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Resilience of Disaster-Prone Village Communities to Face Landslides in Lempongsari Village, Semarang City

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ABSTRACT

Lempongsari Village is one of the villages in Gajahmungkur District that is prone to landslides. The landslide disaster that occurred in Lempongsari Village RT 01 RW 03 in 2024 hit densely populated villages. Meanwhile, in March 2024, a landslide hit 1 house located on Jalan Veteran Kelurahan Lempongsari. The purpose of this study is to analyze the resilience of disaster-prone village communities in facing landslides in Lempongsari Village, Gajahmungkur District, Semarang City. The method used in this study is quantitative with the population of all people living in landslide-prone areas in Lempongsari Village, Gajahmungkur District, Semarang City. Sampling is carried out by *stratified random sampling techniques* with criteria for the level of vulnerability to landslide disasters, data collection techniques using observation, questionnaires, and documentation. While data analysis techniques are in the form of *descriptive* analysis. The results showed that physical resilience in Lempongsari Village includes the existence of slope barriers, evacuation routes, early warning systems, and landslide disaster management organizations. Meanwhile, community capacity resilience indicators related to landslide disasters are in the high category (40%), emergency response training is in the low category (31%), preventive activities are in the medium category (38%), and landslide disaster recovery activities are in the medium category (44%).

Keywords: Resilience, Community, Landslide Disaster

INTRODUCTION

In general, disaster vulnerability that occurs in Indonesia is in the high category. Disaster can be interpreted as an event that occurs suddenly so that it can threaten people's lives resulting in casualties, environmental damage, damage, ecosystems, and psychological impacts caused by both natural, non-natural and human factors so that it requires assistance both from local and outside to deal with it. Landslide disasters can be interpreted as the movement of slope-forming materials in the form of rocks, robbery materials, soil or mixed materials, moving or out of the slope. Landslides occur when water that seeps into the soil adds weight to the soil. If the water penetrates until the impermeable soil that acts as a slip plane, then the soil becomes slippery and the soil that experiences weathering on it will move along the slope and then out of the slope (Dwiyanto, 2002).

Landslides are one of the disasters that often occur in most regions in Indonesia, especially areas that have topographic

conditions in the form of hills, such as Semarang City. Landslides are natural disasters caused by geological processes that can have a negative impact on the community and the surrounding environment, both physically, socially, and economically (Anugrahanto et al., 2021).

Semarang City is the capital of Central Java Province which is located in the middle of the city with an area of 37,366,838 Ha and has 16 districts and 117 kelurahan. In addition, Semarang City is the center of economic activities in Central Java because of its very strategic location. This resulted in the Semarang City area becoming one of the areas with a fairly high population density compared to other regions due to the increase in the number of people occupying Semarang City. The increase in population in Semarang City will affect the increasing need for residential land, while the availability of land in Semarang City is decreasing, so it will result in the development of residential areas that are not in accordance with its provisions. Based on its topography, Semarang City has a morphology in the form of hills in the south because it is located at the foot of Mount Ungaran which stretches from east to west, and the coastal alluvial plain area which is located in the north because it is directly adjacent to the Java Sea. When viewed from the topography, Semarang City is prone to disasters, one of which is landslides. Based on data obtained from the Semarang City BPBD, since 2019-2024 Semarang City has experienced landslides 118 times with low to high intensity and caused losses both physically, socially, and economically to the directly affected communities (BPBD, 2024).

Gajahmungkur District is one of the districts in Semarang City that is prone to landslides. Lempongsari Village is one of the villages in Gajahmungkur District that is prone and has the potential for landslides. Based on data from January 2019, a landslide occurred in Lempongsari Village RT 01 RW 02 and hit a resident's house just below the cliff. There were no casualties due to this event, but losses were estimated at 15 million (Fajlin, 2019). Based on data from February 2021, a landslide occurred on Jalan Lempongsari I RT 01 RW 03 which resulted in a 6-meter-long landslide talud with a height of 8 meters and hit 1 resident's house (BPBD, 2021). In January 2024, a landslide hit a densely populated village in Lempongsari Village RT 01 RW 03. The landslide disaster occurred at 20.00 WIB and hit 1 house and 3 motorcycles (Iman, 2019). Meanwhile, in March 2024, the landslide disaster of 1 house located on Jalan Veteran Lempongsari Village. In this incident, 1 resident's house was injured and 1 man was injured by landslide collapse material (Arifianto, 2024).

Landslide disasters that occur in Semarang City from year to year, especially in Lempongsari Village, show that community resilience is very important for people in landslide-prone villages because the resilience possessed by these communities will explain that people in disaster-prone villages are able to reduce the negative impacts produced by landslides.

Disaster resilience is defined as the capacity or ability of the community to anticipate, prepare, respond, and recover from the impact of disasters. Resilience is generally seen as a broader concept than capacity because it goes beyond specific behaviors, strategies and actions for risk reduction and management which are usually understood as capacity. However, it is difficult to separate concepts clearly because in everyday use, 'capacity' and 'handling capacity' often mean the same as 'resilience' (Twigg, 2009).

Based on the above problems, this study is intended to analyze community resilience based on physical resilience variables and community capacity resilience, so the purpose of this study is to analyze the resilience of disaster-prone village communities in facing landslides in Lempongsari Village, Gajahmungkur District, Semarang City.

MATERIALS & METHODS

The type of research carried out is quantitative research. The study population is all heads of families in Lempongsari

Village, Gajahmungkur District, Semarang City. The sampling of this study used *a stratified random sampling* technique, where populations are grouped into strata based on the characteristics of residences that have the potential for landslides. Locations with high potential for landslides include Rukun Warga (RW) 1, 3, and 4 with a total of 55 heads of families (KK). Based on this, the sample in this study was 55 heads of families living in landslide-prone areas in RW 1, 3, and 4. The variables of this study are elaborated from previous research on community resilience. The variables and indicators of this study can be seen in Table 1.

Table 1. Community Resilience Variables and Indicators

Variable	*Indicator*
Physical Endurance	1. Existence of Evacuation Routes 2. Existence of an Early Warning System 3. The existence of slope retaining 4. Existence of Disaster Management Organization
Community Capacity Resilience	1. Knowledge of Landslide Disasters 2. Emergency Response Training 3. Landslide Disaster Prevention Activities 4. Landslide Disaster Recovery

Source: Researcher Analysis, 2024

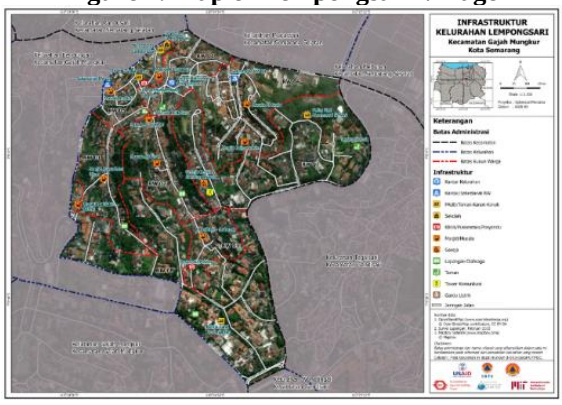
In this study, the data used were primary and secondary data. Primary data in this study were obtained from observation, interviews, and questionnaires. Observations were made to determine the condition of the community's physical resilience in the face of landslides. Interviews were conducted with residents affected by landslides to support observational data related to the physical resilience of the community in dealing with landslides. The questionnaire is a list of questions intended for the sample, to determine the capacity of the community in dealing with landslide disasters. While the secondary data in this study is in the form of local government documents which include monographs of Lempongsari Village.

RESULT AND DISCUSSION

Geographic Conditions of Research Locations

Lempongsari Village is one of the villages in Gajahmungkur District, Semarang City, Central Java. Lempongsari Village is a densely populated village and has an area of 87,671 km2 with a population in 2023 of 6,258 people. Administratively, Lempongsari Village is bordered by South Semarang District (north), Gajahmungkur Village (south), Dam Village (west), and Candisari District (east). The following map is presented Lompongsari Village:

Figure 1. Map of Lempongsari Village



Source: Lompongsari Village Data, 2024

Lempongsari Village has a topography in the form of hills with flat to very steep relief, and is located at an altitude of >150 meters above sea level with slopes ranging from 0-2% to >40%. The average rainfall that occurs in Lempongsari Village is 27.7-34.8 mm / year. Based on these conditions, Lempongsari Village is one of the areas that has a high category of landslide disaster intensity as evidenced by landslide disasters in Lempongsari Village that occur regularly every year.

This research was conducted in Lempongsari Village, Gajahmungkur District, Semarang City, consisting of 8 RWs and 38 RTs. The determination of the location of the study was carried out by considering that all areas in Lempongsari Village have a high intensity of landslide disasters because this area is

classified as an area that is vulnerable to landslides, so it is important to assess the resilience of the community in facing landslide disasters.

Physical Resilience

Physical resilience describes the physical infrastructure of the region that plays an important role in reducing the risk of landslides. The existence of physical infrastructure related to disasters is a form of community preparedness in facing disasters. (Rahmawati, 2023) The variables of physical resilience of the Lempongsari Village community include indicators of the presence of slope barriers, the existence of evacuation routes, the existence of early warning systems, and the existence of landslide disaster management organizations.

Soil retaining structure is a technique used to withstand soil pressure and prevent soil shifts in slope areas. The construction of soil retaining structures can help reduce the likelihood of landslides. Based on the results of observations in the field, the existence of soil retaining structures in Lempongsari Village is different in each location. The soil retaining structure in Lempongsari is mostly in the form of soil retaining walls. However, in certain locations communities also apply *bioengineering* techniques or use plants as soil retaining structures (See figures 2 and 3).

Figure 2. The presence of a soil retaining wall at the site of the landslide

Source: Research, 2024

Figure 3. The existence of bioengineering engineering slope retaining in landslide-prone locations

Source: Research, 2024

The availability of early warning systems and safe and open evacuation routes allows people to quickly leave areas affected by landslides. An Early Warning *System (*EWS) is a tool designed to monitor hazards and assess disaster risks to enable individuals, communities, and governments to take appropriate action in minimizing the impact of disasters (Rahmawati, 2023; Tenda et al., 2021). Lempongsari Village has no early warning system and official evacuation route. Nevertheless, the initiatives shown by the local community show awareness and responsibility for the safety of themselves and others. Disaster management organizations have a very important role in increasing the physical resilience of the community to disasters. In this case, the form of existence of disaster management organizations in Lempongsari Village is in the form of emergency response posts that operate in the event of a landslide.

Community Capacity Resilience

Community capacity has a reference to the strength and ability of people affected by disasters in reducing disaster risk. In this case, the strength and capabilities possessed by communities in landslide-prone areas can aim to respond and overcome disasters. Based on community capacity variables, this study is supported by capacity indicators in the form of knowledge, emergency response training, preventive activities in preventing landslide disasters, and post-landslide recovery with the main target being people living in RW 1, 3, and 4 of Lempongsari Village, Gajahmungkur District, Semarang

City. The recapitulation of the scores of the calculation and classification results using *descriptive analysis* on the variable of community capacity resilience based on the questionnaire sheet is presented in the following table 2:

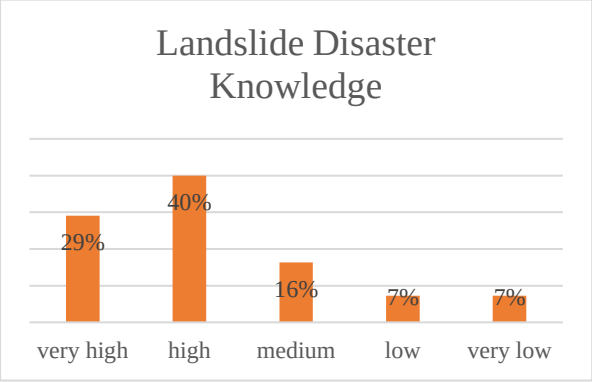
Capacity Resilience	Score Range	Frequency	%	Category
Knowledge	61-80	22	40%	High
Emergency Response Training	21-40	17	31%	Low
Preventive Activities	41-60	21	38%	Medium
Recovery Activities	41-60	24	44%	Medium
Average Score			38%	
Category			Low	

Table 2. Recapitulation of Community Capacity Resilience Variable Acquisition Score

Source: Researcher Analysis, 2024

Community knowledge related to landslide disasters is one of the important aspects that need to be owned by people living in Lempongsari Village because this area is an area prone to landslides. The knowledge in question includes information owned by the community related to the characteristics or signs of landslide disasters, rescue steps when landslides occur, evacuation routes, and other information related to landslide disasters so as to minimize the impact and risks generated in the event of a landslide disaster. Indicators of public knowledge related to landslide disasters based on the results of counting and classifying using *descriptive* analysis are presented in figure 4 below.

Figure 4. Community Knowledge of Lempongsari Village



Source: Researcher Analysis, 2024

The knowledge of the people of Lempongsari Village on landslide disasters is classified into 5 categories, including very high, high, medium, low, and very low. The results of the questionnaire obtained in the field found that out of 55 respondents on the knowledge indicator, there were 22 respondents or 40% were in the high category. While in the very high category there were 16 respondents with a percentage of 29%, the medium category had 9 respondents with a percentage of 16%, the low category had 4 respondents with a percentage of 7%, and the very low category had 4 respondents with a percentage of 7%. The results show that the knowledge possessed by the majority of people living in Lempongsari Village is in the high category (40%). In this case, the community not only knows, but also understands that the area where they live is an area prone to landslides, so that through the experience possessed by the community in dealing with landslide disaster events that almost occur every year, the community recognizes the signs and causes of landslide disasters. In addition, people in Lempongsari Village know and understand the impacts and dangers that occur due to landslides. Based on an interview with one of the respondents, Mrs. Suwati (53 years old) explained that although the house she lived in was right under the slope and was very prone to landslides, Mrs. Suwati did not use the room beside the slope to be used as a bedroom to minimize casualties in the event of a landslide.

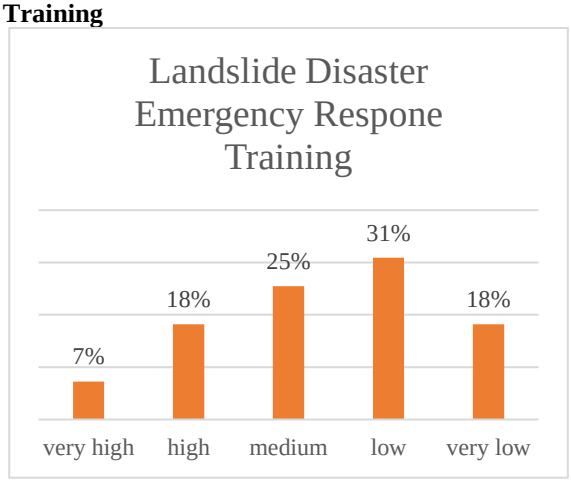
The knowledge possessed by the people of Lempongsari Village shows that they understand what steps need to be taken during pre-disaster (before a disaster), during emergency response (during a disaster), and post-disaster (after a disaster). According to the results of an interview with Mr. Agus (46 years old) who is one of the victims of the landslide disaster in Lempongsari RW 01 Village, explained that he had carried out pre-disaster steps, one of which was routinely checking, cleaning, and repairing the drainage channels under the talud. Meanwhile, during the emergency response, the steps taken are to stay away from the

talud and provide information to the community regarding the landslide disaster through *whatsapp groups*, so that during the post-disaster the steps taken by Mr. Agus and the surrounding community are one of them is to immediately clean up the materials that cover the road so as not to interfere with residents' activities.

Although the knowledge possessed by the people of Lempongsari Village is in the high category, there is a need for increased knowledge that can be carried out by the local government or related agencies regularly and *continuously* through disaster response training and socialization to increase public knowledge related to landslide disasters, especially during pre-disaster, emergency response, and post-landslide disasters, because of the knowledge possessed by The community related to landslide disasters is very important considering the condition of Lempongsari Village is an area prone to landslides, while every year Lempongsari Village experiences human resource mobilization, so that with the knowledge possessed it is able to produce strength and ability to minimize the risk of disasters.

Disaster emergency response training includes an activity that needs to be given to communities in disaster-prone areas, because disaster emergency response training is useful to minimize the negative impacts generated by landslides that occur through a series of actions carried out as a form of effort and steps taken both from the community to government agencies. Activities carried out by the community in disaster response consist of rescue and evacuation activities, property, fulfillment of needs during emergency and post-disaster response conditions, as well as recovery of facilities and infrastructure due to landslides. Landslide emergency response training indicators based on the results of calculation and classification using *descriptive* analysis are presented in figure 5 below.

Figure 5. Landslide Disaster Emergency Response Training



Source: Researcher Analysis, 2024

Landslide emergency response training in Lempongsari Village is classified into 5 categories, including very high, high, medium, low, and very low. The results of the questionnaire obtained in the field found that out of 55 respondents on the landslide emergency response training indicators, there were 17 respondents or 31% in the low category. While in the medium category there were 14 respondents with a percentage of 25%, the high category there were 10 respondents with a percentage of 18%, the very low category there were 10 respondents with a percentage of 18%, and the very high category there were 4 respondents with a percentage of 7%.

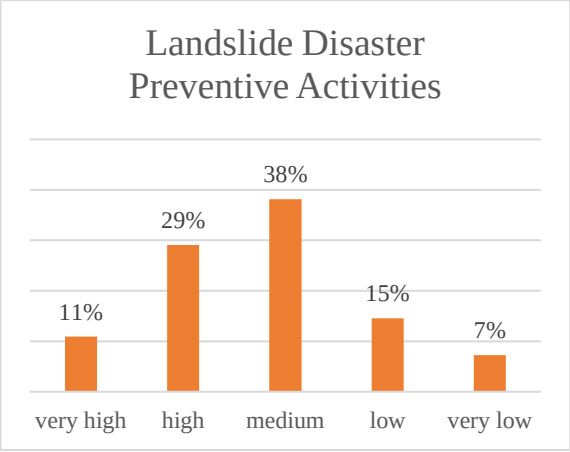
The results showed that landslide emergency response training in Lempongsari Village was in the low category (31%). This is because the majority of respondents in Lempongsari Village have never attended training, socialization, or other activities related to landslide disasters because of the lack of emergency response training and landslide disaster socialization provided to the community in Lempongsari Village by the local Regional Disaster Management Agency (BPBD), village government, and other related governments. According to information obtained through an interview with Mrs. Indar Feny (49 years old), landslide disaster training and socialization activities were carried out by the local government in Lempongsari Village several

years ago and were only attended by certain communities such as the Head of RT and Head of RW.

Based on technology and information related to *early warning systems*, Lempongsari Village does not yet have early detection or warning tools that can be used to detect soil movement, while this area is an area that is very vulnerable to landslides. Meanwhile, after the landslide disaster, the community uses *WhatsApp group* media to disseminate information related to landslide disaster events, so that from this information people get information which then flocks to the location of the landslide disaster to carry out cleaning efforts and handling after the landslide disaster.

Preventive activities to prevent landslides are one form of mitigation carried out by the community to reduce the threat of disasters in the area where they live. Locations that have a high level of vulnerability to landslides are several locations in RW 1, 3, and 4. The following preventive activities that are used as a reference in obtaining data can be seen in figure 6.

Figure 6. Landslide Disaster Prevention Activities



Source: research 2024

Landslide prevention activities in Lempongsari Village can be described into 5 categories, namely very high, high, medium, low, and very low. Of the 55 respondents, there are about 11% of people in the very high category. This shows that 6 people have done very well preventive activities such as the construction of retaining walls and land use arrangements that minimize the risk of landslides. In the high category of about 29%, where there are about 16 people have carried out preventive activities. This category includes effective preventive measures, but may require further monitoring. For example, vegetation management, good drainage, and public education about landslide risk. In the medium category, it is 38%, where the medium category is the highest category because the number of respondents is 21 people. This shows that preventive activities are carried out by paying attention to various factors and choosing balanced and effective actions to reduce disaster risk. In the low category, about 15% have carried out preventive activities with a total of 8 people. This indicates that preventive measures have not reached the expected level. It needs to be further evaluated to identify constraints and take corrective measures. For the latter, the very low category is around 7% with 4 people already carrying out preventive activities. This shows that there are serious problems in prevention efforts and need to be corrected immediately to reduce disaster risk.

The people of Lempongsari Village affected by the disaster have taken important steps to prepare themselves for the landslide disaster. This shows that the majority of respondents have thought about and planned ways to secure themselves in the event of a landslide. A good evacuation plan includes safe routes, gathering points, and procedures that all community members must follow. Knowing the early signs of a landslide is an important awareness because it allows individuals to recognize potential hazards before they occur and take necessary precautions. These signs can be changes in the landscape, cracks in the ground, or unusual sounds from the ground.

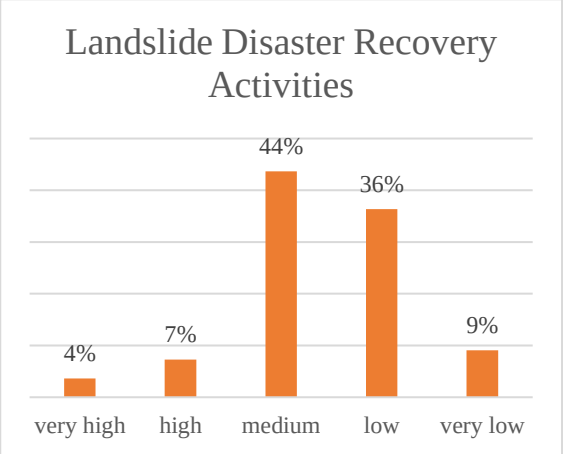
Disaster insurance is a form of preventive activity that can help reduce the economic impact of natural disasters. This is very important because it provides financial security for post-disaster recovery, helping individuals and families to help return to their lives without a heavy financial burden. Further efforts are needed to educate the

public about the importance of disaster insurance and how it can help in post-disaster recovery. Financial institutions and governments can work together to create insurance products that are affordable and accessible to rural communities. The government could consider providing subsidies or intensive for those who take out disaster insurance, so that more people are encouraged to protect themselves financially and ensure the long-term resilience of rural communities to landslides. Collective activities such as tree planting on landslide-prone slopes show good initiative from the government and private institutions, as well as active community participation. This reflects an increasing understanding of the importance of maintaining environmental balance to prevent landslides. On the other hand, independent activities such as the creation of soil reinforcement structures and emergency supplies show individual awareness in the face of disasters.

This discussion highlights that despite the efforts made, there is still room for improvement, especially in terms of regularity and consistency of preventive activities. The importance of education and training for the community to increase awareness and skills in dealing with landslide disasters cannot be underestimated. In addition, weather monitoring and early warning systems can be an important next step in strengthening disaster mitigation systems in the region.

Post-landslide recovery efforts are important steps taken by communities to rebuild and strengthen their areas after disasters. In several locations in RW 1, 3, and 4 that have a high level of vulnerability to landslides, various recovery activities have been carried out. The following recovery activities that are used as a reference in obtaining data can be seen in figure 7.

Figure 7. Landslide Disaster Recovery Activities



Source: research 2024

Landslide disaster recovery activities are divided into 5 categories, the first of which is very high at 4%. This shows that there are only 2 out of a total of 55 respondents who carry out very effective recovery activities. Examples include reforestation to strengthen slopes, repair damaged infrastructure, and rehabilitate land affected by landslides. In the high category of 7% with 4 people who have carried out effective recovery such as slope stability and vegetation management. The medium category is 44%, which is the highest category in landslide recovery activities. Most of the communities affected by the landslide are in this category of recovery efforts. The low category is 36%, where about 20 people have never received a training program related to disaster mitigation, have not managed drainage and vegetation maintenance. Very low category of 9% about 5 people who do not carry out recovery activities. This is due to several factors such as the absence of funds to rebuild and the absence of local government assistance, so in this case it is still necessary to carry out monitoring and preventive measures so that risks remain minimal.

In this recovery activity, the affected communities have taken proactive measures to repair the damage caused by the landslide. These infrastructure improvements could include roads, bridges, waterways, and damaged buildings. This includes positive indicators of community resilience and the ability to quickly restore essential village

functions. Improvement of public facilities will be prioritized by the government compared to private facilities. Based on the area studied, most of the damaged buildings are privately owned, so there is no assistance from the local government and must be borne by yourself. Some communities affected by the landslide disaster have replanted trees in vulnerable areas, as well as repaired drainage channels to prevent landslides. This is a good step to minimize landslides that can come at any time. Replanting is not only important to restore damaged ecosystems but also as a preventive measure to reduce the risk of future landslides. There needs to be an increase in recovery efforts in terms of self-preparedness, such as participating in training programs related to landslide disaster mitigation so that oneself will be better prepared and understand what to do. Increased cooperation and coordination between all relevant parties will go a long way in strengthening village resilience to landslides. In addition, an integrated approach involving the government, private institutions, and communities in planning and implementing recovery activities is key to achieving sustainable resilience.

CONCLUSION

Based on the results of research conducted on the resilience of people in disaster-prone areas in facing landslide disasters, it can be concluded that community resilience to landslides does not only depend on government policies and programs, but is also strongly influenced by active participation and community readiness in facing landslide disasters. People who have good knowledge, skills, and awareness tend to be better able to act independently in emergency situations. Public knowledge related to landslide disasters is in the high category, while emergency response training is included in the low category. Preventive activities and landslide disaster recovery activities carried out by the community are included in the medium category. Communities in Lempongsari Village have shown resilience and awareness in dealing with landslide risks through emergency response and environmental recovery efforts.

Declaration by Authors

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