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Flood Disaster Risk Management In Manado City

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Abstract

Geological and hydrometeorological disasters are disasters that are often experienced by every region in Indonesia. Hydrometeorological disasters such as floods are influenced by strong westerly winds and world climate change. Apart from that, inappropriate land conversion is also one of the factors causing this disaster. One of the regions in Indonesia that is highly vulnerable to flood disasters is the city of Manado. Geographically, Manado City is surrounded by mountains and 5 large rivers that pass-through Manado City, namely the Tikala river and the Tondano river which merge in the Paal 2 area, the Malalayang river, the Sario River and the Bailang River. To overcome this disaster, it is necessary to carry out appropriate mitigation efforts to minimize the impact caused by the flood disaster in Manado City. The aim of this research is to analyze the risk level of flood disasters in Manado City and provide appropriate recommendations related to flood disaster mitigation in Manado City. This research uses analysis with quantitative descriptive research methods. The results of this research are that there are 3 classes of flood disaster risk levels in Manado City. In the high class there are 53 subdistricts, medium 2 subdistricts and low 32 subdistricts. Policy recommendations are made based on the level of risk by taking into account the main causal factors. Furthermore, it is recommended in every sub-district.

Keywords: Flood Disaster, Mitigation, Risk, Manado.

INTRODUCTION

Flood hydrometeorological disasters are the disasters that cause the most harm to the Indonesian people, both material and immaterial losses. Flood disasters in Indonesia are influenced by climate change and inappropriate land conversion. Floods in urban areas occur because of the correlation between

Hydrometeorological factors are exacerbated by human activities in response to the development process of a city, where meteorological factors are influenced by the intensity of rainfall, while hydrological factors are influenced by the ability and capacity of river basins and river inlets and outlets to accommodate rainwater. accommodate water runoff, land cover, soil moisture and the level of underground water availability. Indonesia is a tropical country that has four seasons. one of which is the rainy season, where in fact the rainfall in Indonesia is classified as very high, this happens almost throughout Indonesia, including the city of Manado. In the period 2012-2019, it was recorded that every year the city of Manado was always hit by flood disasters (BPBD, 2019). The worst case of flood disaster occurred in 2014. At that time, there were 15 fatalities, 40,000 people were displaced, and 1,000 houses were damaged by the flood (Liputan6.com).

This condition encourages the need to carry out disaster mitigation efforts. In disaster mitigation efforts in Indonesia, the government has Law Number 24 of 2007 concerning Disaster Management. This policy consists of three disaster stages, namely pre-disaster, emergency response and post-disaster. At the pre-disaster stage, a disaster risk analysis is carried out where this analysis aims to determine the level of threat and vulnerability as well as the level of community ability to face disasters. Disaster mitigation is an effort to reduce the impact of a disaster, both structurally and non-structurally. Structural mitigation includes the construction of physical buildings, while non-structural mitigation is carried out by increasing public

understanding and awareness through disaster outreach and education. The aim of mitigation itself is to reduce losses due to disasters, both loss of life and loss of property. To determine the right and accurate strategy, a risk assessment needs to be carried out. Disaster mitigation activities should be routine and ongoing activities. This means that mitigation activities should be carried out in the period before the disaster occurs and have a greater intensity than previously estimated. Therefore, this research aims to analyze the level of flood disaster risk in Manado City and provide recommendations for flood disaster mitigation in Manado City. Relevant previous research was conducted by Triana Anggun, Roni Ekha Putera, and Roza Liesmana in 2017 with the title "Community Empowerment in Flood Disaster Risk Reduction in South Padang District"

RESEARCH METHODS

This research uses a quantitative method using a descriptive approach, namely a method that aims to create a picture or description of a situation objectively using numbers starting from data collection, interpretation of the data as well as its appearance and results (Arikunto, 2006). The analysis was carried out by referring to PERKA BNPB No. 02 of 2012 concerning general guidelines for disaster risk assessment. Operational Definition of Variables consists of:Hazard: the potential event that causes accident, injury, loss of property, and loss of life. This hazard can pose as disaster or not. The indicator for this variable is a regional zone map of flood (validated with event data).

1. Vulnerability: several conditions such as social and physical conditions and influencing attitudes of internal community capabilities that carry out mitigation prevention, preparation and action. The indicators for this variable are social vulnerability, physical vulnerability, economic vulnerability, and environment vulnerability.
2. Capacity: the ability to respond to the situation with certain resources available (human, physical, finance and others). Capacity can also be an event told from generation to generation. The indicators for this variable are disaster education, disaster management, law and order concerning disaster management, and early warning system.
3. Risk: potential loss resulting from disasters in a certain area over time. The indicators for this variable are hazard level, loss level, and capacity level.

In addition to that, to analyse the flood disaster mitigation level, this research uses calculation guidelines based on BNPB regulation No. 02 of 2012 concerning General Guidelines for Disaster Risk Assessment, using determination scoring class as follows:

Table 1. Scoring

Level	Grade	Percentage	Scoring
Low	1	100%	0,333333
Medium	2		0,666667
High	3		1,000000

RESULT AND DISCUSSION

Flood Disaster Hazard and Vulnerability Analysis in Manado City

Based on the results of calculations via index threat and exposed population index obtained "threat level as follows: 53 subdistricts are high, 17 are subdistricts medium, and 17 subdistricts are low. Flood disaster hazard index map in Manado City can be seen in Picture 1 below.

Picture 1. Flood Disaster Hazard Map in Manado City
Source: BPBD Kota Manado.

Based on the results of the vulnerability analysis in Manado City, vulnerabilities can be seen in each aspect as follows:

1. Social vulnerability in Manado City is divided into 3 classes, namely: 48 subdistricts are high, 32 sub-districts are medium, and 7 sub-districts are low.
2. Economic vulnerability in Manado City is divided into 3 classes, namely 34 sub-districts are high, 30 sub-districts are medium, and 23 sub-districts are low.
3. Physical vulnerability in Manado City is divided into 3 class namely 19 subdistricts are high, 67 subdistricts are medium, and 1 subdistrict is low.
4. Environmental vulnerability in Manado City is only 1 vulnerability class, namely low class with a total of 87 sub-districts.

From the analysis carried out where the level flood vulnerability is calculated based on the results of social, physical, economic and environmental vulnerabilities, it was found that the level of flood vulnerability in Manado City is divided into 3 classes, namely 9 sub-districts are high, 71 subdistricts are medium, and 7 subdistricts are low. From the analysis carried out, the flood loss index is calculated based on the results of economic, physical and environmental vulnerabilities. Furthermore, to determine the level of loss using the confluence matrix of the loss index and hazard level, it is found that the flood loss level in Manado City namely 7 subdistricts are high, 48 subdistricts are medium, and 32 subdistricts are low. Manado City flood vulnerability level map can be seen in Picture 2 below.

Picture 2. Flood Disaster Vulnerability Map in Manado City
Source: Based on research.

Flood Disaster Capacity and Risk Analysis in Manado City

Based on data from BPBD North Sulawesi Province, it was found that the capacity index of Manado City is only classified into 1 class, namely the medium class in total 87 sub-districts. To determine the level of flood disaster capacity using the meeting matrix of the capacity index and the level of threat of flood disasters in Manado City with the results of the analysis it was found that the flood capacity in Manado City is divided into 3 levels, 55 sub-districts are high, 17 sub-districts are medium, and 17 sub-districts are low. Flood disaster capacity level in Manado City can be seen in Picture 3 below.

Picture 3. Flood Disaster Capacity Level in Manado City
Source: Based on research.

To determine the level of risk of flood disasters in Manado City, using a meeting matrix from loss rate and capacity level. With result analysis obtained that the level of disaster risk floods in Manado City are divided into 3 classes, namely 53 subdistricts are high, 2 subdistricts are medium, and 32 sub-districts are low. Flood disaster risk level in Manado City can be seen in Picture 4 below.

Picture 4. Flood Disaster Risk Level in Manado City
Source: Based on research.

Policy Recommendations for Flood Disaster Risk Mitigation in Manado City

Referring to the results of the flood disaster risk analysis that has been done, the following is an outline recommendation for mitigation efforts that can be carried out to minimize the risk of flood disasters in Manado City.

1. Population dentisity and sex ratio. Disaster mitigation effort for population dentisity can be done by nonstructural mitigation. The policy recommendation for this aspect is to socialize the Family Planning program to reduce birthrate in Manado City.
2. Disability and age ratio. Disaster mitigation effort for this aspect can be done by nonstructural mitigation. The policy recommendation is to provide tools for

disabled and elderly people on every sub-district and provide a special team for dealing with vulnerable groups.

3. Poverty ratio. Disaster mitigation effort for poverty ratio can be done by nonstructural mitigation. The policy recommendation for this aspect is to cooperate between the government and poor communities by creating or marketing superior products, to empower poor population and reduce poverty level.
4. Housing. Disaster mitigation effort for housing can be done by both structural and nonstructural mitigation. The policy recommendation for this aspect is to build the housing area with a house design which is resistant to flood disaster and prohibit housing settlement development in the water infiltration area.
5. Public and critical facility. Disaster mitigation effort for public and critical facility can be done by nonstructural mitigation. The policy recommendation for this aspect is to plan the public and critical facility building location in the low hazard area.

Productive land. Disaster mitigation effort for productive land can be done by structural mitigation. The policy recommendation for this aspect is to plan the irrigation channels for the productive land area and plan to build reservoir construction

CONCLUSION

In accordance with the formulation of research objectives, as follows are conclusion that can be expressed in this research. According to the analysis carried out by the researcher, it is known that there are 53 sub-districts has a high level of risk of flood disasters, 2 sub-districts with medium risk level and 32 sub-districts with a low level of risk of flooding. Policy Recommendations for Disaster Mitigation Floods in Manado City are adjusted to factors which causes a high risk of flood disasters in every sub-district in Manado City.

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