, and Mulala Danny Simatele. "Climate-smart agricultural practices among rural farmers in Masvingo district of Zimbabwe: perspectives on the mitigation strategies to drought and water scarcity for improved crop production." *Frontiers in Sustainable Food Systems* 7 (2024): 1298908.

Muhammad Aqeel Ashraf, Muhammad Aqeel Ashraf, Mohd Jamil Maah Mohd. Jamil Maah, Ismail Yusoff Ismail Yusoff, Abdul Wajid Abdul Wajid, and Karamat Mahmood Karamat Mahmood. "Sand mining effects, causes and concerns: a case study from Bestari Jaya, Selangor, Peninsular Malaysia." (2011): 1216-1231.

Musah, Jafaru Adam, and Bjorn H. Barkarson. "Assessment of sociological and ecological impacts of sand and gravel mining: A case study of East Gonja District (Ghana) and Gunnarsholt (Iceland)." *Final Project, Land Restoration Training Programme, Keldnaholt* 112 (2009).

Nalule, Victoria R. *Mining and the Law in Africa: Exploring the social and environmental impacts*. Springer Nature, 2019.

Nilsson, Erik. "Socio-economical feasibility study for a proposed weir on the Magoye River, Zambia." (2012).

Ren, Zijian, Meng Jiang, Dingjiang Chen, Yadong Yu, Fei Li, Ming Xu, Stefan Bringezu, and Bing Zhu. "Stocks and flows of sand, gravel, and crushed stone in China (1978–2018): Evidence of the peaking and structural transformation of supply and demand." *Resources, Conservation and Recycling* 180 (2022): 106173.

Rentier, S. Eline, and Erik L. H. Cammeraat. "The Environmental Impacts of River Sand Mining." *Science of The Total Environment* 838 (2022).

Teltumbde, Anand. "Natural resources policies of the Government of Maharashtra: An analytical review." (2007).

Vansina, Jan M. *Oral tradition as history*. Univ of Wisconsin Press, 1985.

Zdanow, Louise, and Natasha van de Haar. "Botanical Screening Assessment for Proposed Sand Mining At Southern Home Farm Along The Mtwalume River, Kwazulu Natal." (2016).

Zhu, Qian. *River-Sand Mining: An Ethnography of Resource Conflict in China*. Vol. 45. Brill, 2022.

Zhuwarara, Selina Kudzai. "The Potential of Digitisation in Enhancing Regulation and Sustainability in the Artisanal and Small-Scale Mining (ASM) Sector in Zambia, Nigeria, and Ghana." In *Mining Law and Governance in Africa*, 193-217. Routledge, 2023.

Zubir, S. S., and Carlos Alberto Brebbia, eds. *The Sustainable City VIII (2 volume set): urban regeneration and sustainability*, Vol. 179, WIT Press, 2013.

Unpublished Dissertations

Attipoe, Selasi Kofi. "An assessment of flood mitigation measures in Accra, Ghana." PhD diss., 2015.

Conz, Christopher R. "Wisdom does not live in one house": compiling environmental knowledge in Lesotho, Southern Africa, c. 1880-1965." PhD diss., Boston University, 2017.

Madison, Tariro. "Case studies of environmental impacts of sand mining and gravel extraction for urban development in Gaborone." PhD diss., University of South Africa, 2013.

Makaba, Lebogang Peggy. "Effectiveness of the strategic environmental assessment process in Botswana." PhD diss., North-West University, 2014.

Naha, Ignatius Matete. "Full decentralisation of powers, resources and functions in the Kingdom of Lesotho: an evaluation from a developmental local government perspective." PhD diss., Stellenbosch: Stellenbosch University, 2015.

Rantlo, Tiisetso John. "Environmental impact assessment legislation in Lesotho, Swaziland and South Africa." PhD diss., North-West University (South Africa), Potchefstroom Campus, 2015.

Shakhane, Bokang. "Accumulation of selected nutrients and heavy metals in the Khubelu River catchment, Mokhotlong, Lesotho." PhD diss., Cape Peninsula University of Technology, 2019.

Tlebere, Liteboho. "An inquiry into the mining industry of Lesotho." PhD diss., National University of Lesotho, 2023.

Tapole, Amandus Thabang. "The environmental impact assessment (EIA) under the Lesotho Environment Act No. 10 of 2008: a comparative analysis with the South African EIA regime." PhD diss., 2011.

Seminars and Occasional papers

Chanda-Kapata, Pascalina. "Public health and mining in East and Southern Africa: A desk review of the evidence." *Zambia Ministry of Health with Training and Research Support Centre in the Regional Network for Equity in Health in East and Southern Africa (EQUINET). EQUINET DISCUSSION PAPER* 121 (2020).

Laws

Constitution of Lesotho

Environment Act, 2001

Environment Act, 2008

Land Act, 1979.

Land Act, 2010

Land Act, 1979

Local Government Act, 1996

Local Government Act, 2008

Mines and Minerals Act, 2005

Mining Rights Act, 1967

Regulations in Terms of Chapter 5 of the National Environmental Management Act (1998), Department of Environmental Affairs and Tourism, 2006.

Newspapers

'Marafaele Mohloboli, "Thabane dragged into quarry mine, residents clash", Lesotho Times, 06 September 2019

Liapeng Raliengoane, "Qoo visits Nazareth community over quarry grievances" Informative Newspaper, 18 May 2021

Pascalinah Kabi, "Fights saddle Polihali Dam project", Lesotho Time, 25th September 2019

Pascalinah Kabi, "The hidden Environment Toll of Sand Mining on Mohokare", Uncensored News, October, 2023

Thabo Thakalekoala," Lesotho Highland Development Project Quarry is a Menace to the Ha Ntsi Community", International rivers, 14th November, 2002

The Post Newspaper. "Mine has gone rogue, say villagers." 16 November, 2021

The Reporter. "Quarry Mine Pollution Uproar." 25 March, 2019

Internet Sources

Moradi Crushers. “Home.” Moradi Crushers. Accessed April 13, 2024. http://moradicrushers.co.ls

World Bank. "Environmental and Social Management Framework for Lesotho." World Bank, last modified April 2020. https://documents1.worldbank.org/curated/en/148841588144549881/text/Environmental-and-Social-Management-Framework-for-Lesotho.txt

LEX Africa. "Lesotho Mining 2022." LEX Africa, January 2023. https://lexafrica.com/wp-content/uploads/2023/01/Lesotho-Mining-2022.pdf

San Matekane Foundation. “MGC Samuel Ntsokoane Matekane: the Biography” accessed May 12, 2024. https://sammatekanefoundation.org.ls/?page_id=12

NSSGA. "Home." National Stone, Sand & Gravel Association. Accessed July 11, 2024. https://www.nssga.org/info@environment.gov.ls

Transformation Resource Centre. "Home." Transformation Resource Centre. Accessed July 11, 2024. https://www.trc.org.ls/