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## Land Degradation Associated with Illegal Sand Mining in Rural Areas and Lack of Formalization of the Industry in South Africa: A Review

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### ABSTRACT

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*environmental impact, illegal sand mining, rural communities, sustainable development, sand exploitation*

Sand mining has gained popularity in rural South African communities, as a result of the growing need for building materials in the surrounding villages and as a source of income for rural communities. Consequently, sand is a vital natural resource for every civilization in the world. Despite the growing dependence of rural communities on sand, communities involved in this industry will face significant obstacles if it is not regulated. The link between environmental concerns and sand mining in South Africa has remained a contentious issue and an under-researched field, despite the existence of literature indicating an increase in environmental awareness among some mining operations. Therefore, the review paper seeks to give a detailed review of the degradation of land due to illegal sand mining in South Africa's rural areas, as well as a lack of formalization in the industry, contribute to land degradation. The development of a passive regulatory agenda for sand mining makes enforcement tough and complex. The absence of defined criteria for dealing with sand mining operations and the inability of regulatory bodies result in unscrupulous sand mining and environmental destruction. It is advised that local governments enact rules to maintain the biological beauty of their towns, even though there are now no regulations in existence. The communities in the area of the extraction sites should undergo environmental awareness training, and there should be a clear check on the regulatory bodies in order to discourage unlawful sand mining. Consequently, there is a need to regulate sand mining in both national and international rivers, and it should only be permitted after a comprehensive scientific investigation demonstrates that there will be no negative environmental impact. Greater consideration of alternatives and utilization of resources more sustainably could significantly reduce environmental impact.

## 1. INTRODUCTION

Sand mining is the technique of harvesting sand, often through an open pit but also from beaches and inland dunes or by dredging from the ocean and riverbeds. Sand can also be mined using a combination of these methods [1]. Sand is not just employed in building; it is also commonly utilized in the manufacturing industry, for example as an abrasive or in concrete. Sand and gravel account for approximately 70-80 percent of the yearly mining total of 50 billion tons of material worldwide [2, 3]. People are led to believe that sand is a renewable resource due to the ongoing replenishment of sediment deposits in river bottoms and estuaries through sediment transport. This common misconception leads to confusion and frustration when facing the environmental and economic challenges of sand extraction [4]. Sand is fundamentally non-renewable because that it takes millennia for it to emerge from the weathering of rock. Furthermore, continual extraction of sand from the environment that is not sustainable will eventually lead to the depletion of sand resources [1, 4-6]. The most widespread negative effect that sand mining has on the environment is the degradation of land, as well as the conversion of areas that were formerly undeveloped or natural, to mines [2, 7, 8]. The mining of sand takes place throughout the world, in both industrialized and

developing nations. According to Pieterse [9], researchers, economists, environmentalists, legislatures, governments, civil society from both developed and developing nations are debating these problems at an international level. Pieterse [9] cited a number of other ongoing debates as well. Sand's increasing significance and importance in the building industry is driving up demand for the material [1, 4, 9, 10].

Sand mining is widely regarded as one of the most significant environmental challenges confronted by South Africa today [5]. This makes sense given that Bagchi [11] identifies projects or activities related to sand mining as one of the causes that contribute to the deterioration of land and environment. Concerns about the environment are frequently disregarded, particularly when people are able to profit from natural resources [1, 4, 5, 9, 10]. According to Kondi and Mathanda [6], a number of illegal operators have mined the resource and then abandoned the sites without engaging in any form of rehabilitation after the resource has been depleted. This has led to the degradation of the land that was caused by sand mining. According to the research of Hamann [5], this kind of activity almost always leads to irreversible damage of the surrounding environment, which will be difficult to rectify in the future. The reason for this is that mining activities entail the destruction of vegetation through tree cutting and burning, thereby exacerbating land degradation and negatively

impacting associated ecosystems [11]. Rapid residential development is driving the expansion of new areas in Limpopo, including Mentz, as locals construct their own homes, responding to a surge in settlement growth [6]. Kondi and Mathanda [6] suggested that sand miners should repair the regions where they extract sand by taking into account the growing demand for sand as well as the need to restore the ecosystem. Sand miners are required to keep up with the demands of local inhabitants and other stakeholders; hence, the higher the demand for sand, the more severe is the rate of land degradation [12].

Although a lot of attention has been paid to individuals who are involved in the mining of precious metals and jewels like gold and diamonds, it is crucial to remember that illicit sand mining poses a serious threat to local communities [13]. This is something that should be kept in mind. Sand and gravel are both essential components in the manufacturing of cement. The need for these resources is always growing because of the tremendous development that is taking place and the requirement for new residential, commercial, and industrial buildings. According to a report published by the UNEP in 2014 titled "sand, rarer than one might believe", sand and gravel make up the largest volume of solid material that is removed around the world. The analysis indicates that sand and gravel are the basic materials that are utilized the most on the globe, second only to water. Despite resources are being exploited at a rate that has never been seen before, the United Nations Environment Programme (UNEP) has issued a warning that the volume of extraction is wreaking major havoc on river, delta, coastal, and marine ecosystems. Because of these activities, ecosystems and habitats are being lost and disrupted as well. Furthermore, in regions with high water tables, productive pasture and croplands may be disrupted or destroyed, and natural waterbodies may become contaminated. As a result, the purpose of this review study is to evaluate the impact of illicit sand mining activities in the rural areas of South Africa and the nature of those activities.

## 2. LITERATURE METHODS

The literature searches comprised English publications that had undergone peer review, as well as relevant reports. All data employed in the evaluation and extensive project reports, published papers, and websites were consulted to compile the review. The Google Scholar and Web of Science databases were utilized to identify all pertinent articles and papers. The selection criteria included the following: illegal sand mining; rural sand mining activities; effects of sand mining in rural areas; causes of illegal sand mining in rural areas; and, impact of illegal sand mining. Firstly, a systematic process was utilized to pick these publications by examining relevant examples involving illegal sand. Additionally, legal requirements and laws regarding public input were addressed [14]. The various reasons, or lack thereof, of this occurrence in both industrialized and developing nations were examined, with a primary focus on South Africa. Secondly, a systematic review was conducted, building on our experiences and describing best practices in conduct and reporting. To capture a wide range of articles from different sources across the country, additional searches were systematically sourced through the reference lists of key articles. This practice incorporates the use of snowball methodology from the appropriate list of references generated in the first search. The

current study acknowledges the strict use of the comprehensive search of literature in English as a basic limiting factor for such studies on South Africa.

## 3. SIGNIFICANCE OF SAND MINING IN RURAL AREAS IN SOUTH AFRICAN CONTEXT

Results from the present analysis shows that in recent decades, the relation between mining a long-term economic development has been tied to the surge in the demand for sand due to the accelerated pace of industrialization, urbanization, and various interconnected advancements [15-17]. When people in rural areas try to move away from shacks or squatter camps and into suitable housing, the issue of sand mining - whether it should be legal or illegal - becomes relevant due to its impact on land availability and building materials. The mining industry has a significant amount of untapped potential in terms of output on a local and national scale, employment opportunities, revenue distribution, and overall socioeconomic expansion [18]. For example, local small-scale employment is created, especially for drivers and others who provide them with goods and services [19]. This results in shifts in particular salary levels and income disparities which can have a negative impact on the quality of life for those living in such areas [17]. On the other hand, this might be beneficial for the income of the people who work in the local mining industry.

A significant number of communities and traditional leaders within a domain will sell communal land to miners in order to profit from sand mining in Nsugbe, Anambra state, Nigeria [20]. The reason for this is that people's livelihoods depend on nearby and easily accessible natural resources, in this case, sand mining [1]. According to the research of Madyise [1], sand, like diamonds, is a highly wanted natural resource in the building industry, used for reinforcing structures when mixed with cement and concrete; plastering; combining with concrete when producing foundation; and molding bricks for the creation of dwellings and rental properties that generate money for locals [19]. Due to the quantity and accessibility of sand, villagers may affordably construct contemporary, long-lasting homes. More than 200 illegal mines were active in the provinces of Eastern Cape and KwaZulu-Natal, where the majority of illegal sand mining was occurring in South Africa [15, 17, 20].

## 4. DEGRADATION OF THE NATURAL ENVIRONMENT EMANATING FROM ILLEGAL SAND MINING IN RURAL COMMUNITIES

There have been a lot of headlines about illegal mining in relation to gold and diamonds, but there is evidence that illegal sand mining occurs on a larger scale and is much more dangerous. There is a lack of government intervention when it comes to illegal sand mining because sand mining takes a backseat to mineral mining like diamonds and gold. Despite the fact that the Mineral and Petroleum Resources Development Act of 2002 regulates sand mining or extraction, it continues unchecked and has increased over the past five years [20]. Illegal sand mining may cause soil erosion, sinkhole development, biodiversity loss, soil, groundwater, and surface water contamination [10]. In regions with a high-water table, these activities may also disturb or destroy productive grazing and croplands and pollute natural water

bodies. In the agricultural region of Philippi municipality in the Western Cape, for instance, large-scale illegal sand mining was affecting crop output and endangering the livelihoods of thousands of agricultural workers over time [20-24]. On a local scale, illegal sand miners eliminated vital riparian stabilizing plants. Along riverbanks and shorelines, this vegetation reduces erosion by retaining soil, filters sediments and pollutants, and provides habitat for wildlife and fish cover for water quality [21]. Water security has become one of the nation's most pressing concerns for the next five to ten years. This is due to rivers being the only source of inland water, combined with low precipitation levels, rising pollution, and rapid growth in consumption. Moreover, sand dunes were eroding, as a result of unlawful sand mining, putting lives and property at risk. According to Madyise [1], sand mining is one of the most obvious and immediate causes of environmental degradation.

Illegal sand mining by so-called artisanal and small-scale mining (ASM) miners in the Sand River basin, a tributary of the Limpopo River (one of Southern Africa's major rivers), has reached crisis proportions in the agricultural sector of this province (Limpopo Province) [6]. It appears that the involved mining companies and Environmental Assessment Practitioners (EAPs) are attempting to circumvent environmental and water use license authorization requirements by applying for multiple mining permits for adjacent areas less than 5 hectares in size. [4, 10]. Collectively however, these areas cover an extended area of approximately 70 hectares [21, 25, 26]. Traditional and commercial fishing could be hampered by the extinction of benthic wildlife, and agriculture could be harmed by the loss of arable land resulting from river erosion and a lowering water table [22]. Downstream erosion, which includes streambank erosion and undercutting infrastructure such as roadside, bridges and houses can occur due to increased rate of erosion from the illegal mined regions. [1, 17]. It is important to note that in many situations, there has been no public consultation on such developments [17].

Table 1 below summarizes the environmental impacts associated with illegal sand mining across the South African provinces.

**Table 1.** The environmental damages of illegal sand mining in the rural communities of South African provinces

| Provinces     | Villages     | Environmental Impacts                | Sources                     |
|---------------|--------------|--------------------------------------|-----------------------------|
| Limpopo       | Nzhelele     | Depletion in water quality           | Sengani and Zvarivadza [16] |
| Kwazulu-Natal | Umzumbe      | Divert the river's natural flow      | DWS [26]                    |
| Eastern Cape  | Qolora Mouth | Massive soil erosion                 | Davies [27]                 |
| Limpopo       | Lephalale    | Removal of riparian vegetation       | Maeko [28]                  |
| Mpumalanga    | Sabie        | Siltation                            | Wray [29]                   |
| Gauteng       | Dilopye      | Loss of land through coastal erosion | Ledwaba [30]                |
| Limpopo       | Musina       | Threat to food security              | FFM [31]                    |

## 5. GOVERNMENT EFFORTS OF DEALING WITH ILLEGAL SAND MINING WITHIN THE LEGAL FRAMEWORK

The Mineral and Petroleum Resources Development Act of 2002 safeguards sand mining by requiring permit applications to be submitted to the department of mineral resources. Those wishing to mine sand must adhere to these criteria. As part of a state-wide crackdown in 2014, environmental management inspectors from the Department of Environmental Affairs, conducted a nationwide operation to root out illegal sand mining activities. Our results show that at least twenty entities who were apprehended, as a consequence of the inquiry faced legal action. Although the operation was deemed successful, it mostly targeted large-scale miners. This implies that small-scale unlawful operators, who continue to harm communities such as those in Hammanskraal (Gauteng Province), were able to continue their operations. In 2016, the Department of Water and Sanitation petitioned the court for an injunction to prevent a company from mining sand in KwaZulu-Natal Province without the proper authorizations. This province is among the region's most badly affected by illegal mining. Due to the fact that civil law has supplanted customary law, rendering chiefs powerless against criminals, some researchers and local journalists have asserted that traditional leaders are facing difficulties as a result of legal obstacles [9, 27]. The government must regulate and supervise illegal sand miners just as it governs and monitors artisanal miners. It is important to note that illegal mining has the potential to significantly undercut regular mining because illegal miners are not compelled to pay for land use or other mining-related utilities [9, 27-30].

Studies show that South Africa lacks the capacity for small-scale sand mining frameworks that offer acceptable environmental compliance, and the enforcement mechanisms are unable to effectively deter illicit activity due to a lack of financial and human resource capacity [31]. In addition, there is an absence of frameworks for small-scale sand mining that can facilitate enhanced environmental compliance [10]. Consequently, a substantial number of new players have entered the business, resulting in the construction of a system that faces problems on multiple levels, including those that are social in nature, environmental in nature, legislative in nature, and structural in nature [32]. Even if the cumulative impact of these illegal actions has not yet been determined, the rules and management procedures currently in place are insufficient to avoid the irreversible damage of riverbeds and adjoining estuarine zones [33]. In 2013, the Department of Economic Development, Environmental Affairs, and Tourism (DEDEAT) released a draft statement stating that some of the existing sand-mining sites must be shuttered and proposing that other strategically positioned locations be authorized and managed appropriately. In order to protect the environment, the statement also suggested that some current sites must be closed [26]. However, this has not occurred because the government continues to be asked to legalize the industry. Currently, South Africa's mining regulations do not regulate artisanal and small-scale mining (commonly known as ASM) as a distinct form of mining. Instead, a mining authorization, which is easier to get than a mining privilege, can be obtained; nonetheless, ASM miners still struggle to meet the permit's conditions. The ASM policy was released by the minister of mineral resources and energy on March 30, 2022 [9, 27]. The

fundamental purpose of the policy is to build a legitimate ASM sector that can operate sustainably and contribute positively to the economy. Even though one of the policy's objectives is to discourage illegal mining, the situation is still extremely dire for the environment, the agricultural industry, and the country's already restricted water supplies, as a result of illegal mining.

## 6. DISCUSSION

Illegal sand mining will only provide precarious employment to a tiny number of locals as long as non-renewable materials are available. Similarly, Sengani and Zvarivadza [16] argue that the sand mining sector is crucial to the South African economy as it generates one-third of the sector's total revenue. This data adds support to the notion that the sand mining industry is vital to the South African economy. Because sand mining is carried out without formal approval from regulatory agencies, Mngeni et al. [3] states that its value cannot be precisely assessed. Therefore, the South African Revenue Services (SARS) receive no tax payments from sand miners. It is important to note that there are villages where the tangible benefits of democracy have been painfully slow to materialize precisely due to illegal mining of sand. However, the majority of strip mining comes from businesses such as local contractors, building supply stores, and large construction firms. Even though corporations constitute the primary demand driving strip mining, this is the reality [32]. Every location where land extends into the ocean contains at least one illegal mine. Some of these mines were established to construct local homes, while others were established to establish tourism businesses.

In the meantime, the rehabilitation of mined areas is mandated by South African rules such as the National Environmental Management Act 107 of 1998 and must be completed as quickly as possible. Plans for sand mine rehabilitation must conform with NEMA 107 of 1998, which mandates that these plans include provisions for the availability of topsoil. It is of the utmost importance to underline that the resultant deterioration must be avoided and that damaged land must be adequately recovered to prevent or at least lessen land surface erosion.

In the Dedeat Draft Environmental Management Plan from November 2013, it was stated that the Department of Mineral Resources has been unable to legalize sites because it is invariably impossible to reach an agreement on who should be the holder of the mining license, as well as whom and how the benefits from the sale of sand should accrue [7]. This was because "it has been unable to get an agreement on who should hold a mining license and how sale proceeds should be distributed". Due to the numerous parties involved, some of whom have opposing interests, the situation is made more complicated. Many government personnel may have ulterior motives, thus complicating the problem. Purnomo et al. [34] supports this thesis, in that the community's different viewpoints on mining suggest that activities that harm the environment and disrupt the agricultural sector cannot sufficiently sensitize the opposition. In addition, Purnomo et al. [34] stated that the majority of the community's adaptation efforts are still short-term reactive rather than long-term proactive.

Local, regional, or national administrations, including the Department of Mineral Resources (DMR) and the Dedeat, as well as the South African Police, have not yet put a stop to the

vast illegal sand mining that is causing massive damage. According to Purnomo et al. [34], the attempts that have thus far been made to stop the mining in the area have yielded nothing except frustration and dead ends.

## 7. CONCLUSION

Due to the dynamic nature of sand, its harvest is a component of a larger system. Sand extraction is a form of extraction because the resource has been depleted. Future demand for sand from the construction industry will perpetuate the current situation in which mining exceeds natural replenishment, depleting sand supplies. It is important to evaluate sand output for different river systems and limit mining activities upstream that can lead to severe downstream effects. These obstacles must be evaluated in light of their environmental and social impact. Better enforcement is required to deter illegal activities and criminalize river and estuarine sand extraction, while the construction industry searches for alternative sand suppliers [10]. Inadequate scientific techniques have resulted in the indiscriminate mining of river sand, while both weak government and corruption have led to extensive illegal mining. Poor collaboration exists between marine research organizations and the marine aggregates industry [35].

Sand mining contributes to construction of buildings and infrastructure, mineral extraction, and economic and social development. Without environmental protection, industrial sand mining erodes these achievements and raises environmental concerns. The mining of sand from rivers must be governed and permitted only after a competent scientific investigation demonstrates that there will be minimal environmental impact. Alternatives and sustainable resource utilization could lessen the impact on the environment. Other initiatives should include ecological restoration and scientific mining which entails using evidence-based techniques and advanced technology to minimize ecological damage and ensure that mining practices are environmentally responsible, economically viable, and socially acceptable. The enforcement of passive sand mining regulations remains to be difficult. The absence of clear criteria and regulating agencies is the cause of unscrupulous sand mining and environmental degradation. Communities in the vicinity of extraction sites should receive environmental education and mining areas should be inspected to prevent illegal sand mining. This will aid in monitoring and enforcing in support of community livelihoods.

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