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Community perception on the utilization of natural resources in the Cisadane Watershed

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Abstract. The communities living around the upstream area of the Cisadane Watershed have carried out various activities to utilize the natural resources around them. Community interaction with natural resources also correlates with community perceptions of watersheds and resources that can be used by the community. The purpose of this study is to explain the form of community interaction and perceptions in the use of natural resources around the watershed. The results showed that various forms of community interaction included land use for settlements along rivers, micro-economic activities and land use for gardens. The public perception of the watershed shows that 50.8% of the community do not know the concept of watershed well, 69.2% of community know that the environmental conditions around the watershed have undergone various changes, 53.8% of the community generally do not know the functions and functions the role of watershed and 58.5% of the community knows enough about how to utilize the potential of natural resources around the watershed. The government and related parties are expected to be able to make various policies in directing the community to use natural resources that uphold the sustainable aspects of watershed functions and the active role of the community.

1. Introduction

Watersheds are a complex and dynamic system because it involves interrelated social, physical, and biological systems. The social system is a major component because people do not just exploit natural resources but is also able to rehabilitate it, that's why humans play an important role in determining the quality of interaction between the system of watersheds [1]. River management as part of environmental management has a very fundamental challenge in the management of river resources and environmental carrying capacity for optimum and sustainable human benefits [2]. Natural resources and environmental carrying capacity should be developed to be socially and economically beneficial [3], [4].

The Cisadane Watershed has been designated as one of the 26 priority watersheds in Indonesia [5], where the management of the upstream area aims to maintain the quality and capacity of water resources and more broadly to support the sustainability of the functions of the surrounding area. The rapid population development around the watershed has implications for land use and management in the Cisadane Watershed, which is undergoing significant changes. The utilization of river riparian zones is quite high for various economic activities of the community [6]. On the one hand, the Government has determined that riparian zones need to be maintained according to their function. Watershed development should consider various conflicts of interest that may occur between several



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parties and Community Collaboration can be built by building networks that involve various stakeholders involved in order to encourage more sustainable natural resource management [7].

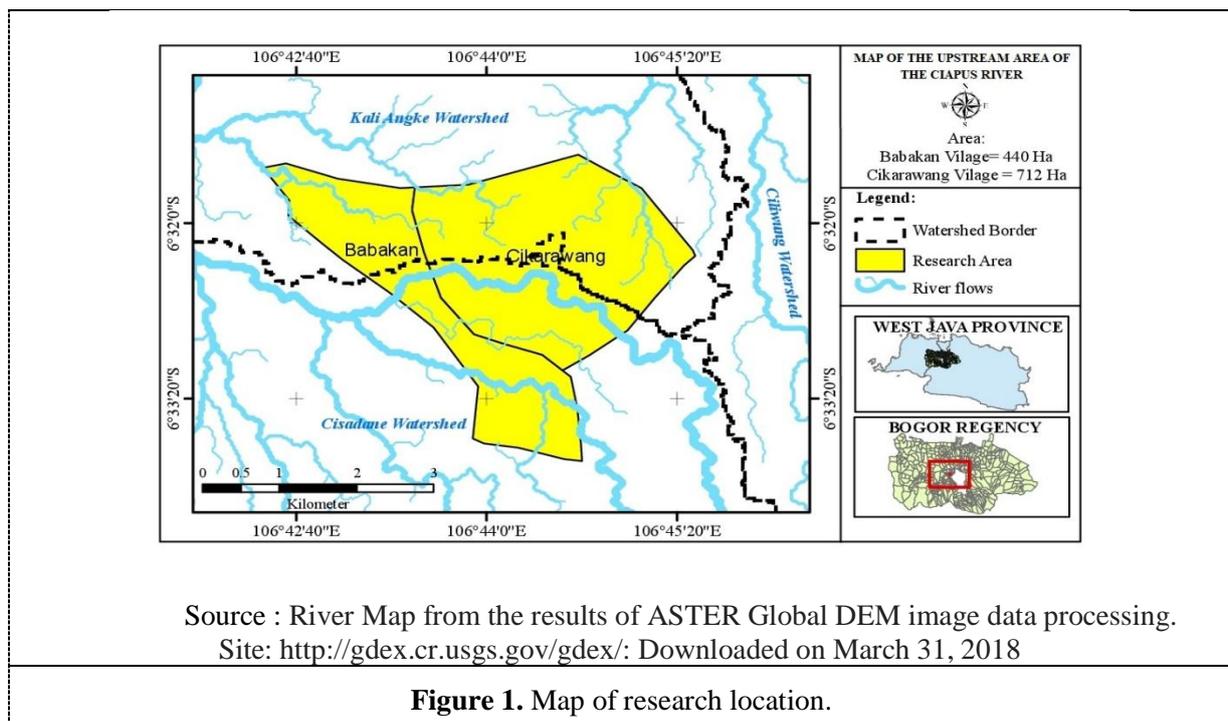
Certain social indicators of a community affect the relative potential to restore watersheds, more than just ecological conditions [8],[9]. Changes in land use patterns by communities can lead to changes in hydrological conditions that have the potential to reduce water quality, high rates of upstream erosion, flooding and landslides. Community activities in the upstream Cisadane sub-watershed, such as agriculture and plantation development, settlements and mining, have resulted in significant land use changes since 2000. The community needs to understand that based on the Government Regulation of the Republic of Indonesia No 38, 2011 about River which regulates the river, where the role and function of the riparian zone of rivers is a major concern. This riparian zone needs to be properly conserved where the role of the community in the watershed is important for this.

It has implications for communities with watersheds which have implications for the sustainability of the functions and roles of watersheds so that the use of resources in the watershed is highly correlated with people's perceptions of community behavior towards the watershed [10],[11],[12]. A good perception will have implications for the good interaction of the community [13],[14]. Therefore, this study aims to describe the interactions and perceptions of the community about the potential use of natural resources in the watershed. This knowledge and understanding are useful for various parties involved in formulating recommendations for community regulation and management of natural resources around the watershed in a fair and sustainable manner so that the watershed can be preserved and beneficial to all parties.

2. Materials and Methods

2.1. Research time and location

This research was conducted from March to May 2018 in the upper reaches of the Cisadane river, especially in Babakan Village and Cikarawang Village, Bogor Regency. The object of this research is the Ciapus river area, upstream Cisadane and the people who live on the riverbank. The research location can be seen in Figure 1.



2.2. Data collection

The sampling method was purposive sampling with the age range of respondents between 18-60 years. The number of samples is 65 people. The selected community is determined by the criteria of actively utilizing natural resources around the river, including those that have economic activities, live in river repants, and own gardens. Data collection methods used were interviews, FGD, observation and literature study. The FGD involved representatives from community leaders, religious leaders, and local government officials from the two villages.

2.3. Data processing

Data analysis serve it out quantitatively. Data analysis by way of classifying, calculating answers and percentage based on the answer category. Then the relationship between variables was determined by using the Spearman rank correlation test using statistical product and service solutions (SPSS).

3. Results and Discussion

3.1. Overview of research location

The Cisadane Watershed is located in West Java (covering an area of 113,535.66 ha or 74.11%), Banten Provinces (covering an area of 39,500.64 ha or 25.78%) and a small part of the downstream area in the DKI Jakarta Province (covering an area of 172.61 ha or 0.11%). The coordinates of this watershed are 106 ° 28 '53 " - 106 ° 56' 42" BT and 6 ° 00 '14' ' - 6 ° 47' 17 " LS with a total area of 153,208.91 ha. There are Gunung Gede Pangrango National Park and Gunung Halimun Salak National Park in the upper reaches of the Cisadane watershed. Most of the area has an average height of around 260 m asl with the altitude varies from 214 m asl to 520 m [15]. Flat topography dominates the area, which is 50% and the slope occupies the second place, 41%, there is no area with slopes of more than 40% or very steep.

Both Villagers are indigenous residents. Natural resource utilization activities around the watershed have been carried out by the community from generation to generation. The work carried out by the community in Babakan village is dominated by renting a settlement as a boarding house and for the Cikarawang village community is dominated by work as agricultural laborers. The low income of the community and the low level of formal community education as well as education for the community to maintain and preserve environmental functions also influence people's behavior in the use of natural resources in this area.

3.2. Community interaction in utilizing potential of land in Cisadane Watershed

3.2.1. The Utilization of land for farms and rice fields. Potential fields and rice fields that lies on the banks of the Ciapus River are used by communities for cultivation activities. Land in the Cikarawang Village around 128.109 ha or 56.55% is used for rice cultivation and 35.226 ha or 12.55% is designated as plantation/farm on the border Ciapus River [16]. The community has average fields ranging from 0.5 to 1 ha. Each head of household averages ½ ha of fields to be planted with seasonal crops, especially rice (*Oryza sativa*) and the rest with vegetables and fruits such as corn (*Zea mays*), sweet potatoes (*Ipomoea batatas*), long beans (*Vigna unguiculate*), guava (*Psidium guajava*) and oranges (*Citrus* sp). The agricultural produce is used by the community to fulfill their own needs (subsistence) and partly to be traded (commercially). Cikarawang Village community activities have been going on for generations since ten years ago. The land for Cikarawang Village is a heritage land, but there are some who work on the borrowed land.

The people in the Cikarawang Village who are involved in the river valley, especially the Ciapus river are local people as much as 310 head household or 13.94% of the total villagers who work as farmers. The cultivation of riparian area is intensively conducted and managed by productive and well-organized farmer groups. Currently, the main crops grown by the community is sweet potato (*Ipomoea batatas*). People are taking advantage of the high market demand for sweet potatoes. The community also developed sweet potatoes for various products such as flour, cake, syrup and other products.

The Ciapus River as one of the Cisadane Watersheds plays an important role in the sustainability of agriculture and is developed by cultivated fields. So far, the cultivation activities that have been developed have not been fully environmentally friendly because the community still uses pesticides to deal with diseases and this activity has implications for water and soil pollution. According to [17] the use of fertilizers and certain agricultural chemicals such as insecticides and herbicides can cause serious environmental pollution. The same opinion was conveyed by [18] who said that the use of inorganic fertilizers is always followed by environmental problems, both on biological fertility and on the physical conditions of the soil and on consumers. In addition, in managing waste management, communities still tend to burn waste, especially dry biomass often collected and burned directly on the land, then the ashes are used as organic fertilizer. Although it is easy and cheap to profit it will damage the physical and biological soil, the soil becomes solid and the organic material is run out [19].

3.2.2. Land utilization for settlement and micro business activity. Ciapus river border area was also utilized by Babakan Village as a place to live. There are as many as 92 families who live in this river border area as a residential settlement or temporary residence. This settlement has grown due to the increase in population growth and the opportunity of open land by the river to be a place to live. The village government does not make any warning or prohibition for the settlement communities in the river as stated in the in [9] Article 22 paragraph (2) in point b; In the case of river borders there is an embankment for the interest of flood control, protection of the embankment is carried out by the prohibition: a. planting crops other than grasses, b. to build a building; and c. reduce the dimension of the embankment. The river border or floodplain exists between the river ecosystem and the terrestrial ecosystem. Based on the Decree of the Based on the Decree of the President of the Republic of Indonesia No 32 1990 about the Management of Protected Area, river basins are defined as areas along the left and right of the river, including artificial river/primary irrigation canals, which have important benefits for maintaining river functions. In the river border, flooding in the rainy season is a natural event that has important ecological functions in maintaining the balance of the environment and soil fertility. Besides for the settlement, at this time, people make the river border as a micro business location such as vehicle wash service and chicken slaughtering business. This activity has a major effect on river pollution especially if the waste from the business activity is directly discharged into the river without being processed first, thus causing the quality of the river water to decrease.

Based on interviews and field observations, it is known that the micro-enterprises do not have waste processing so they directly dispose of the remaining products to the Ciapus River. People who live around the river banks still have a tendency to throw garbage into the river, and even some people still do bathing, washing and defecating activities on the river. Those activities have implications for the sustainability of the function and role of the watershed. As stated by [4] that of the 20% of waste has been discharged into the river, it contributes 60-70% of pollution to rivers that cross towns or densely populated settlements. It is important to note that the border region has an important function that includes the river border area that is part of the river body that only flooded during the rainy season, and the area outside the border that holds the river water flows in the rainy season and has a soil moisture higher than the soil moisture at terrestrial ecosystem.

The same thing was expressed by [20] that the quality of river water in an area is greatly influenced by human activities in the vicinity. If these activities are followed by high awareness from the community in preserving the river environment, the river water quality will be relatively good. On the other hand, without the awareness and active participation of the community, the quality of river water will deteriorate. According to [21] that what the government should do is increase public understanding of the applicable regulations. It is necessary to raise legal awareness that there are regulations prohibiting activities of any kind against river boundaries. For that, the arrangement of settlements in this watershed area needs special attention from the government.

3.3. Community perception about watershed and utilization

The public perception in these two villages shows that 50.8% of the community does not know the concept of watershed (table 1). The community knows that the watershed is a river area that is used for their needs. Meanwhile, community who know enough (18,5%) and know (30,8%) only understand

watershed as a river that flows in their environment. This public perception shows that the community still lacks knowledge of watersheds. For this reason, efforts are needed to increase this understanding through intensive counseling activities. It is in line with what was stated by [22] that promotion is needed for community involvement in watershed activities so that they will increase their understanding of the watershed and participate in maintaining it.

Table 1. Community perceptions of the watershed concept

| Description | Respond | | | | | |
|---|---------|------|-------------|------|-------------|------|
| | Know | | Know enough | | Do not know | |
| | Total | % | Total | % | Total | % |
| Definition of watershed | 20 | 30.8 | 12 | 18.5 | 33 | 50.8 |
| Environmental conditions around the watershed | 45 | 69.2 | 10 | 15.4 | 10 | 15.4 |
| Role and Function of watershed | 27 | 41.5 | 3 | 4.6 | 35 | 53.8 |
| How to utilize the watershed potentially | 22 | 33.8 | 38 | 58.5 | 5 | 7.7 |

Furthermore, the results of this study indicate that 69.2% of the community's perceptions know and 15.4% know quite well that the environmental conditions around the watershed have changed a lot where the color of the water changes tends to be dirty and the river flow is reduced. For the perception of the people who don't know (15.4%), it was explained that what appeared was the water flow getting smaller. This perception illustrates that there has been a change in the watershed environment which is an indicator of disruption of watershed function. This is in line with the opinion [23] that various forms of land use by communities around the watershed will contribute to river pollution due to high sedimentation.

Based on public perception of the function and role of the watershed area found that 41.5% stated know, 4.6 % stated enough to know and do not know equal to 53.8 % people who claim to know, say that the watershed has the function and role as a provider of water, maintaining water quality and the source of life for the community. According to [24], the river flow corridors play a role in regulating the flow of water and minerals from surrounding land and it's affecting the transport of materials and water to the stream. The effective natural river corridor width on all sides of the river will minimize erosion of river cliffs and mineral nutrient flows that can reduce sedimentation and suspended particular matter in river flows in addition to other shared ecological functions. Therefore, it is necessary to conduct socialization activities to provide knowledge to the public about the importance of the role and function of watershed both ecologically and economically. The reason people do not know about the importance of the role and function of watershed due to the lack of intensive counseling from relevant agencies and programs that involve the community in watershed conservation efforts.

Public perceptions about how to utilize the potential of a watershed show that 58.7% know enough and 33.8% know about how to utilize the potential of existing resources, namely by applying for permits to the village government for settlements and developing the developed micro-businesses. The community claims that all natural potentials utilized are inherited from generation to generation who live. Permission is required for the legality of the utilization activities. Furthermore, 7.7% of people who have the perception of not knowing state that the utilization of existing potential is only based on participation by following community behavior who had previously cultivated this potential. The lack of community perceptions about how to utilize the existing potential in the watershed requires socialization, especially from the village government to provide clear and firm rules in regulating the use of potential resources in the watershed. Watershed conservation programs need to be prioritized in addition to economic aspects. The development of the role of the community needs to be encouraged to create a sense of community ownership of all open access and common property resources in the environment. As stated by [25] it is important to foster a positive attitude towards the preservation of the community. Therefore, the use of appropriate information sources and practical training for the community effectively increases understanding of how to make good use of the potential of environmental watersheds.

River management efforts need to be explored, studied and understood as a potential, as well as obstacles in its utilization by the local community. [26] states that watershed is one of the common pool resource resources determined by hydrological relationships where optimal management requires coordination by all users in resource utilization. Watershed development seeks to manage the relationship hydrology to optimize the use of natural resources for conservation, productivity, and poverty reduction. To achieve this, coordinated management of the various resources within the watershed is required.

3.4. The relationship between community perception variables

Based on the results of the correlation test, it was found that people's perceptions of the watershed concept had a significant correlation with community perceptions of the role and function of watersheds with a value of 0.327, meaning that increasing community understanding of the concept of watershed community perceptions also increased community perceptions of the role and function of watersheds (table 2). This is in line with what [27] that watershed as a system will maintain its existence and function as a whole through interactions between its components.

Table 2. Correlation between community perception variables

| Item | V1 | V2 | V3 | V4 |
|------|----|--------|----------|----------|
| V1 | 1 | -0.051 | 0.327** | 0.181 |
| V2 | | 1 | -0.379** | -0.399** |
| V3 | | | 1 | 0.400** |
| V4 | | | | 1 |

Information:

** : significant correlation at level 1%

V1: Public perception of definition of watershed

V2: Community perception of environmental conditions around the watershed

V3: Community perception of the role and function of watershed

V4: Community perceptions about how to utilize the watershed potentially

For community perceptions about environmental conditions around the watershed, there is a significant negative correlation with community perceptions about the role and function of the watershed of -0.379, which means that the increase in community knowledge about the environmental conditions around the watershed will decrease people's perceptions of the role and function of the watershed. This illustrates that it is important to have a good understanding of the community on the functions and roles of the watershed so that efforts to support creating a sustainable watershed environment can be improved.

For community perceptions about environmental conditions around the watershed has a significant negative correlation with community perceptions about how to utilize the potential of the watershed with a value of -0.399 which means that environmental knowledge around the watershed tends to influence community interactions in its use. In line with what was stated by [28] that the condition of the upstream watershed which functions as a water catchment area is an area that often experiences human disturbances. For this reason, watershed conservation efforts and utilization of existing natural resource potentials should pay attention to the behavior, socio-economic conditions and institutional conditions of the surrounding community [29].

Meanwhile, community perceptions about the role and function of the watershed have a significant positive correlation with community perceptions about how to utilize the potential of the watershed with a value of 0.400, meaning that a good perception of the community about the role and function of the watershed will increase a good understanding of the utilization of the watershed potential. The communities living around the watershed have a major role in managing the watershed. Watershed management programs should focus on increasing community awareness and commitment to the need to protect natural resources for the common interest

4. Conclusions and Recommendation

Communities have various forms of interaction in the utilization of potential natural resources in the watershed and. This interaction affects the sustainability of watershed functions and roles. Public perception of watershed shows that only 30.8% know about watershed and 33.8% know how to utilize the potential of natural resources around the watershed. For this reason, socialization and education activities are needed to increase community knowledge and understanding of watersheds and how to manage their resources by upholding aspects of watershed sustainability. The government and stakeholders are expected to be able to establish specific regulations/policies to regulate the form of natural resource use by the community by taking into account aspects of watershed conservation.

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