



## Land Cover Change Model in Sirimau Sub-district, Ambon City, Indonesia

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### ABSTRACT

This study aims to analyze the Pattern of Land Cover Change in Sirimau District, Ambon City, Indonesia. The introduction of the research discusses the importance of understanding the dynamic interaction between human activities and land resources in the context of spatially distributed land cover. The research method used was descriptive quantitative with a spatial approach, conducted in Sirimau Sub-district, Ambon City, which experienced high population growth and development of built-up areas. Satellite image data analysis was used to identify patterns of land cover change from 2014 to 2024. The results showed the dominance of agricultural land in 2014, with certain areas converted to residential and built-up land in 2019 and 2024. The findings provide valuable insights in understanding the dynamics of land cover change in Sirimau sub-district and its relevance in sustainable land resource management.

**Keywords:** Cover, Sirimau, Urban

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## INTRODUCTION

Land cover as a manifestation of the dynamic interaction process between human activities and land resources, which is spatially distributed over the land surface and identifies the biophysical cover of the terrain; this includes inland water, bare land or human infrastructure (Supriatna et al., 2016; Manakane et al., 2023), land cover and its limiting elements affect the processes that occur on the land surface (Latue & Rakuasa, 2023). Land cover change has a significant effect on regional development planning and ecosystem function at all spatial scales (Talukdar et al., 2021; Rakuasa & Pakniany, 2022), from global to local, therefore it is important to understand the relationship between social and natural phenomena, especially in urban areas to improve the sustainability of dynamic landscapes and to predict the effects of land use planning (Sihasale et al., 2023).

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The increase in population is in line with the increase in human activities in various sectors, especially the economic sector, so that the need for land resources will also increase, while the existence of land is fixed (Amini Parsa et al., 2016; Latue et al., 2023), this will lead to increased competition in land use, so that economic and social needs will always be a priority in land use change (Achmadi et al., 2023), therefore, this will lead to increased competition in land use, 2023), therefore, the utilization and efficiency of urban land cover should be improved based on rational land cover planning with the aim of sustainable development (Rakuasa, 2022; Rakuasa et al., 2023), so it is necessary to improve and manage development potential (Septory et al., 2023). Because one of the keys to sustainable development in urban areas is spatial planning and structuring, especially in the development of green open space (Rakuasa, & Sihasale 2023).

Land use change can take place at different times and in different scales of shape and size (Latue et al., 2023). Land cover change can also be said to be the transition of one land function to another which is directly or indirectly related to human goals in an effort to fulfill their life needs (Somae et al., 2023). This condition becomes a regional problem due to the demands of land needs and land limitations and needs to be studied to be able to provide solutions in structuring the future land use of Serimau Sub-district which is sustainable based on ecological aspects and conservative efforts to support land use planning and appropriate land use allocation in addition to carrying out conservative activities as a preventive effort in ecologically based land use (Sugandhi et al., 2022; Manakane et al., 2023).

Ambon City, as the capital of Maluku Province, is the center of economic, administrative, and socio-cultural activities in the region. Sirimau sub-district, one of the sub-districts in Ambon City, has an important role in the urban and agricultural dynamics of the region (Latue & Rakuasa, 2023). However, urban growth and human activities have had a significant impact on land cover in this sub-district (Rakuasa & Latue, 2023). Rapid population growth in Ambon City, including in Sirimau Sub-district, has increased pressure on natural resources and land (Latue et al., 2023). As the population increases, the demand for land for housing, industry and infrastructure increases significantly (Salakory & Rakuasa, 2022). This urban expansion is also closely related to infrastructure development (Latue & Rakuasa, 2023). The development of roads, bridges, and other public facilities is an important part of supporting economic and social growth in Sirimau Sub-district. However, infrastructure development also has the potential to significantly alter land cover patterns, especially if not well regulated.

In addition, the agriculture and plantation sectors also play a role in land cover change in Sirimau Sub-district (Rakuasa et al., 2022). The change from traditional agriculture to more intensive modern agriculture or commercial plantations can result in greater land use (Jafarpour Ghalehtemouri et al., 2022). It can also result in a reduction of land available for subsistence farming activities for local communities (Demissie, 2022). Land cover change can also have significant environmental impacts. For example, conversion of forest land to agricultural land or settlements can lead to loss of habitat for local flora and fauna and increase the risk of soil erosion and water quality degradation

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(Wang et al., 2021). In addition to these factors, land cover change in Sirimau Sub-district can also be influenced by government policies, climate change, and global economic dynamics. All these factors are interrelated and provide a complex picture of the dynamics of land cover change in the region. This has resulted in the conversion of agricultural and forest land into dense urban areas, and increased the risk of conflict between land users (Ni et al., 2021).

Research on land cover change using high-resolution satellite image data is a first step in future land management and sustainability, this research can also facilitate the government / stakeholders and stakeholders in handling and managing land wisely so that profitable land use decisions can be made in the dimensions of sustainable land use planning along with the future development of Serimau District. Based on this description, this study aims to determine the Pattern of Land Cover Change in Sirimau District, Ambon City, Indonesia.

## **RESEARCH METHODOLOGY**

The research method is descriptive quantitative with a spatial approach, this research was conducted in Serimau Sub-district, Ambon City which has population growth and land cover development, especially built-up areas, which are high in other sub-districts in Ambon City. Land cover describes built-up land and open space, because higher population growth causes higher land demand. The higher the land demand, the less available land there will be due to the relatively fixed amount of land and the increasing built-up area. This research uses 2014 Sentinel 2 imagery, and 2019 and 2024 SPOT 6 imagery. The spatial analysis process was carried out in Arc GIS software by digitizing on screen, then overlay analysis was carried out to determine land development in the last 10 years (2014-2024).

## **RESULT AND DISCUSSION**

Classification of images was carried out using the SNI 7645 - 2010 classification standard on Land Cover Classification. After making adjustments that the data required is data on settlement development, the land cover classification is divided into 5 classes. The land cover classes include: residential land, agricultural land, settlements, water bodies and forests (National Standardization Agency, 2010).

### **Land Cover in 2014**

Land cover in 2014 was dominated by agricultural land with an area of 18,745.80 ha or 63.14%, forest areas had an area of 9,561.80 ha or 32.20%, residential areas had an area of 1,103.70 ha or 3.72% open land had an area of 23.98 ha or 0.08% and water bodies had an area of 255.31 ha or 0.82%. Overall land cover can be seen in Figure 1.

### **Land Cover in 2019**

Land cover in 2019 is still dominated by agricultural land cover, which amounted to 19,016.83 ha. A decrease also occurred in forest land cover of 7,355.47 ha or 23.52%,

settlement land has an area of 4,355.53 ha or 13.93%, open land of 290.69 ha or 0.93% and water bodies have an area of 255.31 ha or 0.82%. It can be seen in the figure (Figure 1) the composition of the land cover class in 2019 where the built-up land cover is still concentrated in villages or sub-districts located in the central area of Ambon City or in the Coastal area.

### **Land Cover Year 2024**

In 2024 land cover, residential land cover increased to 6762.57 ha or 21.63%, open land covering 509.17 ha or 1.63%, agricultural land covering 18,745.80 ha or 59.97%, forest covering 4988.38 ha or 15.96% and water bodies covering 255.31 ha or 0.82%. In (Figure 1) below the composition of land cover classes in 2024 where the built-up land cover is still concentrated in villages or sub-districts located in the central area of Ambon City and in suburban areas. The development of built-up land follows the main road pattern in Seirimau Sub-district.



Figure 1. Land cover map of Sirimau Sub-district in 2014, 2019 and 2024

Analyzing land cover change in Sirimau Sub-district, Ambon City, Indonesia, using satellite imagery data can provide a number of significant benefits. The following are some patterns of benefits that can be derived from such analysis:

- 1) **Real-time Land Change Monitoring:** Satellite imagery data can provide accurate and up-to-date information on land cover change in Sirimau sub-district. This allows for real-time monitoring of land use activities, including urban expansion, agricultural land conversion, deforestation, and infrastructure development.
- 2) **Identification of Land Change Patterns:** With the analysis of satellite imagery data, it is possible to clearly identify patterns of land cover change in Sirimau Sub-district. For example, it is possible to pinpoint where urban expansion is occurring, which areas are experiencing deforestation, as well as changes in the pattern of wetland and agricultural land use.
- 3) **Estimating the Extent and Intensity of Change:** Satellite imagery data makes it possible to estimate the extent and intensity of land cover change more accurately. This is useful for gauging the impact of such changes on ecosystems and the environment, as well as estimating the need for further mitigation or management.

- 4) Trend Analysis of Land Change: By comparing satellite image data from different periods, it is possible to analyze the trend of land cover change in Sirimau Sub-district. This helps in understanding the dynamics of change over time, as well as identifying factors that influence these changes.
- 5) Evidence-based Decision Making: The analysis of land cover change using satellite image data provides a strong basis for evidence-based decision-making. Accurate and detailed information on land cover change can be used by governments, research institutions and other stakeholders to design more effective and sustainable policies, land management programs and regional development plans.

Thus, the use of satellite imagery data for land cover change analysis in Sirimau Sub-district, Ambon City, Indonesia, provides extensive benefits in monitoring, analyzing and managing land resources more effectively and responsively to changes that occur.

## CONCLUSION

From the research on Land Cover Change Patterns in Sirimau Sub-district, Ambon City, Indonesia, it can be concluded that the analysis using satellite image data provides a deep understanding of the evolution of land cover in the studied time period. Significant changes occurred in the transfer of land functions from agriculture to settlements and built-up areas, in line with population growth and higher land demand. The results of this study provide a strong foundation for evidence-based decision-making in sustainable and effective land use planning in Sirimau sub-district. Thus, responsive monitoring, analysis and management of land cover change are key in maintaining the sustainability of land and environmental resources in the area.

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