Identify of soil and water conservation techniques in village forest of Tompobulu District Bantaeng Regency

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Abstract. Soil and Water Conservation is an effort to protect, rehabilitate, improve and maintain the function of land soil in accord to the ability and land allocation land to support the sustainable development and sustainable living. This research aims to identify and assess the proper use of soil and water conservation techniques applied by farmers in the village forest of Tompobulu District, Bantaeng Regency. It was on the assessment guidelines for soil and water conservation techniques. This research is expected to be used as an essential substance in the government of Tompobulu District, Bantaeng Regency, which is a forest village to give the information of activities of farmers to apply a good soil and water conservation techniques. This research was conducted for four months started from May to September 2019. This research used observation methods, such as the form of surveys and interviews with farmers who apply soil and water conservation techniques. Vegetative techniques applied in the form of ground cover plants, mixed gardens, and gardens, while mechanical techniques in the form of land management, bench terraces, and irrigation. The presentation of soil and water conservation techniques was 71.3% good, 4.7% rather good, and 24% not excellent.

1. Introduction

Land use that continues to increase without paying attention to the principle of sustainability, especially in the principles of Soil and Water Conservation is one of the factors causing land degradation that will threaten environmental sustainability, reduce agricultural productivity, and even cause natural disasters such as floods, landslides, drought, etc. In order to reduce land degradation, it is necessary to apply proper and correct soil and water conservation techniques.

The application of soil and water conservation techniques is carried out by vegetative methods and mechanical methods. This techniques is sometimes still not considered by some farmers, especially in social forestry land management. Communities in managing social forestry land need to know the correct and appropriate application of soil and water conservation techniques. Based on the Decree of the Minister of Forestry No. 55/Menhut-II/2010, there is a Social Forestry area with a village forest scheme covering an area of 704 ha which is divided into three village management areas in Bantaeng district, namely Patteneteang Village, Labbo Village and Campaga Village [1].

The village forest of Bantaeng Regency is located upstream of the Bialo watershed and upstream of the Biangloe watershed which is part of the Village Forest area. The community in the forest of Tompobulu village uses the land as agricultural land, gardening cloves, coffee, candlenut and some who
plant crops both in the form of yards or mixed gardens. Based on the results of observations, the discovery of land use, especially in agricultural areas that have not applied soil and water conservation techniques, will disrupt the preservation of Village Forests that are in protected forest areas. As well as the existence of land that is not vegetated (empty or overgrown with bushes), former fields left by the community.

Inappropriate management of the upstream area will have a profound impact on the downstream area. The various impacts can be in the form of sedimentation, silting and even landslides. Therefore, it is necessary to identify the application of soil and water conservation techniques that are good and appropriate as material for counselling and monitoring on the implementation of forest and land rehabilitation for social forestry land management.

2. Research methods
This research was conducted for four months from May 2019 to September 2019 in the Village Forest of Tompobulu District, Bantaeng Regency. The data processing was carried out at the Watershed Management Laboratory, Faculty of Forestry, Hasanuddin University Makassar.

2.1. Research procedure
2.1.1. Determination of research location. Before taking data in the field, first determined the location of the Village Forest in Pattenteang Village, Labbo Village and Campaga Village in Tompobulu Sub-district, Bantaeng Regency by interpreting it based on the appearance of the 2019 Google Earth image.

2.1.2. Determination of sample points. The sample points were determined based on purposive sampling technique with several considerations, including accessibility, village forest area and land use.

2.2. Method of collecting data
2.2.1. Primary data. Primary data was obtained directly in the field. This research was carried out using direct observation methods in the field either in the form of a survey or in the form of an interview. Interviews were conducted with farmers who applied soil and water conservation techniques. Observations were made by identifying soil and water conservation techniques applied by farmers with field surveys by assessing the application of soil and water conservation techniques as follows:

- Vegetative techniques: Cover crops, agroforestry (mixed gardens and yards)
- Mechanical engineering: Tillage, terraces, drainage channels and water structures
- Assessment of Soil and Water Conservation Techniques applied by farmers in the field was adjusted to the assessment guidelines of the Directorate General of Watershed Management and Social Forestry Management (2011) and [2].

2.2.2. Secondary data. Secondary data is the data needed to support primary data. Secondary data is a map of information about the general condition of the research location.

2.3. Data analysis
The data analysis was carried out by following:

The data obtained in the research activities were then tabulated based on each village forest. First, it classified based on soil and water conservation techniques. Second, gave an assessment according to the number of criteria in each method applied by the community. Guidelines for Assessment of the Directorate General of Watershed Management and Social Forestry Management (2011) and [2]. Then, give a percentage (%) according to the accuracy of the soil and water conservation techniques applied by the community using the formula:

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\text{Percentage} = \frac{\text{Number of Criteria Matched}}{\text{Total Criteria}} \times 100
\]
Classify by class on the assessment guidelines. The classes used to measure the application of soil and water conservation techniques by farmers in the field are defined in 3 (three) categories according to the Assessment Guidelines of the Directorate General of Watershed Management and Social Forestry Management (2011) and [2], namely:

The application of Soil and Water Conservation Techniques is said to be appropriate if it meets the requirements 100% in accordance with the guidelines.

The application of Soil and Water Conservation Techniques is said to be quite appropriate if it meets the requirements of 75% - <100% according to the guidelines.

The application of Soil and Water Conservation Techniques is said to be inappropriate if it meets the requirements <75% in accordance with the guidelines.

3. Results and discussion

The research location is in the Village Forest of Tompobulu District, Bantaen Regency, which is divided into managing areas, namely Labbo Village, Patteneteang Village and Campaga Village. The working area of the Bantaeng District Village Forest is 704 ha with an area of 342 ha in each village in Labbo Village, 339 ha in Patteneteang Village, and 23 ha in Campaga Village. The entire working area of the Village Forest is a protected forest area. Forest cover is dominated by secondary forest, partly vegetated by shrubs and agricultural areas [1].

Based on the watershed map issued by the Ministry of Environment and Forestry 2017, the Bantaeng District Forest area is located in 2 watersheds, namely the upstream of the Bialo watershed and the upstream of the Biangloe watershed. The land area of the Bantaeng Village Forest area has a slope ranging from 0% to 75%. The types of plants found in the research location were generally dominated by coffee (Coffea, sp), cloves (Syzygium aromaticum), Candlenut (Aulirites mollucana), banana (Musa paradisiaca), cocoa (Cocoa sp), bamboo (Bambussa sp) and Guava (Psidium guajava).

3.1. Identification and assessment of soil and water conservation techniques

The results showed that the application of soil and water conservation techniques applied by farmers in the Village Forest of Bantaen Regency was vegetative and mechanical. Vegetative techniques were applied in the form of ground cover crops, yards and mixed gardens, while the mechanical techniques were in the form of bench terraces and irrigation canals. The results of research on the application of soil and water conservation techniques are presented in Table 1.

| No. | Village/Sub-district | Assessments (%) | Total (%) |
|-----|----------------------|-----------------|-----------|
|     |                      | Precise | Less Precise | Non precise |
| 1   | Campaga              | 53      | 7            | 40         | 100        |
| 2   | Labbo                | 90      | 0            | 10         | 100        |
| 3   | Patteneteang         | 71      | 7            | 22         | 100        |
|     | Tompobulu district   | 71.3    | 4.7          | 24.0       | 100        |

The identification result of soil and water conservation techniques in the Village Forest of Bantaen Regency, the community applied vegetative techniques in the form of ground cover crops, mixed gardens and yards, while mechanical techniques were in the form of bench terraces and irrigation canals.
Based on the Guidelines for Soil and Water Conservation Techniques, the Labbo Village Forest community applies more precise soil and water conservation techniques. In general, the people in the Village Forest in Bantaeng Regency have applied soil and water conservation techniques appropriately, but the technique for making bench terraces is still not good.

3.2. Vegetative techniques

3.2.1. Ground cover plants. The land cover plants found in the Village Forest in Bantaeng Regency are mostly found in rice fields. The ground cover plants found in the Campaga Village Forest are in the form of king grass (*Pennisetum purpureoides*) and ground cover plants in the Patteneeteang Village Forest in the form of bede grass (*Brachiaria decumbens*) which are used as low ground cover crops by farmers. Apart from low cover crops, high ground cover crops are also used by farmers at the study sites. The high ground cover plants that are widely used by the community in the Campaga Village Forest are bananas, bamboo and cloves. Meanwhile, the Patteneeteang Village Forest is dominated by coconuts and cloves. Ground cover plants will reduce rainwater dispersion [3] and reduce the amount and speed of surface runoff and increase water infiltration into the soil thereby reducing erosion [2].

3.2.2. Mixed garden. In general, mixed garden in the research location is in a good category, it can be seen from the canopy strata which has 4 canopy strata, where at the 4 strata level is filled with clove and teak species. In the level of 3, it is filled with types of coconut, jackfruit, mango, nutmeg, and suren plants. In the second tier, it is filled with types of banana, coffee, cocoa, guava, and bamboo plants. Whereas in canopy 1 stratum is filled with types of chili plants, and many are covered by grass. The combination of annual plants and seasonal plants will produce variations in the canopy which will have a good impact on the soil conditions below [4]. By applying the mixed garden technique, erosion that occurs can be minimized and can also provide benefits to communities around the mixed garden because the crops can be used in the form of wood or fruit.

3.2.3. Yard. The yards obtained in the Campaga Village Forest are divided into two categories, namely the right and the wrong category. The application of the yard is categorized as appropriate because the community uses the land around the house by planting cloves, coffee and cocoa. While on the ground surface, it is widely used by planting chilies and vegetables. The yard was categorized as inappropriate because the land contained only seasonal plants in the form of clove plants so that the canopy strata cover only consisted of 1 strata with an irregular cropping pattern. The condition of the yard was considered inaccurate because the distance between the plant canopy was getting rarer and there was no ground cover which would cause the collision of rainwater to increase and trigger erosion.

A good yard will protect the soil underneath. Varied types of vegetation and an arrangement consisting of several strata will create a good canopy cover so that the soil is protected from rainwater collisions. The same statement is stated by [5] that the effect of vegetation on water in terms of whether or not a soil is easily eroded should pay attention to ground cover vegetation with a multi-layered canopy structure so as to reduce the speed and impact power of rainwater.

3.3. Mechanical engineering

3.3.1. Terrace benches. The results of observations in the Village Forest of Bantaeng Regency, the method of soil conservation in the form of bench terraces are found in rice fields. Rice fields are only found in the Campaga Village Forest and the Patteneeteang Village Forest. The bench terraces that are applied by the community are divided into 2 categories, namely appropriate and imprecise. The application of bench terraces is categorized as appropriate because it has terrace reinforcing plants planted on the lips and sides of the terrace which aims to bind the soil and reduce the impact power of
rainwater. In addition, there are also banana, coffee and shrub plants that aim to reduce surface runoff and the impact power of rainwater on the soil. There is a water drain that functions to remove excess water or drain water on the land.

The application of bench terraces is categorized as inappropriate according to the width of the terrace and the planted area against the slope. This is not in accordance with the PERDIRJEN DAS and HL (2017), that the construction of terraces functions to reduce the length of the slope and hold water, thereby reducing the speed and amount of surface runoff, suppressing erosion, increasing water infiltration into the soil and accommodating and controlling water flow to areas that lower safely. The existence of bench terraces that do not have terrace reinforcing plants will increase the power of rainwater against the soil so that the potential for erosion is even greater.

3.3.2. Irrigation channels. The existing irrigation channels at the research location are generally found in the rice fields of the Campaga Village Forest. Campaga Village Forest farmers use water from the catchment area of the Campaga Village Forest as a source of irrigation water. Water originating from the Campaga Village Forest is distributed to community rice fields through three irrigation areas (DI), namely DI Palaguna, DI Buttono and DI Babangtangayya. Making irrigation channels is one of the efforts of farmers to provide water to the soil in order to meet water needs for plant growth. The construction of irrigation channels aims to drain water from springs in the mountains to farmers' lands. This is in accordance with the Strategic Plan Book of the Agricultural Research and Development Agency 2005-2006 [6], which states that the main purpose of making irrigation canals is to prevent inundation and drain surface runoff so that water flows with the power not to damage soil, crops or buildings, other conservation.

4. Conclusion
Soil and water conservation techniques obtained in the Village Forest of Bantaeng Regency, the community applies vegetative techniques in the form of ground cover plants, mixed gardens, yards, and mechanical techniques in the form of bench terraces and irrigation canals. In general, the people in the Village Forest in Bantaeng Regency have applied soil and water conservation techniques appropriately, but the technique for making bench terraces is still not good. The village forest in the research location is land that is used by the community as their main source of livelihood.

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