



Flood Mitigation in Malang City: The Perspective of Health Policy

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Abstract

Objective: The high intensity of rainfall in Indonesia causes some cities to experience flood, including Malang City. Malang is a mountainous city which is located on highlands, between 444 to 667 meters above sea level. Ironically, every year during the rainy season, many parts of Malang are hit by flood. This flood disaster causes severe health problems. This paper aims to describe the flood mitigation in Malang City. **Method:** The method used in this research is the socio-legal research. It uses the cultural socio-legal approach, with the background of the thought that the law cannot be separated from the lives of the people, in the form of values, attitudes, behaviors, and impacts which it causes. **Results:** The results of this research show that the main cause of the flood is influenced by human activities as the main factor. **Conclusion:** The government should make policies in preventing the health impacts caused by flood.

Keywords: *Rain, Flood, Drainage, Water infiltration. Health, Policy.*

Introduction

Flood is a normal natural phenomenon, but it becomes highly harmful if it threatens the human life. Flood is one of the natural phenomena which cause great harm, which often threatens some areas in Malang City; due to the higher-than-normal intensity of rainfall. Malang is a city which is located in highlands, between 444 to 667 meters above sea level. Geographically, Malang is located in the middle of a mountain range, with Mount Arjuno on the north, Mount Semeru on the east, Mount Kawi and Mount Panderman on the west, and Mount Kelud on the south. Malang City is placed on an area of 252 square kilometers, with the total population of 824.000 people.

The temperature ranges between 17 to 30 degrees Celsius. Ironically, almost every year during the rainy season, the disaster of flood hits various areas in this city. This disaster is a natural phenomenon which may cause destruction to facilities and which also have health impacts to its citizens. Some diseases often emerge due to the flood, including diarrhea, leptospirosis, respiratory organ infections, typhoid fever, dengue fever, until skin diseases.

The flood may in the end cause victims, material losses, the increase of critical land, sedimentation, and the destruction of buildings and facilities. Generally, there are some factors which become the main causes of flood in the Malang area, as explained as follows: (1) First, the human activities which cause the change in the change in the land and spatial use, which changes the nature, such as the decrease of the forest conservation which causes the destruction of the forests and the change in the agricultural land function to become housing complexes or residences. (2) Second, the natural phenomena such as the high intensity of rainfall, without the development of an adequate water infiltration system.

A location without buildings which was before an open green space for water infiltration such as city forests, city parks, and other areas which are able to absorb excessive water becomes home to permanent buildings. There needs to be great efforts to anticipate and to minimize the losses caused by the series of the flood disaster which happens between a relatively short period of time and which repeats it every year.

Some of the government's structural approaches are still ineffective in preventing the flood problem. Also, the top-down and the sectorial policies which do not involve the society are not according to the global developments which demand decentralization, democracy, the participation of stakeholders and especially the participation of the people who are impacted by the flood [1].

Thus, the flood mitigation which is usually only in the form of a structural approach must be synergized with the non-structural approach, which provides a wider space for the people's participation. The people know the areal condition and they are most able in describing the present problems. They may also carry out responsive actions according to the present natural sources and the local capacities available, so that the optimum results may be reached [2].

The government's transparency in communicating all development programs and also the efforts in accepting the society's participation are preconditions which must be fulfilled. If observed profoundly, the party which determines the direction of the city space development and usage are usually commercial parties.

At least, the voice of the private sectors is usually dominant in influencing the institutional power in formulating the various policies of city. Meanwhile, the people's participation (undercurrent) in the cities usually becomes an unconsidered party in managing the spatial planning or the city space [3]. Thus, this research aims to analyze the symptoms of the flood disaster which often happens in Malang City and to profoundly analyze the mitigation and prevention measures under perspective of policy.

Materials and Methods

The method of this research is the socio-legal research which is usually called the non-doctrinal legal research [4]. The sociologic legal research is carried out to comprehensively observe [5] the flood in Malang in the perspectives of law and health. This research uses the descriptive-qualitative approach [6]. This approach describes studies profoundly, that the law cannot be separated from the people, in the form of the present values, attitudes, and behaviors.

The law is not autonomous [7]. Thus, in the perspective of the socio-legal studies (*sociologist rechtswetenschap*) the analysis on law does not only regard normative aspects. But it may be analyzed from the sociological aspect, as to how the law or policy factually lives within the society [8].

Results and Discussion

Flood and Its Types

Flood happens when the surface water is relatively high and which cannot be contained by the drainages or the river. Thus, it flows to the left and the right, and causes puddles or currents which are above normal, which causes loss to human beings. In the Great Indonesian Dictionary, flood is defined as a plenteous or a great flow of water due to continuous rain which flows through the river, which overflows outside of the river and inundate the land (the dry land) around it [9].

The flood may also be defined as a condition where water cannot be contained in the drainages, thus flowing to the area (the flood area) around it. Many factors may cause the flood, such as a high intensity or excessive rainfall. It may also happen because the land in the form of low plains or a basin has overflowing water from a river, a stream, a lake, or the sea.

Generally, in Indonesia or especially in Malang City, the flood is a natural phenomenon which happens due to the high intensity of rainfall and its prevalence where there is an overflow of water which is not contained by a system [10]. Apart from that, the flood may also happen due to water shipments of a river or a lake, or the fluctuation of sea water which overflows and whose volume is above the flowing capacity of the drainage system or the river current system, and also the inadequate capability of the land infiltration or inadequate the water surface storage which makes the land unable to absorb water [11].

According to the Indonesian hydrologic experts, there are three types of flood in Indonesia, which are explained as follows:

- Flood due to overflowing river water. This type of flood is caused by the river which is unable to contain the water flow, or due to the over-capacity of the water debit. In this case, the river water will seek other places,

or will flow around the river which is a floodplain area. It may also be due to the broken watershed area; thus, the water will flow to the river downstream.

- Flood due to the absence of water infiltration. This type of flood is caused by the land/soil which is unable to infiltrate water (because the land is solid, the land is moist, or the land does not have water infiltration). This type of flood happens when there is high rainfall intensity and that there is overflowing water. Thus, the water overflows and inundates the land areas. In this case, there is a high chance of a local flood. [12]

The Causes of Flood in Malang City

Indonesia has two seasons annually, which are the rainy season starting from October to March, and the dry season between April and September. Generally, the floods in Malang City are caused by the following factors:

- First, natural flood in Malang City is caused by physiography, erosion, sedimentation, and drainage capacity. In the rainy season, high rainfall intensity causes flood in the rivers. If it surpasses the river banks, the water will flow to the land, which may cause flood or puddles. The decrease of water containment in the river is caused by erosion and sedimentation in the watershed [13].
- Second, the excessive deposition from the watershed and the embankment erosions may cause flood. This phenomenon has a direct effect which is the overflow of water from the river current to the outside, which causes flood. Apart from the watershed sedimentation and erosion, the Malang City flood is also influenced by the inadequate drainage capacity, which makes it prone to be hit by flood in the rainy season.

The Impacts of Flood

Flood is a disaster which causes relatively a lot of losses which may destroy the physical and the non-physical environments. The loss caused by flood is first place in the amount of losses caused, or second after earthquakes and tsunamis.

Some other impacts of flood which cause losses are as follows [14]: a) it causes death, material losses, and the destruction of residences, business areas, and industrial

areas. This is because the rainfall has high intensity, which makes some residences or people drowned or pulled by the current; b) the destruction of agricultural areas (rice fields, plantations, fields), the destruction of the drainage system and the irrigation, the destruction of roads, residential buildings and other buildings, train tracks, bridges, and the destruction of the telecommunication network system; c) the destruction or the loss of the people's material things (cars, motorcycles, and house utensils); and d) the emergence of disease plagues, as a durable flood may cause diseases and may easily spread diseases.

Flood Mitigation and health policy in Malang City

The People's Role

The people may instill understanding on mutual interests in a wider environment. They may also instill the psychological ownership by participating and by having an active role in handling the development through the self-help line. It is also important to increase the feelings and the actions of concern towards the environment [15].

Because of that, it is absolute for the stakeholders (the government) to strengthen the society's concern by involving them in the spatial management, including the spatial planning, the execution of spatial use, and the spatial management evaluation, as an effort for flood disaster mitigation. They may also do so through the strengthening of Regional Regulations.

The public has a concern in disaster mitigation because they themselves have become victims of floods. Public joint venture funds in disaster mitigation or donate equipment or materials needed. Among the materials provided are medicines or medical equipment needed in flood disaster mitigation, considering that floods cause quite various health problems [16].

The Government Policy

Apart from the various efforts, there is also an early warning system, so that the related parties may undergo an early anticipation to minimize the disastrous impacts. An effort which may be done is that each house must create an infiltration well to contain the rainfall, to decrease the chance of flood and to increase the groundwater reserve.

The government may carry out some of these methods:

- Improving the watershed system by increasing the quality and the quantity to the land-covering vegetation and also the capacity of the hydrologic network and the watershed irrigation. It may be done by replanting the watershed area with plants whose roots may contain the water. There must be reparation of the hydrologic network if the waterway narrows. The actions in the watershed management include biophysical sectors, and empowerment of the society and the institutions. In the flood prevention plan, the solutions must be analyzed through the perspective of the watershed areas.
- There must be a special unit whose job is to anticipate the health problem during and after flood. This special unit may be formed by a combination of related institutions such as the city services, the district or the village government, the military and the police force, the city security team, and also by actively involving the society. Tim ini bertugas untuk menolong orang yang mengalami masalah kesehatan akibat bencana banjir seperti melakukan pernafasan darurat bagi korban tenggelam, menyediakan obat-obatan terutama obat pertolongan pertama bagi korban banjir atau menyediakan angkutan ke rumah sakit bagi korban bencana banjir.
- There must be the development of a commitment to sustainably prevent or avert the flood by building infiltration wells and by fixing water drainages.

Pemerintah menyediakan kapasitas kapasitas tambahan pada fasilitas kesehatan dalam menangani mitigasi bencana banjir, beserta petugas medisnya yaitu dokter, perawat, bidan dan tenaga medis lain [17]. Kebijakan kesehatan di tempuh bersama dengan kebijakan jangka panjang yaitu kebijakan penanggulangan banjir.

Conclusion

The flood in Malang City happens due to a very high rainfall intensity. If there is no action to find a solution, it will cause losses, destroy the environment, and cause health problems. Some diseases which often emerge following the flood disaster include diarrhea,

leptospirosis, respiratory organ infections, typhoid fever, dengue fever, and even skin diseases.

There are some factors which are main causes of flood, which are: 1) human activities which cause the change in the land use and the spatial management, which causes the natural change, 2) natural phenomenon such as high rainfall intensity which is not accompanied with adequate water infiltration system, and 3) the environmental degradation such as the absence of ground-covering plants in the catchment area.

The governments make an effort of policy for flood mitigation. The health policy is implemented by providing emergency services for flood victims who experience health problems. Emergency service policies such as ICPR for drowning victims, medicine and medical treatment at the location of the flood disaster as well as the provision of healthy and proper food for flood victims. Another policy is to provide ambulances and additional rooms in hospitals and health facilities in addition to increasing the number of doctors, nurses, midwives and other medical personnel on duty. There must be a rearrangement of the drainage system, from the downstream as the last containment of water before the river, which is Brantas River as the natural drainage system.

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