Analysis of Mitigation for Landslide Disaster Management in Lumajang Regency, East Java Province

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ABSTRACT

This research aims to analyze the mitigation of natural disaster management, specifically landslides, in Lumajang Regency, East Java Province. Natural disasters are undesirable events, making it crucial for the government and the community to understand the processes and factors leading to such disasters. One significant disaster that requires attention from both the government and the community in Lumajang is landslides, necessitating an understanding of their impacts and management strategies. The alternatives for addressing this issue can involve disaster mitigation through various stages, which are the focus of this study, aimed at reducing the ongoing risks associated with landslide vulnerabilities. This research is descriptive in nature, utilizing a quantitative approach, with subjects comprising individuals who can share their knowledge about the phenomena or cases being studied. The findings indicate that the Regional Disaster Management Agency (BPBD) of Lumajang Regency is responsible for disaster management, including landslides. However, their mitigation stages—such as mapping, inspections, investigations, monitoring, and socialization—have not been effectively implemented to reduce disaster risks. The BPBD tends to act only after a disaster occurs, resulting in a lack of proactive risk reduction through disaster mitigation. There is a pressing need for efforts from various stakeholders to enhance awareness of landslide dangers, including the establishment of an early warning system and community education regarding natural disasters through outreach and education before, during, and after landslide events.

Keywords: Mitigation analysis, Disaster, Landslide

INTRODUCTION

The high potential for natural disasters is essentially a reflection of geographic phenomena that are very characteristic of our homeland. Indonesia is an archipelagic country where three major tectonic plates meet: the Indo-Australian Plate, the Eurasian Plate, and the Pacific Plate. The interactions among these plates further position Indonesia as a region with significant volcanic and seismic activity. Moreover, the intense dynamics of these plates have shaped a unique and highly varied earth surface relief, ranging from mountainous areas with steep slopes that imply a high potential for landslides, to flat coastal regions with threats of flooding, land subsidence, and tsunamis. (Sutikno, 2011).

The series of disasters experienced by Indonesia, especially in recent years, has raised awareness regarding the vulnerability

and susceptibility of the community. The reactive attitude and disaster management patterns currently in place are no longer deemed adequate. There is a felt need to develop a new approach that is more proactive, comprehensive, and fundamental in addressing disasters. Disasters are classified into three types: natural disasters, non-natural disasters, and social disasters. Indonesia experiences all three types. Natural disasters in Indonesia include earthquakes, tsunamis, volcanic eruptions, landslides, floods, droughts, erosion, abrasion, and extreme weather events as well as extreme waves. Non-natural disasters include technological failures, epidemics, and outbreaks of disease. Social disasters include social conflicts and terrorism.

The pattern of disaster management has gained a new dimension with the enactment of Law Number 24 of 2007 on disaster management, followed by several other regulations. One of the main factors contributing to vulnerability to disasters is improper and inadequate land use. This vulnerability is exacerbated if both government officials and the community are unaware and unresponsive to the potential natural disasters in their area. Lumajang Regency in East Java Province is a region with a relatively high risk of natural disasters. In addition to natural disasters such as floods, landslides also require significant attention for disaster mitigation efforts.

According to data from the Regional Disaster Management Agency of Lumajang Regency, East Java Province, there are seven sub-districts that are vulnerable to landslide hazards: Senduro, Pronojiwo, Candipuro, Pasrujambe, Gucialit, Tempursari, and Ranuyoso. Geographically, several of these landslide-prone sub-districts are located on mountain slopes, as Lumajang Regency is flanked by three volcanoes: Mount Semeru (3,676 meters above sea level), Mount Bromo (3,292 meters above sea level), and Mount Lamongan (1,668 meters above sea level).

Based on this data, efforts are needed to reduce the risk of disasters. The general objective of this research is to analyze the mitigation of natural disaster management for landslides in Lumajang Regency, East Java Province. The problem to be studied is how the stages of mitigation for natural disaster management of landslides are implemented in Lumajang Regency, East Java Province.

Definition of Disaster Mitigation

Mitigation is defined as any ongoing action taken to reduce or eliminate long-term risks to life and property. Thus, mitigation can be considered a mechanism for communities to avoid the impacts of potential disasters. Actions may focus on disaster avoidance, particularly by preventing the placement of people and property in hazardous areas. This includes efforts to control hazards through the development of specific facilities and the application of certain technologies. (Damaiyanti, 2010).

Mitigation is a series of efforts to reduce disaster risks, both through physical development and awareness-raising to enhance resilience against disaster threats. Mitigation encompasses decisions regarding what actions to take and where, related to the health, safety, and welfare of the community, which are determined and implemented as risk reduction programs. It represents a sustainable effort to decrease risks to lives and property, as well as their impacts. Another important aspect related to mitigation is the cost-effectiveness calculation of expenditures against the risk

reduction achieved, including potential physical and social risks in the future (UNDP-UNDRO, 2011).

According to Ministry of Home Affairs Regulation Number 33 of 2006, several aspects must be considered in disaster mitigation efforts, including: 1) the provision of information and maps of disaster-prone areas for each type of disaster, 2) socialization to enhance community awareness and preparedness in facing disasters, 3) understanding what actions to take and avoid, as well as knowing self-rescue methods in the event of a disaster, and 4) the regulation and planning of vulnerable areas.

The stages of landslide disaster mitigation include mapping, investigation, inspection, monitoring, and socialization (Fatiatun et al., 2019). Preventive actions are divided into two categories: mitigation and preparedness. Mitigation is further divided into passive mitigation and active mitigation (BNPB, 2022). Passive mitigation activities that can be conducted include:

1. Preparation of legislation,
2. Creation of disaster-prone area maps and problem mapping,
3. Development of guidelines/ standards/ procedures,
4. Creation of posters/brochures/leaflets,
5. Research/study of disaster characteristics,
6. Risk assessment/analysis of disasters,
7. Internalization of disaster management in local education curricula,
8. Establishment of organizations or disaster task forces,
9. Strengthening social units within the community, such as forums,
10. Mainstreaming disaster management in development.

Active mitigation activities are conducted through:

1. Creation and placement of warning signs, prohibitions, and danger notices for entering disaster-prone areas,
2. Supervision of the implementation of various regulations regarding spatial planning, building permits, and other regulations related to disaster prevention,
3. Basic disaster training for officials and the community,
4. Relocation of residents from disaster-prone areas to safe areas,
5. Public education and raising community awareness,
6. Planning for temporary shelters and evacuation routes in case of a disaster,
7. Construction of structures that function to prevent, secure, and reduce the impacts caused by disasters, such as levees, gabions, coastal erosion barriers, earthquake-resistant buildings, and similar structures.

Concept of Natural Disasters
According to the Department of Health (2011), a disaster is an event or series of events resulting from natural phenomena and/or human actions that disrupt human life and livelihoods, accompanied by environmental damage, leading to the helplessness of local potential and infrastructure, necessitating assistance from other regencies or provinces, or from the central government and/or other countries as per established procedures.

According to the regulation of the Head of the Disaster Management Agency Number 2 of 2012, a disaster is an event or series of events that threaten and disrupt the lives of communities caused by natural, non-natural, and human factors, resulting in casualties, environmental damage, loss of property, and psychological impacts. According to UNDP (2012), a disaster is a phenomenon that

occurs when triggering components, hazards, and vulnerabilities work together systematically, leading to risks in the community.

These definitions indicate that disasters are caused by natural, non-natural, and human factors. Therefore, Law Number 24 of 2007 defines natural disasters, non-natural disasters, and social disasters:

1. **Natural disasters** are disasters caused by events or series of events from nature, including earthquakes, tsunamis, volcanic eruptions, floods, droughts, hurricanes, and landslides.
2. **Non-natural disasters** are disasters caused by events or series of non-natural events, such as technological failures, modernization failures, epidemics, and outbreaks of disease.
3. **Social disasters** are disasters caused by events or series of events resulting from human actions, including social conflicts between groups or communities, and terrorism.

Concept of Landslides

A landslide is a type of mass movement of soil or rock, or a mixture of both, moving down or out of slopes due to disturbances in the stability of the soil or rock making up the slope. Landslides occur due to instability in the soil or rock. (BNPB, 2010).

Selby states that a landslide is one type of mass movement (mass wasting), which is a natural phenomenon involving the rapid gravitational movement of soil mass following the slope. Arsad also mentions that there are four physical parameters used to determine landslide-prone areas: flow density, slope angle, landform/relief, and land use. (A.B. Suriadi in Bate, 2018).

Causes of Landslides

According to the Directorate of Environmental Geology, the factors causing landslides include: 1) Topography or slope, 2) Condition of soil or rock, 3) Rainfall or moisture, 4) Earthquakes, and 5) Condition of vegetation or forests and land use. These factors interact with each other and determine the magnitude and extent of landslides.

Hazards of Landslides

Landslide hazards refer to events that can potentially cause physical damage, phenomena, or activities resulting in loss of life, property damage, social and economic disruption, or environmental degradation. Hazards can be caused by natural factors (geological, hydrometeorological, intensity, frequency, and probability) (Astuti in Bate, 2018).

Figure 1. Framework of Thought
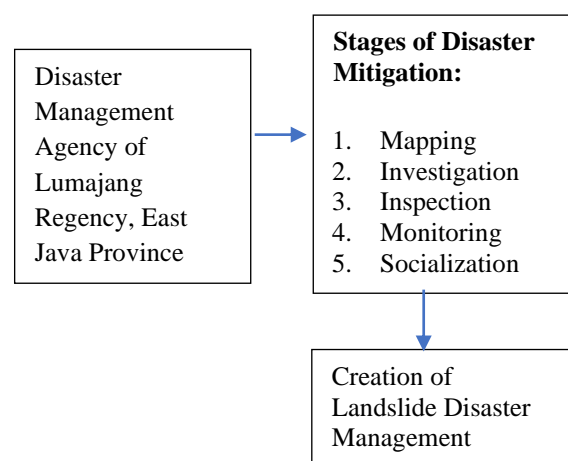
MATERIALS & METHODS

This study is a quantitative descriptive research that describes variables as they are, supported by numerical data derived from actual conditions. This research employs data collection techniques through questionnaires, observations, interviews, and documentation.

Research Location

This research was conducted in Lumajang Regency, East Java Province.

Type of Data

The data used consists of primary and secondary data. Primary data is utilized as a tool to explore in-depth the forms of mitigation implemented by relevant agencies and all parties involved in disaster mitigation efforts. Secondary data is used to reinforce the validity of the statements derived from the primary data collection.

Data Collection Techniques

Data in this research was collected through three methods:

a) Questionnaires: The researcher distributed questionnaires to the research subjects.

b) Observation: The researcher conducted direct observations of the research subjects to observe various phenomena arising from those subjects. This method allows for the collection of direct data based on the researcher's observations.

c) Interviews: This involves a meeting between two people to exchange information and ideas through a question-and-answer format, allowing for the construction of meaning around a specific topic.

d) Documentation: Documents are records of past events. They can take the form of written texts, images, or monumental works by individuals. The researcher continues to use this method even if the desired documents cannot be confirmed in the field.

Data Analysis Techniques

The data analysis process (Bungin, 2011) begins with reviewing all available data from various sources, including questionnaires, observations, interviews, and documentation, up to the conclusion drawing stage.

RESULT & DISCUSSION

Landslide Disaster Mitigation in Lumajang Regency, East Java Province

Landslide disaster mitigation in Lumajang Regency, East Java Province, is carried out by the Regional Disaster Management Agency (BPBD), which is tasked with handling disaster-related issues in accordance with Law No. 24 of 2007 on Disaster Management. Based on this regulation, BPBD of Lumajang Regency has guidelines for implementing landslide disaster mitigation.

According to field research and observations, Lumajang Regency has many hills and areas along riverbanks that are highly susceptible to landslide hazards. Data from BPBD Lumajang indicates that there are seven sub-districts at risk of landslides: Senduro, Pronojiwo, Candipuro, Pasrujambe, Gucialit, Tempursari, and Ranuyoso. Geographically, several of these landslide-prone sub-districts are located on mountain slopes, as Lumajang is bordered by three volcanoes: Semeru (3,676 m above sea level), Bromo (3,295 m above sea level), and Lamongan (1,668 m above sea level).

According to BPBD Lumajang, landslides cause significant losses for local residents. There is heightened concern during the rainy season when high rainfall increases the risk of landslides in hilly areas. Some hills have also become deforested, which is a major contributing factor to landslide hazards. The losses caused by landslides include road access interruptions, buried homes, damaged farmland, and, most tragically, potential loss of life.

These circumstances highlight the need for disaster mitigation to reduce the risk of

landslides. According to Kusumasari in Puri & Khaerani (2007), disaster management should encompass: 1) pre-disaster activities, including prevention/mitigation and preparedness; 2) during a disaster, which is a crucial stage in disaster management; and 3) post-disaster recovery, including rehabilitation and reconstruction, alongside both structural and non-structural mitigation measures. According to Fatiatun et al., structural mitigation can be implemented by reducing the slope angle through terracing systems. Additionally, retaining walls made from rocks and soil can be constructed to mitigate landslide hazards and their effects. Another alternative that local governments should consider is relocating communities living in landslide-prone areas. Non-structural mitigation can also be carried out by raising awareness among residents in landslide-prone regions. This aims to help them recognize signs of impending landslides, understand their causes, and learn how to reduce and manage landslide hazards.

Regarding the prevention and mitigation of natural landslide disasters in Lumajang Regency, East Java Province, the stages of disaster mitigation can be outlined as follows.

Mapping

Mapping in disaster mitigation is crucial for identifying areas with the highest likelihood of natural disasters. It serves as the foundational basis for emergency response efforts that relevant agencies must undertake to understand the topography of disaster-prone areas. The topography includes roads, rivers, contours, and boundaries that form a baseline map to reduce the risk of overlapping issues in disaster response.

The Regional Disaster Management Agency (BPBD) of Lumajang Regency, East Java Province, utilizes the Multi-Hazard Early Warning System (MHEWS) application to assess potential disasters, as stated by Vendy, a staff member of the Pusdalops. Hindam, the Head of Pronojiwo Subdistrict, confirmed that there has been no direct mapping of landslide-prone areas by BPBD, nor have they conducted research or requested data from local agencies regarding locations most at risk for landslides.

Based on these facts, it is evident that BPBD lacks accurate data to mitigate disaster risks. Their mitigation efforts have been limited to remote monitoring, and they do not have a clear topographic map indicating areas where soil contours may be vulnerable to landslides. Additionally, the absence of a map detailing landslide-prone locations can result in significant losses for local residents and even fatalities. This highlights the urgent need for BPBD in Lumajang Regency, in collaboration with relevant departments, to improve their mapping systems to effectively minimize disaster risks.

Investigation

Disaster mitigation is crucial for reducing the risk of disasters, and to achieve this, an investigation of disaster-prone locations is necessary. The BPBD of Lumajang Regency, East Java Province, has taken several steps to mitigate risks after conducting continuous investigations. One of the programs planned by BPBD is the PROGRAM BELI NASI (Learning Disaster Management from an Early Age), which aims to enhance children's knowledge about how to face disasters.

However, regarding infrastructure development, BPBD cannot directly execute

the programs or activities they have planned; they must propose them to the local government, which will then be forwarded to the relevant departments, in this case, the Public Works Department. Once approved by the local government and relevant departments, the program can be implemented according to BPBD's proposal. As a result, disaster mitigation efforts by BPBD of Lumajang Regency are initiated only after receiving information from the community about landslide occurrences, followed by corrective actions.

Examination

Examination in disaster mitigation can be utilized to identify the likelihood of disasters occurring, especially in areas prone to landslides. Landslides are often triggered by heavy rainfall, soil erosion by river flow, and deforestation. The BPBD has a WhatsApp group that includes members from various government organizations (OPD), such as the military (TNI), police (POLRI), civil service police (POLPP), NGOs, and BPBD itself, to share information about disaster occurrences.

According to Hindam, local village officials have been proactive in informing BPBD about the potential for landslides. The information is relayed directly to BPBD, although responses are not always forthcoming. Additionally, we learned that local village officials are not part of the emergency response group established by BPBD.

In this case, the disaster mitigation efforts by BPBD have not included early examinations to reduce the risk of landslides. The examinations conducted by BPBD of Lumajang Regency, East Java Province, only take place after a landslide has occurred. This demonstrates that the operational system of BPBD Lumajang in

disaster mitigation has not been maximized. Furthermore, there is currently no installation of an Early Warning System, which could help mitigate the risk of landslides.

The installation of early warning system tools, as part of disaster mitigation, involves community participation to foster a sense of ownership and awareness regarding the functioning of these tools. (Rahman, 2015).

Monitoring

Monitoring is also an effort to minimize the adverse impacts that can arise from natural disasters such as landslides. This can be carried out through direct investigations at disaster-prone locations periodically, both before and after a disaster occurs, or through remote monitoring. The BPBD has utilized remote monitoring using the Multi Hazard Early Warning System (MHEWS) application, which serves to provide early warnings before a disaster strikes.

Socialization

Socialization is crucial for raising awareness and teaching self-rescue methods in the event of a disaster. The BPBD has conducted socialization in specific locations, especially in areas prone to landslides, to instill early awareness in the community about the importance of disaster mitigation. This effort has been particularly focused on the sub-districts within the high-risk areas of Lumajang, East Java.

Activities have been carried out according to programs proposed by the BPBD to the local government, including providing information in disaster-prone areas through warning signs. However, Hindam pointed out that over the past six years, there has been no substantial socialization conducted by the BPBD, either directly in the local areas or through invitations to the

community for educational sessions or disaster response simulations. The lack of warning signs also indicates a failure in this aspect.

This reveals that the BPBD has not maximized its socialization efforts. They need to work harder on disaster mitigation, especially concerning landslides. The BPBD should rethink its approach to disaster management, which has largely been reactive rather than proactive. Instead of only responding after disasters occur, they should implement preventive measures and risk reduction strategies through community education about issues like deforestation, emergency response simulations, and collaborating with local communities and relevant agencies to build an Early Warning System (EWS).

CONCLUSION

The mitigation of landslide disaster management by the BPBD (Regional Disaster Management Agency) of Lumajang Regency, East Java Province, is not yet operating optimally. Currently, the BPBD tends to respond only after disasters occur. The mitigation stages, including mapping, investigation, inspection, monitoring, and socialization, still rely on related agencies.

Regarding mapping, there is a lack of accurate data on topography, particularly in disaster-prone areas such as those susceptible to landslides. Investigations and inspections of potential disaster areas are conducted only after landslides have occurred, with BPBD and relevant OPDs (Regional Apparatus Organizations) assessing the disaster sites afterward. Monitoring is performed by BPBD using the MHEWS (Multi-Hazard Early Warning System) application to observe weather conditions and identify the potential for landslides. Socialization efforts to the

community currently consist only of advisories and awareness in various districts about disaster risks, lacking regular education or simulations to prepare the public on how to respond, especially to landslides.

This situation is due to the fact that the BPBD of Lumajang must wait for approval from the local government and related agencies before implementing disaster mitigation programs. Therefore, there is a need for increased awareness of landslide dangers, including the installation of an early warning system and enhanced public education about natural disasters through socialization and educational initiatives focused on landslides.

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