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Pre-Disasters Management Analysis of Mount Sinabung Eruption in Kutagugung Village, Namen Taren District, Karo Regency, North Sumatera

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ABSTRACT

This study aims to analyze pre-disaster management of the Mount Sinabung eruption in Kutagugung Village, Naman Teran District, Karo Regency. The focus of the research includes government and community preparedness, the effectiveness of early warning systems, and mitigation programs in raising community awareness of disaster risks. The study uses a qualitative method with a case study approach. Data were collected through in-depth interviews, field observations, and documentation. The results show that community awareness of Mount Sinabung's status as an active volcano varies, with most understanding the risks but requiring further education. Disaster management organizations, such as BNPB and Karang Taruna, have been active, although broader community involvement needs improvement. Disaster mitigation training is considered effective in enhancing preparedness, but its scope remains limited to specific groups. The local tradition Erpangir Ku Lau holds significant potential for integration into mitigation strategies, although it has not yet been optimally utilized. Disaster management infrastructure, such as evacuation routes, assembly points, and shelters, is available but requires quality improvements and sustainable maintenance. Existing early warning systems are helpful but need modernization and expanded coverage. This study concludes that collaboration between the government, the community, and the utilization of local wisdom is key to enhancing the resilience of Kutagugung Village in facing the risks of the Mount Sinabung eruption.

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INTRODUCTION

Disasters are a frequent occurrence in Indonesia, especially since the country is located along a ring of fires, which makes Indonesia vulnerable to disasters such as earthquakes, tornadoes, and droughts that are difficult to predict. Several other disasters, such as floods, landslides, volcanic eruptions, tsunamis, and extreme weather changes, can still be predicted in advance. These disaster events bring various impacts and problems, both social and psychological, to the local community, including casualties, material losses, and psychological trauma. Disasters can be divided into several categories, namely natural disasters, non-natural disasters, and social disasters. (Saputra, 2020)

The Mount Sinabung eruption disaster is a disaster that has a high risk to date. News about the eruption of Mount Sinabung over the past five years has been widely found in the media, both conventional media and online media. News from the media about disasters is needed when a disaster occurs, not only to

provide correct information, but also to build public empathy and also encourage people affected by disasters to be able to rise from problems arising from disasters that are or have occurred. (Praise, 2016)

The Sinabung volcano administratively includes Karo Regency, North Sumatra Province, which is geographically located at 03° 10' N and 98° 23.5' E with a peak altitude of 2460 meters above sea level. Mount Sinabung is classified as a type A volcano after a phreatic eruption on August 27, 2010. The last eruption occurred on July 28, 2021 with an eruption column height of 4500 meters above the summit accompanied by a hot cloud slide with a glide distance of 1000 meters. The Sinabung volcano is continuously monitored visually and instrumentally from the G. Sinabung Observation Post located in Ndokum Siroga Village, Simpang Empat District, Karo Regency which is ± 8.7 km from the top of G. Sinabung to the Southeast (Center for Volcanology and Disaster Mitigation, 2023).

The activity of Mount Sinabung occurred on August 27, 2010, this mountain emitted smoke and volcanic ash. Then, on August 29, 2010 in the early morning at around 00.15 WIB, Mount Sinabung emitted lava. The ash of Mount Sinabung tends to slide from the southwest to the northeast. On September 3, there were 2 eruptions. The first eruption occurred at around 04.45 WIB while the second eruption occurred at around 18.00 WIB. The eruption of Mount Sinabung spewed volcanic dust as high as 3 kilometers and a volcanic earthquake that could be felt up to 25 kilometers around this mountain. On September 7, Mount Sinabung became transparent again. This is the largest eruption since the volcano became active on August 29, 2010. This volcanic dust is sprayed up to 5,000 meters in the air (Ebo, 2010).

The consequences of the eruption volcano disaster can cause losses such as environmental damage, property losses, and psychological impacts. The eruption of Mount Sinabung has an impact on the environment around the mountain, especially for the health of the population. Based on the WCO (WHO Country Office for Indonesia) report on January 22, 2014, there are six diagnoses that are most commonly experienced by refugees from the eruption of Mount Sinabung, namely respiratory system infections, gastritis, high blood pressure, diarrhea, conjunctivitis and anxietasis. Based on health data from Karo Regency on February 5-11, 2014 obtained from http://www.karokab.go.id, every day more than 50% of the population who come to the health post experience respiratory disorders such as ISPA (acute respiratory tract infection). One of the factors causing ISPA is particulate matter (PM10) as one of the constituents of volcanic ash materials. Particulate matter (PM10) scattered in the air can cause many residents to be affected by ISPA, so health measures are needed at a relatively high cost because they require antibiotics in addition to standard medicines for respiratory diseases. (Manurung, C. A. J., & Trilaksono, N. J. 2016).

In this situation, preparedness, early warning and disaster mitigation activities are carried out. Therefore, it is necessary to understand or know the community about disasters to prevent the impact of greater disasters, by identifying local areas that can be used as evacuation places, monitoring and listening to information about the status of volcanoes, following guidance and counseling from the responsible parties, having adequate supplies of basic necessities, such as adequate medicines and food, following evacuation directions from the authorities, carrying valuables, especially important documents and letters. (Damayanti, 2017)

In pre-disaster management, there are several cycles, namely the preparedness phase, the mitigation phase, and the early warning phase with the target being rescue so that the risk is eliminated, and the recovery phase. In addition, a series of data collection and analysis processes are carried out systematically and information about the existence of hazards and/or increased hazard conditions, the purpose of which is to reduce the quality and quantity of the number of disaster victims (if a disaster occurs) through increasing information accessibility.

The purpose of this study is to analyze the pre-disaster preparedness carried out by the government and the community in facing the threat of Mount Sinabung eruption, including assessing the extent of the effectiveness of the early warning system implemented by the government in conveying information to the community in disaster-prone areas. In addition, this study aims to evaluate the effectiveness of pre-disaster mitigation programs in increasing public awareness of the dangers and risks posed by eruptions, so as to minimize the impact that may occur in the future.

RESEARCH METHODS

This study uses a qualitative type of research with a case study approach. A case study is a research approach that focuses on an in-depth exploration of a particular phenomenon or subject in its real-life context (Fitrah & Luthfiyah, 2017). The research was conducted in Kutagugung Village, Naman Teran District, Karo Regency, which is one of the areas affected by the eruption of Mount Sinabung. The selection of this location is based on its relevance and significance with the purpose of the study, which is to analyze the pre-disaster management applied in the area.

The data in this study was obtained through several data collection techniques, the main of which is an in-depth interview. Interviews were conducted with relevant parties, such as local government representatives, Regional Disaster Management Agency (BPBD) officers, and local communities directly

affected by the eruption of Mount Sinabung. The information from the results of this interview is valuable primary data in understanding the experiences, views, and mitigation efforts that have been carried out by these parties. In addition to interviews, field observation techniques are also used to document the situation and preparedness measures that have been implemented (Fitrah & Luthfiyah, 2017). Documentation techniques complement data collection by utilizing official reports, journal articles, and relevant archives.

The results of the interviews and other data will be described in detail in the Results and Discussion section. Data analysis was carried out in a descriptive-qualitative manner, starting with data reduction, data presentation, and conclusion drawn. This process aims to identify patterns, relationships, and the effectiveness of the pre-disaster management strategies implemented. With this approach, the research is expected to provide an in-depth picture of the preparedness of the community and the government in dealing with the risk of Mount Sinabung eruption.

RESULTS AND DISCUSSION

Public Awareness of the Status of Mount Sinabung

The results of the interviews show that the awareness of the people of Kutagugung Village towards the status of Mount Sinabung as an active volcano still varies. Some respondents are aware that Mount Sinabung is one of the active volcanoes in Indonesia, while others do not have sufficient information regarding this. This difference can be influenced by the level of access to information and individual involvement in disaster education activities carried out in villages.

Awareness of volcanic hazards is a key element in disaster risk management. According to the literature, disaster literacy is the public's understanding of threats, risks, and disaster mitigation measures. High disaster literacy allows communities to understand existing threats, recognize red flags, and take proactive action to protect themselves and their communities (Warsari & Iswan, 2023). This literacy is the basis for successful disaster mitigation efforts, especially in areas with high disaster risk such as Kutagugung Village.

One of the signs of a lack of disaster literacy can be seen from the lack of understanding of some people about the latest volcanic activity of Mount Sinabung. Some respondents stated that "there are no signs of danger yet" or that "the mountain is still safe," although Mount Sinabung's volcanic activity continues to be monitored by authorities. This condition shows the need to increase access to relevant information and spread disaster knowledge evenly in the community.

The importance of increasing public awareness is supported by the concept of disaster risk reduction outlined by the Sendai Framework for Disaster Risk Reduction (2015-2030). One of its priorities is to ensure that the public has access to information that can improve their understanding of disaster risks and threats (Resdiana & Alfiyah, 2020). In the context of Mount Sinabung, the delivery of this information can be done through educational campaigns, training, and disaster mitigation simulations that involve the community directly.

The strong public awareness of Mount Sinabung's status not only helps them understand the dangers they face, but also encourages them to be more actively involved in preparedness efforts, such as participation in disaster management organizations, evacuation drills, and the use of early warning systems. The success of disaster mitigation programs depends heavily on this awareness, which is the basis for building resilient communities against disasters.

Organization and Community Participation in Disaster Management

The results of the interview showed that in Kutagugung Village there are several organizations that play a role in disaster management efforts, such as the National Disaster Management Agency (BNPB), Youth Organization, and village officials. These organizations collaborate with local governments and local communities in organizing various disaster mitigation activities. Most respondents stated that the community is actively involved in the activities of the organization, although the level of involvement varies. Some routinely participate in the programs held, while others are only involved in certain conditions, such as when there are signs of danger of eruption.

Community participation is an important element in disaster management. Based on the theory of participation, community involvement in disaster management organizations reflects a sense of belonging to the issues facing their communities. This is in line with the concept of Community-based disaster risk reduction (CBDRR), which emphasized that local communities are the first to be affected and have local knowledge that can be an important resource in disaster mitigation. Their involvement can strengthen the effectiveness of mitigation measures as decisions and actions taken are more relevant to local needs (Pramono & Suranto, 2021).

However, the interviews also revealed challenges in community engagement. Some respondents mentioned that not all individuals are actively involved in mitigation organizations or activities. This is due to time constraints, lack of understanding of the importance of involvement, or lack of inclusivity in the

activities held. For example, some respondents stated that mitigation training more often involved "specific people," so that the broader community felt less engaged.

The existence of organizations such as Karang Taruna that is active in social and disaster activities also shows great potential to empower the community. In this context, community empowerment can be carried out through regular training, group discussions, and disaster simulations involving all levels of society. This is in line with the view that community-based organizations can be a bridge between the government and the community in improving preparedness (Septina Margaretta et al., 2023).

Cooperation between organizations, both at the local and regional levels, is also the key to the success of disaster management. Some respondents mentioned coordination with institutions such as BNPB and local governments, for example in the provision of evacuation routes, gathering points, and evacuation facilities. This kind of cooperation is essential to ensure that available resources can be optimally utilized and that response to disaster threats can be carried out quickly and efficiently.

Mitigation Exercises and Their Effects on Community Behavior

Disaster mitigation exercises have been conducted in Kutagugung Village, although the intensity and scope vary. Most of the respondents mentioned that mitigation training is carried out regularly, especially when there are signs of increased activity of Mount Sinabung. This exercise usually includes evacuation simulations, socialization about evacuation routes, and the introduction of early warning systems. However, some respondents also revealed that this training often only involves certain groups, so not all residents benefit directly.

Mitigation exercises have a positive impact on people's behavior. Respondents who participated in the exercise stated that the activity increased their understanding of evacuation procedures and the importance of preparedness. According to the literature, disaster simulation is an effective way to build disaster awareness and ensure that the public knows what to do in an emergency situation. It also helps reduce panic and improve quick response when a disaster does occur (Ibrahim et al., 2020).

However, some respondents indicated that not all communities were actively involved in this exercise, which has the potential to reduce the overall effectiveness of mitigation efforts. This shows the need to expand the scope of training, especially for vulnerable groups such as the elderly, women, and children. Continuous disaster education is also important to ensure that the community continues to improve their understanding and readiness.

Mitigation training not only equips communities with technical skills, but also strengthens social cohesion. Joint exercises provide opportunities for residents to work together and build trust between individuals in the community. In this way, training not only prepares communities for disasters, but also strengthens social bonds that are important in the post-disaster recovery process (Widarti Gularsih Sukino et al., 2019).

Local Wisdom in Disaster Mitigation

Kutagugung Village has a local wisdom called Erpangir Ku Lau, a traditional tradition that involves gathering at a water source to cleanse oneself physically and spiritually. This tradition functions as a means of strengthening social relations and becoming a moment of collective reflection for the community (Juhadi et al., 2018). In addition to its cultural value, Erpangir Ku Lau It is often used as a medium to share information about preparedness and disaster facing, especially the eruption of Mount Sinabung.

Local wisdom like this is a form of community adaptation to its environment. According to the literature, local traditions based on community life experiences have great potential to support disaster mitigation. Erpangir Ku Lau not only strengthens social bonds, but also creates a collective space that can be used to raise awareness of disaster risk and the importance of well-thought-out preparation (Suparmini et al., 2014).

However, the results of the interviews show that this tradition has not been fully integrated into formal mitigation strategies. For example, the potential of this tradition to be a means of conveying information related to evacuation routes, gathering points, or early warning systems is still not optimal. In fact, utilizing local traditions as part of a community-based mitigation approach can increase the effectiveness of disaster management programs.

Availability of Disaster Management Facilities and Infrastructure

Kutagugung Village has a number of facilities and infrastructure that support disaster management efforts, such as evacuation routes, gathering points, and evacuation locations. The evacuation route in this village is already available and is declared easily accessible by most respondents. The main gathering point is usually located in public facilities such as jambur, which also functions as a temporary evacuation location. However, the results of the interviews showed that the condition of these facilities still needed improvement, with some respondents calling the facilities "incomplete" or lacking adequate maintenance.

The existence of facilities such as evacuation routes and points is very important in the context of disaster preparedness. According to international disaster standards, this infrastructure must be equipped with clear signs, good accessibility, and supporting facilities such as clean water, rest areas, and emergency supplies. Lack of facilities can affect the effectiveness of evacuations, especially in times of emergency (Hutagalung et al., 2019).

Some respondents also underlined the importance of improving the quality of facilities. For example, access to water at evacuation sites is often an obstacle, while the existence of facilities such as toilets, proper shelters, and medical resources is still considered lacking. This shows the need for local government intervention to improve existing infrastructure and ensure its sustainability through regular maintenance programs.

Improving facilities is not only important to ensure a smooth evacuation process, but also to increase people's sense of security when facing disaster threats (Hutagalung et al., 2019). With adequate facilities, the Kutagugung Village community will be better prepared to face the potential eruption of Mount Sinabung, thereby reducing the risk of greater impacts. Integration between good facilities and community involvement in their use will also strengthen community resilience in facing disasters.

Early Warning System

Kutagugung Village already has an early warning system to deal with the potential eruption of Mount Sinabung. Based on interviews, this system includes the use of tools such as toa or megaphone operated by village officials or related organizations, such as BNPB. Some respondents also mentioned the existence of routine patrols or information submitted directly by the local government when the status of Mount Sinabung increased. However, the effectiveness of this system varies, with some respondents stating that the warning system is sometimes inconsistent in its implementation.

Early warning systems play an important role in reducing disaster risk. According to the literature, a good system should include threat detection, rapid and clear dissemination of information, and an organized community response (Ministry of Health of the Republic of Indonesia, 2002). In Kutagugung Village, the existence of this system is an important element to prepare the community to face the threat of eruptions, especially in areas close to hot cloud slides and lava flows.

Although the warning system already exists, some shortcomings have been identified, such as the lack of more modern support tools and limited coverage in some regions. Some respondents also suggested increasing the frequency of simulation exercises using this system so that the public better understands how to respond to the warnings given (Ministry of Health of the Republic of Indonesia, 2002).

To increase its effectiveness, Kutagugung Village can take advantage of modern technology such as mobile-based applications or automatic sirens that can reach more people. The integration of traditional systems such as the use of prescriptions with new technologies can create a more comprehensive and efficient warning mechanism. With a reliable early warning system, the community will be better prepared to deal with emergency situations, so that potential losses can be minimized.

Challenges and Obstacles in Disaster Mitigation

In disaster mitigation efforts in Kutagugung Village, there are several challenges that need to be overcome. The results of the interviews showed that the main obstacles included the lack of maintenance of evacuation facilities, the lack of access to clean water at the evacuation site, and the limitations of more modern early warning equipment. In addition, community involvement in mitigation exercises is also still uneven, with some groups, such as the elderly and women, less accommodating in these activities.

These challenges reflect common problems often faced in disaster management in vulnerable areas. According to the literature, the success of disaster mitigation depends on good coordination between governments, communities, and related organizations. Resource constraints, such as budgets for facility maintenance or the provision of early warning technologies, are often a major obstacle to creating an effective mitigation system (Norma Aroyandini et al., 2022).

The lack of awareness and involvement of some people is also a significant obstacle. Some respondents mentioned that only certain groups are actively involved in mitigation training or disaster organizations, while other groups tend to be passive. This shows the need for a more inclusive approach, such as organizing activities that involve all levels of society and more intensive education (Warsari & Iswan, 2023).

Overcoming these challenges requires close collaboration between local governments, disaster management agencies, and communities. A community-based approach that integrates local wisdom, modern technology, and sustainable education programs can help create a more resilient mitigation system. Thus, Kutagugung Village can face the risk of Mount Sinabung eruption more prepared and organized. (BNPB, 2009; Ministry of Health of the Republic of Indonesia, 2002; Hutagalung et al., 2019; Ibrahim et al., 2020; Juhadi et al., 2018; Norma Aroyandini et al., 2022; Pramono & Suranto, 2021; Resdiana & Alfiyah, 2020;

Septina Margaretta et al., 2023; Suparmini et al., 2014; Trisnawati, 2023; Warsari & Iswan, 2023; Widarti Gularsih Sukino et al., 2019)

CONCLUSION

The conclusion of this study shows that the pre-disaster management efforts of the eruption of Mount Sinabung in Kutagugung Village, Naman Teran District, have a number of strengths and challenges. Public awareness of the risk of eruptions is quite diverse, with most understanding the dangers posed but still needing ongoing education. The existence of disaster management organizations such as Karang Taruna and BNPB has made a positive contribution, although widespread community participation needs to be increased. Mitigation and socialization exercises are considered effective in increasing community understanding and readiness, but their scope is still limited to certain groups. Local traditions such as Erpangir Ku Lau have great potential to be integrated into mitigation strategies, but are currently not being utilized to their full potential. On the other hand, disaster management facilities such as evacuation routes and gathering points are already in place, but their quality and maintenance require more attention. The existing early warning system is quite helpful, although it needs modernization and expansion of coverage. Overall, collaboration between the government, the community, and the use of local wisdom can strengthen the resilience of Kutagugung Village in facing the risk of Mount Sinabung eruption disaster.

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