IJMR E-ISSN: XXXX-XXXX
INTERNATIONAL JOURNAL OF MULTIDISCIPLINARY RESEACH

THE IMPACT OF QUARRYING ON THE ENVIRONMENT AND MITIGATION EFFORTS IN THE KENDENG MOUNTAINS OF SOUTH PATI

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Received: January 2025	Accepted: March 2025	Published: April 2025

Abstract:

This study aims to analyze the environmental impacts of Class C mining activities and the mitigation efforts undertaken in the Kendeng Mountains region, South Pati, particularly in the villages of Sumbersari, Gadudero, and Wegil. The research employed a qualitative descriptive approach through field observations and interviews with local communities and village authorities. The results indicate that mining activities have led to land degradation, erosion, flooding, and a decline in groundwater quality. Beyond ecological impacts, social tensions have emerged due to conflicting economic interests among residents. Mitigation efforts such as land reclamation, water resource conservation, and the application of environmentally friendly mining technologies have been initiated but remain suboptimal. Strengthened supervision, law enforcement, and active community participation are essential to achieving sustainable mining management. This study highlights the importance of consistently implementing environmental policies to balance development needs with environmental conservation.

Keywords: *Impact Quarrying, Mitigation Efforts, Kendeng Mountains.*

INTRODUCTION

C-excavation mining is the extraction of materials such as sand, soil, stone, and gravel, which is one of the most common activities in Indonesia. C excavation activities play an important role in the development of infrastructure such as roads, bridges, and buildings, so C excavation has a significant positive economic impact on local and national communities. However, despite its economic benefits, C excavation mining often causes serious negative impacts on the environment, especially if it is carried out uncontrolled and without applying sustainable management principles (Pratama & Surur, 2021).

The Kendeng Mountains, located in the southern part of Pati Regency, is an area that has the potential for C excavation resources in the form of a fairly large area of land. There are several points of the area that are places of C-excavation mining, namely in Sumbersari Village, Kayen Subdistrict, Gadudero Village, Wegil Village, Sukolilo Subdistrict. The exploitation of excavation C in this area has been going on for the past few years and involves various business actors ranging from small-scale to large-scale extraction. This intensive mining activity has caused considerable environmental problems, such as land degradation, erosion, flooding, and decreased groundwater quality (Wahyuditha & Syahrin, 2025).

Land degradation due to C-excavation in the Kendeng mountain range

has reduced the ecological function of the area, which previously played an important role in maintaining hydrological balance and biodiversity. The mining process removes vegetation and soil layers, making the land more vulnerable to erosion, landslides and flooding, especially during the rainy season (Podungge et al., 2025).

In addition to physical impacts, C-excavation activities also have the potential to cause undesirable social and economic impacts. The imbalance between economic interests and environmental preservation often leads to conflicts between business owners, the government, and local communities. This is due to weak supervision and regulations governing mining in the area (Poluan et al., 2023). Therefore, it is necessary to take a comprehensive approach to managing C excavation activities by considering environmental, social and economic aspects in an integrated manner.

In this context, mitigation efforts become very important to balance the needs of development and environmental preservation. Effective mitigation includes the implementation of reclamation of ex-mining land, conservation of water catchment areas, use of environmentally friendly technology in mining, and strict enforcement of regulations on C excavation activities. In addition, the role of local communities in environmental monitoring and rehabilitation is also a key factor in successful mitigation (Alfaris & Nur, 2025).

This study aims to analyze the impact of quarrying C on the environment in the Kendeng Pati South Mountains area and examine mitigation efforts that have been and can be done to minimize these impacts. A deeper understanding of the relationship between C excavation activities and environmental damage is expected to be the basis for formulating more sustainable natural resource management policies.

RESEARCH METHOD

This research uses a descriptive qualitative approach, which aims to describe and analyze the impact of C excavation activities on the environment and mitigation efforts carried out in the Kendeng mountainous area of Pati Regency. This approach was chosen because it allows researchers to understand social phenomena and the surrounding environment in depth through direct observation and interviews with relevant parties while in the field. In addition, interviews were also conducted with the village government.

The research was conducted at three points in the Kendeng mountain mining area, namely, Sumbersari Village, Kayen Subdistrict, Gadudero Village, Sukolilo Subdistrict, and Wegil Village, Sukolilo Subdistrict.

The data collected was then analyzed qualitatively using the descriptive method (Orenstein et al., 2023). The analysis process includes data reduction, data presentation, and conclusion drawing (Mattke et al., 2022). Field data in the form of observation and interview results were then processed to identify patterns of environmental impacts and mitigation strategies that have been implemented (Lim, 2024). In addition, the analysis also links field findings with applicable environmental policies.

FINDINGS AND DISCUSSION

Environmental Impacts of Mining Activities

Based on the results of observations and interviews conducted in three research locations, namely Sumbersari Village, Kayen Subdistrict, Gadudero Village, and Wegil Village, Sukolilo Subdistrict, the C-excavation mining activities in the South Kendeng Pati Mountains area have had a real and quite heavy impact on the environment, the following are the impacts of C excavation activities:

1. Land Degradation and Landscape Change

Large-scale land mining without adequate reclamation efforts has drastically changed the landscape. The surface of the land that was originally covered with natural vegetation is now turned into arid land and in the form of large depressions that are left after the material is transported. The loss of topsoil not only reduces soil productivity, but also results in the loss of local biodiversity, as many species of flora and fauna lose their natural habitat (Holqi & Salam, 2024).

2. Erosion, Landslides, and Flooding

One of the most serious impacts is the increase in erosion and landslides. The process of material extraction that does not take into account soil conservation techniques causes land stability to be disrupted, especially when the activities of C-excavation are carried out irregularly or in large-scale quantities. During the rainy season, open land becomes highly vulnerable to water erosion, which carries sedimentary material to surrounding rivers. This accumulation of sediment contributes to river siltation, increasing the risk of flooding in the lowlands. Some local communities have complained that flooding has become more frequent and severe in the last five years (Mambi et al., 2023).

3. Decrease in Groundwater Quality and Quantity

C-excavation activities also have an impact on underground water resources. The reduction of water catchment areas due to the clearing of mining land leads to reduced recharge of local aquifers. In addition, the presence of heavy equipment and material transportation vehicles increases the risk of groundwater pollution due to seepage of oil, fuel and other solid waste (Alfaris, 2024).

Social and Economic Impact

In addition to physical impacts, C-excavation mining activities have impacts on the surrounding community, as follows:

1. Social Conflict

C-excavation mining not only has implications for ecological damage, but also triggers social tensions at the local level. There are different attitudes among the community: most residents who work in the agricultural sector feel disadvantaged because the productivity of their land has decreased, while some other residents involved in mining activities get short-term economic benefits. This conflict sometimes leads to community protests and tensions with the village government and mining business actors.

2. Economic Dependency

Mining is one of the main sources of income for several community groups

in the study area. Jobs such as truck drivers, heavy equipment operators, and laborers transporting materials have become alternative employment opportunities. However, this dependency creates socio-economic vulnerability, as income from this sector is not sustainable as mining materials run out and the government potentially closes the site (Cerya & Khaidir, 2021).

Possible Mitigation Measures

Seeing some of the impacts of C-excavation mining activities, it is necessary to make changes in the surrounding environment, following the mitigation efforts that need to be done:

1. Land Reclamation and Rehabilitation

Reclamation efforts on ex-mining land are still very limited. Some companies have begun to carry out reclamation in the form of replanting trees and backfilling ex-mining pits, but in general the implementation of reclamation is not optimal. Local governments need to strengthen policies that require mining actors to carry out reclamation before and after mining operations (Tunggala et al., 2024).

2. Water Resources Conservation

Protection of catchment areas is an important priority in mitigation. Conservation measures include the construction of infiltration ponds, restoration of native vegetation in river buffer areas, and the application of biopore technology to increase water infiltration.

3. Application of Environmentally Friendly Technology

The limited use of environmentally friendly technology in the mining process is a major concern. For example, the application of tiered mining methods and the use of heavy equipment with dust filtration systems can help reduce environmental impacts. In addition, the use of prohibition signs and special lanes for transporting materials can reduce damage to village roads and the risk of traffic accidents.

4. Strengthening Supervision and Enforcement of Regulations

One of the main problems is the weak supervision of mining activities. Many illegal mining sites operate without official licenses (Izin Usaha Pertambangan Rakyat - IUPR). Local governments together with relevant agencies need to increase the capacity of field supervision, tighten the granting of mining licenses, and impose administrative or criminal sanctions for violations.

5. Community Empowerment and Participation

The success of mitigation efforts cannot be separated from the active role of the community. Through training and extension programs on environmental conservation, it is expected that local communities can play a role in environmental monitoring and obtain alternative sources of livelihood, such as agro-tourism, conservation plantations, or local resource-based micro-enterprises (Azuga et al., 2025).

Linkage of Field Findings with Environmental Policy

development and environmental protection. In fact, according to the provisions in the Law of the Republic of Indonesia Number 32 of 2009 concerning

Environmental Protection and Management, every activity that has an important impact on the environment must be equipped with an AMDAL or UKL-UPL document. In the field, the implementation of environmental studies is often ignored or merely a formality without real implementation. Therefore, it is necessary to strengthen the policy through:

1. Integration of environmental considerations in the licensing process.
2. Strict monitoring of the implementation of AMDAL/UKL-UPL.
3. Increased community participation in the process of formulating and evaluating mining policies (Wahyuditha & Syahrin, 2025).

CONCLUSION

Quarrying activities in the Kendeng Mountains of South Pati, particularly in Sumbersari, Gadudero and Wegil villages, have had a significant impact on the environment and the community. Ecologically, mining causes land degradation, erosion, flooding, and decreased groundwater quality due to loss of vegetation and infiltration areas. Socially, this activity triggers conflict between residents and economic dependence on the mining sector which is unsustainable.

Mitigation efforts such as land reclamation, water conservation and the application of environmentally friendly technology have begun to be carried out, but have not been optimized. Weaknesses in regulatory supervision and enforcement exacerbate the negative impacts. Enforcement of Law No. 32/2009 on Environmental Protection and Management is an important key to encourage more sustainable mining management based on active community participation.

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