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Community Development for Disaster Response in Volcanic Landscapes Based on Participatory Approach in Rua Village, Ternate City

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Kata Kunci
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Abstrak

Bencana alam tanah longsor dan banjir bandang merupakan bencana alam yang sering terjadi pada bentang lahan vulkanik. Kejadian ini menghasilkan dampak yang signifikan. Kurang nya pemahaman, minimnya kesiapsiagaan, serta rendahnya kesadaran terhadap risiko bencana dapat mengakibatkan korban jiwa, kerugian materi yang besar, serta hambatan dalam proses pemulihan pascabencana. Mitigasi bencana merupakan solusi jitu dalam penanganan aktivitas pasca bencana. Tujuan kegiatan pengabdian ini adalah mengenalkan pentingnya mitigasi kebencanaan berbasis partisipatif untuk mewujudkan kampung tanggap bencana. Kegiatan dilaksanakan di Kelurahan Rua, Kecamatan Pulau Ternate, Kota Ternate. Metode pengabdian masyarakat yang digunakan adalah metode dengan pendekatan sosialisasi, pendampingan hingga monitoring evaluasi. Kegiatan dilakukan secara langsung pada masyarakat di Kelurahan Rua. Hasil kegiatan terjadi peningkatan pemahaman tentang mitigasi bencana pada wilayah rawan bencana utamanya pada bentang lahan vulkanik. Selanjutnya, tim menyoroti tentang perlunya upaya penanganan seperti penanaman pohon, pembangunan rumah tanggap bencana hingga memperkuat ketahanan komunitas. Selain itu, perlu adanya koordinasi tingkat lanjut antara masyarakat dengan pemerintah daerah tentang penanganan area rawan bencana sehingga menjadi wilayah prioritas bagi pemerintah daerah untuk terwujudnya masyarakat tanggap bencana.

Abstract

Landslides and flash floods are common natural disasters in volcanic landscapes. The repercussions of these events are substantial. A dearth of understanding, preparedness, and awareness of disaster risks can result in casualties, significant material losses, and impediments to the post-disaster recovery process. Disaster mitigation has been demonstrated to be an effective solution for managing post-disaster activities. The objective of this service activity is to elucidate the significance of participatory-based disaster mitigation in establishing a community that is responsive to disasters. The activity was carried out in Rua Village, Ternate Island District, Ternate City. The community service method employed is characterized by a socialization approach, encompassing mentoring, monitoring, and evaluation. Activities are carried out directly in the community in Rua Village. The findings of the initiative have contributed to an enhanced understanding of disaster mitigation strategies, particularly within the context of volcanic landscapes, in regions susceptible to such events. Additionally, the team emphasized the importance of implementing initiatives such as afforestation, erecting disaster-response shelters, and strengthening community resilience. Furthermore, additional coordination is necessary between the community and the local government to effectively manage disaster-prone areas. These regions must be identified as priorities so that the local government can implement initiatives aimed at cultivating disaster-resilient communities.

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INTRODUCTION

Volcanic landforms are directly linked to natural disasters. Along with volcanic eruptions, other natural disasters that frequently occur in this landscape include landslides and flash floods. Landslides are the third most frequent natural disaster after floods (Noviyanto *et al.*, 2020), whereas flash floods are the most devastating (Zhang *et al.*, 2024; Zhao *et al.*, 2025). Extreme events that might result in property destruction and fatalities are typically linked to flash floods and landslides. Flash floods and landslides have major social and economic effects and typically happen in places like Indonesia that are experiencing rapid population increase (Anshori *et al.*, 2022). This phenomenon is frequently initiated by natural factors, including substantial precipitation, seismic events, and volcanic activity. However, human actions that disregard geological and geomorphological conditions, including industrialization and deforestation, can potentially exacerbate it. People who live near the mountain and along the riverbanks are at risk since flash floods are usually caused by heavy rainfall that carries debris from eruptions. One kind of natural disaster that commonly happens in many places is landslides, especially in places with steep slopes and unstable soil (BNPB, 2023). The increased frequency of extreme weather patterns brought on by global climate change also raises the risk of landslides and flash floods. Unusual weather conditions, including intense rainfall in a brief period of time, can hasten soil saturation and cause abrupt ground mass changes. In order to create effective mitigation strategies, it is crucial to gain a better understanding of landslide behavior by learning about internal landslides (Samodra *et al.*, 2020). Rua Village is one of the villages on Ternate Island where people live at the foot of Mount Gamala. Mount Gamalama is now classified as a stage 3 active volcano. Accordingly, this type of volcanic eruption falls into the group of eruptions that produce dangers at the local level, including ash precipitation surrounding the volcano (Whelley *et al.*, 2015). On the other hand, this volcano area frequently experiences natural calamities in the form of flash floods followed by cold lava floods (Tidore *et al.*, 2024). The flood disaster in Rua Village had occurred in 2017, not yet followed by a flash flood event, but the next event was followed by flash floods and landslides which claimed the lives of up to 19 people, 15 injured 30 damaged settlements and severely damaged road access (Tangge *et al.*, 2024). The lack of understanding of the community in dealing with secondary disasters is only 18.33% who are ready while 61.67% are not ready, one of the causes of the high percentage of unprepared people is that the community does not understand the steps that need to be prepared in reducing disaster risk (Anwar *et al.*, 2021). The level of community understanding of hazards, risks and early warning systems determines their independence and preparedness in the face of disasters (Andreastuti *et al.*, 2017). The active involvement of communities in mitigation planning, supported by local leaders who understand the local culture, increases community participation and empowerment (Mutiarni *et al.*, 2022; Mutolib *et al.*, 2025). Participatory-based disaster mitigation is of significant importance as it involves communities directly in disaster prevention, preparedness, and management efforts. Participatory approaches have been demonstrated to enhance effectiveness, sustainability, and community resilience in the face of disasters. Some previous studies have identified the primary advantages of participatory disaster mitigation, which include the cultivation of a more profound awareness among communities regarding the potential hazards and methodologies for disaster management through active engagement (Khaspuria *et al.*, 2024). Participation fosters a sense of ownership and responsibility for the implemented solutions (Rizzi & Porębska, 2020). Furthermore, mitigation programs are more effective and sustainable when tailored to local needs and contexts (O'Grady *et al.*, 2019; Cazabat, 2024). These localized solutions are more innovative and relevant because they are informed by local knowledge (Trejo-Rangel *et al.*, 2021). Based on these conditions, assistance to the Rua village community needs to be carried out to prevent more casualties if a natural disaster occurs again. This community service activity aims to increase community capacity through a participatory approach, which not only provides education but also actively involves residents in the mitigation process by increasing community understanding of disaster risks and impacts, building community capacity in dealing with disasters through training and realizing a disaster response village model that can be replicated.

METHODOLOGY

The method of community service activities employs a community participatory approach. This method focuses on increasing community capacity through socialization and continuous coaching. A participatory-based approach is a strategy that can empower communities to enhance their disaster preparedness and mitigate the impact of disasters. The stages of the method used in this partnership community service activity include several procedures which are described as follows:

Preparation

The activity begins with coordinating the proposer and partners. The aim is to harmonize the understanding of the implementation of community service activities. Next, conduct field observations and develop educational modules on types of disasters, mitigation, and evacuation that are tailored to the cultural and social characteristics of the local community.

Socialization

The activity began with a pre-test through answering a questionnaire. The aim was to determine the level of community knowledge about disasters, impacts, and how to respond to disasters. Next, conduct a Forum Group Discussion (FGD) on disaster mitigation and community preparedness for disasters. The content of this activity included providing information about the early signs of disaster and self-rescue steps.

Monitoring and Evaluation

Assessment of the results of the activity was carried out by answering a questionnaire in the form of a post-test. The aim was to measure the effectiveness of the program and to observe the changes in behavior and preparedness of the community after the socialization activities. Furthermore, the evaluation of activities includes analyzing weaknesses in socialization and coaching methods. Then develop recommendations to improve the effectiveness of activities and continue the program through partnerships with related institutions and universities.

RESULT AND DISCUSSION

Preparation

The activity was conducted in Rua Village, which is located in the Ternate Island District of Ternate City. The activity is situated approximately 3 kilometers from the campus II of Universitas Khairun. The team conducted direct observations in the field and engaged in discussions with the local government. The natural disaster in Rua Village was a flash flood followed by a landslide. A total of 16 people died in this incident. In addition, 25 houses and one place of worship were damaged after the incident (Figure 1). Furthermore, the issue at the service location is that community unpreparedness in facing disasters is a significant problem that can exacerbate the impact of the disaster itself. A dearth of understanding, preparedness, and awareness of disaster risks can result in casualties, substantial material losses, and impediments in the post-disaster recovery process (Pu *et al.,* 2024). The community's unresponsiveness to disasters can be attributed to various factors, including a lack of awareness regarding the significance of disaster mitigation measures (Polcarová *et al.,* 2022). The perpetual occurrence of these conditions invariably engenders the perpetual threat of temporary flood disasters to the community, exerting a detrimental influence on the safety of people's lives.

Figure 1. Post-natural disaster conditions in Rua Village, Ternate Island District, Ternate City.

Socialization

The outreach activity began with an opening by the community service team, followed by a presentation on natural disasters, namely flash floods and landslides (Figure 2). During the outreach activity, the team also explained the factors that influence the occurrence of natural disasters, starting from natural factors such as extreme rainfall, steep to very steep slopes, and the level of water saturation on the ground surface, as well as factors from anthropogenic activities such as deforestation, land use change, and development without risk impact analysis. The community service team also explained the flash flood hazard map (Figure 3). In their presentation, the team explained the flow of the flash flood and the areas with varying levels of risk, ranging from low to moderate to high. The information provided by this map was also very helpful for the community in Rua Village, which lacked information on a spatial scale. During the presentation, the team held many two-way discussions with the community. The socialization of disaster threats, which highlights the necessary steps, is often limited. Suboptimal early warning systems and a lack of understanding of how to respond to them cause people to fail to take anticipatory steps. Furthermore, communities are often resigned to the situation, making less effort to mitigate disasters. As a result, unresponsiveness to disasters can result in more casualties and greater economic losses. Social support, local government disaster response, post-disaster cooperation, and satisfaction with relief services positively affect post-disaster community resilience (Lim *et al.*, 2024).

Figure 2. Forum Group Disscussion (FGD) of natural disasters and disaster mitigation activities.

The service team also emphasized the importance of facilities and prevention efforts in the event of a natural disaster. Using traditional tools such as kentongan, recognizing natural signs, and following hereditary practices such as planting trees and building disaster-resilient houses strengthens community resilience (Napsiah *et al.*, 2019). However, knowledge alone is insufficient without increased preparedness through training and education (Zeballos-Velarde *et al.*, 2023). Additionally, solidarity actions, social networks, and trust in early warning systems are essential for post-disaster adaptation and recovery (Thouret *et al.*, 2022).

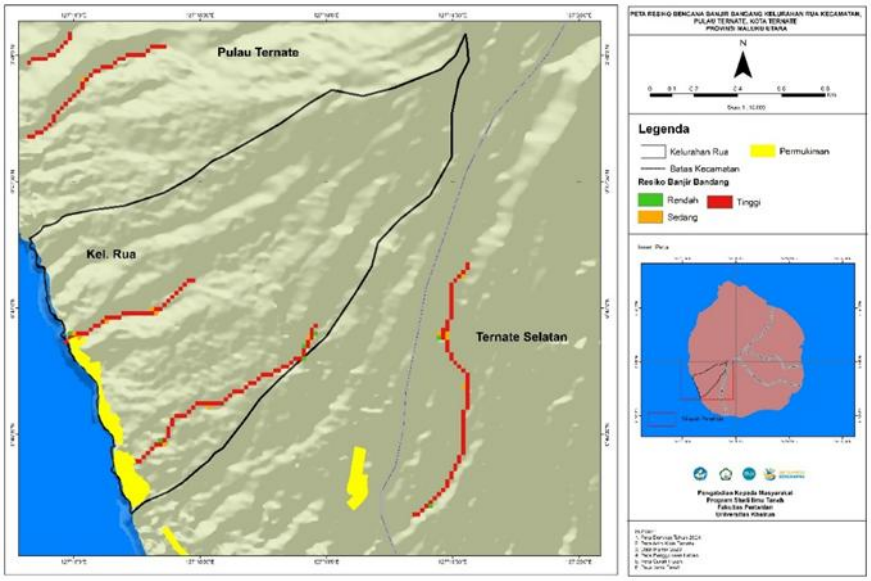

Figure 3. Map of the hazard level of flash flood risk.

The community service team also explained the map of the level of danger of natural disasters such as flash floods..

Monitoring and Evaluation

The activity was methodically executed in stages. The activity commences with the administration of a pre-test to the community, which comprises multiple inquiries concerning their insights into natural disasters on volcanic landscapes and the mitigation of such disasters. In addition, at the conclusion of the activity, the community in Rua Village was administered post-test inquiries pertaining to their comprehension of the socialization of disaster response communities.

Table 1. Community response before and after activity implementation.

No	Types of Questions	Response	
		Before (%)	After (%)
1	Definition of disaster emergency response	30	80
2	Potential disaster risks in volcanic landscapes	0	75
3	The main key is the level of public awareness	35	90
4	Forms of community preparedness for natural disasters in volcanic landscapes	30	80
5	Function of evacuation routes	50	100
6	Impact of natural disasters in volcanic landscapes	60	100
7	Solutions for handling natural disasters in volcanic landscapes	30	95

The findings of the preliminary examination indicate a persistent absence of comprehension regarding the community's awareness of various inquiries, particularly the extent of their cognizance concerning imminent natural disasters that are probable occurrences within volcanic terrains (refer to Table 1 and Figure 4). This tendency is due to the fact that the public is still unfamiliar with natural disasters and how to deal with them. In addition, many people feel indifferent to the dangers of natural disasters. There is a lack of literacy and educational outreach from stakeholder. This dearth of insight can be attributed to the limited access to information and the role of the media (German *et al.*, 2022). The media plays a pivotal role in the dissemination of information; however, access to and utilization of this information remain constrained (Kurata *et al.*, 2022). Additionally, the limited availability of institutions and human resources impedes the effective dissemination and

mitigation of information (Biggs *et al.*, 2021). Moreover, norms, beliefs, and a sense of attachment to one's place of origin can impede the acceptance of novel information. Consequently, traditional knowledge has not been thoroughly integrated with modern scientific principles in disaster education (Nazaruddin, 2022).

Figure 4. Community pre-test and post-test results on understanding of natural disaster emergency response mitigation.

The results of the post-test demonstrated a substantial increase, with two questions achieving 100% achievement (see Table 1 and Figure 4). Community development initiatives employing a participatory approach have been shown to facilitate an enhancement in the knowledge and understanding of the community, particularly in regions classified as disaster-prone areas. Furthermore, a comprehensive array of educational and socialization initiatives, encompassing counseling, training, and simulations, has been identified as a pivotal strategy to enhance comprehension and readiness (Muzambiq *et al.*, 2024). Participatory community service encourages communities to be more independent in decision-making, risk identification, and resource management. Community involvement in disaster mitigation planning and implementation strengthens social networks, solidarity, and collective confidence. Local values, traditional wisdom, and cultural practices are important social capital in building community resilience.

CONCLUSION

Community service activities in Rua Village, Ternate Island District, Ternate City proceeded in an orderly manner. The community exhibited a notable level of enthusiasm and a favorable response to this community service activity. The improvement of community knowledge about natural disasters in volcanic lands after disaster mitigation socialization is driven by a combination of direct education, technology utilization, community involvement, and integration of local wisdom. This approach has proven effective in building preparedness and practical knowledge to face volcanic disasters. Moreover, the necessity of synergy among the government, the community, and other relevant stakeholders is of paramount importance, particularly in the domains of emergency training, the development of disaster-resistant infrastructure, and the coordination of evacuation procedures.

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