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DISASTER MITIGATION GOVERNANCE TO MAINTAIN ENVIRONMENTAL SUSTAINABILITY BASED ON CO - SERVICE BY NON GOVERNMENTAL ORGANISATIONS: A STUDY OF THE MUHAMMADIYAH DISASTER MANAGEMENT CENTRE (MDMC) IN WATULIMO SUB DISTRICT, INDONESIA

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Abstract

Environmental sustainability in disaster-prone regions requires measurable community resilience, and this study quantitatively examines the role of the Muhammadiyah Disaster Management Centre in supporting environmental sustainability through disaster mitigation in Watulimo District. A survey method with a structured questionnaire was distributed to community members, volunteers, and local stakeholders, producing 120 valid responses. The instrument measured perceptions of environmental awareness, mitigation readiness, and the effectiveness of MDMC interventions using a five-point Likert scale. Data were analyzed using descriptive statistics and correlation tests to identify the relationship between MDMC activities and indicators of environmental sustainability. The results show that MDMC programs significantly contribute to environmental sustainability, with high mean scores in environmental education (M=4.21), community preparedness (M=4.08), and ecological risk reduction (M=4.15). Correlation analysis indicates a positive and significant relationship ($r=0.62$, $p<0.01$) between MDMC mitigation efforts and community-based environmental resilience. These findings suggest that the Centre's interventions play a measurable role in strengthening sustainability outcomes, although resource limitations and uneven environmental literacy remain challenges. Overall, the study provides empirical evidence of MDMC's contribution to environmental sustainability in Watulimo District.

Keywords: *Environmental Sustainability, Disaster Mitigation, Environmental Governance, NGos, Co-Service*

INTRODUCTION

Environmental sustainability has become an essential foundation for reducing ecological degradation and promoting long-term resilience, particularly in regions where environmental pressures intersect with disaster risks [1]. The increasing frequency of climate-related hazards such as intense rainfall, extreme weather, and land instability calls for integrated approaches that combine environmental management with disaster mitigation [2]. Efforts to strengthen sustainability at the community level are widely recognized as a strategic pathway to reducing vulnerability and ensuring that environmental systems remain adaptive amid changing conditions [3].

Watulimo District represents a landscape highly exposed to environmental threats, including landslides, flooding, and coastal hazards [4]. These recurring events not only endanger human life but also accelerate environmental degradation, weaken local ecosystems, and disrupt community livelihoods [5–7]. Limited access to environmental education and inconsistent mitigation practices further contribute to ecological vulnerability [8]. As a result, sustainable disaster management in Watulimo requires a coordinated approach that strengthens both environmental awareness and the community's ability to respond to environmental hazards [9,10].

NGO play a crucial role in advancing environmental sustainability through community-based disaster mitigation actions [11]. The Muhammadiyah Disaster Management Centre has emerged as a key factor in Watulimo by promoting risk awareness, facilitating preparedness activities, and encouraging environmentally responsible behaviour [12]. Through volunteer networks, educational programs, and community engagement initiatives, the Centre provides an important platform for integrating environmental considerations into disaster mitigation [13]. Its contributions are particularly relevant in areas where state capacity and resources remain limited.

Despite its growing role, empirical evidence on how the Muhammadiyah Disaster Management Centre supports environmental sustainability remains limited. Previous studies have focused primarily on its disaster response or community service activities, with little attention given to measurable environmental outcomes. This creates a research gap regarding the Centre's actual influence on environmental resilience and sustainability practices. Therefore, this study aims to quantitatively evaluate the extent to which the Centre's disaster mitigation programs contribute to environmental sustainability in Watulimo District, offering new insights into the effectiveness of community-based institutions in strengthening ecological resilience.

LITERATURE REVIEW

2.1 Environmental Sustainability in Disaster-Prone Areas

Environmental sustainability in disaster-prone areas refers to the capacity of an ecosystem and its surrounding communities to maintain ecological stability while minimizing environmental degradation caused by natural hazards [14]. The concept emphasizes the integration of environmental protection, resource management, and long-term ecological resilience to ensure that disaster risks do not lead to irreversible environmental damage. Key indicators of environmental sustainability in vulnerable regions include environmental awareness, land-use management, conservation practices, community preparedness, and the ability of local ecosystems to recover after disturbances. In disaster-prone settings, these indicators are closely linked to the frequency and intensity of hazards, the sensitivity of local environments, and the capacity of institutions to implement sustainable mitigation strategies. Ensuring environmental sustainability in such areas is highly relevant, as it helps reduce
ecological vulnerabilities, supports adaptive capacity, and strengthens the resilience of both communities and ecosystems against future disasters.

2.2 Community-Based Disaster Mitigation

Community-based disaster mitigation refers to strategies and actions that prioritize local participation, collective preparedness, and community-driven risk reduction efforts. This approach recognizes that communities are the first to experience disaster impacts and therefore hold valuable knowledge about local hazards, vulnerabilities, and coping mechanisms [15]. Key components of community-based mitigation include risk education, early warning dissemination, participatory planning, and the mobilization of local volunteers to strengthen response capacity. By empowering residents to take an active role in disaster preparedness and environmental protection, this model fosters shared responsibility and enhances local ownership of mitigation initiatives. In environmentally sensitive areas, community-based mitigation becomes even more relevant, as proactive engagement and environmental stewardship can significantly reduce ecological degradation, improve adaptive capacity, and support sustainable recovery following disaster events.

2.3 Role of non-governmental organization (NGO) in Environmental Governance

Non-governmental organizations (NGO) play a vital and increasingly strategic role in environmental governance by serving as intermediaries that connect policy frameworks with grassroots needs, promoting inclusive participation, transparency, and adaptive management of ecological resources [16], while simultaneously operationalizing the principles of co-production and co-service through community engagement in planning, implementing, and evaluating environmental programs, enabling citizens to act not only as beneficiaries but also as collaborative partners in risk identification, capacity building, and sustainable disaster mitigation, thereby strengthening institutional responsiveness, enhancing ecological resilience, and ensuring that environmental management practices remain context-sensitive, socially embedded, and aligned with long-term sustainability goals [17].

2.4 Previous Studies on Disaster Mitigation and Environmental Sustainability

Previous research highlights the growing importance of integrating environmental sustainability into disaster mitigation frameworks. Studies have shown that sustainable land management, ecological conservation, and community education significantly reduce vulnerability to disasters, especially in regions with fragile ecosystems. Several scholars emphasize that local institutions play a decisive role in shaping environmental behaviour, facilitating preparedness, and coordinating community-based initiatives. However, existing literature also reveals that many mitigation programs still focus predominantly on emergency response, with limited attention to long-term environmental outcomes. Research examining the role of non-governmental and faith-based organizations in environmental sustainability remains relatively limited, particularly in the Indonesian context. This gap indicates the need for more empirical evidence on how institutions such as the Muhammadiyah Disaster Management Centre contribute to ecological resilience and sustainable disaster mitigation practices.

RESEARCH METHOD

3.1 Research Design

This study employs a quantitative descriptive survey design to measure community perceptions and evaluate the role of the Muhammadiyah Disaster Management Centre in supporting environmental sustainability through disaster mitigation in Watulimo District. The quantitative approach enables the collection of measurable data from a large number of respondents, allowing for objective analysis of patterns related to environmental awareness, preparedness levels, and the effectiveness of MDMC's mitigation initiatives. The descriptive survey design focuses on describing existing conditions without manipulating variables, providing an accurate representation of how disaster mitigation efforts influence environmental sustainability indicators at the community level. Data were gathered using structured questionnaires based on a five-point Likert scale, enabling the assessment of key constructs such as environmental resilience, community participation, and institutional effectiveness. This research design is appropriate for identifying trends, summarizing numerical findings, and generating empirical evidence that reflects the community's evaluation of MDMC's contribution to sustainable disaster management.

Fig. 1. Research Conceptual Framework Diagram.

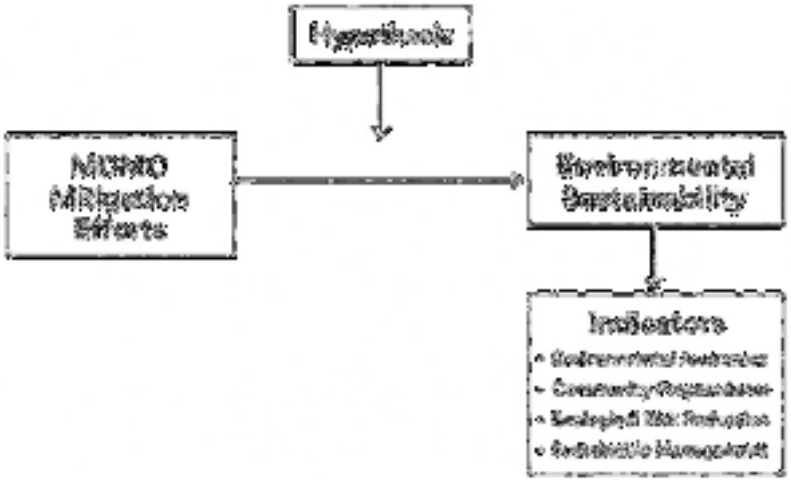


Figure 1 shows the conceptual framework of the study, which illustrates the relationship between disaster mitigation efforts carried out by the Muhammadiyah Disaster Management Centre (MDMC) as an independent variable and environmental sustainability as a dependent variable in Watulimo Subdistrict. MDMC mitigation efforts include disaster education, preparedness improvement, community capacity building, and early disaster response, which are assumed to have a direct impact on environmental sustainability. The dependent variable is operationalised through four main indicators, namely environmental awareness, community preparedness, ecological risk reduction, and sustainable management. The arrow connecting the two variables indicates the direction of influence tested in this study through a quantitative survey approach. This framework serves as a theoretical basis that guides the development of instruments, variable measurement, and data analysis processes to assess MDMC's contribution to strengthening environmental sustainability in disaster-prone areas.

3.2 Population and Sample

The population in this study consists of residents living in disaster-prone areas of Watulimo District who have been directly or indirectly exposed to disaster events such as landslides, floods, drought, and strong winds during the 2020–2024 period. This population is relevant because community members in these areas experience the direct impact of disasters and interact with mitigation initiatives implemented by the MDMC. The sample size for this study was determined to ensure adequate representation of community perceptions, resulting in a total of 100 respondents who were selected to reflect variations in age, occupation, and exposure to disaster risk. The sampling technique used was purposive sampling, which was deemed appropriate because respondents were required to meet specific criteria namely, residing in hazard-prone areas and having knowledge or experience related to MDMC disaster mitigation activities. This approach allows the study to obtain more accurate and relevant data regarding the effectiveness of MDMC's mitigation efforts and their contribution to environmental sustainability in the district.

3.3 Data Collection

Data were collected using a structured questionnaire with a five-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree). The instrument measured two main constructs: MDMC Mitigation Efforts (disaster education, community preparedness, volunteer engagement, and early response) and Environmental Sustainability Indicators (environmental awareness, preparedness for environmental hazards, ecological risk reduction, and sustainable management). All items were reviewed for clarity and distributed directly to respondents living in disaster-prone areas to obtain accurate and context-specific quantitative data.

3.4 Data Analysis Techniques

Data were analysed using descriptive statistics, including mean and standard deviation, to summarize respondents' perceptions of MDMC mitigation efforts and environmental sustainability indicators. Correlation and simple regression analyses were employed to examine the relationship between the independent and dependent variables. Instrument quality was ensured through optional validity and reliability testing using Pearson product- moment correlations and Cronbach's alpha.

RESULT AND DISCUSSION

Descriptive statistical analysis indicates that community perceptions of MDMC mitigation efforts fall within the high category, with indicator means ranging from 3.82 to 4.21. The disaster education indicator recorded the highest score (Mean = 4.21; SD = 0.61), followed by community preparedness (Mean = 4.09; SD = 0.64), while early response capacity showed the lowest yet still strong score (Mean = 3.82; SD = 0.74). For the Environmental Sustainability variable, the mean values ranged from 3.90 to 4.18, with environmental awareness achieving the highest score (Mean = 4.18; SD = 0.57), reflecting improved ecological understanding among communities in disaster-prone areas. These results are summarized in Table 1, which presents the mean and standard deviation for each indicator.

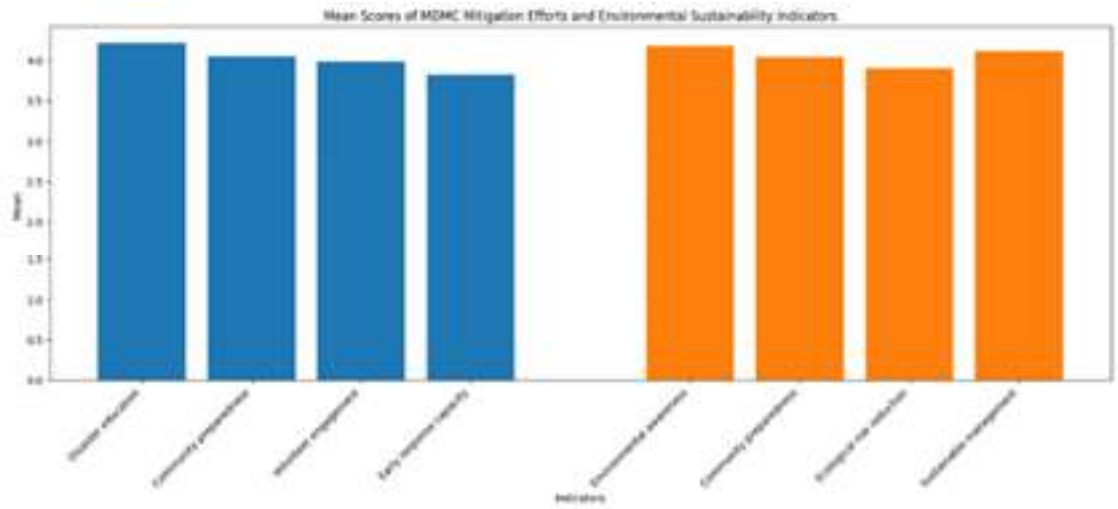
Table 1. MDMC Mitigation Efforts and Environmental Sustainability Scores.

Category	Indicator	Mean	SD (Standard Deviation)
MDMC Mitigation Efforts	Disaster education	4.21	0.61
	Community preparedness	4.05	0.67
	Volunteer engagement	3.98	0.72
	Early response capacity	3.82	0.74
Environmental Sustainability Indicators	Environmental awareness	4.18	0.57
	Community preparedness	4.04	0.72
	Ecological risk reduction	3.90	0.69
	Sustainable management	4.11	0.65

Source: Processed by researchers

Figure 1. provides a visual representation of the overall perception patterns, illustrating how each indicator contributes to the community's evaluation of MDMC mitigation efforts and environmental sustainability. The graphical display helps clarify the distribution of responses and highlights the relative strength of each component within the conceptual framework.

Figure 2. Environmental Governance and Disaster Mitigation Evaluation.



Correlation analysis reveals a significant positive relationship between MDMC mitigation efforts and environmental sustainability ($r = 0.63$, $p < 0.01$), indicating that stronger mitigation interventions are associated with higher sustainability outcomes. Simple regression analysis supports this result, showing that MDMC Mitigation Efforts significantly predict Environmental Sustainability ($\beta = 0.63$, $t = 7.12$, $p < 0.001$). Overall, these findings demonstrate that MDMC's mitigation programs not only enhance community preparedness but also contribute directly to more sustainable environmental outcomes through increased

ecological awareness, reduced environmental risks, and more adaptive environmental management practices.

CONCLUSION

The findings of this study demonstrate that the Muhammadiyah Disaster Management Centre plays a significant and measurable role in strengthening environmental sustainability in the disaster-prone areas of Watulimo District. High mean scores across indicators of disaster education, community preparedness, ecological risk reduction, and sustainable environmental management reflect strong community recognition of MDMC's mitigation efforts. The significant positive correlation between MDMC activities and sustainability outcomes further confirms that community-based mitigation contributes directly to improved ecological awareness and resilience. Regression analysis reinforces this relationship, indicating that MDMC's interventions are a key predictor of enhanced environmental sustainability at the local level. Despite these positive outcomes, the persistence of limited resources and uneven environmental literacy suggests that further improvements are still needed to maximize long-term sustainability impacts. Overall, the study provides empirical evidence that strengthening community-driven disaster mitigation initiatives can serve as an effective pathway toward advancing environmental governance and promoting sustainable ecological practices in vulnerable regions.

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