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ASSESSING LAND USE ARRANGEMENT IN LANDSLIDE PRONE AREA IN THE TAJI VILLAGE, JABUNG REGENCY, MALANG

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Abstract:-
The aim of this research to assess the landuse arrangements in the landslide prone area in the Taji Village, Jabung Regency, Malang. The method was carry out by observation and purposive in-dept interview. The results showed that there were characteristic of arrangement land use after landslide and arrangement the land for agriculture for landslide mitigation. For the land use after landslide, the community use the land for planting the cassava crops. In this case the type of landslide is translational landslide. For the arrangement land which does not occur landslide, the community uses it to plant horticultural crops such as cabbage, pre onion, carrot, apples, coffee, and chilli. The land use arrangements in this study area to landslide disaster risk reduction.

Keyword:- *Land use, arrangement, Landslide, Taji Village*

INTRODUCTION

Land is a resource that can be used by humans to support the sustainability of human life. It has an important role as a medium for growing plants (Fans & Features, 2020; Wang et al., 2020; Yu et al., 2016). However, land also has physical characteristics that must be considered to create land sustainabilitu and based on their function. Land characteristics i.e. topographic conditions, soil types, soil physical properties and existing geomorphological processes that must be considered to appropriate land use. The assessing of land use needed to achieve sustainable land use.

Landuse assessing study is important strategy to conduct a sustainable living environment (Zeng et al., 2020). Land use which not appropriate with the physical conditions of the soil can lead to potential disasters i.e landslides, thus land use will affect the risk of soil loss (Ashraf et al., 2019; Onda et al., 2020; Satir & Berberoglu, 2016; Wang et al., 2020; Yu et al., 2016). Land use which not appropriate with the physical conditions of the soil can lead to potential disasters i.e landslides, thus land use will affect the risk of soil loss.

Landslides are the most frequent disasters in Indonesia. The potential for landslides is influenced by geomorphological conditions and rainfall. Most of the landslides occurred in rough morphological conditions and thick soil conditions (Igwe, 2015). However, landslides can also be initiated by human activities which do not pay attention the physical conditions with the landuse management (Skilodimou, et al., 2018; Barnard., Et al., 2001; Zhang, et al. , 2012). For instance, cutting slopes by humans can trigger landslides. This condition is related to slope stability. Cutting the slope which initiated by human create the unstable slope, thus the potential of landslide is greater.

Geographically, Taji Village is part of Jabung District, Malang Regency. Taji Village has an area of 45.6 km^2. The position of Taji Village is the upper part morphology of Malang Regency and Malang City, thus it has a very influence on villages that are in the lower morphological part. The landscape of Taji Village mostly has hilly morphology and thick soil which from the deposition of Mount Bromo Volcano material. It makes the potential for landslides to occur. The intensity of the process of erosion and landslides causes the movement of soil material on the O horizon and organic matter decreases, thus reducing soil fertility and affecting agricultural production (Blanco Sepúlveda & Aguilar Carrillo, 2015; Maltsev & Yermolaev, 2020; Sadeghi et al., 2020; Wang et al., 2020; Wolka et al., 2020).

Based on the morphological conditions of Taji Village, this area is not appropriate for the living because it is very prone to landslides. However, the community of Taji Village have a way to live harmony in the landslide prone area. There are differences in land use by the community to reduce the landslide risk. The assessing of landuse after landslide and before landslide to reduce the landslide disaster risk is rare. Most of the research regarding land use are assessing land suitability. The research of landuse that produce findings in the field regarding the adapting communities to harmony with nature are interesting things to elaborate. Land use research are important to carry out to create land sustainability.

Methods

Determining the landslide-prone areas of Taji Village through data processing using Arc GIS 10.1. The data is using DEMNAS. Through DEMNAS data and processing using Arc GIS can be seen areas in the Taji Village which has prone to landslides. The observation in the field was done to accuracy checked and validation data. The results of DEMNAS processing are used to elaborate the spatial related between the study area and the surrounding landform units.

Data collection methods were carried out through observation and purposive in-depth interviews with community who have houses close with the landslide prone are. In addition, in-depth interviews were also conducted with the village head to access information about mitigation efforts that had been carried out. The explanation regarding land use is focused on the community's efforts in utilizing land after landslides to minimize the risk of landslides and lands where landslides have not occurred as an effort to prevent landslides

Result and Discussion

Geomorphology of Taji Village and Landslide Characteristics

Taji Village has potential for landslide prone area. It is caused by an area of Taji Village is has hilly morphology, thick soil material which is resulted by deposition of Mount Bromo Volcano material and erodible soil. The types of landslides that occurred in Taji Village were landslides are translational landslide and rotational landslides. Translational landslide typology occurred at several part of peak interfluve morphology and were associated with roads. It was caused by cutting of slope and the slope became unstable. Whereas, for the rotational landslides occur on agricultural land. Most of the landslides that occurred in Taji Village were of the rotational landslide typology.

Rotational landslides is the one of the landslide typology. The rotational type landslide has a landslide body with a curved shape. The volume of soil material that is moved in the rotational type landslide is greater than that of the rotational type landslides. The rotational type of landslide in the Taji Village is mostly used for mixed gardens (Fig.1). Soil conditions was resulted by landslide material have a better fertility rate than areas that are not landslide. Most of the landslide material that occurs in the Taji Villages is horizon A, so the depositional area of landslide material has higher fertility than the non-depositional areas.

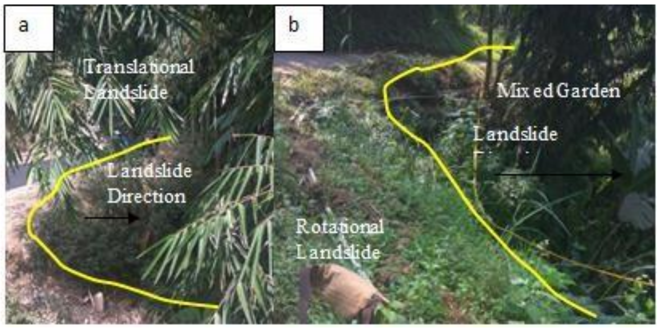

Figure 1: a) x: 703991 y: 9120533; b) x: 703368 y: 9120711

The landslide bodies for translational landslide is flat (planar). Most of the translational landslides that occurred in the Taji Villages occurred at a higher slope value than the rotational type landslides. Landslides of the translational type are mostly associated with roads. This is because most of the roads in the Taji Village cut the slopes, thus the slope become unstable (Figure 2)

Figure 2: a) x: 703774 y: 9121113; b) x: 702295 y: 9120495; c) x: 701662 y: 9120396

Assessing of Landuse in the Study Area

The community of Taji Village have a way to utilize land that has occurred landslides and has not occurred. Each landslide has their characteristic regarding the type of plantation.

Translational landslides has a slope of 30%. The community of Taji Village used translational landslide land for planting cassava plants. Based on the community of Taji Village, planting cassava can reduce the potential for soil material movement. The community of Taji Village utilize land that has not occurred landslides by utilizing multi-stratified plants in each single slope. In the peak interfluve, most of them were planted with woody species i.e bamboo and cloves, the upper slopes to the middle slopes were planted with a combination of coffee, apples, carrots, cabbage, pre onion, while for the lower slopes with chilies, tomatoes and eggplant. The planting system alternating with heterogeneous plant types is better for soil fertility than the same plant types (Keesstra et al., 2016; Yu et al., 2016; Zeiss, 2000). Multistratified planting is one solution to reducing the risk of landslides (Zuazo and Pleguezuelo, 2008).

There are differences landuse after landslides and those where landslides have not occurred. Land use is implemented by the Taji Village community to reduce the potential for movement of soil material. The use of land after landslides and before landslides is implemented by the Taji Village community is one way to reduce the movement of soil material. Land use applications made by the community of Taji Village can be applied to other areas that have the same morphological characteristics.

Landslide Mitigation

Landslide mitigation carried out by the community of Taji Village includes structural mitigation and non-structural mitigation. The Taji Village community has interacted adaptively. The interaction of community adaptation for landslides is making sandsacks on steep slopes that have the potential for landslides occur. The aims to resist the movement of soil material to the lower slope. Most of the sandsack is made on the slopes of the foothills, the slopes adjacent to the highway, and houses. Based on the results of the focus group discussion with village officials and representatives of several communities, it was stated that making sandsack could reduce the risk of dislodging material. Making sandsack is carried out by the surrounding community based on their experience of frequent landslides on houses, roads and rice fields. The community has realized that disasters cannot be avoided but the impact can be minimized. In addition, based on the results of the focus group discussion with village officials and community representatives, the mitigation that has been carried out in the Taji Villages is an effort to reduce multi-disaster risks, i.e socialization, counseling and training on disasters from the Regional Disaster Management Agency (BPBD). Some of the socialization, counseling and training activities for disasters are in the form of socialization of landslide hazard maps.

Conclusion

The community of Taji Village utilizes land after landslide with cassava plants, while land that has not occurred landslides is used for multi-stratified types of plants that consider morphological aspects. In the peak interfluve are planted with woody plants such as cloves and bamboo, while for the upper slopes to the lower slopes are planted with types of plants such as apples, coffee, carrots, cabbage, and pre onions. For the foot slope are planted with eggplant and chilies. The difference land use after landslides and those that have not occurred landslides is one of the mitigation efforts to reduce the risk of landslides and as a preventive measure from landslides.

References

[1]. Ashraf, M., Sanusi, R., Zulkifli, R., Tohiran, K. A., Moslim, R., Ashton-Butt, A., & Azhar, B. (2019). Alley-cropping system increases vegetation heterogeneity and moderates extreme microclimates in oil palm plantations. *Agricultural and Forest Meteorology*, *276–277*(July), 107632. https://doi.org/10.1016/j.agrformet.2019.107632

[2]. Barnard, Patrick., Owen, Lewis., Sharma, Milap., Finkel, Robert. (2001). Natural and Human Induced Landsliding in the Garhwal Himalaya of Northern India. *Geomorphology* , 2135. Barnard, Patrick., Owen, Lewis., Sharma, Milap., Finkel, Robert. (2001). Natural and Human Induced Landsliding in the Garhwal Himalaya of Northern India. *Geomorphology* , 21-35.

[3]. Blanco Sepúlveda, R., & Aguilar Carrillo, A. (2015). Soil erosion and erosion thresholds in an agroforestry system of coffee (Coffea arabica) and mixed shade trees (Inga spp and Musa spp) in Northern Nicaragua. *Agriculture, Ecosystems and Environment*, *210*, 25–35. https://doi.org/10.1016/j.agee.2015.04.032

[4]. Fans, A., & Features, S. (2020). *Landforms, Geomorphology, and Vegetation*. 21–45.

[5]. Igwe, O. (2015). The geotechnical characteristics of landslides on the sedimentary and metamorphic terrains of South-East Nigeria, West Africa. Geoenviromental Disaster, pp. 1-14. doi: DOI 10.1186/s40677-014-0008-

[6]. Keesstra, S. D., Bouma, J., Wallinga, J., Tittonell, P., Smith, P., Cerdà, A., Montanarella, L., Quinton, J. N., Pachepsky, Y., Van Der Putten, W. H., Bardgett, R. D., Moolenaar, S., Mol, G., Jansen, B., & Fresco, L. O. (2016). The significance of soils and soil science towards realization of the United Nations sustainable development goals. *Soil*, *2*(2), 111–128. https://doi.org/10.5194/soil-2-111-2016

[7]. Maltsev, K., & Yermolaev, O. (2020). Assessment of soil loss by water erosion in small river basins in Russia. *Catena*, *195*(June), 104726. https://doi.org/10.1016/j.catena.2020.104726

[8]. Onda, Y., Sweeck, L., Shinano, T., Dercon, G., Yi, A. L. Z., & Kato, H. (2020). Soil and vegetation sampling during the early stage of Fukushima Daiichi Nuclear Power Plant accident and the implication for the emergency preparedness for agricultural systems. *Journal of Environmental Radioactivity*, *223–224*(August), 106373. https://doi.org/10.1016/j.jenvrad.2020.106373

[9]. Sadeghi, S. H., Sadeghi Satri, M., Kheirfam, H., & Zarei Darki, B. (2020). Runoff and soil loss from small plots of erosion-prone marl soil inoculated with bacteria and cyanobacteria under real conditions. *European Journal of Soil Biology*, *101*(October), 103214. https://doi.org/10.1016/j.ejsobi.2020.103214

[10]. Satir, O., & Berberoglu, S. (2016). Crop yield prediction under soil salinity using satellite derived vegetation indices. *Field Crops Research*, *192*, 134–143. https://doi.org/10.1016/j.fcr.2016.04.028

[11]. Skilodimou, Hariklia., Bathrellos, George., Koskeridou, Konstantinos., Rozos, Dimitrios. (2018). Physical and Anthropogenic Factors Related to Landslide Activity in theNorthern Peloponnese, Greece. *Land* , 1-18

[12]. Wang, K., Ma, Z., Zhang, X., Ma, J., Zhang, L., & Zheng, J. (2020). Effects of vegetation on the distribution of soil water in gully edges in a semi-arid region. *Catena*, *195*(September 2019), 104719. https://doi.org/10.1016/j.catena.2020.104719

[13]. Wolka, K., Biazin, B., Martinsen, V., & Mulder, J. (2020). Soil and water conservation management on hill slopes in southwest Ethiopia. I. Effects of soil bunds on surface runoff, erosion and loss of nutrients. *Science of The Total Environment*, *xxxx*, 142877. https://doi.org/10.1016/j.scitotenv.2020.142877

[14]. Yu, Y., Loiskandl, W., Kaul, H. P., Himmelbauer, M., Wei, W., Chen, L., & Bodner, G. (2016). Estimation of runoff mitigation by morphologically different cover crop root systems. *Journal of Hydrology*, *538*, 667–676. https://doi.org/10.1016/j.jhydrol.2016.04.060

[15]. Zeiss, M. R. (2000). Soil health: Managing the biotic component of soil quality - Introduction. *Applied Soil Ecology*, *15*(1), 1–2. https://doi.org/10.1016/S09291393(00)00066-4

[16]. Zeng, Y., Fang, N., & Shi, Z. (2020). Effects of human activities on soil organic carbon redistribution at an agricultural watershed scale on the Chinese Loess Plateau. *Agriculture, Ecosystems and Environment*, *303*(June), 107112. https://doi.org/10.1016/j.agee.2020.107112

[17]. Zhang, Fanyu., Chen, Wenwu., Liang,Shaouyun., Chen, Ransheng. (2012). Human Induced Landslide on High Cut Slope: A Case of Repeated Failures due to Multi-Excavation. *Rock Mechanics and Geotechnical Engineering* , 367-374.

[18]. Zuazo, Duran and Pleguezuelo. (2008). Soil Erosion and Runoff Prevention by Plant Cover. A Review. *Agronomy Journal* , 65-86.

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