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EROSION HAZARD LEVEL IN THE BAYANG SANI RIVER BASIN

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ABSTRACT: This research is a continuation of previous research on measuring the erodibility of the soil in the Bayang Sani watershed. This research aims to reveal the level of erosion hazard by estimating the volume of soil lost in a field when erosion occurs in the Bayang Sani watershed. This research is quantitative research with a survey method. Data collection techniques were measured in the field and analyzed quantitatively using the Universal Soil Loss Equation (USLE) formula. The results obtained in this study were the level of erosion hazard in the Bayang Sani watershed, namely heavy and very heavy (8.22 – 36.07 tons/ha/year. The weight category on land units V3.III.Ht.Tomp.Lat (8, 22) and very heavy F3.II.Kc.Qal.Lat (33.31 tons/ha/year), V2.II.Kc.Tomp.Lat 36.07 tons/ha/year), V2.II.Sm. Comp. Lat (29.25 tons/ha/year).

Keywords: *Erosion Hazard Level, Erodibility, Bayang Sani River Basin*

1. INTRODUCTION

Erosion is a natural phenomenon in which there is erosion of the surface of the land caused by the movement of wind and water [12]. A stretch of land will always experience a process of erosion, where erosion will occur in one place; in another, a landfill will occur, so its form can change [5]. The amount of erosion that can occur depends on several factors, such as soil type, climate, topography, and land use [13].

In addition, the length of the slope and the slope of the slope also have a significant role in determining the intensity of erosion. The longer the slope, the volume of water that accumulates on it will also be large and will then descend with increasing speed and volume [6]. The soil at the bottom of the slope will experience considerable erosion from the soil at the top of the slope because the further down, the more water that collects, and the flow velocity will also increase so that the erosion power will be greater [3].

The increased level of erosion hazard has serious implications for human life. First, soil erosion can threaten the sustainability of food systems. Eroded soil loses the fertile soil layer essential for plant growth. This results in decreased agricultural productivity, cause food scarcity, and increased dependence on food imports [1]. In addition, erosion can damage infrastructure, reduce the availability of clean water, and increase the risk of natural disasters such as landslides and floods [4].

This research is a continuation of previous research on measuring the erodibility of the soil in the Bayang Sani watershed. The results obtained from previous research were the level of soil erodibility in the Shadow Sani watershed, namely good and moderate (0.15-0.28) [8]. As a follow-up study, the authors seek to reveal the erosion hazard level by estimating the volume of soil lost in a field when erosion occurs [2]. being transported can also solve the problem (Santoso et al., 2017).

The erosion hazard level can be analyzed quantitatively using the Universal Soil Loss Equation (USLE) formula [9]. The use of the USLE method allows planners to estimate the average rate of erosion of a particular soil on a steep slope with a certain rain pattern for each type of cropping and management actions (soil conservation) that may be carried out or are being used [11].

2. RESEARCH METHODS

2.1 Research Sites

This research was conducted in the Bayang Sani Watershed, Bayang District, Pesisir Selatan District, West Sumatra Province. Geographically, the Bayang Sani watershed is located at 100°33'20" E - 100°37'.50" E and 1°14'46" S - 1°12'15" S.

2.2 Tools and Materials

The data collection process in this study uses several tools and materials. The tools used in this study were an altimeter (as a tool to obtain altitude data for research sites), tape measure (as a tool for measuring slope length), GPS (a tool for determining coordinates), Abney Level (as a tool for measuring slope), geological hammer and sample ring (as a tool in taking samples at research locations). Then the material used in this research is the research location which is sourced from the Batumbuk Water Topographic Map scale 1: 50,000 South Coastal Spatial Planning, then Land Use Maps, Slope Maps, Soil Type Maps, Geological Maps, and Land Form Maps are used as materials to make Landform Maps. , where all of these maps are sourced from the Batumbuk Water Topographic Map Scale 1: 50,000 Bappeda Pesisir Selatan District.

2.3 Data Collection Technique

This research is quantitative research with a survey method. Data collection techniques are carried out by measuring in the field. The results of field measurements will be tested at the West Sumatra AIAT laboratory to determine soil type, structure, permeability, texture, and organic matter. Afterward, the results will be adjusted to the soil erodibility (K).

The samples in this study were taken using area sampling techniques based on variations in land units. The samples in this study were land units obtained by overlaying landform maps, slope maps, geological maps, soil type maps, and land use maps.

Sampling was carried out based on the Purposive Random Sampling technique, namely determining the sample points randomly assigned based on the objective, where the randomly assigned samples could represent all variations of land units to determine the level of credibility in the Bayang Sani Watershed. The Bayang Sani watershed has 16 land units. From this land unit, four land unit profiles were taken as samples suspected of having the greatest changes in erodibility and soil erosion rates. The 4 sample points are shown in Table 1, and the research sample map is shown in Figure 2.

Table 1. Research Sample on Land Units

No	Land Units	Area
1	F3.II.Kc.Qal.Lat	2,98 ha
2	V2.II.Kc.Tomp.Lat	4,4 ha
3	V2.II.Sm.Tomp.Lat	0,76 ha
4	V3.III.Ht. Tomp.Lat	97,58 ha

2.4 Data Analysis Technique

Analyze Erosion Hazard Level used the formula proposed by Wischmeir and Smith [14] with the USLE formulation as follows:

A = R x K x L x S x C x P
A = Soil erosion rate (tonnes/ha/year)
R = Rain erosivity index
K = Soil erodibility index
L = slope length
S = slope slope
C = Vegetation cover index
P = Index of land management or soil conservation measures

Table 2. Erosion Hazard Grade Class [10]

No	Class	Erosion Rate (ton/ha/th)	Erosion Hazard
1	I	< 1,75	Very Light
2	II	1.75-17,50	Light
3	III	17,50 – 46,25	Currently
4	IV	46,25-92,50	Heavy
5	V	>95,50	Very heavy

3. RESULTS AND DISCUSSION

The Universal Soil Loss Equation (USLE) general soil loss equation was used to determine the amount of soil loss or surface erosion in this study. The results of calculating the amount of soil loss and the value of the erosion factor in the study area land unit are as follows:

a. Erosivity

The erosivity value of the rain in the study area was obtained from the calculation of the average rainfall for the last 10 years in Table IV.2 which was then processed using the formula EI30 = -8.79 + (7.01 x R), the erosivity value (R) of the study area are as follows: 2176.22 cm/month.

Rain's erosivity value is one factor causing erosion because it generates kinetic energy against the soil, which can break down soil aggregates and then produce surface runoff on the soil through which it passes.

b. Erodibility (K)

Erodibility (K) is one of the factors that determine the amount of erosion that occurs in a land. Based on the results of labor analysis to determine the erodibility value (K) using the Bouyoucos method or the so-called clay ratio method (% sand, % dust to clay content %) the erodibility value of the study area can be seen in table 3 below :

Table 3. Erodibility Value (K) Bouyoucos Method

No	Land Units	Value
1	F3.II.Kc.Qal.Lat	1,42
2	V2.II.Kc.Tomp.Lat	1,85
3	V2.II.Sm.Tomp.Lat	1,12
4	V3.III.Ht. Tomp.Lat	2,59

c. Length and Slope (LS)

The length and slope values (LS) were obtained from field surveys and then calculated

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using the equation proposed by Pangimbatan, 2011 as follows:

LS = 0.2 s1.33 +0.1

Information :

LS = length and slope index

S = slope slope

Then the LS value in the study area is as follows. It can be seen in Table 4 as follows:

Table 4. Slope and Long Slope (LS) Value of the Study Area

No	Land Units	Value
1	F3.II.Kc.Qal.Lat	0,154
2	V2.II.Kc.Tomp.Lat	0,128
3	V2.II.Sm.Tomp.Lat	0,12
4	V3.III.Ht. Tomp.Lat	0,146

d. Land Cover and Conservation Measures (CP)

The study area's land cover and conservation measures are mixed gardens and shrubs. Based on the results of observations in the field and then calculated with the C x P equation. For this reason, in analyzing the P = 1 value for all research locations, these two factors are combined into a CP index, while the CP value is as follows, which can be seen in Table 5, following :

Table 5. Land Cover Values and Conservation Measures (CP)

No	Land Units	Value
1	F3.II.Kc.Qal.Lat	0,07
2	V2.II.Kc.Tomp.Lat	0,07
3	V2.II.Sm.Tomp.Lat	0,1
4	V3.III.Ht. Tomp.Lat	0,01

e. Large Value of Land Loss (A)

To determine erosion, the soil solum thickness and erosion measurements are used in Table III.10. Factor value of

A = R.K.L.S.C.P

For potential erosion is as follows:

The erosion factors in the study area are as follows: erosivity (R) 2176.22 mm/bl, erodibility (K) 0.12 –2.59, length and slope (LS) 9.34–34.54, land cover and conservation measures (CP) 0.1 – 0.07. Furthermore, based on the results of the calculation of the erosion value, the erosion rate value for each land unit is between 8.22 – 36.07 tons/ha/year, more details can be seen in Table 6, as follows:

Table 6. Calculation of Erosion in Land Units with the USLE Method

No	Land Units	Value
1	F3.II.Kc.Qal.Lat	33,31
2	V2.II.Kc.Tomp.Lat	36,07
3	V2.II.Sm.Tomp.Lat	29,25
4	V3.III.Ht. Tomp.Lat	8.22

Based on the table above, it can be seen that the erosion rate of tons/ha/year on 4 land units found 2 classes of erosion hazard levels, namely very heavy and heavy. On the land unit F3.II.Kc.Qal.Lat with mixed garden land use, the erosion rate was 33.31 tons/ha/year (very heavy). On land unit V2.II.Kc.Tomp.The erosion rate of land use mixed gardens was 36.07 tons/ha/year (very heavy) on land unit V2.II.Sm.Tomp.Lat land use shrubs the rate value erosion of 29.25 tons/ha/year (very heavy), and on the V3.III.Ht land unit. Tomp.Lat use of forest land has an erosion rate of 8.22 tons/ha/year (weight).

Erosion factors with the formulation of the USLE method are Rain erosivity (R), Soil Erodibility (K), Length and Slope (LS) factors, and Soil Use and Management (CP) factors. Based on the analysis of erosion estimation using the USLE method for each unit of land, the largest erosion rate value occurs in the land unit F3.II.Kc.Qal.Lat, with an erosion rate of 36.07 tons/ha/year, is included in the very heavy category where the land use is mixed gardens at a slope level of 38% (steep) with latosol soil type, followed by land unit V2.II.Kc.Tomp.Lat, with an erosion rate of around 33.31 tons/ha/year, is included in the very heavy category where the land use is mixed gardens at a slope level of 23% (sloping) with latosol soil type.

Furthermore, the land unit V2.II.Sm.Tomp.Lat, with an erosion rate of around 29.25 tons/ha/year, is included in the very heavy category where the land use is shrubs at a slope level of 18% (sloping slope) with latosol soil types, and the lowest is in the land unit V2.II.Sm.Tomp.Lat, with an erosion rate of around 8.22 tons/ha/year, is included in the heavy category where the land use is a forest at a slope level of 33% (sloping slope) with latosol soil types.

The previous results have obtained land unit maps which are the result of merging by overlaying the three erosion factors and then entering the results from the erosivity of rain factor analysis into the multiplication of erosion factors based on the USLE method through attribute data on land units so that the resulting magnitude erosion of the Bayang Sani watershed in each land unit. The erosion rate map can be seen in Figure 3.

4. CONCLUSION

The level of erosion hazard in the Bayang Sani watershed is heavy and very heavy (8.22 – 36.07 tons/ha/year. The heavy category for land units V3.III.Ht.Tomp.Lat (8.22) and very heavy F3. II.Kc.Qal.Lat (33.31 tons/ha/year), V2.II.Kc.Tomp.Lat 36.07 tons/ha/year), V2.II.Sm.Tomp.Lat (29.25 tons/ha/year).

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