Carrying capacity water control procedures of land use changes in sub watersheds Cimanuk upstream using GIS (Geographic Information System)

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Abstract: Subzone Cimanuk sub-watershed upstream is playing an important role towards the conservation of water resources for the downstream subzone. To meet the needs of the community, drinking water for agricultural irrigation. However, the amount of land conversion causes the water system in the watershed disturbed. This study aimed to analyze the changes in land use in the watershed Cimanuk upstream and analyze changes in the carrying capacity of the water system upstream use Cimanuk geographic information systems. The analysis shows that it has increased there use of its land area cultivated by horticultural fields such as carrots, potatoes, and other crops. Food and agricultural land development in research, at least from 2005 to 2015, has an adverse impact on the functioning of the Sub-Basin Upstream Cimanuk characterized by decreasing the carrying capacity for water regulation. Or that the development of agricultural land in this area is actually very appropriate if only from the aspect of that is because of relatively fertile landforms (volcanic areas), but the development has destroyed sub-watershed function itself as a water catchment area.

Keyword: water regulation, changes in land use and geographic information systems.

1. Introduction

Watershed (DAS) Cimanuk is a river in the province of West Java. Cimanuk River has an important role in providing water for the needs of the surrounding community. In administrative DAS past four districts, namely Cimanuk Garut, Sumedang, Majalengka, and Indramayu district. Cimanuk watershed has a very important role in the local and national arena in the provision of water needs. Indramayu is downstream of the watershed Cimanuk is one of the largest rice producers in Indonesia in the supply of rice. But since the 2008 drought occurred in Indramayu resulted in 461 ha of rice fields affected by drought in the dry season and the rainy season flooded. Surely this community suffered heavy losses.

This is a big question about the carrying capacity of the watershed environment. Changes in land use and physical environmental conditions need to be the focus of attention because there is a correlation between the use of land to the physical conditions in the watershed, because it can increase surface flow in the watershed. According [1], [2], [3], [4], [5], [6], [7] Ecosystem watershed upstream part is a very important part because it has a protective function against all parts of the watershed, one of them as a function of the water system. Therefore, watershed upstream the focus of research.

According [8], [9], [10], [11], [12] Characterized as the upstream watershed areas of conservation, the watershed is an area downstream utilization. Watershed upstream section is of significant importance, especially in terms of protection function water system, therefore every
occurrence of activities in upstream areas will impact downstream areas in the form of changes in fluctuation and transport of sediment and dissolved materials in a water flow system. [13], [14], [15], [16], [17], [18], [19], [20] Watershed ecosystem, the upper part has a function of protection against the whole watershed. This protection, among others in terms of water function. The environmental carrying capacity of a watershed is an important factor that must be considered for the process of sustainable development that can be implemented in the sense of being able to meet the needs of the present without ignoring the ability of future generations to provide the availability of water to meet water needs. Therefore, we need a method that can help in the study's analysis by [21]. GIS applications can be used for various purposes as long as it processes the data as a geographic reference or can also be interpreted. The data is an object that can be presented in physical form and has a spatial location by [22], [23]. The main aim of the utilization of the Geographic Information System is to simplify get information processed and stored as an attribute of a location or object. Also, the usage of Geographic Information System application can also facilitate spatial analysis of an object, as in the lab below. Noting the above, the study aims to:

1) Analyze changes in land use in the Cimanuk watershed upstream and
2) Analyze the changes in the carrying capacity of the water system upstream use Cimanuk geographic information systems.

2. Research Methods

Data used in this study are primary data and secondary data. Primary data results from an interview with an expert using a questionnaire semantic differential. The differential semantic questionnaire is one form of measurement instruments in the form of a scale, which was developed by [24]. Analysis of carrying capacity of water regulation on land-use changes using the geographic information system (GIS) [25], [26]. Analysis of environmental capacity for carrying water regulation in this study with the landscape approach is by using force sub-facets land as the unit of analysis or mapping unit (mapping unit). The mapping unit resulting from the overlap (overlay) between land facet maps with land use maps. Of each sub-unit of the subsequent land, facet rated supportability based on ecosystem services of experts. Further analysis was also performed spatially through GIS analysis on each sub-facets of land which has been given by the weight attributes and scores have been determined in the AHP. It processed data using Arc GIS 10.2 software to get the distribution of carrying capacity from lowest to highest. The formula for the carrying capacity assessment are:

$$DDL = (\sum PL (PL WX) + \sum FL (WXM) + (WXR) + (WX KL) + (WX CDE))$$

Description: DDL is the carrying capacity of the environment, PL is a score of land use, FL is a facet of Land, M is the material, R is a relief, KL is a slope, CDE is the depth of weathering and W is the weight parameter (Weight).

3. Results and Discussion

The text of your paper should be formatted as followsCarrying capacity of water regulation and land-use changes in 2005It dominates figure 2a shows moor area of 43 356 ha, or about 36% of the area. Then the second-most extent is the use of wetland about 36 774 ha, or 31%, forests 24 645 ha, or 20%, settlements 4. 896 ha or 4.16%, mixed garden 2. 934 or 2.49%, 2. plantation 039 ha or 1.73%, open land 1 267 ha or 1% and meadow area of 1,040 ha, or 0.8%.

The result of spatial analysis carrying capacity for regulation of water flow is presented in Figure 2b shows the class of the carrying capacity of 2005 for regulating water flow, where the region has a class of high carrying capacity (43 268 ha) spread on landform plateau fluvial-volcanic, valleys and volcanic mountains with a kind The dominant form of land use of forest and mixed farms. Meanwhile, a region that has medium carrying capacity class (36 117 ha) spread predominantly on the lower slopes of the volcanic cone landform with the land use such as plantations and little moor area of 53 044 ha. As for areas that have a low carrying capacity classes (38 293 ha) spread on the middle slopes of the volcanic cone landform and complex Papandayan volcano Guntur with the open and moorland use dominant.
Figure 1. (A) The land use Upstream Cimanuk subzone 2005 (b) The carrying capacity of water regulation Upstream Cimanuk Watershed 2005.

Until it still dominates 2015 land uses today is the use of moorland area of 50,702 ha, or 43%, use of dry land this period increased to 7,346 ha, or about 7%. Then that was expanded after the moor is increasing settlement covering 3,896 or about 4%, and after that mixed farms covering an area of 486 ha, or 0.5%, while land use has decreased significantly is the use of the forest land in 2015 reached about 20% but in 2015 decreased the width of 5%. (Figure 3a).

In Figure 3b or picture classes carrying capacity of water regulation in 2015 showed that areas with high carrying capacity (35,887 ha) for regulating water flow are spread on landform plateau fluvial-volcanic, valleys and volcanic mountains to the type of land use dominant form of forests and mixed farms. Meanwhile, a region that has medium carrying capacity class (37,036 ha) spread predominantly on the lower slopes of the volcanic cone landform with the land use such as plantations and little moor area of 51,390 ha. Regions with low carrying capacity classes (44,764 ha) landforms scattered on the middle slopes of the volcanic cone and complex Papandayan Volcano Thunder to the land use in the form of open land and moor.

Meanwhile, the tendency carrying capacity for water regulation in study for each class is also changing differently. High-grade carrying capacity for regulation of water flow has decreased both in 2005 and 2015 respectively by 17%. For carrying capacity class different is changing for 2005 and 2015, where from 2005 to increase that by 21%, while that for 2005-2015 experienced a slight increase of 0.03%. The small number of this could be for the small potential area (forest) that can still be cleared for farmland. Meanwhile, low-grade carrying capacity was increasing for years 1995-2005 and 2005-2015, respectively by 38% and 17%.

Figure 2. (a) The land use Upstream Cimanuk subzone 2015 (b) water regulation in the sub-watershed Cimanuk Hulu 2015

Based on the above tendency, we can conclude it that the development of agricultural land in the food research area, at least from 2005 to 2015, harms the functioning of the Sub-Basin Upstream Cimanuk characterized by decreasing the carrying capacity for water regulation. Or that the development of agricultural land in this area is actually very appropriate if only from the aspect of that is for relatively fertile landforms (volcanic areas), but the development has destroyed sub-watershed function itself as a water catchment area. See the symptoms of this trend, according to some researchers[27] changes Forest land in this region is estimated to have improved fluctuations in river flow and sedimentation in the Sub-Basin Upstream Cimanuk, This is for the forest have an important role in managing water in the watershed [28], so that with the decrease of forest area made increased surface flow to carry out the DAS and result in reduced availability of water in the dry season [29], [30], [31], [32], [33], [34]. Thus by the time the rainfall has exploded (extreme) then a lot of rain stored (set), the rest becomes runoff and result in flash floods. From a searching review of the literature
shows that in the upstream sub-watershed has undergone many changes in land use since 1995 [35] even increased area of critical land in it.

It is necessary to include, but that interrupts the flow of the article, may be consigned to an appendix. It should include any appendices at the end of the main text of the paper, after the acknowledgments section (if any) but before the reference list. If there are two or more appendices, they should be called appendix A, appendix B, etc. Numbered equations should be in the form (A.1), (A.2), etc, figures should appear as figure A1, figure B1, etc and tables as table A1, table B1, etc. [36],[37] say that watershed damage is also triggered by unwise land use by the community so that this can cause disruption of the hydrological function which will then result in erosion, flash floods and drought.

4. Conclusion

The conclusion of this study is to decrease the function of water regulation in the watershed so that DAS can not function as expected (the management system) which serves primarily for storage or regulate the water system. Here, according to the Ministry of Public Works (2010) it has set the main functions such as watershed Cimanuk Hulu is as a water catchment area (recharge areas) or as a water conservation area. Thus, the main target to be achieved in Upstream Cimanuk Watershed management is the availability of adequate water throughout the year without the birth of a disaster both in the upstream and downstream regions

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