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Spatial Planning of the Noongan Minahasa Watershed

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***Abstract*— The spatial plan that has been made is not realized properly, due to inadequate law enforcement, so that land use in the Noongan Sub-watershed is not by the ability of the land. Therefore, a reassessment needs to be done and more importantly, the enforcement of spatial rules and their more explicit realization in the Noongan Sub-watershed area to support environmental sustainability and sustainable use of space in Lake Tondano. Problem Formulation, to formulate the right spatial model based on the function of the area in the Noongan Sub-watershed, which can support environmental sustainability and sustainable use of space". Research Objectives, to formulate appropriate spatial planning models by the function of the area in the Noongan Sub-watershed, to support environmental sustainability and sustainable utilization of space. The method used, a) Making a Map of the Land Unit with GIS. b) Determination of Regional Functions. Results of the study: Protected forest area category (A), this area covers the upstream area of the Noongan River Sub-Region namely Protected Area is an area with natural water resources, flora and fauna conditions such as protected forest, asylum forest, tourism forest, area around water source, river channel, and other protected areas; Buffer Zone (B) is a buffer function area, an area that can function as a protection and cultivation function, located between the protected function area and cultivation function areas such as limited production forests, plantations (perennials), mixed gardens and the like; Annual Crop Cultivation Area (C), The area of annual crop cultivation function is the cultivation area cultivated with annual crops such as Permanent Production Forest, Industrial Plantation Forest, Community Forest, Plantation (perennials), and fruit plants; Seasonal Plant Cultivation Area (D), the annual cultivation function area is an area that has the function of cultivation and cultivated with annual crops, especially food crops or for settlements.**

Keywords— ***Spatial planning, sub-watershed, conservation of lake Tondano***

I. INTRODUCTION

Lake Tondano is the estuary of the Noongan Sub-watershed. Therefore the kelterian of Lake Tondano is influenced by the sustainability of the Noongan Sub-watershed. Considering that the function and benefits are huge for the welfare of the community, it is necessary to preserve the Noongan Sub-watershed concerning the conservation of Lake Tondano.

Lake Tondano is a significant asset because it has an essential economic role in North Sulawesi, namely having a variety of benefits for the surrounding population, namely water sources for freshwater fisheries, bathing, washing and latrines, water exploitation for the benefit of drinking water companies consumed by tens of thousands of Minahasa residents and some residents The city of Manado, besides being one of the attractions in North Sulawesi. Results of the 2000 NRM / EPIQ research, there was a decline in the quality of Lake Tondano in the Tondano watershed, namely a high sedimentation rate of 15-20 ppm in 1970 to 25 ppm in 1980, 30 ppm in 1990, and 30-50 ppm in 2000. Siltation occurred in 1934 with a maximum depth of 40 meters, in 2000 the maximum depth was only 20 meters, in 2010 the most profound point was 12 meters. Acceleration of silting because every year there is silting of approximately 1.04 meters. Eutrophication occurs with the entry of fertilizers, detergents, solid waste, fish culture waste in cages (nets), and organic materials [1]).

Noongan sub-watershed has a forest area based on its function used as a protected area and conservation of natural resources. The Noongan Sub-watershed is an upstream sub-watershed where Lake Tondano is included, and this Sub-watershed is a source of considerable water distribution for agricultural purposes, especially rice field agriculture. However, now it has changed, namely the decline in environmental resources where natural forests become residential and restaurant areas, infrastructure/road, plantation,

and agricultural buildings which have increased the rate of erosion, flooding and a decrease in water discharge

Spatial planning in the Noongan Sub-watershed already exists, but the law enforcement efforts are still inadequate, so that land use in the field is no longer appropriate with its intended use as planned. To overcome damage to the Noongan Sub-watershed, one of the efforts is to make spatial planning based on the function of the Noongan Sub-watershed area for the conservation of Lake Tondano.

According to reference [2]), spatial planning needs to be carried out by various parties, both government and society, in order to support each other in the environmental and spatial sustainability program of a region. The use of space by the ability of the region is expected to provide support for the maintenance of a sustainable and supportive environment for human life in a sustainable manner.

Spatial plans that have been made are not realized properly, due to inadequate law enforcement, so that land use in the Noongan Sub-watershed is not in accordance with the capabilities of the land. more firmly in the Noongan Sub-watershed area to support environmental sustainability and sustainable use of space.

"How to formulate the right spatial model based on the function of the area in the Noongan Sub-watershed, which can support environmental sustainability and sustainable use of space".

To formulate an appropriate spatial planning model in accordance with the function of the area in the Noongan Sub-watershed, in order to support environmental sustainability and sustainable utilization of space. Lake Tondano is the estuary of the Noongan Sub-watershed, by which the Lake Tondano subesterement is influenced by the sustainability of the Noongan Sub-watershed. Considering the very large functions and benefits for the welfare of the community, it is necessary to preserve the Noongan Watershed Sub-watershed in relation to efforts to preserve Lake Tondano.

II. RESEARCH METHODS

A. *Making a Map of Land Unit with GIS*

The research method used is direct measurement of primary and secondary data in the field with a land unit approach. Maps of land units are made based on overlapping land maps, slope maps, landform maps, and land use maps.

B. *Determination of Area Functions*

Determination of regional functions in the study area based on Minister of Agriculture Decree No. 837 / Kpts / Um / 11/1980, and No. 683 / Kpts / Um / 8/1981 concerning the criteria and procedures for establishing protected forests and production forests. Criteria for determining the function of the area through the assessment of 4 variables of land characteristics, namely; slope, soil type, rainfall intensity, classification and score scores of the following three factors:

TABEL 1. CLASSIFICATION AND SCORE OF SLOPES

CLASS	SLOPE	CLASSIFICATION	SCORE
I	0-8 %	Flat	20
II	8-15 %	Ramps	40
III	15-25 %	Rather Steep	60
IV	25-40 %	Steep	80
V	> 40 %	Very Steep	100

Source: [3]

TABEL 2. CLASSIFICATION SCORE OF SOIL TYPES

CLASS	TYPE OF SOIL	CLASSIFICATION	SCORE
I	alluvial, glei, planosol, hidromorf, laterik, latosol	Not Sensitive	15
II	Latosol	Less Sensitive	30
III	brown forest soil, non calsic brown, mediteran	Sensitive	45
IV	andosol, laterit, grumosol, podsol, pedsolic	More Sensitive	60
V	Regosol, litosol, organosol, rensina	Very Sensitive	75

Source: [3]

TABEL 3. CLASSIFICATION AND SCORE OF RAIN INTENSITY

CLASS	RAIN INTENSITY	CLASSIFICATION	SCORE
I	0-13,6	Very Low	10
II	13,6-20,7	Low	20
III	20,7-27,7	Medium	30
IV	27,7-34,8	High	40
V	34,8	Very High	50

Source: [3]

Determination of the function of the area is carried out by adding up the scores of the three variables above in each land unit. The amount of the score value is the value of the area function criteria score. The type of regional function is determined based on the value of the land capability score and other special criteria, as well as the criteria and procedures specified in the RLKT pattern preparation instructions. Area functions as follows:

a. Install protected forest functions
b. Buffer forest function area
c. Annual crop cultivation area
d. Seasonal cultivation area

The object of the research is the Noongan Sub-watershed spatial arrangement model according to the function of the area in the framework of preserving the lake ofondondano. Subjek is the Noongan Watershed Land.

III. RESULT AND DISCUSSION

The spatial plan is the spatial plan for the Regency, specifically the Noongan Sub-watershed. The preparation of detailed spatial plans is based on various considerations, including the development of growth centers, revitalization of the downtown area, development of large-scale residential areas, and the preservation of Lake Tondano. Similarly, in areas prone to erosion and landslide disasters, a detailed spatial plan must also be prepared based on considerations of saving the environment from the threat of disasters, especially the preservation of Lake Tondano. In the detailed plan of the

Noongan Sub-watershed spatial layout, the direction of developing aquaculture activities is limited to activities that are in accordance with the characteristics of the area. In addition, the detailed spatial plan also includes directives for the construction of disaster prevention infrastructure such as embankments, retaining walls and so on in areas prone to erosion and landslides.

Regarding the management of erosion-prone areas, landslide disasters, spatial plans at all levels must contain rules that are consistent with the criteria and determination of protected areas, cultivation areas, and areas prone to erosion and landslides. In order for the consistency of inter-level spatial planning to be realized, it is needed:

Intensive dialogue in the process of preparing spatial plans

Lower level of government compliance with the provisions set out in the above spatial plan.

Based on the results of the research, the classification of the function of the Noongan Sub-watershed area is divided into 4 categories, namely:

a) Protected Area (Code A)

Protected Area is an area with natural water resources, flora and fauna such as protected forests, asylum forests, tourism forests, areas around water sources, river channels, and other protected areas as stipulated in Presidential Decree 32 of 1990. Protected areas in this study were obtained data as follows: the intensity of the rain is as big as? 175 or meet one of the following criteria: (1) has a slope of> 40%, (2) has a height of 900 m dpal. Based on the physical criteria, an area is included in the category of protected forest area (A), this area covers the upstream area of the Noongan Sub-watershed.

b) Buffer Area (Code B)

The buffer function area is an area that can function as a protection and cultivation function, located between the protected function area and cultivation function areas such as limited production forests, plantations (hard plants), mixed plantations and the like. A land unit designated as a buffer function area meets one of the general criteria as follows: (1) the physical condition of the land allows for economical cultivation, (2) its location is economically easy to develop as a buffer zone, (3) does not harm the environment if developed as a buffer zone. Based on these physical criteria, an area is included in the buffer zone (B) category, and this area includes the middle area of the Noongan Sub-watershed.

c) Annual Crop Cultivation Area (Code C)

The function area of annual crop cultivation is the cultivation area cultivated with annual crops such as Permanent Production Forest, Industrial Plant Forest, Community Forest, Plantation (hardwood), and fruit plants. A land unit is designated as the area and function of annual crop cultivation if it has a slope of 15-40% and meets general criteria such as the buffer function area. Based on these physical criteria, an area is included in the category of annual crop cultivation area (C), the area of coverage includes; Noongan Sub-watershed in Touliang region.

d) Seasonal Plant Cultivation Areas (Code D)

The seasonal cultivation function area is an area that has a function of cultivation and cultivated with annual crops, especially food crops or for settlements. To maintain the sustainability of the area of cultivation function of seasonal crops, the selection of the type of commodity must consider the suitability of the commodity to be developed. The value of land capability meets the criteria of land that can be developed as a cultivation area, and the slope of the slope is not more than 8%, so in this area there is no land that meets the criteria of slope should not be greater than 8%, so that at the location of research the function of annual cultivation area does not meet the requirements for planting land with annual crops only. Planting land with annual crops can be done by integrating the planting pattern of annual crops between core crops or perennials that are at the research site. Its coverage area is Noongan Sub-watershed, Tompaso (North Langowan District, Tolok); Langowan (Toraget, Tumaratas, Walewangko).

IV. CONCLUSION

Spatial planning in the Noongan Sub-watershed area is carried out with consideration of the ability of the area based on the characteristics of the land in question. Determination of the function of the area for specific uses is carried out with consideration of physical and social characteristics. Important spatial planning is carried out by various parties, both government and society, to support each other's environmental and spatial sustainability programs, especially the Noongan Sub-watershed within Lake Tondano. The use of space in accordance with the ability of the region is expected to provide support for the maintenance of a sustainable and supportive environment for human life in a sustainable manner. Community empowerment to become a community that is aware of environmental conditions will be crucial for the success of the regional structuring program. Regional arrangement is not only based on increasing community economic activities, but also considering the preservation of the natural environment of the Noongan Sub-watershed in the vicinity, especially the preservation of Lake Tondano.

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