Level of Erosion Hazard in Buffer Zone of Great Forest Park Sultan Syarif Hasyim Riau

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Abstract. The buffer zone of Great Forest Park Sultan Syarif Hasyim, is adjacent to the conservation area that must be protected. Conditions of this hilly area there are water dams and some areas open because of forest burning. In the area there are traces of human activities to open and work the land. This will result in erosion, which impacts the silting of the dam. The purpose of this study is to identify the level of erosion hazard. This research uses survey method. Data retrieval is done by field checks. The data taken, among others; land cover or land use pattern and soil type at the study site. The result of calculation of erosion rate value by using USLE formula then classified into five classes, which is very light, light, medium, heavy, and very heavy. The level of erosion hazard for the area around the dam at the study site shows the category from mild to moderate. The lowest alleged soil erosion is found in the forest and highest in agricultural crops. The area of agricultural crops has a category of erosion hazard at a moderate level with an estimated erosion of 68.19 tonnes / ha / year. And areas with forest cover in the category of light erosion hazard with an estimated erosion of 27.15 tonnes / ha / year

Keywords: buffer zone, land, level of erosion hazard

1. Introduction

The erosion at the top of the soil surface by the movement of water or wind is a natural phenomenon, commonly called erosion. Erosion depends on natural factors on the site of the erosion, but with population growth, humans also play an important role in erosion. Natural factors that affect erosion include: soil erodibility, landscape and climate characteristics. Further, the buffer zone of the Great Forest Park Sultan Syarif Hasyim located in Siak Regency, Riau Indonesia, is a border area with conservation areas that must be protected. Conditions of this hilly area there are water dams and some areas open because of burning. Dams located in the area is a source of water for the Regional Water Company (PDAM) in the district. In the area there are traces of human activities to open and work the land. This will result in erosion, which impacts the silting of the dam. As a result of human influences such as land use that is not in accordance with the allocation or land management that is not based on soil and water conservation measures in the area will increase the rate of erosion, therefore it is necessary to predict the level of erosion hazard. Prediction of erosion hazard level used Universal Soil Loss Equation (USLE) method with the help of Geographic Information System.
Knowing the magnitude of erosion that occurs in a region is important because in addition to knowing the amount of land that is transported can also be used as one step to find a solution of the problems mentioned above. Therefore, to know the amount of erosion that occurs need to do research on the level of erosion hazard in the buffer zone of Great Forest Park Sutan Syarif Hasyim. Therefore, the purpose of this study was to identify the level of erosion hazard through erosion prediction by USLE method.

2. Research Methods

This research was conducted in the area around the dam which is administratively located in Minas District of Siak Regency, Riau Province. The time it takes to do this research for 1 month. The tool used in this study is a computer using ArcGIS software 10.3, digital cameras, GPS, and stationery. While the materials used in this study is a digital map slope, land cover map, rainfall data, and soil type map around the dam.

2.1 Data collection

This research uses survey method. The data collected consists of primary and secondary data. Primary data retrieval is done during field check. The primary data collection to know land cover or land use pattern and soil type around in research location. While secondary data include rainfall data, soil type digital map, digital land cover map and digital map of the rough.

2.2 Data processing

For map making of Erosion Hazard Level (EHL) arithmetic method used in overlay process of erosion hazard parameters in the form of a method of harnessing the weight of each vulnerability parameter of erosion hazard level. Making grade interval values of erosion hazard class aims to differentiate the class of hazard levels from one another. The formula used to create a modified interval class of the USLE formula is

\[ A = R \times K \times LS \times CP \]

Where:
- \( A \) = Annual Land Erosion (ton/ha/yr)
- \( R \) = Erosivity
- \( K \) = Erodibility
- \( LS \) = Long Factor
- \( CP \) = Crop Management Factor and Conservation Measures

2.3 Class level of erosion hazard

The result of calculation of erosion rate value by using USLE formula then classified into five classes, which is very light, light, medium, heavy, and very heavy. Table 1 shows the classification of EHL.

| Class EHL | Loss of land (ton/ha/yr) | Categories    |
|-----------|--------------------------|---------------|
| I         | < 15                     | Very Light    |
| II        | 16-60                    | Light         |
| III       | 60-180                   | Medium        |
| IV        | 180-480                  | Heavy         |
| V         | > 480                    | Very Heavy    |

Source: Ministry of Forestry (1998)
3. Results and Discussion

Types of land cover that exist in the research area and based on survey results there are 5 types namely: primary forest, agricultural land, shrubs, vacant land and lakes. The type and extent of each land cover can be seen in Table 2.

| No. | Land Cover      | Area (Ha) |
|-----|-----------------|-----------|
| 1   | Primary Forst   | 79.59     |
| 2   | Agriculture Plants | 1.39   |
| 3   | Shrubs          | 8.97      |
| 4   | Vacant Land     | 1.92      |
| 5   | Dam             | 17.13     |

Source: Results of processing (2018)

To determine the level of erosion hazard in the research area used several variables namely rainfall, soil type, slope level, and type of land cover. The level of erosion hazard can be seen in Table 3.

| No. | Land Cover     | Category | Erosion (Ton/ha/yr) |
|-----|----------------|----------|---------------------|
| 1   | Primary Forst  | Light    | 27.15               |
| 2   | Agriculture Plants | Medium | 68.19               |
| 3   | Shrubs         | Light    | 30.59               |
| 4   | Vacant Land    | Light    | 32.79               |
| 5   | Dam            | -        | -                   |

Source: Results of processing (2018)

The calculation of the erosion hazard for the area around the lake in the research location shows the category from mild to moderate. Area of agricultural crops with an area of 1.39 ha has the category of erosion hazard at a moderate level with the estimated erosion that occurs is 68.19 tons /ha/year. This happens because most of the land is managed by opening and cultivating the soil to grow crops, so when it rains some of the soil material drifts towards the dam. It is also influenced by the direction of plant beds that are made parallel to the slope, which can accelerate the rate of surface water. This agrees with, that the longer the slope on the ground will be the greater the speed of water flow on the surface so that the erosion of the parts of the soil is greater.

The type of forest cover located in the research location has an area of 79.59 ha with the category of light erosion hazard with the estimated erosion of 27.15 tons/ha/year. In this area there is still good enough tree vegetation density so that the rate of erosion is retained by trees (canopy, stem, root) and forest litter as infiltration. According to, mulch or litter can minimize soil erosion caused by rainwater, heighten soil aggregation and improve soil structure and maintain water holding capacity high enough to reduce the amount of surface flow and erosion. However, in this area there is still a little erosion because some of the trees are still relatively small. The lowest alleged soil erosion is found in the forest and highest in agricultural crops.

The level of erosion hazard can basically be determined from the calculation of the ratio between the rate of soil erosion and the rate of erosion that is still tolerated. Factors of crop management and conservation measures are important factors in erosion on a research field. This is in accordance with statement, the successful implementation of soil conservation program one of the important
information that must be known is the level of erosion hazard (EHL) in a study area. References states that soil properties that affect soil sensitivity to erosion are soil texture, shape and soil structure, infiltration, soil permeability, organic matter content, field capacity, thickness of horizon and moisture content. By knowing the level of erosion hazard of an area, the priority of land rehabilitation can be determined. Map of erosion hazard level can be seen in Figure 1 below.

Figure 1. Map of Category of Erosion Hazard Level (EHL) in Research Area

4. Conclusion

The level of erosion hazard for the dam area in the study sites shows the category from mild to moderate. The lowest alleged soil erosion is found in the forest and highest in agricultural crops. The area of agricultural crops has a category of erosion hazard at a moderate level with an estimated erosion rate of 68.19 tons/ha/year. And areas with forest cover in the category of light erosion hazard with an estimated erosion of 27.15 tons/ha/year.

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