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MANAGEMENT OF THE UPSTREAM CILIWUNG WATERSHED, BOGOR REGENCY

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ABSTRACT: This report presents research results on managing the Upper Ciliwung River Basin (DAS) in Bogor Regency, which aims to analyze the relationship between upstream area factors and flood events in Jakarta and provide recommendations for better management. This research used a qualitative descriptive method through field surveys and literature studies. The results show that the Upper Ciliwung Watershed has diverse physical characteristics, with topography varying from lowlands to steep and a climate influenced by high rainfall. Land use changes, especially the increase in residential areas, have reduced water absorption capacity and surface runoff, contributing to increased flood risk downstream. In addition, the geological and hydrological conditions of the watershed also affect river flow discharge. Therefore, integrated and sustainable management is needed to maintain ecosystem balance and reduce environmental negative impacts. Recommendations include strengthening land zoning policies, implementing conservation techniques, and increasing community participation in water resource management**.**

Keywords: Watershed Management, Ciliwung, Flood, Land Use, Conservation.

1. INTRODUCTION

River Basin Area (DAS) is a water catchment area that flows through a river network to the estuary. The upstream of the Ciliwung DAS is located in the springs of Mount Gede, Mount Pangrango, and Telaga Saat, which are on the slopes of the Jonggol Mountains, with a length of 117 km and an area of 34,700 Ha. This upstream area is the primary source of ecosystem services and is very important for water storage to prevent flooding in downstream areas. Administratively, the Upper Ciliwung DAS covers 30 villages in Bogor Regency with an area of 14,860 ha, consisting of 6 sub-DAS [1-5].

Changes in land use due to development around the upstream area of the Ciliwung DAS significantly impact environmental conditions, not only in the upstream but also in the middle and downstream. This activity can cause fluctuations in water discharge, sedimentation, and pollution, contributing to Jakarta flooding. With a poor drainage system and unplanned land use patterns, the contribution of surface flow from the downstream area reaches 57.56%, while from the upstream and the middle regions, it is only 42.44%. For that reason, this study was conducted to analyze the management of watersheds, especially the upstream part of the Ciliwung watershed [6-8 [8-12] states that watershed management is the rational management of all resources to achieve maximum profit in an unlimited time with minimal risk of environmental damage, or in other words, implemented with the principle of resource sustainability. In addition, this study seeks to find out the upstream factors that cause flooding in Jakarta to reduce flooding In Jakarta.

2. METHOD

Data collection was conducted through field observation and open discussion techniques. Observations were conducted to observe the physical conditions of the Upper Ciliwung Watershed, including topography, slope gradient, soil type, land cover and use, and watershed management infrastructure. Open discussions were conducted with field guides to explore information on community perceptions of environmental conditions, land use impacts, and challenges in watershed management. The data obtained were then analyzed thematically to identify the relationship between factors in the upstream area and flooding events in Jakarta and formulate recommendations for better management. A systematic approach explored meanings, experiences, and perspectives from field reality [13-15]

3. RESULTS AND DISCUSSION

Description of the Ciliwung Watershed Upstream

The Ciliwung Watershed covers an area of 34,700 ha and crosses two provinces, West Java and DKI Jakarta. The main river, Ciliwung, is 117 km long and divided into three parts: upstream, middle, and downstream. The upstream section covers most of the Bogor Regency area, with 30 villages involved. The sub-watersheds in the upstream section consist of six sub-watersheds, namely Ciesek, Ciliwung Hulu, Cibogo, Cisarua, Cisukabirus, and Ciseuseupan.

The upstream section covers a mountainous area with an elevation between 300 m and 3,000 masl. The upstream section is generally characterized by fast-flowing mountain rivers, especially during the dry season. High slope variations. With a slope of 2-15% (70.5 km²), 15-45% (52.9 km²), and the remaining 24.6 km² above 45% [16-20].

Topography of the Upper Ciliwung Watershed

The topography of the research area varies from lowlands to very steep. Most of the area is dominated by flat slopes (32.95%) and undulating (25.19%). Steep slopes (>15%) and very steep (>45%) are also found, which have the potential to increase the risk of landslides. The following table shows the distribution of slopes in the Upper Ciliwung Watershed:

Climate of the Upper Ciliwung Watershed

The Ciliwung Hulu watershed is included in climate type A and B2, with high rainfall contributing to water availability. Data from the Citeko Climatology Station shows an average maximum temperature of 24.2ºC and a minimum temperature of 19.8ºC.

Hydrology of the Upper Ciliwung Watershed

The Ciliwung River has a varied flood discharge, with an estimated 2-year flood discharge of 100 m³/s and a 25-year flood discharge of 200 m³/s. The water discharge in the upstream tends to be higher than in the downstream, which is influenced by rainfall and land use factors.

Geology of the Upper Ciliwung Watershed

The parent material of the soil in the Upper Ciliwung Watershed comes from pyroclastic rocks and andesite tuff, which affect water absorption and slope stability. Inappropriate land use can accelerate the process of erosion and soil degradation.

Upstream Slope of Ciliwung Watershed

Minister of Public Works Regulation No. 22/PRT/M/2007 confirms that buildings in areas with steep slopes (>15%) to steep (40%) can disrupt slope stability and trigger landslides. In the Upper Ciliwung Watershed, which has many areas with steep slopes, the frequency of landslides is quite high.

Landforms of the Upper Ciliwung Watershed

The Ciliwung watershed has a dendritic shape from the upstream to Katulampa, which shows a balance between the increase and decrease in flow during floods. Downstream, the shape becomes parallel and narrower, making the role of the upstream area very important with a significant contribution of surface flow. The total area of the Ciliwung watershed reaches 370.8 km² with a main river length of 124.1 km, and a total flow length of 1,076.1 km, and a surface flow network density of 2.9 km/km². Changes in land use can result in significant changes in river flow characteristics.

Land Use in the Upper Ciliwung Watershed

Land use in the Upper Ciliwung Watershed shows that built-up land is the largest land use, followed by dry land agriculture and rice fields. Changes in land use patterns have an impact on reducing water absorption capacity and increasing surface runoff, which contributes to increasing flood risk downstream.

Population growth

Population Growth increased from 9,364 (2018) to 9,657 (2023). This shows a growth of 293 people in a period of 5 years. Population Density also increased from 4,682 people (2018) to 4,828.50 people (2023).

Distribution Pattern of Springs in the Upper Ciliwung Watershed

The shape of the Upper Ciliwung Watershed resembles a fan, with tributaries flowing into the main river from the left and right sides, concentrated at one point around Katulampa. The main river flows from south to north, and its source comes from Lake Telaga Warna at an altitude of 1,433 meters above sea level. This configuration shows the importance of good management to maintain ecosystem balance and reduce the risk of flooding downstream.

Discharge from the Upper Springs of the Ciliwung Watershed

The spring discharge in the Ciliwung River varies depending on the season and weather conditions. Observations at Katulampa Station showed that the water discharge ranged from 0.71-14.52 m^3/second, higher than Depok Station, which ranged from 0.72-12.13 m^3/second. Both stations recorded the lowest discharge from June to October, which coincided with the dry season. The water discharge decreased downstream, reaching 0.30 m^3/second in the DKI Jakarta area. This decrease was caused by the accumulation of solid waste and sediment that slowed the water flow and lower rainfall downstream compared to upstream. Rainfall is the main factor influencing the fluctuation of water discharge, with intensity varying spatially and temporally. This shows the importance of good management in maintaining the quality and quantity of water flow in the Ciliwung River..

Lake Saat

Telaga Saat, located in the Puncak area of Bogor, West Java, is known as the "headwaters of the Ciliwung River" and is the main source of water for the river. The lake has clear water and is sourced from springs in the surrounding forest, making it important in the region's ecosystem and hydrological cycle. Surrounded by dense forest, Telaga Saat is a habitat for various species of flora and fauna typical of the highlands, attracting the attention of nature lovers and photographers. As a natural tourist destination, Telaga Saat offers natural beauty, trekking, and camping, and it is an ideal place to enjoy tranquility and fresh air. Environmental conservation efforts are carried out by the local government and local communities to maintain the cleanliness and sustainability of the lake, preventing pollution that can disrupt the ecosystem and flow of the Ciliwung River.

Thematic Analysis

The results of this study show the characteristics of the Ciliwung Watershed, especially in the upstream, which has a topography that varies from flat to very steep. Steep topography increases the risk of landslides, which is reflected in the increasing frequency of disasters. Changes in land use, especially the increase in residential areas, reduce water absorption capacity and increase surface runoff, which has an impact on increasing flood discharge downstream, including Jakarta. River water quality decreases due to domestic and industrial waste and erosion, with BOD and COD values indicating high pollution [21].

The Ciliwung River's water discharge varies, with the upstream having a higher discharge than the downstream. The decrease in discharge downstream is caused by solid waste and sediment accumulation. The climate of the Upper Ciliwung Watershed, which is included in types A and B2, affects the river flow pattern, with low discharge in the dry season and increased runoff during the wet season.

The geology dominated by pyroclastic rocks and andesite tuff plays a role in water absorption and slope stability, but inappropriate land use can accelerate erosion. Population growth is also a challenge in maintaining ecosystem balance.

Overall, this study emphasizes the need for an integrated approach to managing the Ciliwung Watershed, taking into account aspects of topography, hydrology, water quality, and land use change to achieve a balance between human needs and environmental sustainability.

3. CONCLUSION

The Ciliwung watershed has diverse physical characteristics, with topography varying from lowlands to hills and a climate influenced by high rainfall. This contributes to water availability but also increases the risk of flooding. Steep topography and high rainfall upstream make this area vulnerable to landslides and floods, so management must focus on erosion control and land conservation through practices such as reforestation and terracing.

The upstream part of the Ciliwung watershed plays a vital role as a provider of water sources and controller of flow discharge to the middle and downstream parts. Ecological instability in this area can have severe downstream impacts, such as increased flood discharge and sedimentation. Therefore, conservation efforts in the upstream watershed are significant in maintaining the overall hydrological balance.

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