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Evaluation of Land Cover Based on the Regional Spatial Plan (RTRW) of Aceh Province in the Krueng Aceh Watershed

Ichsan^{1, 4*}, Hairul Basri² and Muhammad Rusdi³

¹Magister Konservasi Sumber Daya Lahan, Fakultas Pertanian Universitas Syiah Kuala Darussalam - Banda Aceh.

²Ilmu Tanah, Fakultas Pertanian Universitas Syiah Kuala Darussalam - Banda Aceh.

³Magister Konservasi Sumber Daya Lahan, Fakultas Pertanian Universitas Syiah Kuala Darussalam - Banda Aceh.

⁴ Balai Pengelolaan Daerah Aliran Sungai Krueng Aceh, Direktorat Jenderal Pengendalian Daerah Aliran Sungai dan Rehabilitasi Hutan (Ditjen PDASRH), Kementerian Lingkungan Hidup dan Kehutanan Republik Indonesia.

*E-mail: ichsandulugondrong@gmail.com

Abstract

This study aims to analyze the area and distribution of land cover in the last 10 years in the Krueng Aceh and evaluate the alignment between the regional spatial plan (RTRW) and the land cover in the Krueng Aceh watershed. The results of the analysis were obtained through digital image processing derived from Landsat 7 ETM 2009 and Landsat 8 OLI 2020. This study show that land cover in the form of primary forest has changed from 2009 to 2020, where in 2009 primary forest cover had an area of 60,245.62 ha or 34.11% of the entire area while in 2020 it was reduced to 48,512.00 ha or 27.47% of the entire area. And Based on the results of the evaluation of the consistency of land closure conditions in the Krueng Aceh watershed against the Aceh Provincial RTRW, 98.40% of the area of the Krueng Aceh watershed obtained land cover consistent with the RTRW. But Based on the results of the Evaluation of the Consistency of Area Status in the Krueng Aceh River Basin against the Aceh Province RTRW, it was found that an area of 176,301.71 ha or equal to 99.99 % of the area of the Krueng Aceh River Basin, the status of the Area was consistent with the RTRW.

Keywords : land cover, RTRW, watershed

INTRODUCTION

Land is a physical environment consisting of climate, relief, water, flora and fauna, as well as the formation of cultural products. The real state of land is very important for living things because the land can be cultivated to meet human needs, the processing of the land in the form of land use. Land use is any form of human intervention towards land in order to meet the needs of their lives both material and spiritual (Jamulya and Sunarto, 1995).

Land cover change is triggered by rapid population growth and development. The interaction between communities and land causes changes in land cover, causing negative impacts on watersheds. Land use change is a change in land use that is different from previous uses, both for social, economic, cultural, and industrial purposes. The physical resources of an area such as soil, climate, topography, and geology largely determine the potential of an area for various types of use (Hardjowigeno and Widiatmaka, 2001).

A watershed is a land area that is a unit of a river and its tributaries, which functions to hold, store, and drain water from rainfall to lakes or into the sea naturally, whose boundaries on land are the separator of topography and sea boundaries up to water areas that are still affected by land activities. Watershed is a complex system composed of three systems that are interrelated and interacting, namely physical systems, biological systems, and human systems (Susetyaningsih, 2012).

In detecting changes in land cover in watersheds can use remote sensing techniques, remote sensing methods have the ability to cover very varied study areas ranging from small to extensive (couplehensive), can provide a picture of spatial elements that are comprehensive with correct relative geometric shapes (and neighborly relationships), the measurement (observation) period is relatively short and can be repeated quickly and consistently (precision), the scale (accuracy of spatial data) obtained varies from small to large, the tendency to get the most up-to-date data, the overall cost, time and so on which are considered cheap (Prahasta, 2008).

In remote sensing techniques, imagery is an important element. Dijital imagery is data used in remote sensing techniques, digitized imagery is a two-dimensional representative of an object in the real world, in the field of remote sensing the image is a partial image of the earth's surface as seen from space (satellite). Dijital imagery is basically sensor recording data in the form of rasters, matrices and grids, each element is referred to as a pixel (picture element) whose coordinate values are known and the average intensity (value) of the entire earth's surface area represented by pixels (Prahasta, 2008).

MATERIALS AND METHODS

This research was carried out from September 2021 to January 2022 with the scope of research on the Krueng Aceh watershed which is geographically 5°03' 41"–5°38' 10" North Latitude (LU) and 95°11' 41"–95°49'46" East Longitude (BT). The area of the Krueng Aceh River Basin based on the Decree of the Minister of Environment and Forestry Number: SK.304/MENLHK/PDASHL/DAS.0/7/2018 concerning the Determination of River Flow Maps is an area of 1,766,094,937.51 Ha.

The data used to support and the data sources used in this study are Landsat 7 ETM and 8 OLI imagery, Administration Map, RBI and Regional Spatial Plan Map (RTRW) of Aceh Province 2013-2033.

The tools used in this study are Erdas Imagine 9.3 software, Arc GIS 10.8, Microsoft Office Word, Microsoft Office Excel, GPS and digitized camera. Broadly speaking, this research consists of four stages of activities, namely: (1) the preparation and data collection stage, (2) the spatial and data analysis stage, (3) the field checking stage, (4) the data analysis stage and report preparation.

RESULTS AND DISCUSSION

1. Land Cover Change in the Krueng Aceh River Basin 2009 – 2020

The results of the 2020 landsat image land cover interpretation test results are in a very strong/very good class, which is in the range of 80%–100% (Viera and Garrett 2005). Excellent interpretation accuracy in the 2020 land cover was used to create the interpretation key used in the land cover of landsat imagery in 2009.

Imagery interpretation carried out using the 2020 interpretation key resulted in a 2009 land cover map. Visually, there has been a significant change in residential cover from 2009. The growth of the red hue representing the land cover of settlements is rapidly expanding downstream of the watershed which is the capital of Aceh Province. Dryland agriculture has also experienced a decline in area replaced by several other land cover such as shrubs, settlements, open land and agroforestry. Primary forests located upstream of the watershed do not appear to have undergone drastic changes in all periods of interpretation.

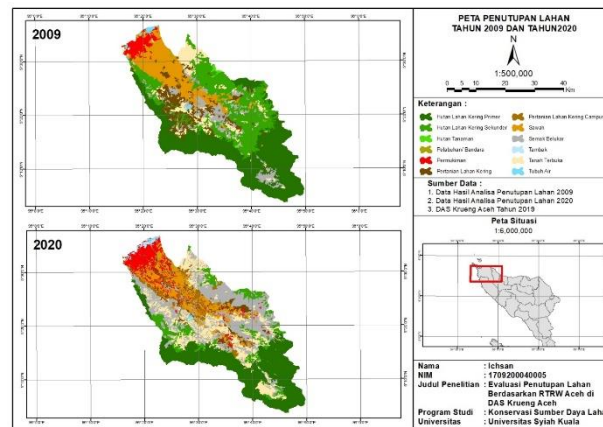


Figure 1. Results of visual interpretation of landsat 2009 and 2020

Tabel 1. Land cover change in the Krueng Aceh 2009 - 2020

Land cover	2009		2020	
	Area (Ha)	Proportion %	Area (Ha)	Proportion %
Primary Dryland Forest	60 245.62	34.11	48 512.00	27.47
Secondary Dryland Forests	43 544.58	24.66	14 716.71	8.33
Forest Plantations	566.34	0.32	58.68	0.03
Port / Airport	172.02	0.10	135.50	0.08
Settlement	5 057.41	2.86	12 236.14	6.93
Dryland Agriculture	14 405.39	8.16	5 850.64	3.31
Mixed Dryland Agriculture	0.00	0.00	8 051.85	4.56
Shrubs	13 803.45	7.82	39 455.06	22.34
Paddy	25 149.27	14.24	18 422.21	10.43
Open ground	12 597.00	7.13	26 515.95	15.01
Body of Water	1 068.41	0.60	1 657.90	0.94
Pond	0.00	0.00	996.85	0.56
Total	176 609.49	100.00	176 609.49	100.00

Table 4 shows that in 2009 and 2020 primary forest cover was the dominating type of land cover. However, land cover in the form of primary forest has changed from 2009 to 2020, where in 2009 primary forest cover had an area of 60,245.62 ha or 34.11% of the entire area while in 2020 it was reduced to 48,512.00 ha or 27.47% of the

entire area. Although there is a reduction in area, land cover in the form of primary forest still dominates, this happens inseparable from the status factor of the forest area in the area, where the forest area will be maintained as mandated in the applicable laws and regulations. The loss that occurs in the primary forest area is mostly caused by the increase in secondary forest due to the large growth of forest roads and encroachment on areas with gentle to rather steep slopes.

Plantation Forest underwent a change in cover from 566.34 Ha in 2009 to 58.68 ha. This happens because of the harvesting of timber by IUPHHK-HT holders but has not been replanted.

Settlements experienced an increase in area from 5,057.41 ha in 2013 to 12,236.14 ha in 2020. The increase in residential area that occurred in the Krueng Aceh watershed also occurred in Africa (Gibbs et al. 2010), Ethiopia (Wubie et al. 2016) Slovakia (Tarasovicova et al. 2013), and Portugal (Araya and Cabral 2010) explained if. The increase in residential land occurred due to the conversion from agricultural land, open land, and shrubland to settlements. Research conducted by Riad et al. (2020) revealed that residential area planning is very necessary to overcome environmental problems such as reduced land and water supply in urban areas.

Dryland Agriculture, Rice fields experienced a reduction in area as designated by the table above, based on the results of observations made dryland agriculture mostly turned into shrubs and open ground. Shrubs and Open Ground respectively experienced the largest increase in area where the Shrub increased from 13,803.45 in 2009 to 39,455.06 and Open Land 12,597.00 ha to 26,515.95 ha. A similar change occurred in a study in South China where Hasan et al. (2020) found urbanization in several local government centers caused dryland agricultural cover to decrease by 15,105 ha over a period of 12 years (th 2005–2017).

2. Evaluation of Land Cover for Land Allocation According to the RTRW 2013-2033

RTRW that has been compiled and determined to be a regional regulation within a certain period of time often experiences incompatibility caused by population growth and the development of the times, so that there will be such a thing as land conversion which will later increase the growth of areas such as industry, trade complexes, offices, and other strategic functions. This alignment needs to be monitored by comparing current or existing land use with land use plans which are one of the materials in the spatial plan of the area.

Based on the results of the Evaluation of the Consistency of Land Closure Conditions in the Krueng Aceh river basin against the Aceh Province RTRW, it was found that an area of 173,780.57 ha of the total research area of 176,609.49 ha (98.40%) of the area of the Krueng Aceh River Basin land cover was consistent with the RTRW and 2,828.92 ha (1.60%) Inkosisten with RTRW.

The cause of inconsistency is the non-construction of an area according to its designation and the construction of an area not in accordance with the direction of the RTRW. The inconsistency value is still very low at 1.60%, but this should be an alarm reminder that the RTRW as a reference for development has experienced deviations and needs to be improved by the Aceh Government because according to (McNeil et al, 1998) the factors that drive land use change are political, economic, demographic, and cultural. The political aspect is the existence of policies carried out by decision makers that influence the pattern of land use change. Furthermore, economic growth, changes in income and consumption are also factors causing changes in land use. For example, the

increasing need for living space, transportation and recreational areas will encourage land use change.

3. Evaluation of the Consistency of Forest Area Status towards the RTRW of Aceh Province

Based on the status of the forest area, the research location is divided into several functions as presented in the following table:

Table 5. Forest Area Status in Krueng Aceh Watershed

Fungsi Kawasan	Area (ha)	%
APL	71.543,46	40.58
CA	14.945,77	8.48
HL	37.908.90	21.50
HP	39.737.69	22.54
HPK	4.074.51	2.31
TAHURA	2.842.47	1.61
Water	1.139.09	0.65
TWA	4.127.32	2.34
Jumlah	176.319.20	100.00

Based on the table data above, it is known that the total forest area at the research site is 103,636.70 ha above equal to 56.44% of the total area of the Krueng Aceh watershed. This is in line with the mandate of Law 41 of 1999 concerning forestry which in article 18 paragraph 1 states "The government establishes and maintains the adequacy of forest areas and forest cover for each watershed, and or island in order to optimize environmental benefits, social benefits, and economic benefits of local communities" and paragraph 2 which states "The area of forest area that must be maintained as referred to in paragraph (1) is at least 30% (thirty percent) of the area of the watershed rivers and or islands with a proportional distribution.

Based on the results of the Evaluation of the Consistency of Area Status in the Krueng Aceh River Basin against the Aceh Province RTRW, it was found that an area of 176,301.71 ha of the total area of the Krueng Aceh Watershed was 176,609.49 ha or equal to 99.9901% of the area of the Krueng Aceh River Basin, the status of the Area was consistent with the RTRW. However, from the results of the Evaluation of the Consistency of Area Status in the Krueng Aceh River Basin against the Aceh Province RTRW, it was obtained that an area of 17,495,126 ha of area status was inconsistent with the Aceh Province RTRW. The inconsistency in the status of the forest area to the Aceh Provincial RTRW covering an area of 17,495,126 ha is indeed very small when compared to the total area of the Krueng Aceh watershed, but this will have an impact on the development that will be carried out by the Aceh government. Because it is impossible to carry out activities or development of Wetland Agriculture, Dryland Agriculture or Community Plantations in areas with protected or conservation area status.

CONCLUSION

The Krueng Aceh River Basin from 2009 to 2020 has undergone land cover changes with the largest change in the reduction of primary dryland forest cover by 11,733.62 ha and the increase in land cover area in the form of shrubs by 15,651.61 ha so that from the area of shrubs that previously had an area of 13,803.45 to 39,455.06 ha.

The reduction in vegetation closures such as primary dryland forests and secondary dryland forests and the increase in land closures in the form of open areas such as shrubs, settlements and agricultural land shows that there is pressure on vegetated areas to be utilized by vegetation through tree felling and the use of the area as a cultivation area.

And based on the evaluation of the consistency of land closure conditions in the Krueng Aceh River Basin to the Aceh Province RTRW, it was found that an area of 173,780.57 ha from the total research area of 176,609.49 ha or equal to 98.40% of the area of the Krueng Aceh River Basin land cover is consistent with the RTRW. The total forest area at the research site is 103,636.70 ha upper, equal to 56.44% of the total area of the Krueng Aceh River Basin. This is in line with the mandate of Law 41 of 1999 concerning Forestry stating that the area of forest areas that must be maintained is at least 30% (thirty percent) of the area of watersheds and or islands with a proportional distribution.

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