ANALYSIS OF CHANGES IN LAND FUNCTION AND SOCIAL CULTURE OF COMMUNITY IN BENGGAILA WATERSHED

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ABSTRACT

The Benggaila watershed disembogues into Kendari Bay, the upper part was dominated by forest areas and the middle and downstream parts were dominated by residential areas. Its location in the capital city of Southeast Sulawesi causes a very high change in land use and social culture in the watershed. The purpose of this research was to present the development of land-use change in the Benggaila watershed from the aspects of function, soil characteristics, and socio-cultural conditions of the community in the period 2004 to 2019. The data analysis was used analysis and tabulation of data from field observations and interpretation of data from the analysis of soil samples in the laboratory, then comparisons were made from 2014 and 2019 and then made in the form of a report. The results showed that changes in land use during that year range were very high. Changes from agricultural land and forest to the settlement were 67.4% dominate the other changes. This condition causes a shift in the socio-cultural pattern of society. The people of origin who lived in the downstream and middle of the watershed were moved to the upstream, while the immigrants stayed downstream of the watershed. These changes have also changed the patterns and methods of farming as well as behavior in utilizing forests. Soil and water conservation efforts were carried out by integrating changes in land use and the current social conditions of the community through adequate land planning and the community's mindset in utilizing the land.

Keywords: benggaila watershed; community socio-culture; land function

INTRODUCTION

A Watershed is a water system ecosystem and is used as a rational management unit for vegetation, soil, and water resources. A Watershed is a land area with natural boundaries in the form of ridges so that it does not always coincide with government administrative boundaries (Nasrullah & Kartiwah, 2010). The Benggaila watershed is a micro watershed which disembogues into Kendari Bay. The watershed has the Middle and Headwater parts which are dominated by forest land use and the downstream parts are dominated by residential areas. The watershed is located in the Murhum People's Forest Park (TAHURA) area which is a nature conservation area in Southeast Sulawesi located in Kendari City. The location of the watershed is in the middle of downtown in Kendari City as the capital of Southeast Sulawesi Province will affect changes in the surrounding environment. From headwaters to deltas, the watershed is a complex, dynamic, interconnected, and social-ecological interacting system. Healthy rivers provide all the basic necessities for human survival and developmental needs of mankind (Dunham et al., 2018).

Changes in the land-use change in the Benggaila watershed tend to increase space and time as a result of an increase in population. The downstream position of This study aimed watershed will also accelerate changes in land use where human activities and development of residential spaces are running rapidly. Initially in the middle part of the watershed was used as agricultural land by the community and settlements in the downstream areas, but the area developed into residential land due to an increase in population and a shift in the original population with immigrants. Humans are the
main factor in changing the function of land both in their capacity as direct users of the land and as a determinant of the function of a plot of land (Lutfi, 2006). Land changes or land conversion is a change in the function of a part or all of the land area from its original function (as planned) to other functions that can result in negative impacts on the environment and the potential of the land (Ante et al. 2016). Every activity carried out in one site in the upstream part of the watershed has an impact or implication elsewhere or off-site in the downstream part of the watershed, or vice versa, that the utilization of natural resources in the downstream area is the result of an upstream area which is autonomous or different administrations in the management area (Paimin et al., 2012).

According to Ante et al. (2016), the land is a development resource that has relatively constant availability or area characteristics due to changes in area due to natural processes (sedimentation) and very small artificial processes (reclamation). For farmers, the land is a place to grow crops and a source of life, while for urban residents land is a space to build buildings such as houses, shops, and so on. The increase in the intensity of land conversion changes has a negative effect on the hydrological conditions of the watershed such as increasing peak discharge, fluctuating discharge between seasons, surface flow coefficient, and increasing sedimentation, flooding, and drought (Mirhosseini et al., 2018). On the other hand, this change in function will change the socio-cultural life of the community in the watershed (Hastanti, 2017). This study provides an overview of changes in land use in the watershed in the middle of the city with a very fast population increase and space allotment for development. The purpose of this research was to present the development of land-use change in the Benggaila watershed from the aspects of function, soil characteristics, and socio-cultural conditions of the community.

MATERIALS AND METHODS

This research was conducted in the Benggaila watershed administratively in the area of West Kendari District, Kendari City. Initial research was carried out in 2014 by Kartini (2014) and continued in 2019, and was conducted for three months from March to May. The method has used the interpretation of maps and satellite imagery and surveys with an analytical approach. In 2004 was used direct field measurements and in 2019 was used Google Earth Pro data sources and field checks. An overview of the research location can be seen in Figure 1. The materials were used in this study namely fieldwork maps, plastic bags, label paper, rainfall and temperature data, and materials for laboratory analysis. The tools were used GPS (Global Positioning System), compass, clinometer, roll meter, hoe, shovel, field knife, machete, soil drill, sample ring, pin, raffia rope, writing instruments, and equipment for laboratory analysis.

Figure 1. Study site

The stages of the research implementation include the preparation, data collection, data analysis, and laboratory stages as well as making reports. The preparatory stage was carried out through collecting various libraries that support the research problem, collecting information data on the conditions of the research location, making fieldwork maps at a scale of 1: 50,000, arranging research permits, preparing tools and materials.

The data collection stage was carried out in three ways, namely collecting data on the suitability of land-use change, land data, and socio-culture. Changes in land use were obtained by cross-checking the results of satellite image analysis using ArcGIS 10.3 software. Soil samples were taken at the same location in 2014 (Kartini, 2014) in the form of physical soil samples including texture, moisture content, weight content, porosity, and soil permeability. The socio-cultural data were collected by using qualitative data collection techniques, namely field surveys, literature studies,
interviews, and questionnaires. Interviews and questionnaire data collection was carried out using a purposive sampling method, namely sampling of respondents by randomly selecting parties who had a major influence on changes in land function, with the age limit of respondents being at least 30 years old, and respondents were native residents of the local area.

The data analysis was used analysis and tabulation of data from field observations and interpretation of data from the analysis of soil samples in the laboratory, then comparisons were made from 2014 and 2019 and then made in the form of a report.

RESULTS AND DISCUSSION

General Condition of The Watershed

The Benggaila watershed was a micro watershed covering an area of 683.28 Ha and administratively located in the Kemaraya Village, West Kendari District, Kendari City. The climatic conditions in the watershed according to the Oldeman classification system were classified as D2 agro-climatic type and according to the Schmidt-Fergusson classification system that the coverage area of the rainfall station is classified as C climate type. The average annual rainfall in the study area was 2,009.32 mm (P. 75% = 1,744.28 mm) in 110 rainy days. The temperature ranges from 27-30°C and humidity range from 78% to 80%.

The shape of a steep or mountainous area occupies the widest area of 45% of the watershed area and generally has the soil parent material derived from schists, phyllites, conglomerates, and quartz. According to the USDA (United States Department of Agriculture), the distribution of soil types in the Benggaila watershed developed in the Entisol and Inceptisol orders (Soil Survey Staff, 1999). According to Soil Survey Staff (1999), the criteria of Entisol soils are recently formed soils that lack well-developed horizons, found on unconsolidated river and beach sediments of sand and clay or volcanic ash, and some have an A horizon on top of bedrock, also they are 18% of soils worldwide. Meanwhile, Inceptisol soils are young soils that have subsurface horizon formation but show little eluviation and illuviation and constitute 15% of soil worldwide. The land conditions in the Benggaila watershed were flat land in the middle of the watershed which was now occupied by the community for gardening and as a place to live.

Changes in Land Function

The land was a natural resource that can be renewed and at the same time an environmental medium for producing food, settlement, and others. The increase in population accompanied by increased development activities has resulted in a shift in land-use patterns (Permatasari et al., 2017). The use of natural resources in a watershed can be broadly classified into two types, namely the use of land resources and the use of water resources. Utilization of land resources in a watershed includes agriculture, forestry, plantations, fisheries, mining, and others; while the use of water resources is intended for irrigation water supply, drinking water supply, hydropower plant, industrial water supply, and others (Andreassian et al., 2003). Benggaila watershed has functions of forest land, mixed garden, settlement, and residential land. The results of satellite image analysis were shown in Figure 2 and changes in land use were presented in Table 1.

Figure 2. Analysis of satellite imagery of changes in the land function of the Benggaila watershed from 2014 (A) to 2019 (B)

Figure 1 showed that in 2014 the land function in the Benggaila watershed was dominated by forest, followed by settlements and mixed gardens. In 15 years, there was a change in clearing forest
land into mixed gardens and settlements as well as open land. The change in the function of forest land into settlements and mixed gardens led to mountainous areas and had entered the Tahura Forest area. This was because the land available for use by the community downstream was already limited and land changes were moving upwards. On the other hand, the local people who lived earlier were converted to immigrant communities, while the local people cleared new land at the upwards. Population density affects the performance and vulnerability of the watershed because the number and activities of the population affect land sustainability. The higher the population, the greater the pressure on the land (Paimin et al., 2012). Likewise, the increase in population in the upstream watershed has an impact on increasing land requirements, thus affecting the overall watershed management (Taena, 2016). For its utilization to be sustainable, management, and monitoring of the condition of a watershed must be carried out optimally and continuously.

Table 1. Analysis of changes in land function in the Benggaila watershed in 2014 and 2019.

| Land Function | 2004 | 2019 | +/− |
|---------------|------|------|-----|
|               | Ha   | %    | Ha  | %   | Ha  | %   |
| Forest        | 602.10 | 88.08 | 554.67 | 81.14 | -47.43 | -6.94 |
| Mix Garden    | 17.62  | 2.58  | 44.49 | 6.51  | 26.87 | 3.93 |
| Settlement    | 63.90  | 9.35  | 82.73 | 12.10 | 18.83 | 2.75 |
| Oped-field    | 1.73   | 0.25  | 1.73 | 0.25  |       |      |
| **Total**     | 683.62 | 100.00 | 683.62 | 100.00 |       |      |

Source: Land use map (Kartini et al., 2014) *) and satellite imagery analysis **) 
Description: (+): has increased in area; (-): experienced extensive depreciation

It can be seen that the largest land cover was forest (around 81%) in 2019. This proportion was still relatively high, although when compared to 2004, the forest area has decreased by 6.94% or equivalent to an area of 554.67 Ha. The reduction in a forest area that occurs for fifteen years was equivalent to an average reduction rate of 3.162 Ha year⁻¹. The rate of change was far below the national rate of change in forest area figures, both the findings of the Government and non-Governmental organizations. The decline in forest land caused an increase in the area of mixed garden land by 3.93% or 26.87 hectares or an annual increase of 1.79 Ha. These results indicated that this change was not too extreme considering that the community also knows that the land used was in forest areas. Ownership of land for settlements and mixed plantations by the community was only temporary because no certificate of ownership would be issued. According to Triatmodjo (2009), land use activities that change the landscape in a watershed can often affect water yields, especially vegetation management where forests as regulators affect the timing and distribution of water flows. Other factors that influence runoff are soil, climate, and percentage of the watershed area. The greater the land-use change, the greater the runoff that occurs.

Changes in Physical Properties of Soil

Soil characteristics that are difficult to change are physical characteristics, while soil chemical properties tend to change, the physical properties of the soil reflect the soil’s ability to maintain plant nutrients and the toxic content of the surrounding environment (Upadhyay et al., 2013). For this reason, in this study, physical properties become an indicator of changes in land use. The results of observations of the average physical properties of the soil in the Benggaila watershed can be seen in Table 2.

Table 2. Observations on the average physical properties of the soil in the Benggaila watershed

| Soil Physical Properties | 2004 | 2019 |
|--------------------------|------|------|
| Soil bulk density (g.cm⁻³) | 1.16  | 1.08  |
| Soil porosity (%)         | 48.53 | 54.14 |
| KAT (%)                   | 23.13 | 23.14 |
| Permeability (cm.hour⁻¹)  | 12.15 | 13.77 |
| Texture                  |      |      |
| Clay (%)                  | 31.01 | 15.1  |
| Dust (%)                  | 42.44 | 46.67 |
| Sand (%)                  | 26.55 | 38.22 |
Table 2 showed that the physical properties of the soil from 2004 to 2019 did not show any significant changes except that the porosity and permeability of the soil increased but in a small amount. The increase occurred due to an increase in the value of soil texture in the sand fraction and a reduction in the clay texture. This condition explains that in 15 years the physical characteristics have not changed too much from the land-use change in the Benggaila watershed. Although the impact of changes in the function of the watershed was not very significant, these changes have resulted in a decrease in soil and land quality leading to degradation and erosion of the soil due to changes in the function of a part or all of the land area from its original function to other functions would have a negative impact or problems on the environment and the potential of the land (Irsalina, 2010).

Socio-Cultural Community

The changes in land functions were related to socio-economic life included in the community livelihood strategy (Kusdiane et al., 2018). The socio-cultural conditions of the community affect the existence of watersheds in land-use change including population, availability of infrastructure, and culture. The total population of West Kendari District in 2017 was 54,884 people, consisting of 27,532 males and 27,352 females (BPS, 2019). Meanwhile, the population in Kemaraya Village which is part of the Benggaila watershed in 2019 was 8,606, consisting of 4,247 men and 4,359 women and 97.43% gender ratio (BPS, 2019). Meanwhile, the population in the Benggaila watershed from 2004 to 2019 increased by 19.73% for men and 21.75% for women. This illustrates showed that the female population was more dominant than men, and this population growth causes the need for residential land and agriculture to increase. The change in population in the Benggaila watershed was presented in Table 3.

Table 3. Data on population conditions in 2004 and 2019 and their changes

| Population | 2004 | 2019 | Change |
|------------|------|------|--------|
| Man        | 147  | 745  | 19.73  |
| Women      | 209  | 961  | 21.75  |
| Total      | 356  | 1,706| 20.87  |

Table 3 showed that in 15 years, the population increased by 20.87% from 356 to 1,706 people and the female population increased by 21.75% compared to men by 19.73%. This condition showed that the community in the Benggaila watershed was dominated by women, so the acceleration of land conversion was relatively slower than if there were more male residents.

For a long time, community life in the Benggaila watershed was quite heterogeneous considering its proximity to the city. The use of the Benggaila River as the main means was only carried out by people who live on medium banks far from the river, they were using land for gardening on locations with sloping slopes. Initially, the people planted gardens around the riverbanks and gradually cleared the forest and turned it into a settlement. The Benggaila watershed community was an educated society, its ethnicity and religion are diverse and the economic level belongs to the lower and middle communities.

Based on Table 3, the total population of 80.8% were Muslims, the rest were Christian and Hindu, and there were eight mosques. Relations between religious communities are well established even though they are near the city area. On the other hand, there were two kindergarten schools, three elementary schools, two junior high schools, and one university. Health facilities in the form of one health center, one unit of Bank, and three units of Hotel. This condition causes the downstream of this watershed to be congested in development activities.

The majority of people in 2004 came from the majority of the Tolaki and Bugis tribes, the rest of the Buton, Menui, Muna, Javanese, and ethnic Chinese. In 2019, there were no more dominant tribes, many immigrant tribes have settled downstream and displaced the local people out of the watershed and some have moved to the middle and upstream parts. Communication between communities in the middle and upstream areas of the watershed was still good, while in the downstream area, communication between communities was not good. The bad social relations between communities were caused by competition and social jealousy. According to Putri (2015), competition and social jealousy in land use arise as a result of three economic and social phenomena, namely limited land resources, population growth, and economic growth.

Therefore, the role of social and cultural institutions in watershed management was very important because it can regulate human behavior in the utilization and preservation of the watershed.
environment. This institution includes norms, symbols, beliefs, customary or community regulations, and status that affect community life, such as religion, education, economy, and life management (Darmanto et al., 2015). In addition, watershed management must fulfill environmental, social, and economic aspects, because watershed management was intended to provide maximum economic benefits for humans, especially for local communities and poor communities without neglecting environmental sustainability and creating independent and participatory communities (Emilia, 2013).

CONCLUSIONS AND SUGGESTION

In conclusion, (1) changes in forest land functions in the Benggaila watershed in 2004-2019 change into gardens and settlements was 47.43 Ha or 6.94%. (2) The physical characteristics of the soil have not undergone significant changes from the transfer of land functions in the Benggaila watershed. (3) The population in the Benggaila watershed shifted from a local tribe to a dominant immigrant tribe. The occurrence of acculturation due to the large number of tribes who lived in the Benggaila watershed. Religious and social life has more impact on the middle and upstream watersheds. (4) The population in the Benggaila watershed shifted from a local tribe to a dominant immigrant tribe. The occurrence of acculturation due to the large number of tribes who lived in the Benggaila watershed. Religious and social life has more impact on the middle and upstream watersheds. There needs to be a change in farming patterns and methods as well as behavior in utilizing the conversion of forest land into agricultural land, also the soil and water conservation efforts are carried out by integrating changes in land use and the current socio-cultural conditions of the community through adequate land planning and the community’s mindset in utilizing land.

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