



DISASTER INFORMATION SYSTEM FOR MANAGING OVERFLOW FLOOD DISASTER

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ABSTRACT

Indonesia is located at the confluence of active tectonic plates, active mountain ranges, and tropical climates; thus making most of its territory vulnerable to natural disasters. Based on the theory and concept of disaster management which includes several stages, namely: the emergency response phase, the reconstruction and rehabilitation phase, the preventive and mitigation stages, and the preparedness stage, disaster management efforts must be supported by a system. Adequate disaster information in accordance with the characteristics of potential hazards and disaster threats based on analysis and recorded history of disaster events. A good disaster information system is very helpful to the Disaster Management Operations Control Center in conveying suggestions and suggestions for determining policies and coordinating disaster management, distributing logistics, determining evacuation locations, and post-disaster rehabilitation and reconstruction.

Keywords: *disaster; disaster information system; disaster characteristics*

INTRODUCTION

Indonesia is located at the meeting point of three active plates/crusts, namely the Indo-Australian Plate in the south, the Euro-Asian Plate in the north and the Pacific Plate in the East which continue to move and collide with each other, causing earthquakes, volcanic trails and faults. or fracture.

Natural disasters are quite complicated problems if handled manually. Many of the current disaster management procedures are ineffective or even misdirected, all of this is due to information being received too late and especially inaccurate. The existence of information technology today is very helpful in the decision making process when a disaster occurs. Information Technology cannot prevent disasters as a whole, but with Information Technology we can minimize all forms of loss, loss of life, and provide effective and efficient actions, and can even minimize the impact of these disasters.

Disaster management is a dynamic, integrated and sustainable process to improve the quality of steps related to a series of activities which include prevention, mitigation, preparedness, emergency response, evacuation, rehabilitation and reconstruction.). Meanwhile, mitigation is actions to reduce or minimize the potential negative impact of a disaster. Disaster mitigation is a series of efforts to reduce the risk of disasters both through physical development and awareness and increasing capacity to face the threat of disasters.

The existence of the Operations Control Center (Pusdalops) has a very important function and role, because it is the eyes and ears in handling disasters in Indonesia. Pusdalops business functions and processes, first, data management, analysis and dissemination of disaster emergency information, to provide rapid assessment support during disaster emergencies. Second, preparing coordination for the preparation of norms, standards, procedures and criteria in the field of controlling disaster emergency management operations, has the function of preparing plans for emergency assistance operations and third, preparing plans for handling operations during emergency alert, emergency response and emergency recovery transitions. Fourth, preparing recommendations for disaster management operations, here has the function of coordinating funds or implementing tactical control. Fifth, organizing coordination, communication and synchronization of disaster management, here in accordance with the main tasks and functions of coordinating and/or carrying out operational evacuations.

METHOD

This research uses a literature review method by examining documents such as journals, books and disaster documents in the Regional Disaster Management Agency or the National Disaster Management Agency. Literature review is a systematic, explicit and reproducible method for identifying, evaluating and synthesizing research works and ideas that have been produced by researchers and practitioners. The aim of the literature review is to make an analysis and synthesis of existing knowledge related to the topic to be researched to find free space for the research to be carried out.

The more detailed objectives are explained by Okoli & Schabram (2010), namely (1) providing a background/theoretical basis for the research to be conducted, (2) studying the depth or breadth of existing research related to the topic to be researched and (3) answering questions- practical questions with an understanding of what previous research has produced.

RESULTS AND DISCUSSION

REGIONAL Characteristics

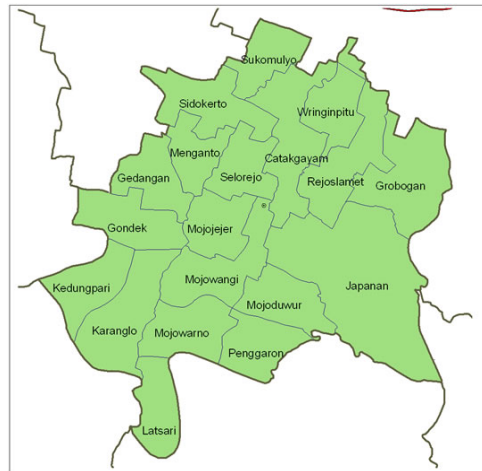


Figure 1. Administrative map of the Mojowarno District area

Mojowarno District is located in the south of Jombang Regency. To the east it borders Bareng District, to the south it borders Ngoro District, to the west it borders Diwek District and to the north it borders Mojoagung District. Geographically, Mojowarno District is located between 1120 24' 01" to 1120 45' 01" east longitude and 070 24' 01" to 070 45' 01" south latitude, with an area of 52.59 km². The government center of Mojowarno District is located in Mojowangi Village which has an area of 3.06 km².

Land use in Mojowarno District is dominated by rice fields which reach 61% or 3,842 km², then settlements/housing 20%, forests 15%, and other uses 4%. Administratively, Mojowarno District is divided into 19 villages consisting of 72 hamlets, which are divided into 123 neighborhood units (RW) and 486 neighborhood units (RT). Catak Gayam Village is the area with the most RTs and RWs, namely 14 RWs and 46 RTs covered in 3 hamlets (Mojowarno District, 2014).

Characteristics of Rainfall as a Trigger for Flood Disasters

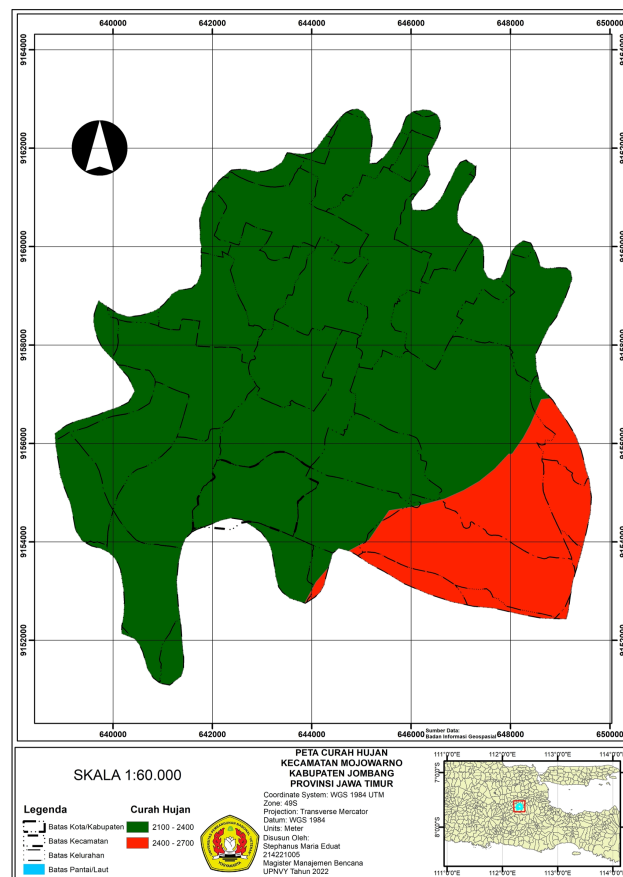


Figure 2. Rainfall map in Mojowarno District

Rainfall has units in millimeters. 1 mm of rainfall is rainwater that falls on each surface area of 1 mm² with a height of 1 mm without evaporating, seeping or flowing, or in other words the amount of rainwater that falls is 1 liter on each area of 1 m². (Meteorology and Geophysics Agency in Effendi, 2008). The major classification of monthly rainfall is:

Table 1. Daily rainfall classification

Very light	<5 mm/24 hours
Light	5-20 mm/24 hours
Currently	21-50mm/hr
Heavy	51-100mm/24h
Very dense	>100 mm/24 hours

Rainy day	Estimate bulk quantity Rain	Cumulative rainfall monthly
5-6 days	10-15mm	10-15mm
6-7 days	60-70mm	70-85mm
6-7 days	180-210 mm	250-295 mm
2-4 days	150-250 mm	400-545mm
1-2 days	110-300mm	510-845mm

The rainfall factor is not based on climate classification, but is based on daily rainfall from December to January. The threat of landslides usually begins in November due to the increasing intensity of rainfall. Rainfall conditions as depicted on the map state that Mojowarno

District is in the moderate to heavy category with average rainfall ranging from 2100 -2700 mm.

Disaster Characteristics

Based on incident data recorded at Pusdalops-PB BPBD Jombang Regency, the disaster that occurred in Mojowarno sub-district was:

1. Overflow Flood



Figure 3. Flood Disaster Event in Mojowarno District, 2022.

The flood hazard assessment is determined based on disaster assessment standards and other reference guidelines in other relevant ministries/institutions at the national level obtained from the INARISK website by processing data on the flood hazard index on the website <https://inarisk.bnpb.go.id/>. For the flood hazard index from INARISK, the index value is estimated by slope slope and distance from the river in flood-prone areas using the fuzzy logic method, in accordance with what is stated in the Indonesian Disaster Risk Book issued by BNPB in 2016. Locations with a vulnerability value of 0 – 0, 33 are included in the low flood hazard index interval, locations with a vulnerability value of 0.33 – 0.66 are included in the moderate flood hazard index interval, and locations with a vulnerability value of 0.66 – 1 are included in the high flood hazard index interval. Apart from data from INARISK, data on potential flood hazards is also combined with data on flood disaster events from various OPDs such as the Jombang Regency Bappeda, Jombang Regency Agriculture Service, Jombang Regency DPUSDA, and Jombang Regency BPBD considering that flood hazards are the main priority in disaster management in the Regency.

2. Strong winds



Figure 4. Wind Disaster Events in Mojowarno District, 2022.

The potential for widespread danger in the Mojowarno sub-district with the potential for extreme weather disasters is in the high class. The extreme weather hazard class is seen based on the class value in each sub-district in Jombang Regency. Areas prone to extreme weather disasters are obtained using 3 parameters, namely rainfall, land cover and slope. Each parameter has its own score and weight. The calculation results using the AHP (Analytical Hierarchy Process) method show high, medium and low vulnerability levels. High levels of extreme weather vulnerability are found in areas with low rainfall intensity, land use with minimal trees or built-up areas such as rice fields, moors and empty land, as well as areas with high levels of slope ($>15\%$). So areas with these conditions will have the highest potential for extreme weather disasters. Meanwhile, extreme weather is being encountered in areas with moderate rainfall intensity, land use in built-up areas such as residential areas, industrial areas and roads, as well as areas with moderate slope levels (8-15%). Then, a low level of vulnerability means that the area has high rainfall, the land cover is forest or an area with a high density of tree vegetation, and has a low slope level (0-8%).

Natural Disaster Management by BPBD Jombang Regency

1. Monitoring



Figure 5. Disaster Monitoring at Pusdalops-PB BPBD Jombang Regency.

Actions taken before a disaster occurs. This takes the form of counter-disaster measures in the form of outreach if the BMKG informs about the potential for a tornado, outreach to build houses according to technical standards and carrying out mitigation based on the potential type of disaster.

The development of a disaster information system at Pusdalops PB to support natural disaster systems aims to improve and develop the use of satellite sensing technology and GIS by providing operational sensory information for disaster management. The development of an information system for mitigating natural disasters using remote sensing data aims, among other things, to:

- a. Building a data base for information on natural disasters, including fires, droughts, floods, food insecurity;
- b. Building a publication media for a natural disaster information database for socialization and distribution in the form of a website/home page that can be accessed by young users via the internet network;
- c. Building coordination media between related institutions/agencies in the context of communication, analysis and determining joint policies for disaster mitigation. This information technology is carried out because of the importance of very fast disaster management. With the existence of IT in disaster management, this can really help in efficiency and preparedness to help and handle an area or place that is hit by a disaster.

2. Response



Figure 6. Rapid Assessment of Disaster Impact by Pusdalops-PB BPBD Jombang Regency.

After receiving reports of incidents, rescuing people, evacuation actions, providing basic needs, and providing public kitchens as well as victim evacuation actions such as making tents are usually not carried out because the victims usually take refuge with relatives.

In general, these response actions have been carried out in the field by BPBD in accordance with theory, but the emphasis is on these response actions being carried out after a disaster occurs, which in theory is intended for ease of representation, and it has been proven that these response actions are carried out at an urgent time after a disaster occurs. . This is not a problem as long as the objectives of the response action are achieved, such as saving lives and protecting victims' property from damage and other effects caused by the disaster.

3. Recovery



Figure 7. House repairs after the Strong Wind Disaster in Mojowarno District, 2022.

In this stage, to facilitate analysis, researchers also divided the recovery stage into three parts based on the type of recovery carried out, namely restoration, rehabilitation and reconstruction. Restoration is cleaning the condition so that it can function in an emergency. Physical rehabilitation (vital), namely improving living facilities such as providing home services, clean water facilities, providing public kitchen facilities and so on. Apart from that, social rehabilitation for disaster victims who experience pressure/stress is aimed at restoring the victims' social functions. Meanwhile, reconstruction is the total repair of the public facilities or facilities of community life so that they can function normally, such as schools, markets, public roads, hospitals, damaged lighting facilities, communication facilities, so that community life can function normally again. The recovery stages as disaster management in Jombang Regency include, firstly, restoration by cleaning up debris, building emergency reconstruction to facilitate evacuation and also as a temporary means for community activities. Second, physical rehabilitation as exemplified above in this case has been included in disaster response measures. Third, social rehabilitation has never been

carried out because during BPBD's existence there has never been a major disaster that required BPBD to do this. Fourth, reconstruction by carrying out DALA (Damage and Losses Assessment) analysis to calculate the value of damage, restoration of public facilities and infrastructure, permanent reconstruction by providing material assistance, providing basic food assistance and material assistance to repair damaged houses for tornado victims, coordinating with the authority owners in the disaster-affected areas to carry out reconstruction, and for areas that are no longer suitable for habitation due to the disaster, efforts will be made to find a new place to live. In general, the recovery actions carried out are in accordance with theory because the aim of these actions has been achieved, namely returning function of buildings damaged by disasters. Although the recovery actions carried out are only limited to restoration and reconstruction actions. Meanwhile, rehabilitation measures for physical rehabilitation are included in the response category and social rehabilitation has never been carried out because when BPBD was formed in December 2011 there was no disaster that required BPBD to do this.

4. Development



Figure 7. Structural mitigation after the flood disaster in Mojowarno District, 2022.

To make analysis easier, in this development stage researchers also divide development actions based on their nature, namely structural and non-structural, as is done in disaster mitigation actions. Structurally, this is done through technical efforts, both natural and artificial regarding facilities and infrastructure. Meanwhile, non-structural are non-technical efforts that involve adjustments and regulation of human activities so that they are in line and in accordance with structural and other efforts. Structural efforts that have been carried out in disaster management in Jombang Regency are the construction of embankments through technical calculations so that if a flood occurs as before, the embankment can be strong enough to withstand the flow of water and there will be no flooding like before; integrated river planning from upstream to downstream; identify risk areas; as well as installing signs and EWS (Early Warning System) for floods and landslides. Meanwhile, for non-structural efforts, the actions taken are the formation of Disaster Resilient Villages, observing trees which, if they are dangerous, are recommended to be cut down as a tornado mitigation measure, recommending that the community build houses according to technical standards, and conducting outreach. disaster to society. In general, the development actions carried out by BPBD above are in accordance with theory. This is because the actions that should have been taken in development efforts have been carried out, such as introducing improved building programs and systemsmodernized, as well as implementing disaster events in future research and development programs

Community Participation in Natural Disaster Management

The dominant form of community participation in managing natural disasters in Jombang Regency is social participation and energy participation because based on interviews that have been conducted, data was obtained that the people of Jombang provide their energy as well as their community to actively participate in managing natural disasters. The action taken by the community in this participation was the involvement of local residents in the process of building embankments that occurred during landslides and tornadoes in Tondowulan Village. Apart from that, the local community helped work to repair the victim's house which was damaged by the wind. This is done through community service in carrying out repairs after landslides, floods and tornadoes occur. So this can also be used as an indicator that social or community participation is also carried out at the same time as workforce participation. This social participation is running well in accordance with the aim of diverting aid which does not allow giving aid in the form of money so that the community's community or mountain falls are not lost. By providing aid in the form of materials which is being carried out now, the community can participate in the process of building or repairing buildings damaged by the disaster. Participation carried out by the community in disaster management is not only the participation of personnel and social services above, but also the participation of thoughts, property, skills and expertise. The idea of community participation is by participating in meetings or socialization about disasters carried out by BPBD to the community. Apart from that, the participation of ideas was also expressed in the form of ideas from Kademangan Village officials to repair the embankments which usually cause flooding in the area, although the results have been to no avail up to now. For property participation, the action taken by the community is to provide property assistance from economically capable people to other communities when a flood occurs, in the form of instant noodles or other basic necessities. Meanwhile, for skills and proficiency participation, the actions taken were training on the use of rubber boats for the youth of Kademangan Village which were used to evacuate residents when the village experienced flooding in the area, as well as community knowledge and mastery of the terrain which helped volunteers to carry out search and rescue.

CONCLUSION

Based on the analysis carried out on the use of the internet in disaster management, the following conclusions can be drawn:

1. The Disaster Information System is able to provide information about weather conditions, heat and volcanic conditions in an area;
2. By maximizing the Disaster Information System, all data obtained from imaging results carried out by satellites, then the data will be received by the server, then the server will be sent to the client regarding information on natural conditions in an area that can be integrated;
3. Users can see the weather conditions, heat and active volcanic conditions in an area and get information if a disaster is about to occur via their cell phone facilities and via a PC or laptop using web-based internet;
4. It is hoped that with a good Disaster Information System, although the characteristics of natural disasters cannot be avoided, at least moral and material losses can be reduced because by knowing the information about the weather conditions in the surrounding area, they will be more alert to the arrival of natural disasters.

Based on the results of the analysis carried out, recommendations and suggestions that can be submitted are as follows:

1. Maximizing threat-based disaster information systems;

2. Involving the community in implementing the Disaster Information System;
3. Carry out efforts to mitigate flood disasters, which are the disaster with the highest probability, through:
 - a. Structural and non-structural activities are carried out through structural activities by building embankments on river banks at points in flood-prone areas with the aim of preventing the overflow of water at a certain height level into flood-prone areas and building canals with the aim of lowering water levels. in river basins by increasing and diverting the direction of river flow;
 - b. non-structural activities with law enforcement supervision of the role of the community in complying with the provisions on spatial use and cultivation patterns of flood plains and upstream watersheds, to avoid narrowing and shallowing of river channels due to solid waste as well as buildings/residential and plants on river banks.
4. Regional government implementing units carry out more intensive coordination so that disaster management is effective, and also carry out coordination so that the business world wants to participate in disaster management;
5. Additional human resources who are competent in disaster management to be placed in BPBD.

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