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Escalation of Recovery of the Impact of Damage to Ex-Mining Agricultural Land Through the Social Functioning of Farming Communities (Case Study in Dengilo District)

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Abstract

This study aims to determine the form of agricultural land damage due to mining activities in Dengilo District, Pohuwato Regency. The research approach used a survey method with a descriptive approach, involving 74 affected farmer respondents. This research was conducted for two months, namely August to September 2025 in Dengilo District, Pohuwato Regency, which is an ex-mining land location with a significant level of agricultural land damage. The results of the study show that mining activities in Dengilo District have caused severe and widespread damage to agricultural land, characterized by decreased soil fertility, degradation of land structure, pollution of irrigation water, and decreased agricultural productivity. These impacts not only disrupt the balance of the ecosystem, but also cause socio-economic losses for the community, especially farmers. Thus, more integrated environmental restoration and management efforts are needed to maintain the sustainability of agriculture and the welfare of local communities.

Keywords: Escalation, Land Destruction, Social Functioning, Mining.

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INTRODUCTION

The damage to agricultural land caused by mining activities not only creates short-term impacts but also has long-term effects on the livelihoods of farming communities. One important aspect of this land degradation is the loss of soil fertility, which can affect agricultural yields. The escalation of the impact of agricultural land degradation through the social functioning of farming communities, especially in ex-mining areas, has become a crucial issue in sustainable development planning. Agricultural land degraded after mining activities often faces significant structural damage, including the loss of essential nutrients and chemical contamination from mining processes. This results in a reduced capacity of the land to support optimal agricultural production and a decline in the economic productivity of communities dependent on the land (Prasetyo, Baderan, and Hamidun, 2025) . The long-term impact of this degradation also includes disruptions to the social functioning of communities, who often struggle to adapt to new conditions after their land is no longer productive.

Meanwhile, the social impact of land degradation on farming communities in ex-mining areas is further evident in changes in their lifestyles and dependence on the

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agricultural sector. Many farmers are forced to shift to other occupations that pose environmental risks, such as working as miners or engaging in less sustainable sectors. Without support from the government or other institutions, these farming communities often struggle to restart their agricultural businesses or even switch to alternative income sources that could bolster their economic resilience (Asparita, Agustina, and Pranoto, 2021) .

Through this research, the researcher aims to explore how the social functioning of farmers, including their welfare, participation in land degradation restoration, institutional and policy support, and social and cultural capital, can serve as a driving force in the restoration process of ex-mining land. The selection of the Dengilo District as a location is based on the empirical reality that this area is one of the areas severely impacted by mining, yet has a strong and active farmer social structure within its community. Furthermore, this research is expected to offer a community-based collaborative model as a sustainable alternative solution, not only to repair land degradation but also to improve the welfare and socio-economic resilience of farmers.

Agricultural Damage Due to Mining

Environmental damage due to mining activities will also leave behind ex-mining land with damaged physical soil conditions, low soil fertility, high soil acidity, high heavy metal content, and low soil organic matter. (Prasetyo, Baderan and Hamidun, 2025) . According to Asparita, Agustina and Pranoto (2021) based on identification and experience, environmental impacts caused by mining industry activities include: changes in natural morphology, ecology, hydrology, water, air and soil pollution. Changes in morphology or landscape, for example, exploitation activities carried out on hill morphology, then excavation activities will change it into plains, puddles or large pools. Morphological changes into large and deep holes, of course, will cause changes in the ecological and hydrological systems in the area.

Water, air, and soil pollution can be caused by dust from excavation activities, dust from crushing or reducing the size of ore and heavy metal waste and other toxic materials from processing and refining processes that are in the vicinity of landslides. The land that experienced landslides is agricultural land owned by local residents, so that the planting area becomes increasingly narrow. The environmental impacts generally affect other people and not the initiators of the activities that cause the impacts in question. Floods, landslides, noise, odors, dust, seawater intrusion, poverty, loss of livelihoods are environmental impacts felt by those who did not initiate the activities.

The Impact of Land Damage on Agriculture

Land degradation caused by mining has serious impacts on the agricultural sector, such as reduced crop yields, disruption to irrigation systems, and contamination of soil nutrients by heavy metals. Assyifa Fauzia (2024) emphasized that crop failure and water crisis are two of the main impacts experienced by farmers in coal mining areas in South Kalimantan.

Declining Land Productivity: Physical and chemical damage to the soil results in a sharp decline in crop productivity. In many cases, the land can no longer be used

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for agriculture without major rehabilitation interventions (Prasetyo, Baderan, and Hamidun, 2025) .

1. Damage to Agricultural Ecosystems
   Mining activities disrupt the balance of natural ecosystems, including the loss of vegetation and fauna that support agriculture, thereby reducing the ecological carrying capacity of the land.
2. Health and Environmental Risks
   Heavy metal contamination from mining residues can enter plants and the food chain, posing a health risk to the surrounding community (Idha
3. Socio-Economic Impact
   For farming communities, loss of land fertility means the loss of a primary source of income. This encourages dependence on external aid and reduces farmers' economic independence.

Land degradation caused by mining not only reduces land productivity but also disrupts the agricultural system as a whole. According to research by Rezki, Aso, and Syahrun (2020) , the extraction of mining materials such as sand and nickel alters soil structure and water management patterns, making the land vulnerable to drought and crop failure. Farmers also face uncertainty regarding planting and harvesting seasons.

Forms of Ex-Mining Damage

the topsoil , which contains nutrients essential for plant growth. According to Yusuf, Nurwaskito, and Imran (2024) , stripping during mining activities causes the soil to lose its aggregate structure, making it dense, non-porous, and poor in organic matter. This directly impacts the soil's ability to retain water and support soil microbial life, which is essential for agricultural processes.

Damage to ex-mining land is the accumulation of physical, chemical, and biological damage that occurs due to natural resource exploitation activities without sustainable management. Ex-mining land, whether for coal, gold, nickel, or sand, tends to be an area with very low productivity value or even cannot be reused without a long-term reclamation process. Damage to ex-mining land is characterized by the loss of soil microorganisms, the death of supporting fauna, and the destruction of soil structure due to the use of heavy equipment. Assyifa Fauzia (2024) , states that mining activities destroy the natural habitat of worms, ants, soil fungi, and plant roots, so that natural soil regeneration is completely hampered.

METHODOLOGY

This study used a descriptive survey method to assess the extent of agricultural land damage caused by mining activities in Dengilo District, Pohuwato Regency. The population comprised 285 farmers affected by mining activities, comprising 185 farmers from Popaya Village and 100 from Karya Baru Village. The research sample was then determined from the research population using the Slovin formula with a 10% error rate. This resulted in a sample of 74 farmers.

The data analysis used to determine the descriptive analysis in this study was used to answer the problem formulation, namely to determine the form of agricultural land damage due to mining activities in Dengilo District. According to Muhajirin, Risnita and Asrulla (2024) , descriptive analysis is a method that aims to present data as it is so that it can provide an initial understanding of the characteristics of the

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research object without generalizing. With this approach, researchers can determine the profile of farmers, both from demographic, social, and economic aspects. Descriptive analysis is used to describe land conditions based on questionnaire data, free questions in the questionnaire are used to strengthen information regarding the forms of land damage experienced by farmers, such as loss of soil fertility, heavy metal pollution, irrigation damage, and degradation of the surrounding ecosystem.

RESULTS AND DISCUSSION

Classification of Forms of Agricultural Land Damage

The results of the classification of agricultural land damage forms are based on the questionnaire questions used, where the first aspect is adjusted to the questions in the first questionnaire, then the second aspect is adjusted to the questions in the second questionnaire, and so on up to aspect 12 and question 12 in the questionnaire. The results of the classification of agricultural land damage forms are presented in Table 1 below:

Table 1. Classification of Forms of Agricultural Land Damage

No	Observed Aspects	Respondents' Response Tendencies	General Category	Narrative Description
1	Soil Conditions	Most respondents said the soil had become hard, difficult to cultivate, and lost its top layer.	Tall	Mining activities cause the land to be covered with mining materials (waste and rock dust), so that water absorption capacity is reduced and the land processing process becomes more difficult.
2	Soil fertility	The majority of respondents stated that nutrients were reduced and the land was becoming barren.	Very high	Farmers must add large amounts of chemical fertilizers to maintain production. The soil loses its natural humus layer and the microorganisms that support fertility.
3	Landform Damage (Erosion & Landslides)	Most respondents reported erosion and holes from excavations around agricultural land.	Tall	Rainwater falling in former mining areas carries sediment to agricultural land, causing shallowing of water channels and erosion of land boundaries.
4	Agricultural Water Quality	Almost all respondents said that the	Tall	Water used to irrigate rice fields is contaminated with mining waste,

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		irrigation water had become cloudy, dirty, and smelled metallic.		reducing the quality of agricultural produce and causing plants to wilt quickly.
5	Crop Yield and Productivity	Most respondents stated that harvest yields had decreased drastically, and some experienced crop failure.	Tall	Mining activities directly impact agricultural productivity. Declining crop yields occur due to changes in the physical and chemical properties of the soil, which disrupt plant growth.
6	Environmental conditions	Does not support agricultural activities	Tall	The environment becomes dry, damaged and polluted. Surface water changes color and the land is no longer fertile so it does not support agricultural activities.
7	Plants that are difficult to grow	Some plants are difficult to grow	Low-High	Food crops such as corn, beans, and sweet potatoes no longer grow optimally due to damage to soil structure and loss of nutrients.
8	Natural food sources	Much reduced to almost nothing	Tall	Populations of river fish, wild plants, and forest products have declined drastically due to water pollution and loss of vegetation.
9	The most severe damage to agricultural land	Physical damage to land and water pollution	Tall	Respondents considered soil damage (hardening, barrenness) and water pollution as the most serious damage because they directly inhibit plant growth and reduce agricultural productivity.
10	Impact on farming	Significantly reduced income	Tall	Land damage increases costs, decreases yields, and significantly reduces farmers' incomes. Some farmers are starting to look

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				for alternative employment options.
11	Land restoration efforts	No effort or little help	Low	Most respondents stated there had been no real remediation efforts from companies or the government, except for small assistance such as fertilizer or limited revegetation.
12	The most important step to restore land	Land structure improvement & government/institutional support	Tall	Respondents considered the most important steps to be improving soil structure (organic fertilizer, lime) as well as support from the government and related institutions for reclamation, technical assistance, and sustainable recovery programs.

Source: Primary Data, 2025.

Based on the classification results, it can be understood that mining activities in Dengilo District have caused high to very high levels of agricultural land damage. Nearly all studied dimensions showed significant negative impacts on environmental quality and agricultural productivity.

Ecologically, land degradation occurs due to:

1. The loss of fertile soil layers (*top soil*) carried away by erosion and mining activities.
2. Irrigation water pollution, which reduces the quality of water sources for plants.
3. Decrease in biodiversity, where some local plants are no longer able to grow due to changes in pH and soil structure.

From a socio-economic perspective, the most significant impacts were decreased crop yields and reduced farmer incomes. Some respondents even stated that they had begun shifting to non-agricultural work because the land was no longer productive. Recovery efforts by relevant parties were deemed suboptimal, as reclamation activities had not directly affected residents' agricultural land. Respondents also believed that the local government had not provided adequate technical support, including counseling, organic fertilizer assistance, or land rehabilitation. This study examined the influence of external factors on accelerating recovery from the impacts of land degradation through community social functioning.

Forms of Agricultural Land Damage Due to Mining Activities in Dengilo District

Based on the analysis results in Table 1 , it can be seen that agricultural land damage in Dengilo District covers several main categories, namely physical, chemical, and biological soil damage. The most dominant form of physical damage found was the loss of topsoil due to excavation activities, soil compaction by heavy equipment, and the formation of depressions and mining pits that cause waterlogging. This

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condition has an impact on reducing the soil's ability to absorb water, slowing plant root growth, and increasing the risk of erosion and landslides.

The next form of damage is seen in changes in the landscape and the loss of natural agricultural structures. Many previously flat rice fields and gardens have now turned into irregular surfaces, filled with rocks and mining waste such as coarse sand and gravel. Some areas have even experienced land subsidence of several meters, causing irrigation channels to be cut off and unable to function again. As a result of this topographical change, some farmers have difficulty cultivating the land with traditional tools such as hoes or plows, because the surface is too hard and rocky. These physical changes not only disrupt agricultural productivity but also alter the socio-economic landscape of the community, as many farmers choose to abandon their land and switch to other, more profitable occupations. In addition, biological damage occurs in the soil, characterized by the loss of microorganisms and soil fauna such as worms and organic-decomposing fungi. This condition causes the decomposition process of organic matter to stop, so that the soil's ability to recover naturally is very low. As stated by Prasetyo, Baderan, and Hamidun (2025) , the loss of soil biota is one of the main indicators of ecological degradation in ex-mining areas.

CONCLUSION

Based on the research results and discussion in the previous chapter, it can be concluded that mining activities in Dengilo District have caused severe and widespread damage to agricultural land, characterized by decreased soil fertility, land structure degradation, irrigation water pollution, and decreased agricultural productivity. These impacts not only disrupt the balance of the ecosystem but also cause socio-economic losses for the community, especially farmers. Therefore, more integrated environmental restoration and management efforts are needed to maintain agricultural sustainability and the well-being of the local community .

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