ZONING PRONE TO LANDSLIDES THROUGH 3D VISUALIZATION USING GEO CAMERA APPLICATION IN CIKUYA VILLAGE, CULAMEGA DISTRICT, TASIKMALAYA REGENCY

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ABSTRACT

Cikuya Village Culamega District Tasikmalaya District, West Java, landslide prone areas that cause material losses and fatalities. The landslide occurred because Cikuya Village is located in the South Mountain Zone with hilly morphology so that it has a steep slope. Other characteristics cause landslides due to high rainfall intensity, geological conditions, soil types, and land use that are not in accordance with the carrying capacity of the environment. Prevention efforts that can be done by measuring the characteristics of landslide prone and 3D visualization zoning maps using map overlays to produce zoning maps and land suitability using ArcGis 10.5 software and Geo Camera applications The results of this study show the characteristics that cause landslides are high rainfall intensity ranging from 2,203 - 3,054 mm / year, Steep slopes range from 8° - 40°, geological conditions (types of rocks) are divided into two types, namely sedimentary rocks and volcanic rocks, podsolic yellow red soil types that are not good in water escape, as well as land use that is not in accordance with the conditions and carrying capacity of the region. The results of the analysis of assessment, weighting and overlay zoning of disaster-prone areas are divided into three "non-prone" hazardous landslide zones with an area of 7,597 hectares, a "prone" zone with an area of 1,972,147 hectares, and a "very vulnerable" landslide vulnerability zone with an area of 256,968 hectares. Further analysis is that land suitability is divided into three "appropriate" zones with an area of 1,057,391 Hectares, "somewhat appropriate" with an area of 1,080,373 Hectares, and "incompatible" with an area of 98,948 Hectares. It is expected that the results of this study can be a reference for the community in recognizing landslide-prone zone areas in Cikuya Village, Culamega Subdistrict, Tasikmalaya Regency.

Keywords: Landslide Disaster, 3D Visualization, Zoning

1. INTRODUCTION

Landslides are the 3rd largest (third) type of disaster in Indonesia after floods and tornadoes. According to the National Disaster Management Agency (BNPB) in 2017 in Indonesia there were 2,862 natural disasters with details of 979 flood disasters, 886 twisters, 848 landslides taking fatalities (DIBI BNPB, 2019). Based on data on the number of residents in Tasikmalaya district in 2018 reached 1,747,318 people. The need for housing will increase to make all land become built regardless of the impact of disasters on an area.

Based on the document of Disaster Management Plan (PRB) Tasikmalaya District 2020-2024 landslide is a disaster with a high level of risk in Tasikmalaya district with a population affected by 471,857 people, exposed land covering an area of 27,535 ha, as well as losses due to landslides reached Rp.1,140,034,000,000 (bpbd Kabupaten Tasikmalaya, 2020). The large number of people affected by landslides is directly proportional to

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the increasing need for housing so that much land that is not ideal for settlement is forced into a place to lives (Arsyad, 2010). There is a lot of hill trimming, leveling of the slope even the construction carried out on the steep slope or under the slope can destabilize the slope with the threat of great danger (Hakim, Erwin Hilman, 2019).

On 06 November 2018 in Culamega Sub-district there were flash floods and landslides a number of isolated points due to road access covered with avalanche material and caused five deaths (Tribunnews.com, 2017). Cikuya Village District Culamega Tasikmalaya district is a village that is prone to landslides because it is located on a steep slope, if viewed based on the map of disaster insecurity Tasikmalaya. The development of science in the field of Geographic Information Systems facilitates the assessment and visualization of disaster modeling in 3D (Harahap dan Yanuarsyah, 2012). Maps become an important reference for people to understand the condition of residence, but the information made by the government is still too widespread so that the level of error caused will be greater (Eddy Prahasta, 2009). There needs to be a modeling of landslide disaster prone zoning maps that are easier to understand and detail information so that it can be used by various elements of the community and village apparatus as a reference for regional and residential development.

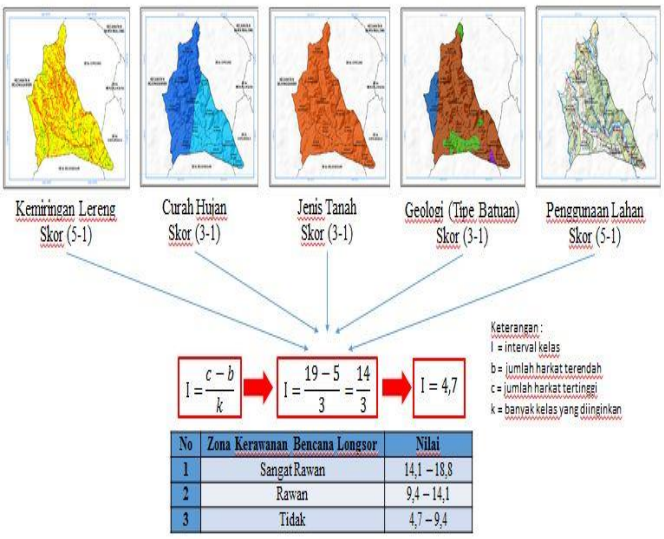
Conditions in the research area are very minimal networks for communication such as constrained internet signals, the unavailability of digital information board screens and the lack of disaster data updates make it difficult for people to understand disaster-prone zoning. Geo Camera application is created to add information about disaster mapping with 3D visualization without the need for internet network. Geo Camera application is considered to be a solution, because people only need to scan barcodes on the map in Cikuya Village so that they can see the map information in 3D and become interactive information.

2. METHODOLOGY

Quantitative descriptive methods are used with data collection techniques through observations, interviews, questionnaires, documentation studies, and literature studies. The population in this study is the entire community of Cikuya Village with a total of 6,353 people or 1,826 households. Sampling techniques used are quota samples by selecting 5 families from 5 hamlets with the worst landslide events from 13 existing hamlets, and purposive sampling for village heads and head of BPBD Tasikmalaya Regency. Data analysis techniques are quantitative analysis, scoring and weighting of each characteristic cause of landslide disasters, as well as map overlays to produce zoning maps and land suitability using ArcGis 10.5 software, Surfer 10, Global Mapper then visualized 3D using geo camera application that has been created.

3. RESULT AND DISCUSSION

3.1 Results



No	Zona Kerawanan Bencana Longsor	Nilai
1	Sangat Rawan	14,1 – 18,8
2	Rawan	9,4 – 14,1
3	Tidak	4,7 – 9,4

Fig. 1 Overlay landslide-prone zoning of Cikuya Village

The results of the grouping of landslide disaster prone zones in Cikuya Village, Culamega District, Tasikmalaya District are grouped into 3 class intervals in accordance with the calculation of variables, namely the total area between polygon scores and included in the formula according to the research reference. The result of the summation process is then classified based on the classification class of landslide disaster prone to be determined by using the calculation of formulas (Indarto, 2012).

$$I = (c - b) \div k$$

I=(19-5)/3=14/3

I=4.7

Description:

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I = class interval
b = lowest number of harkat
c = highest number of harkat
k = many classes

The class interval obtained is 4.7 with a total of 3 classes, so that landslide disaster prone zones are obtained according to the reference of calculated indicators that produce interval values to determine the total value of each interval.

Table 1. Summation of Highs and Lows (2020 Analysis)

No	Variabel	highest score	lowest score
1	Slope	5	1
2	Rainfall Intensity	3	1
3	Geological Conditions	3	1
4	Soil Type	3	1
5	Land Use	5	1

Table 2. Landslide Prone Zone Analysis Results

No	Landslide Prone Zone	Value
1	Very Prone	14,1 – 18,8
2	Prone	9,4 – 14,1
3	Not Prone	4,7 – 9,4

3 categories of zone classification based on interval scoring are:

1) Very prone: the number of scoring >14.1 if the rainfall ranges from 2000 - 3000 mm / year, with a slope of >8 ° (8 ° - 90 °), with the nature of rocks, or berliat-sandy with diverse land use, with an area of 256,968 ha Cikuya Village.

2) Prone: the number of scoring is 9.4-14.1 if the rainfall ranges from 2000 - 3000 mm / year, with slopes ranging from 3 ° - 40 ° , with the properties of rocks with diverse land use, with an area of 1.972,147 Ha Cikuya Village.

3) Not prone: the number of scoring is 4.7-9.4 if the rainfall ranges from <2000 mm /year, with slopes ranging from 0°-3°, with alluvial rock properties or sedimentary with varying land use, with an area of 7,597 ha Cikuya Village.

3.2 Discussion

Cikuya Village located in the southern region of Java Island precisely located at coordinates 7°36'0,764"LS - 108°1'11,672" E or 7,60021222° S – 108.01990889°. The characteristics of landslide-prone areas of Cikuya Village are classified based on scores on 5 aspects, namely slope slope, rainfall, geological conditions, soil type and land use (PVMBG, 2015).

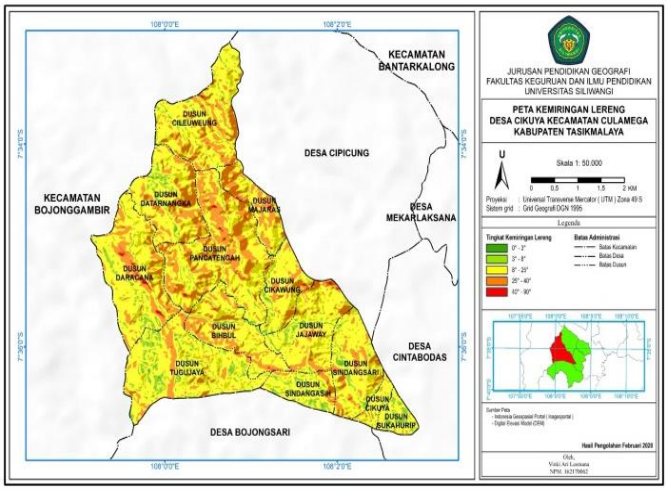

Fig. 2 Slope Map of Cikuya Village

Based on the measurement point in Cikuya Village, Culamega Subdistrict which is divided into 6 measurement points conducted in 5 samples of hamlets that have the worst damage to the purpose to test the slope level against landslide disasters.

No	Lokasi	Lereng				Koordinat
		KL (°)	PL (m)	TL (m)	AL	
1	Titik 1	24,80	70,46	29,53	BD	07°35'43,15"LS - 108°02'50,77"BT
2	Titik 2	20,90	31,89	11,39	TG	07°36'30,95"LS - 108°02'19,49"BT
3	Titik 3	29,90	28,98	14,39	BL	07°35'48,88"LS - 108°01'45,17"BT
4	Titik 4	24,33	18,54	12,44	TML	07°36'03,99"LS - 108°01'17,14"BT
5	Titik 5	29,05	28,27	13,73	TML	07°36'00,70"LS - 108°01'12,14"BT
6	Titik 6	24,09	94,47	23,77	U	07°36'20,03"LS - 108°01'13,01"BT

Fig. 3 Measurement data of cikuya village slope research

Based on the results of slope analysis in **Fig. 3** conducted using mapping software get data using Digital Elevation Model (DEM). Slopes with a slope of 8 °-25 ° has the most wide area of 1,483,926 steep categories that have a high risk of landslides that can threaten at any time.

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Table 3. Cikuya Village Rainfall Data Scoring

No	Station Name	Rainfall (mm/y)	Score	Area (Ha)	Area (%)
1	Karangnunggal	3.054	3	1.140,563	51%
2	Singaparna	2.203	2	1.096,149	49%
Total				2.236,721	100%

The rainfall data in the table 3 is the highest data for the last five years based on the results of station measurements. Karangnunggal observation station has a high rainfall intensity compared to Singaparna observation station which is 3,054 mm / year with an area of 1,140,563 ha or 51% of the area of Cikuya Village has a score of 3.

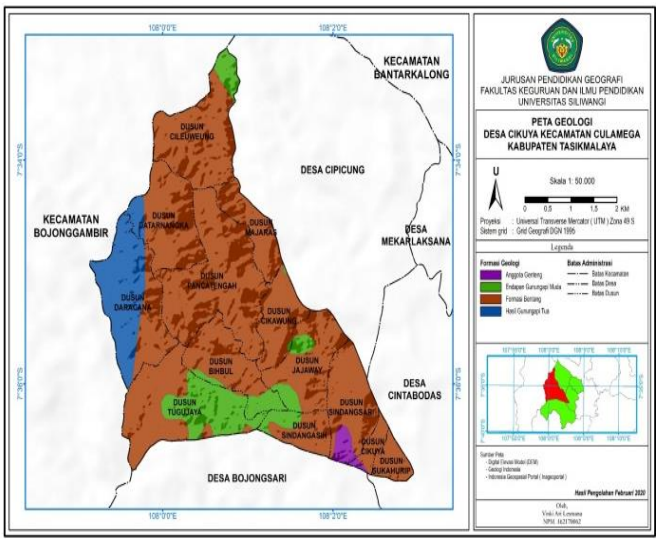

Fig. 4 The geological formations map of Cikuya Village

There are 4 geological formations in Cikuya Village, Culamega District, Tasikmalaya Regency, with the dominance of bentang geological formations at 1,768,712 ha. The effect of landslide disasters due to geological formations or slope builders is less solid sedimentary and volcanic rocks. Weather as a factor that accelerates the occurrence of weathering makes rocks that have rigid properties turn into weathered and easy erosion (Sriyono, 2017).

The land in Cikuya Village varies, with steep slopes, diverse morphology. Land use consists of residential land, rice fields, fields, moors, gardens, forests and shrubs which are the most dominating land. The big problem in Cikuya Village, Culamega Subdistrict, Tasikmalaya, is the lack of understanding of the community about the threat of disasters, especially landslides due to the absence of ancestral heritage regarding landslides.

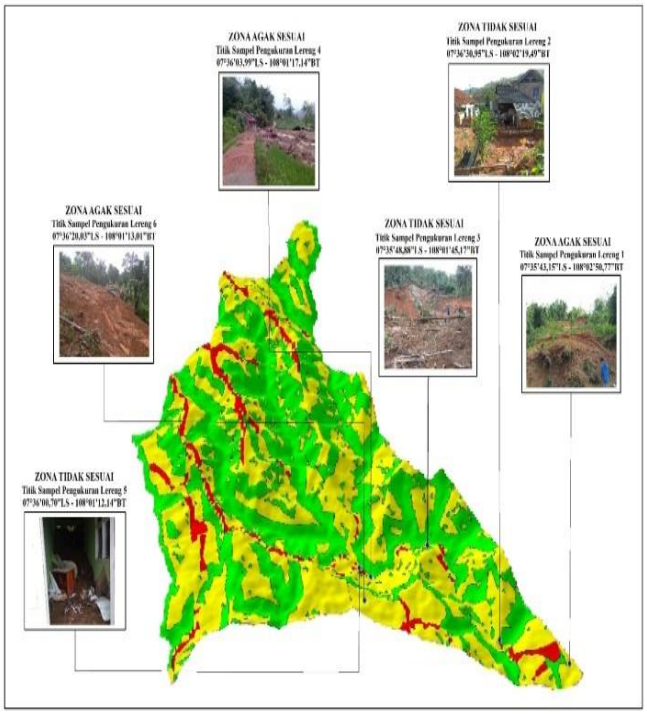

Fig. 5 Type land map of Cikuya Village

Table 4. The result of the calculation of the calculation of land use score of Cikuya Village

No	Land Suitability	Area of the settlement (Ha)	Presentase

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1	Appropriate	9,375	16,5%
2	Quite Appropriate	32,823	57,9%
3	Not Appropriate	14,486	25,6%
Total		56,684	100%

Landslide prone zoning through 3D visualization using Geo Camera application in Cikuya Village, Culamega Subdistrict, Tasikmalaya Regency is an analysis process to zone areas that belong to the landslide prone zone. The last 2 years landslide disaster threatens the safety of the community, damages settlements and damages the agricultural area of the community. Landslide material hoarding and closing road access can lead to other disasters such as flooding because the river body is covered with avalanche material. The location of landslide disasters in the last 2 years based on the results of vloting in the field scattered almost all hamlets. Landslide points that occur in the research area are on the use and closure of different land, starting from landslide disasters that occur in the settlement of cikuya village, landslide disasters that occur in agricultural land such as rice fields, plantations, moors and farmland residents, then landslide disasters that occur on steep cliffs filled by shrubs.

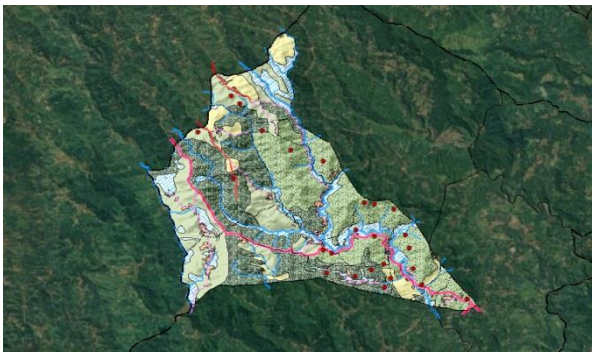

Fig. 6 Landslide points in Cikuya Village

Landslide prone zone in Cikuya Village, Culamega sub-district is divided into 3 insecurity zones and further analysis is carried out which is divided into 3 categories of land suitability. The reference guidelines in determining landslide disaster prone zones and land suitability analysis refer to the reference indicators of Determination of Land Movement Vulnerability Zone by PVMBG (2015), Regulation of the Head of National Disaster Management Agency No. 2 of 2012, Regulation of the Minister of Public Works No. 22 of 2007 concerning Spatial Arrangement of Landslide Prone Areas, and Basic Concepts of Spatial Analysis.

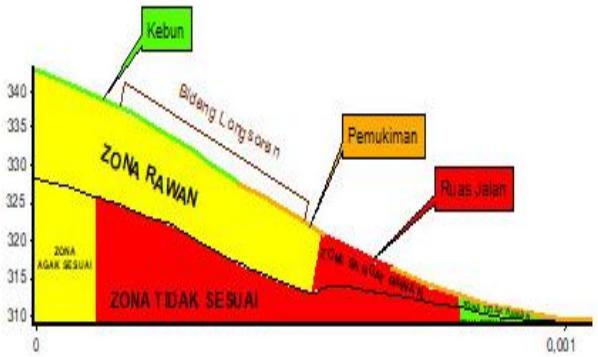

Fig. 7 Results of landslide cross section of Cikuya Village

Zoning map of landslide disaster prone areas through 3D visualization using Geo Camera application in Cikuya Village, Culamega District, Tasikmalaya District is created using scoring and weighting, namely overlaying the map of each variable or characteristic of landslide prone. Analyzed using Arcgis 10.5 mapping app, Surfer 10, Global Mapper 3D results can be viewed using Geo Camera app.

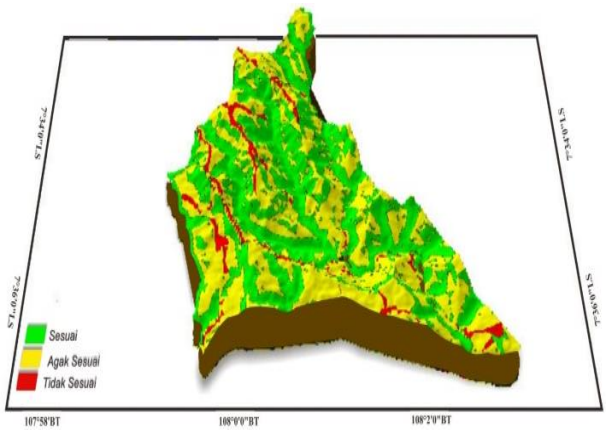

Fig. 8 Results of 3D map of landslide Prone zone

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Fig. 9 View of landslide-prone 3D map and barcode scan on the Geo Camera App

Landslide disaster prone zoning map and land conformity analysis using Geo Camera application can be used in learning in schools as an interactive learning media in the form of 3D maps, can be used by teachers in teaching without using powerpoint viewer projectors or images because the form of maps displayed in 3-dimensional form only requires markers scanned using mobile phones by downloading the Geo Camera application.

4. CONCLUSION

Characteristics that cause landslides are high rainfall intensity ranging from 2,203 - 3,054 mm / year, Steep slopes range from 8° - 40°, geological conditions (types of rocks) are divided into two types, namely sedimentary rocks and volcanic rocks, podsolic yellow red soil types that are not good in water escape, as well as land use that is not in accordance with the conditions and carrying capacity of the region. The results of the analysis of assessment, weighting and overlay zoning of disaster-prone areas are divided into three "non-prone" hazardous landslide zones with an area of 7,597 hectares, a "prone" zone with an area of 1,972,147 hectares, and a "very vulnerable" landslide vulnerability zone with an area of 256,968 hectares. Further analysis is that land suitability is divided into three "appropriate" zones with an area of 1,057,391 Hectares, "somewhat appropriate" with an area of 1,080,373 Hectares, and "incompatible" with an area of 98,948 Hectares. Landsle-prone zoning in Cikuya Village, can be use as one of references by the government and the village community in crarying out development and regional plan, forming evacuation teams and desaster response communities.

5. ACKNOWLEDGEMENTS

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