Original Research Article

PREDICTION OF THE EXTENT OF FLOOD INDICATORS USED FROM THE SLOPE MAP IN THE RIVER FLOW AREA IN THE CITY OF SAMARINDA, EAST KALIMANTAN

ABSTRACT

Flood disasters in Indonesia and Samarinda City in general are disasters that continue to occur every year. Information on the dangers and risks of flooding is needed, including the type of flood, the possibility of a flood occurring, the extent of flood inundation, the depth and speed of the flood, and the level of damage (to life, property, and economic activity). The research aims to determine the extent of inundation and the potential for flooding in areas in the river basin in terms of slope maps. This research was carried out in the Karang Asam Kecil River Basin, Samarinda City, East Kalimantan Province, Indonesia. Research activities include literature study, collection of primary and secondary data, data processing, and analysis. The results of the research show that the biophysical conditions in the Karang Asam Kecil Sub-watershed, for flat slopes of 0-8%, Samarinda Ulu District with an area of 1,153.3 ha are 2.8959% and steep slopes of 25-40% are 18.2 ha of 0 .0457%. For bush cover/utilization with an area of 691.2 ha it is 1.7356%, for mining 65.9 ha it is 0.1655%, for residential areas it is 486.2 ha it is 1.2208%, for open land it is 119.2 ha. ha of 0.2993% and forest cover with an area of 152.6 ha of 0.3832% and an inundation area of 174 ha of 6.44%.

Keywords: Flood Inundation, Land Slope, Karang Asam Kecil Watershed

INTRODUCTION

Flood disasters in Indonesia are disasters that continue to occur every year. The climate change that is occurring has increased the frequency of hydrometeorological disasters in Indonesia, one of which is flood disasters (Klipper et al., 2021). Flooding is a water level that exceeds normal levels in a river and usually flows over the river bank and the overflowing water pools in a puddle area (Hadisusanto, 2011). In general, flooding is defined as an event or situation where an area or land is inundated due to the increased volume of water during the rainy season.

According to KodatieandSugiyanto, (2002), the causes of floods generally consist of (1) caused by nature itself which consists of erosion, sedimentation, and the physiographic/geophysical influence of rivers; and (2) caused by humans, namely inadequate river capacity/drainage and also changes in land use/inappropriate land conversion in riverbank areas which greatly contribute to surface flow. Furthermore, Islam et al (2016) stated that in general, floods that occur in Indonesia are caused by high rainfall causing water drainage systems including rivers, natural tributaries, and artificial channel systems to be unable to accommodate the accumulated rainwater that comes so that it overflows and causes flooding.

According to the United Nations Office for Disaster Risk Reduction (UNISDR, 2018), of all the disasters experienced in the world, floods occur frequently and claim the most lives. Based on data from the Center for Research on the Epidemiology of Disasters (CRED, 2018) shows that between 2008-2017 floods claimed an average of around 5,000 lives a year with more than one trillion USD in total losses or around 40% of all economic losses due to disasters. nature over the last four decades (Munich, 2020).

In Samarinda City, changes in land use patterns affect reducing the area's potential which is caused by the increasingly widespread use of land for buildings which causes a reduction in water catchment areas, puddles or floods occur because rainfall falls to the ground surface and cannot enter water channels because it is blocked by buildings. The roadside channel which is supposed to catch rainwater is not functioning properly so it will disrupt transportation.

Housing development in urban areas is not accompanied by spatial pattern regulations and local government supervision, as a result, community housing patterns grow irregularly. Increasing vulnerability cannot be separated from unplanned urban development. This indicates the increasingly dominant use of urban land as well as the narrowing of open space and the weak capacity of relevant agencies in disaster management, which are also factors causing flood vulnerability. In addition, the population growth factor also increases the density of the city, so the level of vulnerability of the area to the threat of flooding becomes higher.

Flooding in river basins is predicted to become a potential flood area if there is no serious treatment. In controlling river floods, it is necessary to carry out studies on programmed flood control. is a river that flows through Samarinda City, most of the river banks are very sloping. Rivers often flood because the river channel is unable to accommodate the overflowing flood water.

One method to help flood management is carried out using numerical simulations. Numerical simulations of flood estimates cannot immediately get good results because inundation depends on topography and it changes over time. This makes flood prediction more complicated and requires a long process. Flood information with visual displays helps better planning. Geographic Information Systems (GIS) can be used to display flood areas, and can also be used to analyze flood inundation maps to produce flood damage estimates and flood risk maps (Hausmann and Webber, 1998; Clark, 1998 in Goel, et al. 2005). To estimate flood inundation with return period discharge, the use of GIS must be combined with hydrological/hydraulic methods (Goel, et al. 2005).

This research aims to determine the extent of inundation and the potential for flooding in areas in the river basin in terms of slope maps.

RESEARCH METHODOLOGY

1. Location

This research was carried out in the Karang Asam Kecil River Basin, Samarinda City, East Kalimantan Province.

2. Research Object

The research object is the Karang Asam Kecil Sub-watershed and conducting field surveys on the actual conditions of the Karang Asam Kecil River.

3. Research Activities

Research activities include literature study, preparation, data collection, data processing, and analysis. The preparations made include providing a topographic map at a scale of 1:200,000 for Samarinda City, providing a map of the River Basin at a scale of 1:200,000 for the City of Samarinda, and providing a map of the inundation area at a scale of 1:150,000 for the City of Samarinda.

4. Data Collection

The data collected are(a) collection and inventory of related data needed to identify biophysical conditions in the Karang Asam Kecil River Watershed, (b) collection and inventory of related data collected to identify activities in flood-prone areas in Flood-Prone Areas, and (c) collection of related supporting data, topographic maps, flood vulnerability maps, river basin maps.

5. Data Analysis

5.1. Biophysical analysis of river basins includes the determination of slope slope, and slope class based on topographic maps with GIS applications

5.2. Analysis of Flood Prone Areas

5.2.1 Determination of slope, flat, gentle, steep, and very steep slope classes based on topographic maps, flat and gentle slope classes that result in inundation using Geographic Information Systems (GIS) applications

5.2.2 Determining a flood-prone area with inundation area based on a flood inundation area map using Geographic Information Systems (GIS) application

RESULTS AND DISCUSSION

1. Land Slope Condition

The topographic condition of the Samarinda City area based on the Topographic Map/Slope of the River Basin is presented in Figure 1 and Table 1.

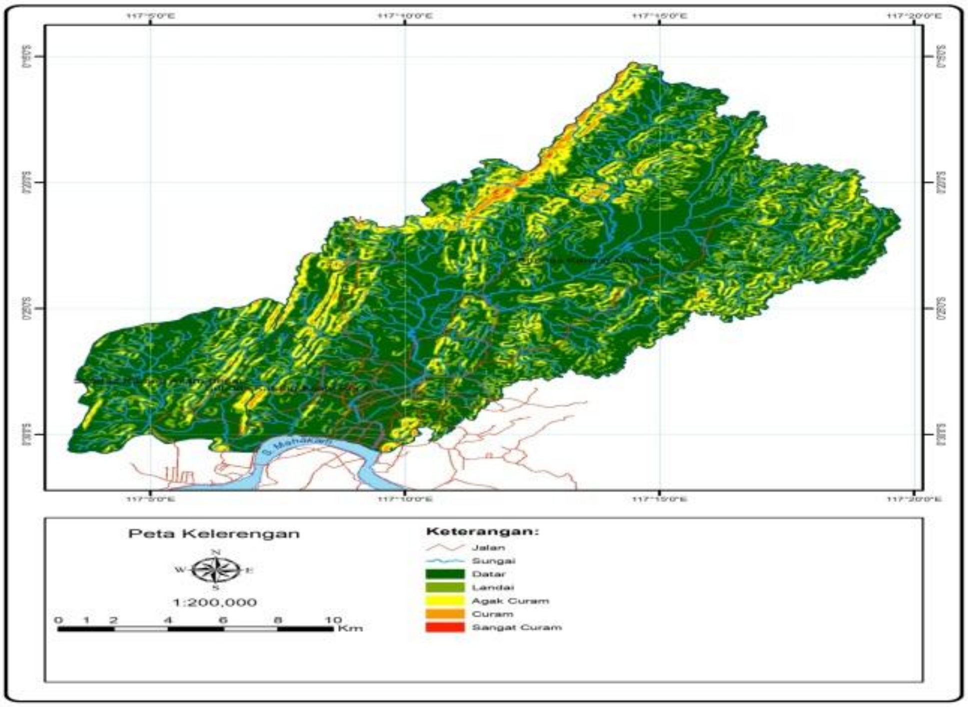

Figure 1. Topography/Slope Map of the River Basin

Table 1. Watershed Slopes

Sub-Watershed	Subdistrict	Slope (%)	Slope Class	Area (Hectare)	Percentage (%)
Karang Asam Kecil	Samarinda Kota	0-8	Flat	6,4	0,0161
		8-15	Sloping	4,1	0,0103
	Samarinda Ulu	0-8	Flat	1.153,3	2,8959
		8-15	Sloping	389,9	0,9790
		15-25	Somewhat Steep	132,5	0,3327
		25-40	Steep	18,2	0,0457
	Samarinda Utara	0-8	Flat	0,1	0,0003
		8-15	Sloping	0,1	0,0003
	Sungai Kunjang	0-8	Flat	93,6	0,2350
		8-15	Sloping	6,7	0,0168
		15-25	Somewhat Sloping	1,6	0,0040
Total				1.806,0	4,5363

Source: Secondary data processed (2023).

Based on data on the slope of the river basin in Samarinda Kota District, the slope is 0-8%, which is classified as flat, covering an area of 6.4 hectares (0.0161%); The slope class of 8-15% classified as gentle with an area of 4.1 hectares (0.0103%). In Samarinda Ulu District there are slopes, namely: 0-8%, classified as flat, covering an area of 1,153.3 hectares (2.8959%); the 8-15% slope class is classified as gentle covering an area of 389.9 hectares (0.9790%), the 15-25% slope class is classified as rather steep covering an area of 132.5 hectares (0.3327), and the 25-40% slope class is classified as an area of 18, 2 hectares (0.0457%). For flat and gentle slopes which result in puddles. In this class, the slopes are quite steep and steep which results in flooding and erosion of the river flow. Furthermore, based on land cover/use data, it consists of bushes with an area of 691.2 hectares (1.7356%), mining of 65.9 hectares (0.1655%), residential areas of 486.2 hectares (1.2208%), open land of 119.2 hectares (0.2993%) and forest land cover of 152.6 hectares (0.3832%) and inundation area of 174 hectares (6.44%). Judging from the biophysical conditions, the relatively wavy/hilly topographic conditions, and the soil type conditions which are dominated by ultisol soil types that are relatively sensitive to erosion, the combination of these conditions can accelerate surface water runoff. As stated by Hadisusanto (2011), these conditions can accelerate surface water runoff.

2. Flood Inundation Conditions

The state of flood inundation in the river basin is presented in Figure 2 and Table 2.

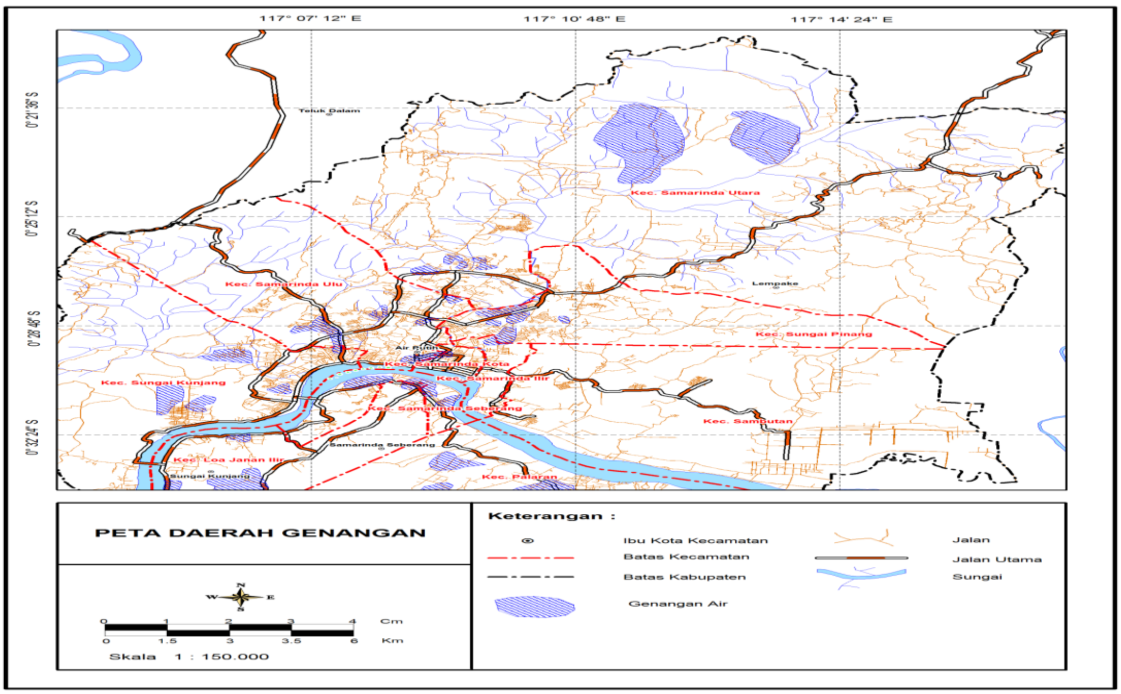

Figure 2. Map of the Area of Inundation in River Watersheds

Table 2. Area of Inundation Based on District Area in the Karang Asam Kecil River Basin

Sub- Watershed	Subdistrict	Village	Area (Hectares)	Percentage (%)
Karang Asam Kecil	Samarinda Ulu	Air Hitam	77	2,85
		Air Putih	81	3,00
		Bukit Pinang	1	0,04
		Sidodadi	1	0,04
		TelukLerong Ilir	14	
		Total	174	6,44
	Sungai Kunjang	TelukLerong Ulu	7	0,26
		Total	7	0,26

Source: Processed Secondary Data (2023)

Based on the research results (Table 2), it shows that in the Karang Asam Kecil watershed in the Samarinda Ulu District area, the predicted area of inundation is as follows: Air Hitam Village is 77 hectares (2.85%), Air Putih Village is 81 hectares (3.00%), Bukit Pinang Village and Sidodasi Village each covering an area of 1 hectare (0.04%), and TelukLerong Ilir Village covering an area of 14 hectares (0.52%). In Sungai Kunjang District, especially in TelukLerong Ulu Village, the area is 7 hectares (0.26%). The slope of the Karang Asam Kecil watershed is dominated by flat slopes (0-8%) and gentle slopes (8-15%), which makes this area always inundated and flooded due to slow surface runoff during the rainy season. According to Kusumo and Nursari, (2016), the slope of the slope affects the direction, rate, and concentration of rainwater, areas with relatively flat slopes will cause the area to always be inundated and flooded during the rainy season.

CONCLUSIONS AND RECOMMENDATIONS

1. Conclusion

Flood-prone areas from the prediction results in the Karang Asam Kecil Sub-watershed occur in the Samarinda Ulu District with an inundation area of 174 ha and the Sungai Kunjang Sub-district with an inundation area of 7 ha.

2. Suggestions

In connection with the existence of flood-prone areas in the Karang Asam Kecil sub-watershed, which exceeds the river capacity, action is needed to normalize river channels including drainage networks, optimize water storage areas and water catchment areas.

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