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LOCAL WISDOM AS LANDSLIDE CONSERVATION IN THE GEDE CATCHMENT MALANG REGENCY

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Abstract:-

Gede Catchment is located in the upper slope of Bromo Mountain. It is located in the Malang Regency, East Java Province. The wide of Gede Catchment is around 17 Km². Based on the analysis of landslide mapping, this area has high potential of landslide around 52,9%. There were several rotational and translational that has been occurred in this area. Based on the physical condition, actually this area is not appropriate for living of human. In the other hand, there were communities from several villages that survived to live harmony with the high of potential landslide. The aim of this paper is elaboration of local wisdom of society as landslide conservation which had been survived in landslide prone area. The method was carried by field survey including observation and in-deep interview to the Gede Catchment's community regarding adaptation strategies for surviving to live harmony with high potential landslide prone area. Field survey for data collection was carried out by grounded research technique. Based on the real condition, the Gede Catchment's community has local wisdom for landslide conservation, so that they can survive in the landslide prone area. The local wisdom in this area is regarding about planted local plantation which considering the unit morphology. It is the local wisdom of Gede Catchment community. The plantation is the effective protection to soil movement.

Keywords:-Local Wisdom, Landslide, Conservation, Gede Catchment

1. INTRODUCTION

As general, the physical condition of geomorphology has affect for living society. Extreme geomorphological process can be risk for sustainable living of society. Geomorphology process embedded at our physical environment that modifies our land characteristic along the time (David and Szabo, 2006). The human activities will have affect to geomorphology process such landslide and erosion. But in the other hand, the human activities in the prone area sometimes can be conservation these area such local wisdom. As human who living in this area will have challenge how to be surviving including how to conserve their environment.

Landslide disasters are hydro meteorology disaster which the most occurred in Indonesia. Based on the DIBI 2019, there were 512 landslides that occurred in Indonesia. Mostly, landslides will occur in the hilly area and in the peak of wet season (Igwe, 2015). The potential of landslide will increase when the population of people who lives in the prone area had been increasing. Geomorphology is the once of landslide's trigger (Qiao, et al., 2013). Mostly, the landslide will be occurring in the rough morphology. But in the other hand, landslide potential can be accelerated by human activities (Skilodimou, et al., 2018; Barnard., et al., 2001; Zhang, et al., 2012). But in the other hand, the activities of human in the prone area also can be conservation their environment. Sometimes, as community who lives in the high potential of landslide has their own way how can live survived in their environment. There were several way one of them is thorough local wisdom of community.

The community of Gede Catchment mostly has been known that their area has high potential of landslide. But they don't to move for their living. The community of Gede Catchment has their own way how to survive with their environment. They have local wisdom to manage their environment and decrease potential of landslide. Their local wisdom was planted the local plantation. Local behavior in preserving their living environment as strategy adaptation for landslide conservation might be the best way as the best solution which considering soil condition, local plantation of agroforestry system and sustainability economic income, however the community has no sufficient knowledge to explain their community adaptation strategies. The societies of Gede Cathment have been living successfully with extreme of geomorphological process in their environment such landslide. They have local strategy as adaptation for their environment that has high potential landslide. They are introducing of new strategy adaptation for landslide prone area with the local agroforestry plant. It is based on the society local knowledge. There were some important values of the local environments that have been neglected and presumed belonged to the similar systems of the new model. The local society may have the best knowledge of their living environments (Tuladha, et al., 2015).

Conservation based on the local wisdom is general to do in landslide prone area, but local wisdom which combining vegetative approach with physical condition is still rare to do, so that this research is to elaborate the local wisdom as landslide conservation in the Gede Catchment.

Gede catchment is the part of Bromo Volcano System. It is located in the Malang Regency, East Java Province. The wide of Gede Catchment is around 17 Km² (Fig. 1). It's located in the middle slope of Bromo Volcano Mountain. The subsurface material is dominated by deposition of Bromo Volcano material.

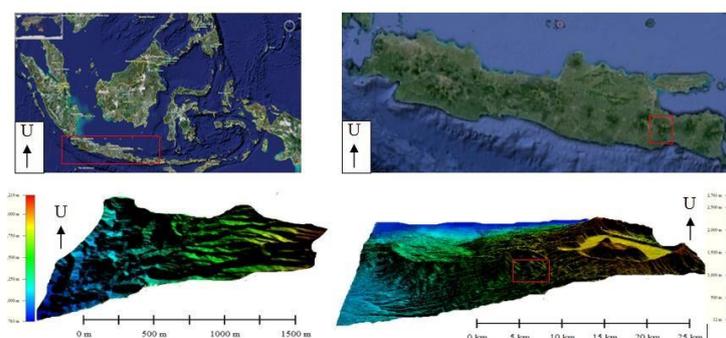


Fig 1: The Study Area

2. MATERIAL AND METHOD

The method of this research is using DEMNAS data for landslide prone area map. From the DEMNAS data we could extract several data such elevation. The elevation data is the necessary for making landslide susceptibility map which created by geomorphometric approach involves several steps i.e 1) DEM download processing; 2) DEM processing, 3) landslide susceptibility map processing, 4) Field check and 5) layout landslide susceptibility map. DEM processing was done by Integrated Land and Water Information System (ILWIS) open source software. The field survey was done for accuracy of landslide susceptibility map and observation of some local effort to control landslide as well as socio economic assessment. The fields survey including observation the kind of local agroforestry or local plantation which had been growth in each morphology. The grounded research was done to observe the local community behavior in their environment including planting, managing and harvesting the local plantation. The field survey also completed with in depth interview local society. The result of this research is the concept of local wisdom as landslide conservation in the Gede Catchment. The formula scientific explanation is based on literature study which had been mixed with the real condition. We found several fact that the local wisdom in the Gede Cacthment could be conserve the landslide prone area.

3. RESULT AND DISCUSSION

3.1 Landslide in the Study Area

Landslide as the natural disaster has characterization including their physiographic characteristic. It will influence to how to conserve soil as material of landslide. The characterization of landslide that has significant influence of landslide i.e surface material, landuse, slope and rainfall which have significant influence each other's. Landslides will increase in thick soil material and unconsolidated soil (Wang, et al., 2016). Inappropriate of land use on thick soils which has high inclination of slope will increase the potential for landslides. Land use has an effect on soil mass loads (Zuazo and Pleguezuelo, 2008). If land use exceeds the threshold of land mass load, the potential for material movement of the soil increases during the rainy season.

The physic condition of study area of landslide is in the Bromo Volcano system. Its located in the upper slope of Bromo Volcano. Mostly, the morphology of the study area is middle slope. The subsurface material is dominated by deposition of Bromo Volcano and it has thick soil. It can be observed by identified of landslide scarp. The elevation in the study area until 2761 mean sea level. Whereas, for the slope until 89 degree. It makes this area has high potential landslide.

Landslide was become the environmental problem in the study area. There have been several landslides in this area which have caused losses in agriculture and damage to roads and settlements. The inclination and the thick soil condition become the most influencer to landslide occurrence. In addition, the cut of slope inclination more than 15% also become the main factor. It makes unstable slope, thus it will increase the landslide potential.

The typology of landslide in the study area is rotational and translational landslide. Both of landslides are including active and inactive landslide and it is used for land farming with the local agroforestry plantation. Each landslide type has their own characterization based on the road association, river and local agroforestry in the landslide's body. Mostly, the body of inactive rotational landslide is used land farming with vegetation like carrot, potato, apple, coffee, and broccoli. The society were used this inactive landslide because the material of landslide makes the surface material more fertile. Whereas, for the active rotational landslide with cassava vegetation. The body of translational active landslide is not used because the shape of landslide body is planar, steep slope, and having lower density vegetation and the soil material is thinner than the body of rotational landslide. Mostly, the typology of landslide in the study area is the rotational landslide. Based on the landslide susceptibility mapping this area consist stable zone such landslide area and unstable zone. For the stable zone is in the peak interfluves and foot slope (Fig.2). Both of them has low slope thus there are not energy to move the soil material. Whereas, for the unstable zone is started from upper slope until lower slope. The topographic position of the slope is started from peak interfluves until channel bad. Soil material starts to move in the topographic position of the upper slope. The geomorphological process found on the upper slope as an indicator of movement of soil material is the presence of cracks (soil cracks) and erosion. Both geomorphological processes can initiate the movement of soil material, so that it can initiate material movements (Samodra, 2014). The topographic position of the slope that has no force to move the material, namely alluvial and colluvial plains. The topography of the Gede Catchment is largely unstable because of slope cutting for road and river.

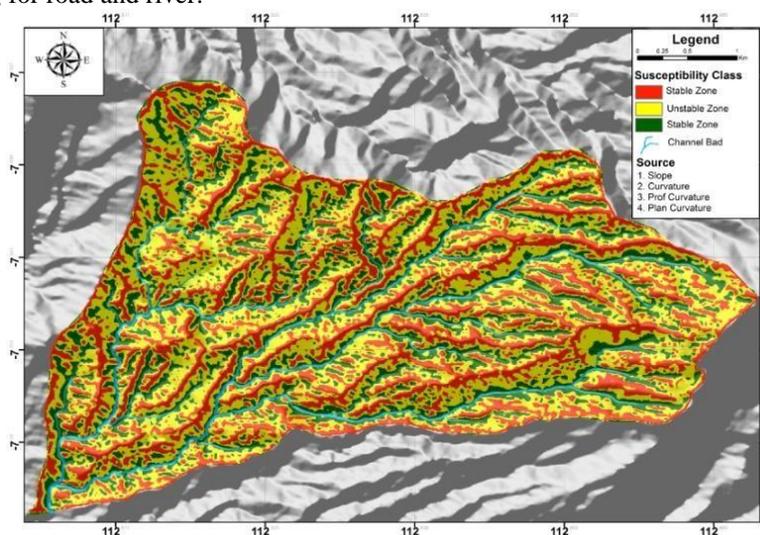


Fig. 2: Landslide Susceptibility Map

3.2 Local Wisdom as Landslide Conservation in the Study Area

Mostly the community of Gede Catchment has known well that their environment has high potential landslide. But, the community of Gede Catchment still living harmony with their environment. The community of Gede's Catchment has local wisdom for living harmony. The local wisdom in this research area can be one of the mitigation ways for landslide risk potential. The local wisdom of Gede Catchment's community is tend how conserve their environment to harmony with landslide potential. The Gede Catchment's community has local wisdom such planted local plantation which considering of economic income, environment and sustainability. The local plantation had been managing with agricultural settings. It means that the local plantation in the study area are based on the ecologically and natural resource management system. Both of them were consider to increase economic income and environmental sustainability. Agroforestry with local mixed gardens can be one of the solutions in environmental management (Zuazo and Pleguezuelo, 2008). This happens because plants are one of the factors that have an influence on soil conditions. This includes

influencing the infiltration process, run off, and soil mass load. Mostly, the land without vegetation has a greater run-off than infiltration. This affects the process of moving soil material during the rainy season.

Landslides as one of the geomorphological processes can be influenced by human activities (Preuth, 2010). It means landslides can occur because they are initiated by humans, but humans can also make conservation efforts through various means as mitigation efforts and reducing the risk of landslides. Community behavior in managing land is the main factor which has influence environmental condition. Therefore, environmental condition has affected and has strongly linked with the human behavior.

Gede Catchment's society had been awareness of living in the study area that has high potential of landslide. The community more selective for determining the type of vegetation in the each unit morphology and considering land cultivation and land uncultivation. Both of them has influence to landslide potential occur. The inclination of slope will be changes if the landslide occurs. It will affect to soil erodibility, run off, and infiltration. The society of Gede Catchment had limited utilize the land that has high slope inclination. As far, the societies don't use the landslide scarp for cultivation. They just cultivated the depositional part of landslide. Nevertheless, the community cannot plant plants carelessly without considering the type and unit of morphology. Communities may only plant several types of plants in certain morphological units. This is important because the type of plant will affect the mass load of the soil.

The land utilization in the Gede Catchment shows spatial arrangement based on physical characteristic in the study area. The spatial arrangement are including type of vegetation, unit morphology and landslide site. The type of vegetation such bamboo, clove and other woody plants has planted in the peak interfluves. The mixed garden such combining of coffee plantation with the horticulture plant such carrot, apple, potato was applied in the upper slope until lower slope. For the foot slope was applied for seasonal vegetation.

The spatial arrangement also applied in the landslide site. There are differences between spatial arrangement in active landslide and inactive landslide. For the active landslide the type of vegetation just grown naturally without planted by society. It will differences with the inactive landslide. Mostly, the society planted several local agroforestry plantation in the spatial arrangement of landslide site. At the crown area, the society planted woody plantation such clove and bamboo. The society has assumed that these plants could conserve the soil movement. But, in fact in the study area the landslide still occurs. Generally, the woody plantation could conserve the soil movement, but it is not appropriate in the study area because the study area has thick soil. Thus, it makes the wood plantation as triggers of landslide because this exceeds the soil mass load. At the landslide body, the society plant horticulture plants such apple, carrot, cassava and coffee with the terrace technique. In the toe of landslide, the society plant the mixed garden also with the type of vegetation such chili and tomato. The spatial arrangement between type of vegetation with the landslide site and unit morphology as community adaptation in the landslide prone area.

4. CONCLUSION

The study area is the mountainous area that has high potential of landslide and intensively for agriculture. As far, the societies are very aware how to conserve their environment. They had been planting local plantation with the agroforestry system and considering the unit morphology and landslide site as adaptation strategy. This strategy adaptation had been considerate the economic income and environmental conservation. The very appropriate conservation is combining environmental aspects and community income. Sometimes, conservation that appropriate for the environment but does not support community income could not apply for a long time.

5. ACKNOWLEDGMENT

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