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Flood-prone Areas Mapping at Semarang City By Using Simple Additive Weighting Method

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Abstract

Semarang city is one of the cities in Java which is flooding frequently. This research develops Mapping of Flood-Prone Areas which is analyzed as the reasons of local flooding. Local flooding happens only in certain places where the rain falls. The criteria used are rain falls, topography, drainage, and the usage of land. There are many aspects that have to be analyzed, so that uses Simple Additive Weighting in order to determinate flood-prone areas. The advantages of this mapping of flood-prone areas are the user can easily access the informations about flood-prone areas that will be displayed in the form of a map, graphic, and table.

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Keywords: Geographic Information System; Simple Additive Weighting; Flood-Prone;Local Flooding; Semarang City.

1. Introduction

Indonesia is a country of prone to natural disasters. Indonesia, especially Java, the cause of the flooding is still dominated by the high rainfall. Semarang city is one of example cities in Java are classified as areas that are often flooded.

Flooding is water runoff that exceeds the normal water level, so exploding from the riverbed caused a puddle on the low land on the river side (BNPB, 2013).

One of the technologies developed at this time is a Geographic Information System (GIS). SIG lately have a role

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in natural disaster mitigation. SIG consists of two components, namely spatial data related to the geometry of the shape of spatial and data attributes that provide information about the spatial form (Chang, 2002).

Determination of flood-prone areas is one of a kind Decision Support System (DSS). DSS is a computer-based information system that combines models and data to provide support to the decision makers in solving semi-structured problems or dependency problems involving users in depth (Turban et al, 2005) .One method used mainly in the SPK is Simple Additive Weighting (SAW). SAW is a multi-attribute procedure based on the concept of a weighted summation. Looking for a weighted summation of rating the performance of each alternative on all alternative criteria which the highest score overall is the best alternative and will be taken. This method can be used to support Geographic Information System with overlay operations (Malczewski,1999).

Research about flooding, have been carried out using various methods, such as using the Analytic Hierarchy Process (AHP) and Fuzzy Logic. Research by the Analytic Hierarchy Process (AHP) presents an approach for detecting flood-prone areas by combining with Geographic Information Systems (GIS). The criteria used to determine the flood-prone areas, are rainfall, geology, slope, the usage of land, soil type. AHP is used to determine the weight and value of each criterion assessment results, then integrated into the GIS system to produce estimates of flood maps (Matori et al, 2014). Whereas in other studies that use fuzzy logic of a model potential flooding that occurs in the arteries in Malang where fuzzy logic model used is the zero-order Sugeno fuzzy. The parameter used is the amount of rainfall, drainage, drainage coefficient and altitude region. In the data processing that will be used as input, several parameters processed using a calculation formula hydraulics, before the data are used as input fuzzy (Dewanto et al., 2013).

Based on above, in this study developed Mapping Prone Areas Flooding in the city of Semarang with the criteria analyzed as cause local flooding that are more local in accordance with the area that shed rain water is rainfall, topography, drainage, and the usage of land. Many aspects that must be analyzed is then used Simple Additive Weighting method in the determination of flood-prone areas. This system is expected to provide information useful for the government and society as widely accessible.

2. Methodes

2.1. Flooding

Floods are the overflow of river water caused by river discharge that exceeds the capacity on the state of high rainfall or inundation occurred in certain areas that are not normally stagnant (Kodoatie & Sugiyanto, 2002).

Causes of flooding can be divided into three kinds, namely (Suripin, 2004):

1. Flood submissions
   Flood flow coming from upstream areas outside the flooded areas. This occurs if rain occurs upstream causing flooding that exceeds the flow capacity of the river or canal flood there, causing runoff.
2. Local Flood
   Puddles arising from rain that fell in the region itself. This can happen if rain occurs exceeds the capacity of the existing drainage system. At the local flood, water inundation height between 0.2 to 0.7 m and the old pool of 1-8 hours. Present in low lying areas.
3. Flood rob
   Flooding that occurs either due to direct the flow of the tide and / or water from the drainage channel behind due to hampered by the tide.

2.2. Simple Additive Weighting

Simple Additive Weighting (SAW) is a multi-attribute procedure is based on the concept of a weighted summation. Looking for a weighted summation of rating the performance of each alternative on all alternative criteria which the highest score overall is the best alternative and will be taken. This method can be used to support Geographic Information System with overlay operations (Malczewski, 1999).

Completion step is (Kusumadewi et al., 2006):

1. Determine alternative, namely A_i.