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Suitability of land use with spacial plan in Lisu watershed

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Abstract. Changes in current land use without regard to ecological aspects result caused suitability of land use. This research aims to identify and analyze the suitability of land use in 2017 with the planned spatial pattern in the Lisu Watershed. The data were collected in the form of primary data was the land use and secondary data spatial plan area. The data were analyzed with interpretation, test accuracy and conformity determination for the overlay in land use with the plan space. Based on the interpretation of the image obtained by land use in Lisu watershed secondary dryland forest covering an area of 8,514.97 ha (21.98%), plantations forest covering an area of 78.83 ha (0.20%), meadows covering an area of 508.20 ha (1.31%), settlements covering 719.28 ha (1.86%), bush mixed dryland farming covering an area of 14,623.84 ha (37.75%), paddy fields covering an area of 6,595.35 ha (17.02%), shrub covering an area of 6,878.54 ha (17.75%), pond covering an area of 517.45 ha (1.34%), open land covering an area of 164.93 ha (0.43%) and a water body covering 140.78 ha (0.36%). Based on the results of the analysis of land use suitability with the plan space is acquired that land use plan that fit the space of 71.62% and which is not in accordance of 28.38%.

1. Introduction

Land use changes that occur usually consider aspects of the social and economic needs of the community without considering the ecological aspects of the land. Changes in land use that do not consider ecological aspects can result in inappropriate land use. Mismatches and violations that occur caused by several factors, including pressure from market developments on space, unclear control mechanisms and weak law enforcement, these deviations can occur because spatial planning products less attention to implementation the aspects of space utilization or otherwise that space utilization less attention plan of spatial pattern [1]. It is feared that the mismatch of land use against the spatial pattern plan can reduce the physical capacity of the land and result in a decrease in the quality of the watershed (DAS).

BPS data for Barru Regency (2017) shows that Barru Regency has an area of approximately 117,462 ha. Most of the land conditions in Barru Regency in 2013 were in a rather critical condition [2]. The largest rather critical land conditions in Barru Regency are in the Lisu watershed area and have made this watershed into the list of Priority II DAS. The Lisu Watershed is the largest watershed in Barru Regency with an area of approximately 38,775.14 ha [3].

Based on data from the Jeneberang Walannae Watershed Management Center (2010), the land use pattern in the Lisu watershed is divided into rice fields (10,620.70 ha), fields (881.03 ha), plantations



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(704.83 ha), forests (68,247 ha), shrubs (1,793.90 ha), ponds (17,620.70 ha), settlements (11,741.10 ha), and other uses (4,731.79 ha).

Based on this description, a study is needed regarding the suitability of land use with regional spatial patterns, so that information will be obtained that can be considered in the future. In this study the authors chose the title "Suitability of Land Use and Spatial Patterns in the Lisu Watershed".

2. Destination

Classifying land uses in the Lisu watershed and analyzing the suitability of land uses in 2017 with the 2011-2031 spatial pattern plan in the Lisu Watershed.

3. Research methods

This research was conducted for five months, from March to July 2018 in the Lisu Watershed and the Watershed Management Laboratory of Hasanuddin University.

3.1. Tools and materials

This study used *receivers* GPS, writing instruments, cameras, *Abney* Levels and computer devices with GIS applications. The materials used *Landsat* 8 imagery of 2017, Lisu watershed boundary maps, slope maps and RTRW maps for Barru Regency.

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3.2. Data collection method

3.2.1. Primary data collection

- a) Identifying the types of land cover.
- b) Determination of the sampling coordinates of the survey based on land use maps. The land use map is overlaid with a spatial pattern map to produce a suitability map. Determination of the representative points in each land use using the principle of *purposive sampling* (representation) on the suitability map by considering the accessibility factor of each selected land use and seeing the extent of each of these land. The predetermined sample points are recorded and the coordinate data is entered into the GPS uses.
- c) Survey and field data collection (*cross check*) in accordance with predetermined points on the working map by observing conditions and land use patterns.
- d) Data analysis by managing field data and making improvements / corrections.

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3.2.2. *Secondary data collection*. Data or information obtained from various related government agencies as the district spatial planning map (RTRW).

3.2.3. Data analysis

- a) Interpretation image
Land use maps are made from satellite imagery data. The satellite imagery used is Landsat 8 Path 113 and Row 64 imagery in November 2017. These images can be downloaded via website <http://earthexplorer.usgs.gov>. Then an interpretation is carried out which begins with the incorporation of the composite band. Next, digitizing is done using the on-screen digitizing method, which is digitizing the image directly by relying on visuals. Land use classes are defined based on the patterns and characteristics (hue, color and texture) of the image.
- b) Accuracy test
The accuracy of interpretation test, an image classification accuracy test is carried out which aims to determine the accuracy of the image interpretation that has been carried out according to Lillesand and Kiefer (1997) in Saripin (2003) [4]. This process called *overall accuracy* with the following equation:

$$OA = \frac{x}{N} \times 100\%$$

where:

x = Number of matrix diagonal values

N = Number of matrix samples

c) Determination of suitability

Land use suitability is determined by spatial analysis method using GIS (Geographic Information System) application. The determination of the suitability of land use forms is based on the function of the area stipulated in the Republic of Indonesia Law no. 26 of 2007 regarding the spatial pattern plan [5]. The spatial plan includes:

- a. Designation of space for protected areas
- b. Allocation of space for the cultivation area

4. Results and discussion

The results of interpretation image and the results of field observations on land use in the Lisu Watershed indicate that there are 10 categories of land use which can then be seen in Table 1.

Table 1. Classification land cover in Lisu Watershed 2018.

No	Land use	wide (ha)	Percentage (%)
1	Forest Secondary Dry Land	8,514.97	21.98
2	Plantation	78.83	0.20
3	Pasture	508.20	1.31
4	Settlements	719.26	1.86
5	Agriculture Mixed Dry Land Bush	14,623.84	37.75
6	Rice fields	6,595.35	17.02
7	Shrub Shrub	6,878.54	17.75
8	Ponds	517.45	1.34
9	Open land	164.93	0.43
10	Water bodies	140.78	0.36
Grand Total		38,742.15	100.00

Based on Table 1, it is known that the widest distribution of land use in dry land mixed with shrubs with an area of 14,623.84 ha (37.75%) with commodities consisting of corn and beans. Then followed by shrubs covering an area of 6878.54 ha (17.75%). Meanwhile, occupy the pond, plantations are with an area of 78.83 ha (0.20%).

Based on the results of the ground check, there were several points of land use that were found to be different from the results of the image interpretation. This difference occurs because of the low level of image accuracy and resolution so that an object cannot be distinguished with certainty. For example, on the map interpretation results in the form of secondary dryland forest, several points visited have turned out to be dry land agriculture. The results of the land use classification in 2017 were then tested for the accuracy of the image interpretation results. The accuracy test is carried out using a confusion matrix table which aims to determine the percentage level of confidence from the results of the image interpretation Landsat 8 of 2017. The number of sample points according to the results interpretation with the conditions in the field divided by the total number of sample points then multiplied by 100. The result will show the percentage level of accuracy image interpretation that has been done. matrix classification usage in 2018 can be seen in Table 2.

Table 2. Confusion matrix land cover classification point sample 2018 Lisu Watershed.

Land cover	Field data in 2018										Total
	P1	P2	P3	P4	P5	P6	P7	P8	P9	P10	
P1	15				2	1					18
P2		2	2								2
P3			3								3
P4				35							35
P5					41	2	4				47
P6					2	37	1				40
P7			1			6	15				22
P8								5			5
P9									2		2
P10										6	6
Total	15	2	4	35	45	46	20	5	2	6	180

Where:

P1 = Secondary Dryland Forest P6 = Paddy Field

P2 = Plantation Forest P7 = Scrub

P3 = Pasture P8 = Pond

P4 = Settlement P9 = Open Land

P5 = Mixed Dry Land Farming Shrub P10 = Body of Water

$$\begin{aligned}
 OA &= \frac{\text{Number of points matched}}{\text{Total number of points}} \times 100 \% \\
 &= \frac{161}{180} \times 100 \% \\
 &= 89.45 \%
 \end{aligned}$$

Land use classification 2018 in Table 2 shows 161 points corresponding to the conditions in field and not match, namely 19 points. Based on these results, the level of accuracy of the interpretation results is 89.45%, so the results of the interpretation can be accepted. This is consistent with the statement of Lillesand and Kiefer (1998), image classifications are acceptable, namely with a minimum level of accuracy of 85% [6].

4.1. Suitability of Land Use in 2017 with Spatial Patterns in 2011-2031 Lisu Watershed

The land use map derived from image interpretation then overlaid with a spatial pattern map. This is done to determine land uses that are in accordance with the Regional Spatial Plan and in appropriate land use in the Lisu Watershed can be seen in Figure 1.

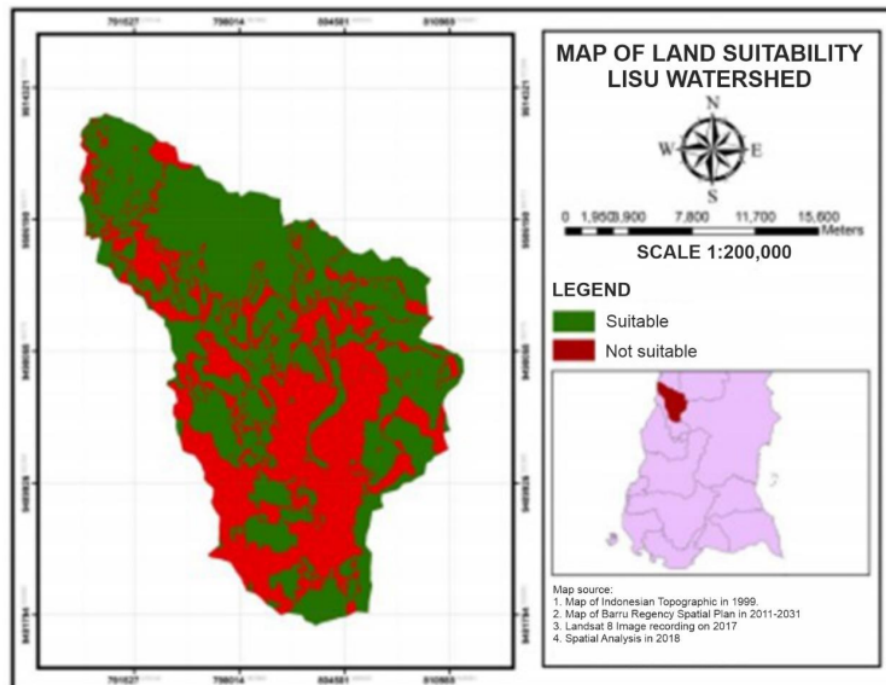


Figure 1. Land use suitability map 2017 with the 2011-2031 RTRW in the Lisu watershed.

Land use map derived from the image interpretation then overlaid with a spatial pattern map. This is done for the suitability of land use determine the suitability of land use in the Lisu watershed and the spatial pattern plan. From these results it can be seen the extent and percentage as in Table 3.

Table 3. Percentage of Land Use Suitability with Spatial Pattern in the Lisu Watershed

No	Land use	wide (ha)	Percentage (%)
1.	suitable	27,747.26	71.62
2.	not suitable	10,851.89	28.38
Grand Total		38,742.15	100.00

Based on Table 3, it is known that land use in accordance with the spatial pattern plan is 22,965.60 ha (59.28%) and in appropriate land use is 15,776.56 ha (40.72%). Based on the Regional Spatial Plan (RTRW) the areas included in the boundary of the Lisu Watershed are designated for cultivation areas and protected areas. The wide use of land in the form of dry land farming shows that most of the population in the Lisu watershed works as farmers.

People of the Lisu Watershed use the land a lot as dry land farming on slopes from flat to steep. This can be seen from the percentage of dry land agriculture in the Lisu watershed of 14,623.48 ha which can be seen in Table 2. Based on the analysis results show that land use in the form of dry land farming is in accordance with a predetermined spatial pattern. The RTRW direction as a cultivation area is appropriate to provide economic benefits to the community because the results obtained from agricultural cultivation are then sold by the community. This is in line with the results of the research

obtained [7], the value of economic benefits obtained by the community as dry land agricultural farmers is very profitable.

The use of scrub land covers an area of 6,878.54 ha (17.75%) of the entire Lisu watershed area. From the results of the analysis of shrub land cover in accordance with the spatial pattern of 3,234.90 ha or about 47.03% and that which did not correspond to the spatial pattern of 3,643.64 ha or about 52.97% of the area of scrub in the Lisu watershed. Land use that is not suitable is in the Cultivation Area. The use of the land is considered inappropriate because shrubs in the cultivation area can reduce the economic value of the land and is not in accordance with the function of the cultivation area which should be used to improve the community's economy.

Residential area in the Lisu Watershed has an area of 719.26 ha (1.86%). Residential area are on a flat to gentle slope, however, some residential locations can also be found in areas with steep slopes. This occurs due to community considerations to prefer to build settlements in the area and carry out agricultural and garden processing activities in areas with steep topography.

The use of paddy fields in accordance with the RTRW has an area of 5,725.05 ha while those that are not suitable are 870.30 ha. The use of paddy fields in the Lisu watershed is rainfed which depends on rainwater. During the dry season the water supply decreases so that the rice fields are planted with beans and corn [8].

Open land in the Lisu Watershed has a total area of 164.93 ha and all of them do not fit the spatial plan. The felling of trees by the community around the forest in order to clear land is one of the causes of finding open land in an area. According to Kusmana (2004) states that in temperate areas, every 10% reduction of forest increases water flow by 40 mm / year, so the use of open land for protected areas is not suitable for use. Rainwater without a barrier falls directly to the ground which will facilitate erosion. In addition, open land without vegetation on rugged slopes will facilitate runoff.

5. Conclusion

Based on the research results obtained, it can be concluded that:

1. There are 10 land use classes in the Lisu Watershed, namely dry land forest, plantation forest, grasslands, settlements, dry land agriculture, rice fields, shrubs, ponds, open land. and bodies of water.
2. Based on the results of the analysis of land suitability with spatial patterns, it is found that land use in accordance with the spatial pattern is 22,965.60 ha (59.28%) and not suitable is 15,776.56 ha (40.72%).

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