



Land Cover Change Analysis of Ternate Selatan Sub-district, Ternate City in 2014 and 2024

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Received: May 05, 2024	Revised: May 15, 2024	Accepted: May 16, 2024	Online: May 16, 2024
ABSTRACT Economic growth, urbanization, and infrastructure development are the main drivers of the increase in built-up land area in Ternate Selatan Sub-district. This study aims to investigate and understand the dynamics of land use evolution over a period of one decade. Using satellite image data and image processing techniques, an analysis was conducted to identify significant changes in land cover, particularly in relation to economic growth, urbanization, and infrastructure development. The results showed an increase in the area of built-up land in Ternate SelatanSub-district from 2014 to 2024 along with changes in land use patterns that reflect development pressure. In 2014, the percentage of built-up land area in Ternate SelatanSub-district was 24.69% and continued to increase in 2024 to 31.44% of the total area of Ternate Island. In contrast to other land cover classes that experienced a decrease in area. The results of this study are expected to provide an important contribution for policy makers, environmentalists, and other stakeholders in designing appropriate measures to maintain the balance between economic growth and nature conservation in Ternate SelatanSub-district. Keywords: Land Cover, Sub-District, Ternate Selatan			

Journal Homepage <https://journal.ypidathu.or.id/index.php/ijnis>

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How to cite: Latue, C, P & Rakuasa, H. (2024). Land Cover Change Analysis of Ternate Selatan Sub-district, Ternate City in 2014 and 2024. *Journal of Selvicoltura Asean*, 1(1), 17-22. <https://doi.org/10.55849/selvicoltura.v1i1.172>

Published by: Yayasan Pedidikan Islam Daarut Thufulah

INTRODUCTION

Ternate Selatan sub-district is one of the sub-districts located on Ternate Island, Indonesia, which has experienced significant dynamics in land cover change over the past ten years (Sarihi et al., 2020). Land cover change in this region is very important to understand as it can provide deep insights into the impacts of human activities, climate change, and other factors on local ecosystems (Sihasale et al., 2023). Since the last ten years, Ternate Selatan sub-district has witnessed various economic developments and rapid population growth (Pertuack et al., 2023). These social and economic changes often have an impact on land use, including settlement expansion, infrastructure development, and industrial sector growth (He et al., 2018). Therefore, analyzing land cover change is

important to understand the dynamics between development and nature conservation in the region.

In addition, climate change is also a relevant factor in assessing land cover transformation in Ternate Selatan sub-district. Increasing global temperatures, changing rainfall patterns, and extreme climate phenomena can affect environmental conditions and land use patterns (Zulkarnain, 2016; Moazzam et al., 2022). Land cover change analysis can help identify climate change impacts and provide a basis for mitigation and adaptation measures (Rakuasa et al., 2023). The region also has high biodiversity, including unique marine and terrestrial ecosystems. Therefore, understanding land cover change is critical in the context of biodiversity and ecological conservation. By involving scientific approaches, land cover change analysis can provide the necessary information to plan effective conservation measures (Latue & Rakuasa, 2023).

The analysis can assist the government and other stakeholders in designing policies that are sustainable and support the well-being of local communities (Rakuasa & Pakniany, 2022). Thus, the analysis of land cover change in Ternate Selatan Sub-district is not only an understanding of the environment, but also a tool to support sustainable development and nature conservation. By analyzing land cover change from 2014 to 2024, this research aims to provide a deep insight into the dynamics occurring in Ternate Selatan sub-district. Through a better understanding of these changes, it is hoped that sustainable and resilient solutions can emerge to maintain the balance between development and nature conservation in this area.

RESEARCH METHODOLOGY

This research was conducted in Ternate Selatan Sub-district, Ternate Island, North Maluku Province. This research began with a preparatory stage containing literature studies from books, journals, or from the internet. Literature study was conducted to understand the basic theories related to spatial analysis of Land Cover Change in Ternate Selatan Sub-district 2014-2024. After the preparation stage, the next stage is data collection. The data collected consists of primary data and secondary data, where this research uses a lot of secondary data. The high-resolution satellite image data used in this research is Worldview -2 in 2014 and 2024 obtained from Maxar Technologies. Worldview-2 satellite imagery is a commercial remote sensing satellite launched by DigitalGlobe in 2009. This satellite is equipped with a multispectral camera system that can produce images with a spatial resolution of up to 50 cm. The 2014 and 2024 Worldview -2 satellite image data obtained were then subjected to an RGB band composite process and pansharpening to facilitate the process of image interpretation and digitization. Land cover is classified based on SNI 7465: 2010 concerning Land Cover Classification which consists of built-up land, agricultural land, open land, non-agricultural land and water bodies (National Standardization Agency, 2010).

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

The results of the 2014 land cover analysis show that agricultural land has the largest area presentation compared to other land cover classes. The type of built-up land cover has an area of 509.48 ha or 24.69%, open land of 80, 78 ha or 3.91%, agricultural land of 1,056.54 ha or 51.20%, non-agricultural land of 397.74 ha or 19.27% and the type of water body land cover has an area of 18.98 ha or 0.92% of the total area of Ternate Selatan Sub-district. Based on Figure 1, it is known that built-up land experienced an increase in area from 2014 to 2024. The type of built-up land cover has an area of 648.83 ha or 31.44%, open land of 53.91 ha or 2.61%, agricultural land of 1,008.19 ha or 48.86%, not agricultural land of 333.61 ha or 16.17% and the type of land cover of water bodies has an area of 18.98 ha or 0.92% of the total area of Ternate Selatan Sub-district. Built-up land experienced an increase in area of 457.07 ha

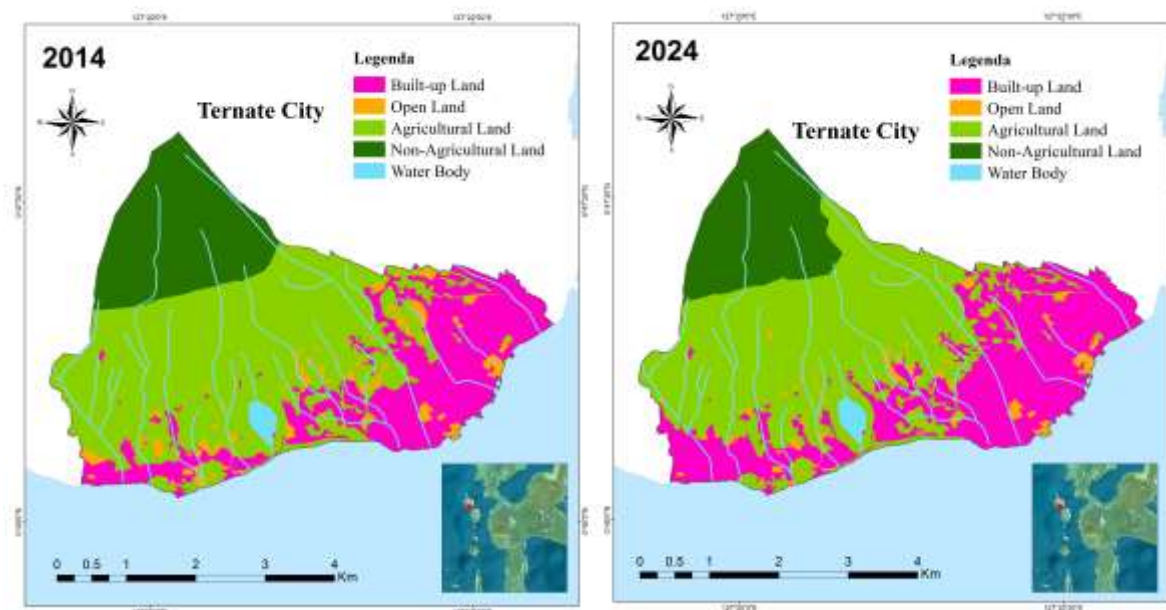


Figure 1. Land Cover Map of Ternate Selatan Sub-district 2014 – 2024

The increase in built-up land area in Ternate Selatan sub-district from 2014 to 2024 is influenced by a number of factors that reflect the dynamics of development and socio-economic changes in the area. According to Mansour et al. (2020), the increase in built-up area can be directly attributed to the significant population growth during the period. With the increase in population, the demand for housing facilities, shopping centers, and public infrastructure increases, driving the expansion of urban areas. Zhang et al. (2020) argue that the development of infrastructure, such as roads, bridges, and other public facilities, can be a key driver of built-up area growth. Investment in infrastructure development tends to open opportunities for the development of the property sector and

shift land use patterns. The success of Ternate Selatan Sub-district in attracting industrial or trade investments can contribute to the increase of built-up land area (BPS, 2023). The construction of factories, trade centers, and industrial complexes can be an important factor in land structure change.

According to Rana & Sarkar, (2021), local government policies, including spatial plans and development permits, can have a significant impact on the growth of built-up land. Regulations that support economic growth may open up opportunities for infrastructure development and new settlements. Accessibility improvement factors, such as the construction of better roads or public transportation facilities, can change the characteristics of the land around the access. Previously remote areas may become more accessible, encouraging further development.

Field survey results show that the development of functional land needs in Ternate Selatan Sub-district, such as changes from agriculture to residential or commercial areas, can be triggered by economic evolution and changes in the livelihood structure of the community. Sometimes, the increase in built-up land area can also be caused by intensive land use pressure. This can be related to industrial growth or infrastructure development that requires expansion of the area. Through an in-depth understanding of these factors, the land cover change analysis can provide rich insights into the transformation of Ternate Selatan Sub-district in terms of built-up land use over the period 2014 to 2024.

The analysis of land cover change in Ternate Selatan sub-district over the period 2014-2024 provides significant benefits in the context of environmental management and sustainable development. First, the analysis allows interested parties, including local government and conservation agencies, to detail the impacts of development and urbanization on the local environment. By understanding changes in land use, policies can be designed to promote sustainable land use, involving the preservation of natural ecosystems and minimizing negative impacts on biodiversity.

Secondly, the information gained from this analysis can form the basis for planning adaptation to climate change. Changes in land cover patterns can affect water retention, temperature and rainfall patterns, all of which are key factors in environmental resilience. By understanding how land evolved over a decade, stakeholders can identify areas vulnerable to climate change and design effective adaptation strategies. Thus, the analysis of land cover change in Ternate Selatan sub-district not only provides insights into current environmental conditions, but also provides tools to plan for a sustainable and adaptive future.

CONCLUSION

The results of this study show that Ternate Selatan Sub-district has experienced significant transformation in land use over the last ten years. Economic growth, urbanization, and infrastructure development are the main drivers of the increase in built-up land area. The findings provide an in-depth understanding of the impact of these changes on the environment and local communities. Successful natural resource management, ecosystem preservation and sustainable development planning depend heavily on the information generated from this analysis. These conclusions can serve as a

foundation for formulating resilient and environmentally sound policies to maintain the balance between economic growth and nature conservation in Ternate Selatan Sub-district.

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