Budiana, N.F. ''Disaster Risk Management Strategy of The Imogiri Royal Cemetery Site''
Kalyanamitra: Journal of Archaeological Resource Management
Vol. 01, No. 02, September 2025, pp. 67-78
E-ISSN 3110-2220

Kalyanamitra: Journal of Archaeological Resource Management

DISASTER RISK MANAGEMENT STRATEGY OF THE IMOGIRI ROYAL CEMETERY SITE

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Received March 17, 2025; Revised September 23, 2025; Accepted September 24, 2025

Abstract:

The Imogiri Royal Cemetery Site is a cultural heritage site designated as a provincial-level heritage site by the Governor of the Special Region of Yogyakarta. Managed by the Ngayogyakarta Hadiningrat Sultanate and Kasunanan Surakarta. Beyond its significance ro the Mataram Islamic royal family, the site holds deep cultural identity value for people of Yogyakarta, particulary those in Imogiri. It servesas a destination for religious tourism, historical exploration, and family recreation due to its scenic beauty and cultural importance. However, its preservation is threatened by various natural disasters, such as earthquakes, landslides, and forest fires. It raising the key research question: What disaster risk management strategies can be applied to the Imogiri Royal Cemetery Site? Data was collected through site observations, interview with stakeholders, and literature studies, which were analyzed to identify potential threats. The findings form the basis for a Disaster Risk Management (DRM) strategy tailored to the site, aiming to mitigate both material and non-material losses and ensure its long-term preservation.

Keywords: The Imogiri Royal Cemetery Site, DRM, mitigation.

How to Cite: Budiana, N.F. (2025). Disaster Risk Management Strategy of The Imogiri Royal Cemetery Site. *Kalyanamitra: Journal of Archaeological Resource Management*, 1(2), 67-78.

1. Introduction

The Imogiri Royal Cemetery Site was established in 1632 AD by the order of Sultan Agung, who designated Bukit Merak as its location. The construction of this royal burial site is documented in Babad Momana, written by K.P.A. Suryanegara, which records that the project began in 1554 Saka (1632 AD) and was completed in 1566 Saka (1645 AD). The cemetery was first used following the passing of Sultan Agung in 1568 Saka (1647 AD), and it has since continued to serve as the burial site for his descendants (Pancaputra & Sunaryo, 2009; Sumartono, 2019).

Before the construction of the Imogiri Royal Cemetery, the burial sites for the Mataram Islamic kings were located in Kotagede and Girilaya Cemetery. Administratively, it is located in Wukirsari, Imogiri District, Bantul Regency, Special Region of Yogyakarta. Bukit Merak at an elevation 166 mean sea level, later become known as Pajimatan Imogiri. The term "Pajimatan" is derived from "jimat" (sacred heirloom), with affixes "-pa" and "-an" indicating a place for storing sacred objects or relics. Meanwhile, Imogiri comes from "hima" (clouds) and "giri" (mountain), making Pajimatan Imogiri literally translate to "a cloud covered mountain that serves as a resting place for sacred relics of the Mataram Kingdom". In Javanese, the site is also reffered to as "Pasareyan Dalem Para Nata Pajimatan Girireja Himagiri" (Pergub, 2020).

The designation of cultural heritage sites is outlined in Law of Republic of Indonesia Number 11 of 2010 on Cultural Heritage, specifically in Article 43, which regulates the criteria for provincial-level cultural heritage designations. The Imogiri Royal Cemetery Complex Heritage Sites has been officially recognized as a cultural heritage site under Decree PM.89/PW.007MKP/2011. This designation was later updated through Governor of Special Region of Yogyakarta Decree Number 316/KEP/2020 , which reaffirmed the Imogiri Royal Cemetery as a Provincial Heritage Site. Within the Imogiri Royal Cemetery, 25 structures and traditional architecture have been designated as Cultural Heritage, including: Pajimatan Imogiri Mosque, Kori Supit Urang, Regol Sri Manganti I, Regol Sri Manganti II, Gapura Papak, Kelir Gapura Supit Urang, Kelir Regol Sri Manganti, Kelir Gapura Papak, Padasan Kyai Mendhung, Padasan Nyai Siyem, Padasan Kyai Danumaya, Padasan Kyai Danumurti, pools, stairways, several Ndalem structures, and eight Astana royal burial sites (Pergub, 2020). This official designation highlights the cemetery's cultural significance, particulary for the people of the Special Region of Yogyakarta.

The Imogiri Royal Cemetery is part of the "Mataram Islamic Axis" concept introduced by Kundha Kabudayan DIY (the Yogyakarta Provincial Department of Culture). Developed in 2021, this initiative gained momentum in 2023 through various Cultural Festivals aimed at promoting key heritage sites within the axis, including Kotagede Cultural Heritage Area, Kerto Plered Cultural Heritage Area, and Imogiri Cultural Heritage Area (Pemkab Bantul, 2023). This program has significantly increased public interest in visiting these heritage sites, particularly the Imogiri Royal Cemetery Site. According to data compiled by Puspita Rani et al. (2018), the Imogiri Royal Cemetery has become one of the most popular tourist destinations in Bantul Regency. Furthermore, based on field observations, visitors frequently engage in various activities at the site, including sports, family gatherings, religious rituals, and photography. Visitor numbers surged in 2022–2023, following the lifting of pandemic restrictions and intensified efforts by both the government and local communities to promote the site through Cultural Festivals.

With the increasing number of visitors, disaster preparedness should be a critical consideration for site management. The Imogiri Royal Cemetery Complex has suffered severe structural damage in the past, particularly due to the 2006 Yogyakarta earthquake, which measured 5.6 on the Richter scale (Savitri, 2021). More recently,

on June 30, 2023, an earthquake with a magnitude of 6.4 struck Bantul, with its epicenter in the Indian Ocean. Although the 2023 earthquake did not cause as much damage as the 2006 earthquake, it exacerbated existing structural weaknesses. Field observations indicate that the 2023 earthquake further widened cracks in the cemetery's structures, particularly along the retaining walls of the Astana courtyards. Despite its official heritage designation and growing public interest, the site remains vulnerable to natural disasters, prompting a crucial research question: What disaster risk management strategies can be implemented for the Imogiri Royal Cemetery Complex?

Previous studies have emphasized the cultural value and tourism potential of Imogiri (Puspita Rani et al., 2018; Savitri, 2021), yet little scholarly attention has been given to disaster risk management (DRM) for heritage sites in Indonesia. Existing management practices at Imogiri, led by the Ngayogyakarta Hadiningrat Palace in collaboration with the Yogyakarta Provincial Department of Culture, remain focused largely on routine maintenance and visitor reception. While some caretakers have received basic disaster training, a comprehensive DRM framework tailored to the site's unique cultural and environmental context is lacking.

This research seeks to address this gap by applying UNESCO's DRM framework to evaluate the disaster risks faced by the Imogiri Royal Cemetery and to propose strategic mitigation measures. By linking international guidelines with local conditions, this study contributes not only to safeguarding one of Yogyakarta's most significant heritage sites but also to advancing academic discourse on DRM for cultural heritage in disaster-prone regions. Currently, the site is managed by the Ngayogyakarta Hadiningrat Palace, in collaboration with Kundha Kabudayan DIY and BPK-X. However, the management primarily focuses on visitor reception and routine maintenance. While site caretakers, including *abdi dalem* and *juru pelihara*, have received basic disaster mitigation training (Hamid, 2020). However, the site itself lacks emergency signage for visitors in case of disasters and fire suppression infrastructure, such as hydrants. This research aims to propose strategic disaster risk management measures to mitigate potential large-scale damage caused by both natural and human-induced disasters, ensuring the preservation of this historically and culturally significant site (Vujicic-Lugassy & Frank, 2010).

2. Method

This study focuses on minimizing the risks posed by disasters that threaten the Imogiri Royal Cemetery Cultural Heritage Site in Bantul, Special Region of Yogyakarta. A mixed-methods approach was employed, combining desk research, field observations, and stakeholder interviews. Desk research was carried out using various secondary sources, including scientific journals, research reports, satellite imagery, and official records of past disasters affecting the Special Region of Yogyakarta, particularly those impacting the Imogiri area. This stage provided historical and contextual data on the types, frequency, and impacts of disasters relevant to the site.

Field observations were conducted between 2023 and 2024 to document the most recent structural conditions of the site, including visible damage and areas of

vulnerability. Direct site inspections allowed the researcher to validate secondary data and assess current risks in situ. In addition, semi-structured interviews were conducted with key stakeholders, such as site custodians (abdi dalem and juru pelihara), local community members, vendors, and visitors or pilgrims. These interviews aimed to capture diverse perspectives on disaster risks, existing coping mechanisms, and community engagement in heritage management.

Table 1. Interview Question Matrix for Disaster Risk Management at the Imogiri Royal Cemetery Site

Stakeholder	Focus Area	Sample Questions	Purpose of Responses
Site Custodians / Abdi Dalem / Site Managers	Routine management	How is the daily maintenance of the cemetery conducted?	To understand basic management mechanisms and their limitations.
	Disaster experience	What major disasters have affected the site (earthquakes, landslides, fires)? What were the impacts?	To collect empirical data on site vulnerabilities.
	Emergency response	What actions were taken by the site management during the 2006 and 2023 earthquakes?	To measure the preparedness of internal management.
	Mitigation capacity	Have the custodians or staff received any disaster preparedness training?	To assess the capacity of human resources.
	Strategy needs	In your opinion, what disaster mitigation measures are most urgently needed at this site?	To identify practical recommendations from site managers.
Local Community Members	Community involvement	To what extent is the community involved in safeguarding the site?	To evaluate local participation in conservation.
	Disaster experience	Have you or the community experienced disaster impacts in the cemetery area?	To gather local experiences related to site vulnerability.
	Role during disasters	What did the community do when earthquakes or landslides occurred at the site?	To assess the role of the community in emergency response.
	Hopes and aspirations	What are your expectations for better site management and safety?	To capture bottom-up perspectives for DRM.
	Local wisdom	Are there local traditions or knowledge that help protect the site from hazards?	To integrate cultural values into DRM strategies.
Vendors around the Site	Disaster response	How do vendors usually react when a disaster occurs?	To measure the preparedness of informal economic actors.
	Economic impact	What economic losses are most felt when a disaster happens?	To understand socio-economic vulnerabilities.

Stakeholder	Focus Area	Sample Questions	Purpose of Responses
Visitors / Pilgrims	Mitigation needs	What kind of safety facilities would make you feel more secure?	To formulate practical solutions for vendors.
	Risk awareness	Are you aware of evacuation routes or emergency signs at the site?	To assess the awareness level of visitors.
	Sense of safety	Do you feel safe if a disaster suddenly occurs during your visit?	To evaluate visitors' perception of risk.
	Personal response	What actions would you take if an earthquake suddenly struck while you were at the site?	To understand individual preparedness.
	Emergency facilities	What facilities should be added to improve visitor safety?	To gather direct recommendations from site users.
	Information & communication	Did site managers provide any safety information before or during your visit?	To evaluate the effectiveness of DRM communication.

The analytical framework for developing a Disaster Risk Management (DRM) strategy was based on the World Heritage Resource Manual by UNESCO (Vujicic-Lugassy & Frank, 2010). This guideline was selected because it provides a holistic approach to disaster management, encompassing risk identification, preparedness, mitigation, response, and recovery in an integrated framework.

Data analysis involved assessing the structural conditions of the site and identifying disaster-related challenges. Key indicators included hazards and vulnerabilities, while variables encompassed earthquake risk, erosion, fire hazards, tourism-related pressures, and potential social conflicts (Dewi et al., 2015). The synthesis of findings resulted in a set of disaster mitigation strategies tailored for the Imogiri Royal Cemetery. These strategies are designed to be practical and implementable by site stakeholders, with the ultimate goal of preserving cultural heritage while reducing the risk of casualties in potential future disasters.

3. Results and Discussion

3.1. Identifying Key Issues

The Special Region of Yogyakarta is highly susceptible to natural disasters due to its unique geographical features. The northern part of the region is home to Mount Merapi, an active volcano; the southern coast is vulnerable to tsunamis; and the central area is traversed by an active fault line, which triggered the devastating 2006 Yogyakarta earthquake. The earthquake, which struck on May 27, 2006, caused significant damage to the Imogiri Royal Cemetery Cultural Heritage Site. Geographically, the site is located approximately 3 km from the earthquake's epicenter, the Opak Fault in Potrobayan, Sriharjo, Pundong, Bantul (Sulaeman et al., 2008).

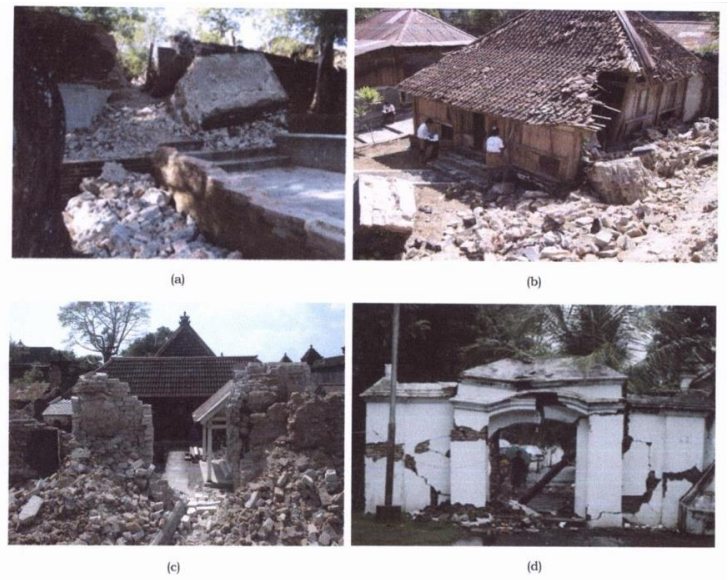

Figure 1. Documentation of the impact of the Yogyakarta earthquake on May 27, 2006, on the Cultural Heritage Site of the Imogiri Royal Cemetery Complex, recorded by the Cultural Heritage Preservation Office of Yogyakarta Special Region.
Source: Pergub (2020)

The Imogiri Royal Cemetery Cultural Heritage Site faces multiple threats. The first is the risk of earthquakes, as the site is situated near the Opak Fault, which extends from the east to the south, following the Opak River from Prambanan to Bantul (Mulyaningsih et al., 2006). The 2006 Yogyakarta earthquake resulted in the collapse of several structures within the site. The most severe damage affected four key objects: the Paduraksa Gate of Astana Sultanagungan, the perimeter wall of Astana Pakubuwanan's first courtyard, the first courtyard of Astana Kasuwargan Yogyakarta, and severe cracks in the eastern gate of Astana Saptarengga. In addition to these major damages, the earthquake also caused widespread structural cracks in walls and retaining structures supporting the terraces within the cemetery complex.

The second threat concerns the soil type of Bukit Merak, where the cemetery is located. The hill consists of latosol soil, which is prone to landslides, particularly during heavy rainfall (Damayanti et al., 2023). A landslide disaster occurred in 2019, causing damage to the designated burial site of Sultan Hamengkubuwono X and resulting in the deaths of at least three individuals who were buried under the debris (Syambudi, 2019;Sidik, 2019). The third issue relates to climate and weather conditions, which contribute to the deterioration of the site's structures. Prolonged droughts and heavy seasonal rains exacerbate cracks in retaining walls and accelerate the weathering of brick structures and wooden pavilions in each astana.

Extended drought periods also pose a fire hazard, as the Imogiri Royal Cemetery Cultural Heritage Site is situated within a protected forest dominated by eucalyptus and teak trees. During prolonged dry seasons, most trees shed their leaves and become highly flammable, increasing the risk of fires due to friction between trees. According to

data from the Bantul Regional Disaster Management Department (BPBD), a forest fire occurred in Selopamioro, Imogiri, Bantul, in 2024 (Eko, 2024). This indicates the potential risk of forest fires that could also threaten the Imogiri Royal Cemetery, given that the site is located within the same region. Additionally, local residents sometimes engage in open burning, which could serve as a potential ignition source. Furthermore, field observations indicate that the primary water source used by the site's custodians and workers originates from a seasonal river on the hillside, approximately 1 km away. During dry seasons, this river often runs dry, posing significant challenges for fire mitigation efforts at the Imogiri Royal Cemetery Cultural Heritage Site.

3.2. Definition of Disaster and DRM for Cultural Heritage Sites

A disaster can be understood as an event or a series of events that disrupt the functional systems of community life, caused by either natural or non-natural factors, and resulting in casualties, environmental degradation, material losses, and the erosion of cultural heritage values (BPBN, 2022; Refnandes & Ramadhani, 2024). For cultural heritage sites, such impacts can be devastating, threatening not only physical structures but also the intangible cultural and spiritual meanings embedded within them. Consequently, the development of a Disaster Risk Management (DRM) plan is essential. A well-formulated DRM strategy provides site managers with clear, flexible, and practical guidelines to anticipate, respond to, and recover from disasters (Vujicic-Lugassy & Frank, 2010).

In the context of the Imogiri Royal Cemetery, DRM planning requires the active involvement of multiple stakeholders. The target audience for the DRM planning at the Imogiri Royal Cemetery includes several stakeholders. According to Worosuprojo (2012), disaster management is divided into six phases: (1) Mitigation Phase, which focuses on efforts to reduce disaster risks; (2) Preparedness Phase, which includes early warning systems and readiness measures; (3) Emergency Response Phase, which involves immediate actions and relief efforts to assist affected communities; (4) Rehabilitation Phase, aimed at recovery and restoring essential services; (5) Reconstruction Phase, which involves rebuilding and long-term development initiatives; and (6) Prevention Phase, which seeks to eliminate or minimize future disaster risks. Stakeholders play a crucial role in implementing the Disaster Risk Management (DRM) plan across all phases: during periods without disasters through preventive measures, during disaster events through mitigation and emergency response efforts, and after disasters through recovery and rehabilitation initiatives.. The key stakeholders include: (1) the royal family (Keraton) and its court servants (abdi dalem) as site managers; (2) the Cultural Heritage Preservation Department (BPK X); (3) Kundha Kabudayan DIY; (4) site caretakers (juru pelihara); (5) local vendors; (6) the surrounding community; and (7) visitors or tourists. However, based on current observations, there is a lack of preventive measures by site managers to mitigate potential disaster impacts in the future.

The recent fire at Gounsa Temple in South Korea on March 25, 2025, underscores the urgency of implementing comprehensive DRM strategies. Reports from the Korea Heritage Service and international media noted that more than 300 buildings

were destroyed or damaged by the fire, with around 20 structures within the Gounsa complex including nationally treasured landmarks such as the Gaunru Pavilion (1668) and Yeonsujeon Hall burned to the ground (Si-jin, 2025). This large-scale disaster highlights the vulnerabilities of wooden heritage structures and the potential scale of loss when preparedness is inadequate. At the same time, it offers valuable lessons in disaster risk management for other sites across Asia, including Imogiri.

Practices developed in the aftermath of the Gounsa fire demonstrate several strategies that could be adapted for Imogiri. These include the early evacuation of fragile artifacts, the application of fire-resistant protective coatings on wooden structures, the enforcement of higher alert levels during periods of heightened risk, and the mobilization of local agencies such as BPBD for emergency response. Beyond immediate measures, the Korean experience underscores the importance of integrating restoration and prevention into long-term management frameworks. By adopting similar strategies, Imogiri can strengthen its resilience, ensuring both the physical protection of its historic structures and the preservation of its cultural and spiritual values. Effective DRM at Imogiri should therefore incorporate structural safeguards, artifact evacuation routes, rapid response training, visible evacuation signage, and accessible fire safety facilities. Ultimately, the Gounsa case illustrates that robust multi-stakeholder collaboration and well-defined preparedness protocols are essential for minimizing losses and safeguarding heritage sites for future generations.

3.3. The Imogiri Royal Cemetery Disaster Risk Management Strategies

Disaster risk management strategies vary depending on the target audience (Vujicic-Lugassy & Frank, 2010). For the the royal family (Keraton) and its court servants (abdi dalem) as site managers, BPK X, and Kundha Kabudayan DIY, which are responsible for site maintenance and preservation, the most appropriate DRM format would be a comprehensive report. Meanwhile, for *abdi dalem*, site caretakers, and vendors who work daily at the site, a handbook containing mitigation strategies for disaster scenarios is necessary. Field findings further reinforce this point. In an interview, Arif Zubaidi (48), a caretaker (juru pelihara) of the Imogiri Royal Cemetery from Kundha Kabudayan, explained that caretakers receive annual disaster preparedness training, including the use of fire extinguishers, appropriate actions during disasters, and first aid in the event of accidents. Observations also revealed practical evidence of such preparedness: when a visitor collapsed from exhaustion after climbing the steep staircase, court servants and caretakers immediately provided first aid and moved the visitor to a safer location, while vendors assisted by offering warm tea to help restore energy and consciousness. This concrete example illustrates how caretakers, court servants, and vendors serve as the frontline of disaster preparedness at the site, albeit with limited equipment and knowledge. For local communities and visitors, the most effective approach would be the installation of informative warning boards at site entrances and clearly marked evacuation routes. The preparation of a DRM plan should therefore be carried out comprehensively, involving relevant stakeholders, including regional authorities and the Regional Disaster Management Agency (BPBD), which has jurisdiction over the area.

Mitigation refers to all efforts aimed at reducing the adverse effects of disasters (Imani, 2017). Based on the identification of past and potential disasters at the Imogiri Royal Cemetery Complex, several mitigation strategies can be implemented to minimize disaster impacts. The following mitigation plans are proposed according to different disaster types:

a. Structural and Traditional Architecture Mitigation Strategies

Disaster impact management at the site should include the inventory of cultural heritage components, routine maintenance, and regular monitoring of structural conditions (Vujicic-Lugassy & Frank, 2010). Daily monitoring should be conducted by the Keraton Ngayogyakarta collaboration with BPK X and Kundha Kabudayan DIY. This monitoring aims to identify minor damages at an early stage so that routine maintenance can prevent more severe structural deterioration.

b. Mitigation Strategies for Earthquakes and Landslides

Earthquakes and landslides are the two most frequesnt disasters affecting the Imogiri Royal Cemetery, making their disaster risk menagement plans a priority (Sutrisno, 2011). The following are two mitigation strategies suited to the condition of the cemetery:

1) The installation of warning boards to inform visitors that the site consists of aged structures vulnerable to collapse during earthquakes or erosion. These boards should also provide evacuation route information to ensure visitors can reach designated safe zones in the event of a disaster.
2) The designation of evacuation routes, installation of route markers, and placement of safe zone signs as gathering points during emergencies (Carrozzino et al., 2012). The safest estimated locations during earthquakes and landslides are the western and eastern areas outside the cemetery terraces, as well as the open courtyard near the Imogiri Cemetery Mosque. The following diagram illustrates the evacuation routes and safe zones applicable to this site:

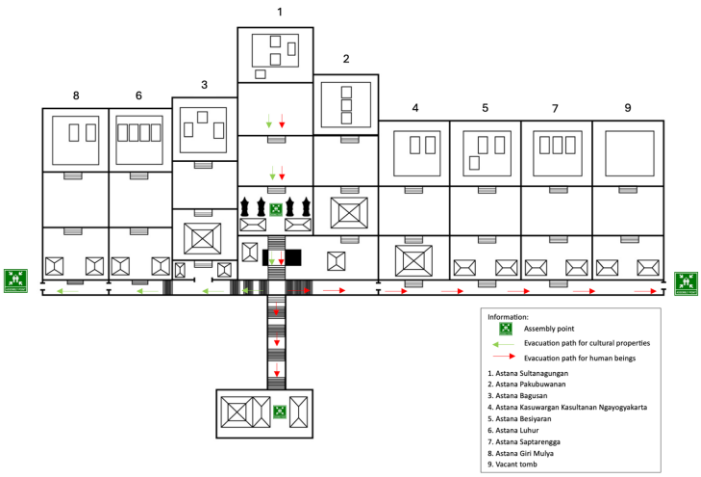

Figure 2. Possible emergency evacuation plan of the Imogiri Royal Cemetery Site (*Source: drawn by Dede Aditya)*

c. Fire Disaster Mitigation Strategies

Fire disasters can be mitigated by ensuring an adequate water supply to protect the cemetery complex. In addition to collaboration with the Regional Disaster Management Department (BPBD) and Search and Rescue Team (SAR), the site must establish independent water storage facilities that can be utilized in case of a fire emergency. These water storage facilities should be sourced from rainwater harvesting systems, which can be constructed around the cemetery complex based on feasibility studies conducted by experts.

Another crucial strategy involves educating local vendors and the surrounding community about fire prevention measures. Specifically, they should be advised against engaging in open burning of waste or smoking within the site's premises. This serves as the most fundamental preventive measure to reduce the risk of fire hazards.

d. First Aid for Visitors

Based on observations, several visitors at the Imogiri Royal Cemetery experienced injuries throughout 2023. These incidents were primarily caused by visitors' physical conditions or accidental injuries, including fainting, sprains, and falls. Given these risks, implementing a structured first aid plan is essential to prevent potential fatalities.

The first step in this plan should involve installing visitor warning signs that provide a description of the site, enabling visitors to assess their physical ability to ascend the steep stairways leading to the cemetery terraces at the hilltop. Additionally, selected personnel, particularly court servants (abdi dalem) and site caretakers (*juru pelihara*), who work at the site daily, should undergo first aid training (Refnandes & Ramadhani, 2024). As the first point of contact for visitors, these personnel play a crucial role in providing immediate medical assistance in the event of minor or major accidents. Their ability to administer first aid can significantly reduce the risk of severe injuries or fatalities.

4. Conclusion

The development of a Disaster Risk Management (DRM) strategy is essential for the Imogiri Royal Cemetery Complex, as this heritage site holds significant cultural and historical value for the people of Yogyakarta. Implementing a well-structured disaster mitigation plan is expected to reduce potential damage to the heritage site itself and minimize the risk of casualties caused by natural disasters or visitor-related accidents. Disaster Risk Management should be continuously communicated to all relevant stakeholders, ensuring that awareness and preparedness remain a priority. Additionally, regular evaluations and monitoring should be conducted annually to assess the effectiveness of the plan and make necessary revisions in response to changes in site conditions or management systems. By maintaining an ongoing focus on disaster

mitigation, all parties involved in the site's operations will remain vigilant and proactive in minimizing the risks associated with potential disasters that may occur at any time.

Beyond these practical measures, the findings of this study also hold policy implications. Integrating DRM into the official heritage conservation framework at the local and national levels would strengthen disaster preparedness across culturally significant sites in Indonesia. Such integration could encourage government institutions, cultural heritage agencies, and community stakeholders to allocate resources, establish legal frameworks, and prioritize risk reduction in heritage management.

Furthermore, this research opens opportunities for future studies, particularly in expanding DRM assessments to other heritage sites facing similar environmental and anthropogenic threats. Comparative studies with international heritage sites could enrich the understanding of best practices, while interdisciplinary approaches such as incorporating digital monitoring technologies or community-based participatory methods could further enhance resilience strategies. By addressing both policy and research dimensions, this study contributes not only to the preservation of the Imogiri Royal Cemetery but also to the broader discourse on safeguarding heritage sites against disaster risks.

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