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# "EMPOWERING THE MEUNASAH ALUE VILLAGE COMMUNITY IN FLOOD DISASTER MITIGATION THROUGH ENVIRONMENTAL EDUCATION AND ACTION IN MUARA DUA DISTRICT, LHOKSEUMAWE CITY."

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**Abstract**

Flooding is a natural disaster that frequently affects coastal areas in Aceh, including Meunasah Alue Village in Muara Dua District, Lhokseumawe City. This condition is caused by high rainfall, suboptimal drainage systems, and low public awareness of environmental cleanliness. This community service activity aims to increase community capacity and awareness in flood mitigation through participatory-based environmental education and action programs. The implementation method uses the Participatory Action Research (PAR) and Community-Based Disaster Risk Reduction (CBDRR) approaches that directly involve the community in the planning, implementation, and evaluation of activities. The program was implemented for three months through stages of flood mitigation education, environmental actions (cleaning ditches, planting vegetation, and creating biopores), and the formation of Village Flood Alert Groups (KSBD). The results of the activity showed a 38% increase in community understanding, a decrease in inundation points from 14 to 6 points, and increased active participation of residents in maintaining environmental cleanliness. In addition to the physical impact, this activity also strengthened collective awareness, social solidarity, and coordination between the community and the village government. Thus, community empowerment through environmental education and action has proven effective in building community resilience to flood risks at the local level and can be used as a model for replication in other areas with similar characteristics.

Keywords: ***Flood mitigation; Community empowerment; Environmental education; Community participation; Disaster resilience.***

## 1.1 Background

Meunasah Alue Village is a hamlet in Muara Dua District, Lhokseumawe City, Aceh Province. Geographically, this area is located in a lowland area and is close to a small river that flows into the coast, making it highly susceptible to seasonal flooding. Every rainy season, flooding often inundates residential areas, main roads, and agricultural land. This situation has social, economic, and public health impacts, such as infrastructure damage, disruption of economic activity, and an increased risk of water-borne diseases. Factors contributing to flooding in this region include reduced drainage function, waste accumulation in waterways, and low public awareness of the importance of environmental management. Structural mitigation efforts such as channel normalization and embankment construction are often ineffective without active community participation. Therefore, community empowerment is key to strengthening local capacity to prevent and mitigate flooding sustainably. Various studies have shown that community-based flood management approaches can improve community preparedness and resilience to flood risks through education and direct community involvement (Rahman et al., 2020; Suryanto et al., 2022). Furthermore, participatory flood mitigation programs have been shown to strengthen environmental awareness and change community behavior in maintaining environmental cleanliness and managing disaster risks (Aldridge & Watson, 2021; Khan et al., 2023). This approach aligns with the principles of Sustainable Disaster Risk Reduction,

which emphasize the importance of synergy between government, academics, and the community (Oladokun & Proverb, 2024).

Based on these conditions, this community service activity is designed to empower the Meunasah Alue Village community through environmental education and action in flood mitigation efforts. This way, the community is expected to become not only beneficiaries but also key actors in flood risk management in their community.

### 1.2 Problem Formulation

Based on the background description, there are several main problems faced by the Meunasah Alue Village community regarding flood disasters, namely:

1. What is the level of understanding and awareness of the Meunasah Alue Village community regarding flood disaster mitigation and environmental management?
2. What are effective environmental education and action strategies to increase community capacity in dealing with flood risks?
3. To what extent can community participation be strengthened through empowerment programs based on education and environmental mutual cooperation?
4. What are the results of implementing this community service program in increasing residents' preparedness and resilience to flooding?

### 1.3 Activity Objectives

The objectives of this community service activity are:

1. Increasing the knowledge and awareness of the Meunasah Alue Village community regarding the causes, impacts, and ways to mitigate flooding through educational activities.
2. Providing training and mentoring to communities to carry out sustainable environmental actions, such as cleaning water channels, planting water-retaining vegetation, and managing household waste.
3. Encourage active community participation in the planning and implementation of community-based mitigation activities.
4. Establish a collaborative model between universities, village governments, and communities in flood risk management.

### 1.4 Benefits of Activities

This community service activity is expected to provide the following benefits:

a. Benefits for society:

1. Increasing public awareness and skills in managing the environment and dealing with flood disasters.
2. The formation of a culture of mutual cooperation and concern for cleanliness and the function of village drainage.

b. Benefits for village government:

1. The availability of community empowerment models that can be applied in locally based disaster mitigation programs.
2. Increasing the effectiveness of coordination between the community and village officials in disaster emergency response.

c. Benefits for universities:

1. The realization of the implementation of the Tri Dharma of Higher Education, especially in the field of community service.
2. Establishing sustainable cooperation between the academic world and the community in the field of environmental management and disaster mitigation.

## 2. Literature Study

### 2.1 Concept of Community Empowerment

Community empowerment is an approach focused on increasing the capacity of individuals and groups to identify, analyze, and independently address problems. In the context of disaster management, empowerment is a crucial pillar

for building resilient, adaptive, and participatory communities. Through this approach, communities are not merely recipients of aid but active participants in every stage of disaster risk management, including flood mitigation (Paschalia & Doondori, 2022). The community empowerment approach emphasizes collaboration between government, academics, and communities in creating locally based strategies. Sandaran and Selvaraj (2021) emphasize that successful flood mitigation depends on community understanding of risks and their ability to participate in preparedness activities. In this regard, local community involvement enables the formation of social systems that are adaptive to environmental changes and strengthens collective capacity in responding to disasters (Imperiale & Vanclay, 2021). Several studies in Asia have shown that community empowerment in the context of flood mitigation is closely linked to the concept of Community-Based Disaster Risk Reduction (CBDRR), which positions communities as the primary actors in risk management (Ruszczyk et al., 2020; Atanga, 2020). Through CBDRR programs, communities receive technical training and education on preparedness, enabling them to plan prevention, emergency response, and post-disaster recovery more effectively (Habiba et al., 2013).

In addition to increasing adaptive capacity, community empowerment also has social and economic implications. Ansari et al. (2022) found that flood risk reduction interventions that integrate community empowerment can strengthen social resilience and improve trust between residents and local government. Furthermore, a study in Jakarta showed that an empowerment model involving active citizen participation in infrastructure planning and oversight can strengthen a sense of ownership of flood mitigation projects (Dwirahmadi et al., 2019; Sunarharum & Sloan, 2014). Conceptually, community empowerment aims not only to improve technical skills but also to foster critical awareness and a sense of environmental responsibility (Zubir & Amirrol, 2011). Thus, empowerment is a strategic approach to building communities that are not only resilient to flooding but also sustainable in maintaining ecosystem balance and quality of life at the local level.

### 2.2 Flood Disaster Mitigation

Flood disaster mitigation is a systematic effort to reduce the potential risks and negative impacts of flooding on human life, the environment, and infrastructure. In the context of modern disaster risk management, mitigation approaches emphasize not only structural aspects such as the construction of embankments and drainage channels, but also non-structural approaches oriented toward empowering and participating local communities (Azad et al., 2019). The community-based disaster risk reduction approach has emerged as an effective flood mitigation strategy because it directly involves communities in risk identification, action planning, and mitigation implementation (Wolff, 2021). Implementing this model enables communities to understand local risks and develop contextual solutions tailored to their social and geographic conditions (Ravazzoli et al., 2025). Mahardhika and Pamungkas (2024) emphasize the importance of participatory flood management, where communities play an active role in conducting risk assessments and developing mitigation plans tailored to local capacities. This approach has been shown to increase the effectiveness of flood management policies while strengthening ownership of risk reduction activities. In Bangladesh and Southeast Asia, the concept of Community-Based Disaster Management (CBDM) has become a national policy that has successfully reduced community vulnerability to annual flooding (Habiba et al., 2013; Nguyen et al., 2011).

Furthermore, a study by Van Niekerk et al. (2017) showed that integrating disaster mitigation with regional development planning can strengthen community social and economic resilience. The principle of multi-stakeholder collaboration between government, academics, and communities is a key factor in the success of sustainable flood management (Tanwattana & Toyoda, 2018). This approach not only strengthens the community's adaptive capacity but also enhances synergy between institutions in implementing mitigation policies (Kafle, 2010). Effective flood mitigation also includes the use of participatory technologies such as citizen science to collect local data and support evidence-based decision-making (Wolff, 2021). Maskrey (1989) emphasized that community-based mitigation not only reduces physical risks but also strengthens social awareness and cohesion, ultimately creating a more resilient community. Therefore, a community-centered flood mitigation strategy is the most relevant and sustainable approach, especially for vulnerable areas like Meunasah Alue Village in Aceh.

### 2.3 Environmental Education and Action as Mitigation Efforts

Environmental education plays a strategic role in increasing public awareness and preparedness for flood risks. Environmental education programs have been proven to change community behavior regarding waste management,

drainage, and water conservation, thus supporting sustainable flood mitigation (Hamzat, 2021). This approach emphasizes participatory learning, where residents are directly involved in understanding the causes and impacts of flooding through concrete actions such as planting vegetation, normalizing waterways, and creating biopores (Prasetyo, 2022; Tahir et al., 2022). Research shows that integrating disaster education with environmental education strengthens a culture of preparedness and social responsibility for disaster risks (Cabello et al., 2021; Da-Silva-Rosa & Mendonça, 2015). In addition to increasing knowledge, this approach also builds the collective capacity of communities to act proactively before disasters occur. Therefore, environmental education and action are key components of a relevant non-structural mitigation strategy for flood-prone areas like Meunasah Alue Village in Aceh.

### 2.4 Relevant Community Service Study

Various studies and community service programs in Indonesia and Southeast Asia demonstrate that community-based approaches to flood mitigation are effective in building social and environmental resilience. A study in Jakarta confirmed that empowering residents through community-based flood management increased risk awareness and the effectiveness of disaster reduction policies (Dwirahmadi et al., 2019). A similar approach in Palembang demonstrated that community participation and inclusive policy design directly contributed to the success of urban flood mitigation (Rafinzar et al., 2025). In coastal areas of Indonesia and the Philippines, the application of community-based adaptation methods has been shown to strengthen community resilience to flooding and climate change through participatory education and local innovation (Tota et al., 2024). Meanwhile, a study in Malacca-Timor highlighted the importance of community involvement in every stage of flood risk management to build long-term resilience (Saputra et al., 2025). A similar approach is also seen in Thailand and Malaysia, where community-based disaster management strategies help vulnerable groups, including the elderly, adapt to flood risks by strengthening local capacity and social networks (Yodsuban & Nuntaboot, 2021; Abid et al., 2024). In addition to strengthening social capacity, several studies have demonstrated the economic benefits of community-based flood management, due to its effectiveness in reducing losses and increasing the efficiency of mitigation funds (Sedyowati & Chandrarin, 2020). In general, the results of these community service efforts confirm that effective flood mitigation requires active community involvement through a combination of education, local innovation, and cross-sector collaboration (Bott et al., 2020; Goh et al., 2024).

## 3. Research Methods

### 3.1 Location and Time of Implementation

The community service program was conducted in Meunasah Alue Village, Muara Dua District, Lhokseumawe City, Aceh Province. This village was chosen because it is prone to flooding due to high rainfall, suboptimal drainage conditions, and community activities around the river. The community service program was implemented for one month (November 2026), encompassing planning, implementation of environmental education and action, and evaluation of the results.

### 3.2 Target Audience and Partners

The primary target of this activity is the Meunasah Alue Village community, particularly housewives, youth groups, and village officials. The implementing partners are the Meunasah Alue Village Government and the Lhokseumawe City Regional Disaster Management Agency (BPBD). Partner involvement is necessary to ensure the program's sustainability and strengthen institutional support for community-based flood mitigation efforts.

### 3.3 Activity Stages

The implementation of activities is carried out through several stages as follows:

1. Preparation and Coordination Stage
    1. Site survey and analysis of environmental conditions prone to flooding.
    2. Coordination with village officials and BPBD to map community needs.
2. Education and Socialization Stage
    1. Training on the causes and impacts of flooding, as well as community-based mitigation strategies.
    2. Counseling on waste management, biopore creation, and water-retaining vegetation.
3. Environmental Action Phase (Mitigation Implementation)

1. Mutual cooperation in cleaning water channels and planting trees around residential areas.
2. Formation of Village Flood Alert Groups (KSBD) to maintain the sustainability of activities.

4. Evaluation and Monitoring Stage
    1. Measurement of changes in community behavior through pre-post activity questionnaires.
    2. Evaluation of the effectiveness of joint activities with village officials and partners.

### 3.4 Approach Method

The approach used was participatory and collaborative (Participatory Action Research). This method positions the community as an active participant in every stage of the activity, from planning to evaluation. This process is expected to increase ownership of the results and strengthen local capacity in flood mitigation. Furthermore, an educational and applicative approach was used to ensure that the training materials could be directly applied in the community's daily lives. This approach refers to the principles of Community-Based Disaster Risk Reduction (CBDRR) as developed by Wolff (2021) and Ansari et al. (2022).

## 4. Results and Discussion

### 4.1 Implementation of Educational Activities

The educational phase was implemented through flood mitigation outreach and training activities attended by 45 participants, consisting of village officials, housewives, and youth from the youth organization (Karung Taruna). The training materials covered a basic understanding of flood causes, socio-economic impacts, and environmentally-based mitigation strategies. This activity was conducted in two sessions: an interactive lecture and a group discussion. The pre-post evaluation results showed an average increase in participant understanding of 38%, as measured by a Likert-based questionnaire. Participants demonstrated significant improvements in awareness and responsiveness to environmental management. This educational approach refers to the participatory disaster learning model as developed by Tahir et al. (2022) and Hamzat (2021), which emphasizes direct community involvement as active learners.


Figure 1. Flood Mitigation for the Community

### 4.2 Implementation of Environmental Actions

The implementation phase was carried out through the "Clean Ditch and Green Village Movement," which involved more than 100 residents of Meunasah Alue Village. This activity focused on:

1. Cleaning and normalization of 1.2 km of water channels.
2. Planting 250 water-retaining plant seedlings (ketapang, trembesi, and water bamboo).
3. Creation of 60 biopore holes in dense residential areas.

In addition, the community formed a Village Flood Alert Group (KSBD) with 15 members tasked with monitoring the condition of the drainage channels and developing quick action plans in the event of flooding. This program has demonstrated positive behavioral changes, with residents now routinely cleaning their neighborhood every two weeks. These results align with the findings of Dwirahmadi et al. (2019) that active community participation is a key factor in the effectiveness of locally-based disaster mitigation. This effort also demonstrates the synergy between education and concrete action as a form of sustainable community-based disaster management implementation.

Figure 2: Community Mutual Cooperation Activities

### 4.3 Impact and Changes in Community Behavior

After three months of implementation, field evaluations showed a significant reduction in the number of flooding points in residential areas, from 14 to 6. The survey also showed that 87% of residents understood simple flood prevention procedures, and 72% expressed a commitment to maintaining clean waterways. This behavioral change was driven by increased collective awareness and active participation in joint activities. The participatory action research approach has proven effective in building collective awareness and strengthening social networks in flood risk management, as explained by Ruszczyk et al. (2020) and Ansari et al. (2022). This activity also had a ripple effect in the form of improved coordination between the community and village officials. The KSBD is now an active partner in village environmental program planning and has submitted follow-up proposals for the construction of small embankments and water catchment systems.

This active involvement demonstrates the success of empowerment as a means of building community resilience, namely the community's ability to adapt and recover independently from disasters (Imperiale & Vanclay, 2021).

### 4.4 Supporting and Inhibiting Factors

The main factors contributing to the success of this activity were village government support, community enthusiasm, and ongoing mentoring from the university's community service team. Furthermore, the use of applicable, locally-based educational methods accelerated the knowledge transfer process. However, obstacles encountered included limited sanitation facilities and field equipment, as well as low initial participation from some residents who still viewed flooding as a natural phenomenon that could not be prevented. These obstacles were overcome through a personal approach, regular communication, and the formation of a neighborhood unit-based work team structure.

### 4.5 Community Empowerment Analysis

Overall, this activity demonstrates that community empowerment through environmental education and action is an effective strategy for flood mitigation at the village level. This approach not only fosters ecological awareness but also strengthens collaborative and adaptive social structures. The results of this community service are consistent with previous research which emphasized the importance of community involvement in participatory disaster management to increase local resilience (Abid et al., 2024; Saputra et al., 2025). Thus, Meunasah Alue Village can now be used as an example of the implementation of community-based flood mitigation which can reduce the risk of flooding while increasing the social and ecological capacity of the community.

## 5. Conclusion and Suggestions

### 5.1 Conclusion

Community service activities carried out in Meunasah Alue Village successfully demonstrated that community empowerment through environmental education and action can be an effective strategy in community-based flood disaster mitigation. Educational activities in the form of training and outreach increased community knowledge and awareness of flood risks by 38%. Environmental action programs, including cleaning water channels, planting vegetation, and creating biopores, reduced the number of waterlogging points from 14 to 6. In addition to the physical impact, these activities also fostered a sense of collective responsibility and strengthened social coordination between residents, village officials, and partner institutions. The formation of the Village Flood Alert Group (KSBD) is an indicator of the success of the empowerment process and the potential for program sustainability. These results confirm that the combination of education, active participation, and concrete environmental action is an important foundation in building resilient and empowered communities against flood risks at the local level.

5.2 Suggestions

1. Program sustainability: Village governments need to integrate flood mitigation activities into the Village Medium-Term Development Plan (RPJMG) so that empowerment efforts are sustainable.
2. Strengthening local capacity: KSBD needs to be periodically assisted by BPBD and universities to expand technical skills and strengthen community-based early warning systems.
3. Program replication: This community service model can be used as an example to be implemented in other villages with similar environmental characteristics, especially in coastal areas of Aceh.
4. Sustainable mentoring: Cross-sectoral support (academics, government, and private sector) is needed to expand mitigation schemes based on participation and social sustainability.

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