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STUDY OF THE IMPACT OF LIMESTONE MINING ON ENVIRONMENTAL DAMAGE IN KLAPANUNGGAL VILLAGE, BOGOR REGENCY

Faizah Nurfitriyah[1*], Winarno[2]
[1,2]Geography Education, Muhammadiyah University Prof. Dr. Hamka, Jakarta, Indonesia

[*]Correspondent Email: Faizahnur3112@gmail.com

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Abstract: Klapanunggal Village is one of the villages which is one of the places for limestone mining to be carried out. The existence of limestone mining which has been operating since 1970 has had a direct impact on the environment of the surrounding community. The purpose of this study is to determine the impact of limestone mining on environmental damage in Klapanunggal Village and to find out the efforts of the local government to reduce the negative impacts of illegal limestone mining in Klapanunggal Village , Bogor Regency. This research is a type of descriptive research. The research results obtained are damage and changes in landscapes, destruction of habitats and ecosystems in limestone hills/mountains, stagnant water or ponds resulting from mining residues, damaged and perforated road conditions, air pollution, and noise. As for the efforts of the government was a 1000 tree planting program but only in a few locations and also carried out road casting in several road areas.

Keywords: limestone mining, environmental damage, geography

INTRODUCTION

In terms of natural resources, both living and non-biological, Indonesia is a nation that has the potential for an extraordinary wealth of natural resources (Sulistiya, 2020). Mining of minerals is one of the activities included in the utilization of natural resources in Indonesia. These resources are used for the welfare of the Indonesian people.

Mineral resources in the form of mineral deposits have unique properties, such as the inability to grow and develop, which make them difficult to renew and require a long period. As a result, an adequate mining system is necessary to manage mineral resources effectively from a technical and economic point of view so that the acquisition can be optimal (Mochamad, 2011).

The series of mining activities are always related to the environment because it is a place where all living things on land and in the air interact. The majority of mining in Indonesia is done through open pit mining which destroys the ecosystem. This disrupts hydrological functions, biodiversity, carbon absorption, oxygen supply, and environmental temperature regulation (Shaifulloh, 2021).

One of the main mineral sources in the karst area is limestone. This rock is used as a mixture of ornaments/decorations, industrial and building raw materials such

as bleaching agents, building materials, and cement production (Avrilan, Siregar, & Suhendrayatna, 2022).

The unique topography known as karst is formed in carbonate rocks such as limestone or dolomite that have been deposited by water (Liu & Peng, 2021). Limestone hills have forests on them, as well as tropical forest areas which are places for the development of flora and fauna in the region (Tolentino et al., 2020).

Klapanunggal Village is a village that has abundant limestone reserves because this village has Klapanunggal rock formations. The existence of limestone mining in Klapanunggal Village has resulted in both positive and negative impacts. The resulting positive impact is creating new jobs.

In addition, limestone mining also causes environmental damage and decreases the quality of the surrounding environment, such as causing air pollution produced by cars transporting limestone, noise pollution produced by stone crushing machines and bombs to destroy limestone, decreasing the quality of land in the mining area and make it barren, dry land has a hot air temperature because the land cannot be grown by plants or trees.

Many environmental problems have arisen because of this limestone mining activity, this mining must be taken seriously by stakeholders, especially by the village government. The government must be able to bridge the problem because even though their work destroys the environment, that is their livelihood. Based on this background, the problems in this research are what are the impacts of limestone mining on environmental damage in Klapanunggal Village and how are the efforts of the local government to reduce the negative impacts of illegal limestone mining in Klapanunggal Village.

LITERATURE REVIEW

Mine minerals are divided into 3, namely groups A, B, and C. Limestone is included in group C minerals because it has rock-like properties (Agustin & Brata, 2019). Limestone is a type of sedimentary rock that is produced through chemical or biological processes and is a non-clastic sedimentary rock. The mineral calcium carbonate (CaCO 3), which is formed as a result of chemical or organic processes, is the main component of limestone (Jufri & Zakaria, 2019).

Limestone is usually white, yellowish white, brownish yellow, and gray to black (Suryana & Wijayanti, 2020). Limestone has many uses, generally, limestone in Indonesia is used as a material for buildings and infrastructure (Amheka, Tuati, & Rumbino, 2019). Other benefits are for the rubber and tire industry, the paper industry, and others. In addition, limestone is an important raw material in the construction and industrial sectors.

According to Law No. 3 of 2020 Mining is the activity of extracting minerals and/or coal and associated minerals or minerals. Each stage of operation has goals and functions to ensure good, environmentally friendly, and sustainable mining operations (Haryadi, 2018, p. 30). The environment in general refers to the external conditions that impact the growth and behavior of all living things, including humans. These influences may be direct or indirect (FIRDAUS, 2019). Mining procedures are always associated with environmental damage.

According to Law Number 23 of 1997 in terms of environmental management, environmental destruction is an act that changes the physical and/or biological characteristics of the environment in such a way that it cannot maintain sustainable growth in the future.

Mining has two contradictory benefits, it can bring prosperity because it helps people make a living, but it also has the potential to damage the environment (Wijayanti & Ramadhita, 2023). Therefore the diversity and distribution of species may be disrupted in the area around the mining area. Human activities that exceed the carrying capacity or capacity of nature, cause pollution or damage to ecosystems around mining areas and disrupt the harmony of coexistence between humans and nature (Wahyuni, 2022). Thus causing a negative impact felt by the community around the mining.

The impact of biotic factors caused by mining results in the displacement or reduction of existing plant and animal species, including fish, snakes, reeds, grasses, and green mosses. Air quality, noise, and dust levels are all affected by the impact of physical factors that can occur (Silfa, 2017).

RESEARCH METHODS

The research design is the basis that becomes the frame of reference for making a general framework for conducting research. In this research, a descriptive research design is used as a research design that describes the problems that arise in the research. According to (Tika, 2005) descriptive research is research that reveals problems or circumstances such as the actual situation.

The researcher choose a descriptive research method because it aims to describe the impacts of limestone mining on the environment and the efforts of the government and local communities to reduce these impacts, which are found in the field. The research was conducted in Klapanunggal Village, Klapanunggal District, Bogor Regency as the research location because Klapanunggal Village has the largest limestone mining activity in Klapanunggal District.

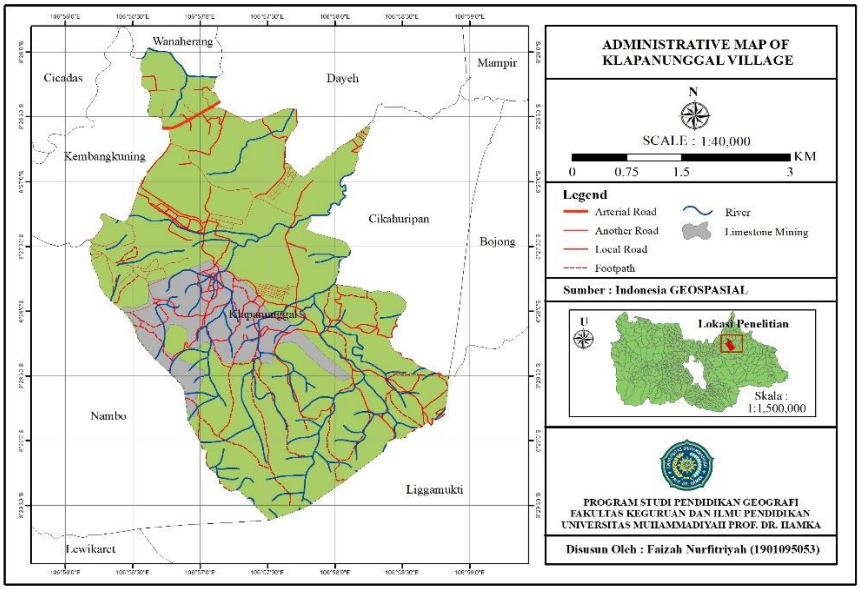

Figure 1. Research sites

The population in this study is a limestone mining site in Klapanunggal Village, Klapanunggal District, Bogor Regency. In determining research subjects, researchers used the purposive sampling method. Purposive sampling is the selection of samples based on certain criteria and objectives. The important thing is not the number of respondents but the depth of information provided by each respondent (PUTRININGRUM, 2018)

In this study, the authors choose several samples, namely the Head of Klapanunggal Village, 10 mining workers, and 10 residents around the mine. Data collection by observation, documentation, and interviews. The data analysis technique in this study is data analysis according to Miles and Humberman in Muhammad (2019: 28), namely data collection, data reduction, data presentation, and conclusion.

RESULTS AND DISCUSSION

Klapanunggal Village is one of the villages that has abundant natural resources in the form of limestone. This is because the area of Klapanunggal Village is in the Klapanunggal rock formation, according to (Van Bemmelen, 1949) The Bogor Basin is covered by a geological formation called the Klapanunggal Formation. Coral limestone, sandy limestone, marl, gluconic quartz sandstone, and green sandstone are all found in the Klapanunggal Formation. Therefore, the surrounding community uses these natural resources to make a livelihood.

The mining located in Klapanunggal Village is categorized as an open pit mine. Open pit mining which is often known as surface mining is a mining technique in which all mining operations are carried out on the surface of the earth, in this case, the open pit mining system in the field of limestone mining is dredging and destroying hills or mountains (Balfas, 2015).

According to interviews that the researchers conducted with respondents consisting of 10 coolies/mining workers, 10 residents, and also the Head of Klapanunggal Village, stated that limestone mining activities in Klapanunggal Village have existed since 1970.

The mining process is also different between the ancient mining process and the present one. The ancient mining process was done manually with simple tools, namely by prying, chiseling and destroying it using a hammer and an axe. Meanwhile, the mining process, which is currently carried out using bombs, is destroyed using a stone breaker and then transported by mining workers to trucks, which are then brought to buyers. However, since 2020 mining using bombs has been discontinued, because it is dangerous.

The location in Klapanunggal Village is in RW 06, with two RTs, namely RT 07 and RT 06. However, the point or area of the mine is still unknown because according to the interviewee's answers, there are PTs and cooperatives and some are owned by individuals or are still not legal.

Based on the results of interviews with respondents, it was shown that the mining workers in the limestone mining were not only from Klapanunggal Village but also from nearby villages, such as Cikahuripan Village and Kembang Kuning Village. The work of laborers or mining workers is the

main job and a side job because there are some residents do farming with this side job as mining workers.

According to respondents, namely the local community and mining workers, the presence of limestone mining is very helpful for the economy of the surrounding community, because it can increase employment opportunities. The impact is beneficial because it helps improve the family's economy, and the local population's economy, from previously lacking jobs or losing jobs to being helped and getting new jobs (Doni & Meitasari, 2023).

And also with the cash that is usually given by every truck that passes. This cash will be managed by the local youth organization or RT, and this cash will be used for the benefit of the social environment of residents such as for PHBI (Indonesian Holiday Celebrations) events, construction of a prayer building, helping sick residents, for assistance to the elderly, and poor people. This also has a positive impact on limestone mining in Klapanunggal Village.

As for the negative impacts of limestone mining on the surrounding environment according to the respondents' answers, namely (1) The beauty of the limestone hills is damaged and the changes in the landscape, due to mining, the limestone hills are not as beautiful as they used to be, what is visible now are the remnants of mining that make up the hills chalk gets abstract; (2) Destruction of habitats and ecosystems in limestone hills/mountains. This happens because before mining the land on the mountain, stripping or clearing of the land is carried out, the process is that the trees and shrubs are cut down and cleaned first (Gofur & Wesnawa, 2018). So this damages the degradation of vegetation and ecosystems in the land; (3) There are puddles or pools of water resulting from mining residues because reclamation operations related to mining have only been partially successful. After completing mining, the land that has been leveled is not immediately processed or planted, thus making the land unable to absorb water and being inundated with water, if this is left unchecked, it will certainly have other negative impacts such as becoming a breeding ground for mosquitoes and it is feared it will endanger residents due to the unknown depth of the pond. Another problem is the emergence of environmental changes that mostly affect surface and groundwater, as well as changes in topography and soil morphology that are ongoing (Rahmatillah & Husen, 2018); (4) The condition of the road is damaged because trucks are passing by, lots of big holes and big rocks. Especially when it rains, the road conditions will become slippery and muddy. This will discourage road users who want to use the road for their activities and will also be at risk of an accident (Hulukati & Isa, 2020); (5) Air pollution, which is produced from the exhaust of trucks and other vehicles that pass on the road and also because of the damaged and dusty road conditions, so it is very disturbing to motorists or the local community whose houses are located beside the road. (6) Noise, which is produced by the sound of stone breaker engines and also passing trucks. Noise is unwanted sound when it is present at a certain frequency and duration and can harm on one's health and the comfort of the

environment (Irvani, 2020). This disturbs the comfort of the local community when they want to take a nap or other activities during the day but at night mining activities are stopped because mining working hours start from 07.00 to 17.00 WIB.

This negative impact, according to the respondents, some people who live around mining admit that they sometimes feel disturbed by the noise generated by stone-crushing machines or from passing cars but some residents also admit that they are used to it, so not bothered. The local community has never complained or demonstrated against the mine owner or the village government about the negative impacts they have felt so far because that's all the consequence they live in areas adjacent to mining.

According to the interviews that the researchers conducted with the community around the mining, the efforts were made by the mine owners and the village government to reduce the negative impacts arising from the limestone mining, the mine owners sometimes sprayed water on the roads through which the trucks passed so that the roads would not dusty, with a frequency of once a week or once every two weeks.

According to the local community, there is also some land that has been reclaimed or repaired, such as the land being backfilled and leveled, after that, it is planted with jeungjing trees or albasia trees, banana trees, and papaya trees. However, some ex-mining lands have not been reclaimed, so the land has become arid. Efforts to reduce the negative impact of mining that the Klapanunggal Village government has carried out are once held a 1000 tree planting program in ex-mining areas and also repaired roads by casting them, but the roads that were cast only 1300 meters long, so there are still many roads in the RW broken.

Open land that has gone through the mining process requires special attention to restore the land to be productive (Oktafitria, Hidayati, & Purnomo, 2019). To minimize the problems associated with neglecting ex-mining land, based on the characteristics possessed by ex-mining land, to determine a more efficient land use path, it is necessary to investigate abandoned ex-mining land. both mining land and existing needs (Khosiah & Utami, 2014). In this way, ex-mining land can be used or can become effective land again.

Not only does the village government take part in efforts to minimize the impact of mining, but the Badan Usaha Milik Negara or Perhutani, which is working with one of the residents of Klapanunggal Village, is utilizing the ex-mining land to become a tourist destination, namely Goa Lalay Tourism Destination which is currently growing and many attracted visitors both from within and outside the village.

The researcher also asked about the hopes for the government in the future to reduce the negative impact of limestone mining in Klapanunggal Village, the respondents' answers are (1) The government must make policies that can alleviate and make it easier for miners here to do their jobs and the people who live around mining can also live safely and comfortably, the policies such as the mining permit policy, the policy of spraying water on the streets with a frequency of time that is frequent or a maximum of once a week, the policy of

having to carry out reclamation or repairing ex-mining land and also policies regarding the initial process until the end of mining. (2) Road repairs that have not been repaired or cast, the people complain about this very much because roads are a very important means of supporting community activities, such as going to school, work, going to the market, and others. (3) Carrying out a lot of reforestation or planting trees on arid lands or the roadside because will minimize air pollution produced by passing trucks and create a cool rural atmosphere. (4) Utilizing ex-mining land into useful lands, such as making it a settlement, plantation, rice field, or a place to create jobs so that it can be utilized by the local community. (5) The local government conducts counseling or outreach, in addition to the government having to make policies regarding lime mining, but the government must also conduct counseling or outreach regarding the policies that have been made. Because the miners and mine owners in Klapanunggal Village do not know and lack further knowledge about proper and correct mining processes. Starting from before mining, when mining takes place, and after mining takes place.

Besides that, researchers have also interviewed the Head of Klapanunggal Village regarding plans for the future of limestone mining in Klapanunggal Village, namely the village government in the future will work closely with mine owners regarding clarity from miners starting from permits, and also the village government will help with the reclamation of ex-mining land that is not reclaimed because, after all, the village government must take responsibility for this and sustainably develop its territory.

CONCLUSION

Based on the results and discussion regarding the impact of limestone mining on environmental damage in Klapanunggal Village, Klapanunggal District, Bogor Regency, the conclusions obtained are as follows: The impact of environmental damage caused by limestone mining in Klapanunggal Village are (1) Destruction of the beauty of the limestone hills and changes in the landscape; (2) Destruction of habitats and ecosystems in limestone hills/mountains; (3) There are stagnant water or ponds that occur as a result of mining remnants; (4) The condition of the road is damaged and has potholes as a result of trucks carrying limestone passing by; (5) Air pollution, which is produced from car exhausts and also comes from road dust; (6) Noise, which is produced by the sound of stone breaker engines and also passing trucks.

The efforts to reduce the impact from the mine owner are that some ex-mining areas are repaired but some are not, and occasionally the mine owner sprays water on the streets to reduce the dust generated by trucks carrying limestone.

While the efforts of the local government to reduce the impact are (1) Planting 1000 trees; (2) Doing road casting, although not in its entirety; (3) Perhutani in collaboration with residents carry out the reclamation or improvement of ex-mining land and take advantage of it to become a tourist destination which is currently developing and is in high demand.

To overcome further environmental damage from limestone mining in Klapanunggal Village, especially for the physical environment, the local government should carry out regular monitoring of the mining process and post-mining activities or reclamation so that the area around mining becomes a beautiful and comfortable area to live in.

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