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ANALYSIS OF LAND USE CHANGES AND ITS IMPLICATIONS ON REGIONAL DEVELOPMENT: CASE STUDY OF PALOPO CITY

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Abstract

Land use change is a phenomenon that occurs along with population growth and economic development of a region. Palopo city has experienced significant changes in land use due to rapid urbanization and infrastructure development. This study aims to analyze the pattern of land use change in Palopo City over a certain period of time and examine its implications for regional development. The methods used are satellite imagery analysis and Geographic Information Systems (GIS) to map land use changes, as well as interviews with stakeholders to understand the factors that influence these changes. The results of the study indicate that there has been a conversion of agricultural land and green areas into settlements, trade areas, and industry. The implications of this change include increased pressure on the environment, changes in community mobility patterns, and challenges in urban spatial planning. Therefore, a sustainability-based policy strategy is needed to manage land use changes more optimally and sustainably.

Keywords: *Land use changes, regional development, urbanization*

INTRODUCTION

Land use change is a phenomenon that occurs in various cities in Indonesia as a result of population growth, urbanization, and economic development. Palopo City, as the center of economic and government activities in Lampung Province, has experienced quite rapid changes in its land use. The increase in population and the expansion of the industrial, trade, and residential sectors have driven the conversion of agricultural land and green open spaces into built-up areas. This transformation not only reflects the progress of urban development, but also poses various challenges in spatial and environmental management.

One of the main impacts of land use change is the reduction in the area of green land that functions as a water catchment area and a balancer for urban ecosystems. Uncontrolled land conversion can increase the risk of environmental disasters, such as flooding and landslides. landslides, which are increasingly occurring due to the lack of green open space. In addition, the growth of residential areas that are not balanced with adequate infrastructure has the potential to cause social problems, such as increased traffic jams, population density, and pressure on public services such as clean water and sanitation.

In addition to environmental factors, changes in land use also have implications for the social and economic structure of society. The conversion of agricultural land into industrial and residential areas causes changes in the pattern of people's livelihoods, from the agricultural sector to the service and manufacturing sectors. This change can create new economic opportunities, but on the other hand also risks increasing social inequality and affecting the welfare of local communities. Therefore, an in-depth study is needed on the pattern of land use change in Palopo City, the factors that drive it, and its impact on the development of the region as a whole.

This study aims to analyze changes in land use in Palopo City in recent years using spatial data and satellite imagery approaches. In addition, this study also aims to identify factors that contribute to these changes and evaluate their impact on regional development. With this study, it is expected that policy recommendations can be obtained that support more sustainable land management, so that city development can be balanced between economic growth and environmental preservation.

THEORY

Land Use Change

Land use changes in Palopo City have shown significant patterns in recent years. Based on the analysis of satellite imagery data and spatial maps, it was found that built-up areas, such as settlements, trade centers, and industries, have experienced rapid expansion, especially in the suburbs. Meanwhile, the area of agricultural land and green open spaces tends to decrease due to massive land conversion.1 One of the most striking trends is the growth of residential areas in peripheral areas.

This is happening along with the increasing population and urbanization that encourages the expansion of residential areas into areas that were previously agricultural land or urban forests. This increase in settlements is also supported by the development of infrastructure, such as toll roads and better transportation access, thus encouraging people to migrate to previously undeveloped areas.

In addition to settlements, industrial areas and trade centers have also experienced significant expansion. Much land previously used for agriculture has been converted into industrial areas to meet investment needs and economic growth. On the one hand, this development opens up new economic opportunities and increases land values, but on the other hand, uncontrolled land conversion has reduced water catchment areas, which has the potential to increase the risk of flooding and other environmental problems. The reduction in green open space is a major concern in land use changes in Palopo City. The conversion of green land into built-up areas has an impact on environmental quality especially in terms of increasing urban temperatures (urban heat island) and decreasing air quality. In addition, the loss of green areas also affects the balance of the ecosystem, including the reduction of habitat for local flora and fauna.

The main factors driving this land use change are population growth, development policies that are more oriented towards the economic sector, and increasingly rapid infrastructure development. Although development has a positive impact on the regional economy, inadequate planning can cause various problems, such as population density, traffic jams, and environmental degradation. Therefore, stricter spatial planning policies are needed to control the rate of land use change so that it remains in line with the principles of sustainable development.

Regional Development

Regional development in Palopo City has experienced dynamics influenced by rapid changes in land use. As the main city in Lampung Province, Palopo continues to develop into an economic, trade, and service

center that attracts investment and population migration. This change has a major impact on regional development patterns, both in social, economic, and environmental aspects. One of the main indicators of regional development is the expansion of residential areas that are increasingly expanding to the outskirts. Infrastructure development, such as the Trans Sumatra toll road and increased transportation access, has also driven the growth of new areas around the city. As a result, areas that were previously agricultural land or urban forests have begun to change function into residential areas, offices, and business centers. This reflects the suburbanization process that occurs due to the increasing need for residential land amidst population growth.

In addition, regional development in Palopo City is also driven by the increasingly rapid growth of the economic sector. Trade and industrial areas have experienced significant expansion, especially in strategic areas with good transportation access. This not only increases the value of land and property in the area, but also opens up new economic opportunities for the community. However, economic growth that is not balanced with good spatial planning can cause disparities between regions, where development is more concentrated in the city center while the outskirts experience limited infrastructure and public facilities. On the other hand, uncontrolled regional development also poses challenges in terms of the environment and spatial planning. The reduction in green open spaces and massive land conversion can cause various environmental problems, such as increasing city temperatures, reducing water catchment areas, and increasing the risk of flooding. In addition, the increasing density of settlements in several areas also puts pressure on city infrastructure, such as traffic congestion, limited clean water, and increasing domestic waste production.

To ensure sustainable regional development, a balanced policy is needed between economic growth and environmental preservation. Spatial planning based on the principles of sustainable development must be implemented to control the rate of expansion of built-up areas and maintain the balance of urban ecosystems. In addition, strengthening regulations related to land use and increasing community participation in development planning can be a solution in creating a more organized and sustainable region.

METHOD

This study uses a quantitative and qualitative descriptive approach to analyze land use changes in Palopo City and its implications for regional development. This method was chosen to obtain a comprehensive picture of land use change patterns, influencing factors, and their impacts on social, economic, and environmental aspects.4This study is a descriptive-spatial study, which aims to identify changes in land use geographically by utilizing satellite imagery data and Geographic Information Systems (GIS). In addition, this study also uses a qualitative approach, namely through interviews with stakeholders to understand social and policy factors that influence land use change.

This research was conducted in Palopo City with a focus on areas experiencing significant land changes, such as suburban areas experiencing rapid urbanization and developing industrial and trade areas.6To

ensure the accuracy of the data, this study uses a data triangulation method, namely by comparing the results of GIS analysis, interviews, and document studies. In addition, the validity of the interview data was tested by cross-checking with several sources from various backgrounds, including government, academics, and the community.

RESULTS AND DISCUSSION

Result

1. Land Use Changes in Palopo City

Based on Landsat satellite imagery from 2010 and 2020 that have been analyzed using the supervised classification method (maximum likelihood), it was found that there were significant changes in land use in Palopo City. The area of built-up land (residential, public facilities, and commercial) increased by 32.4%, while agricultural land and green open land decreased by 18.7% and 13.5%, respectively.

The most dominant land conversion occurred in suburban areas such as Wara Selatan, Telluwanua, and Bara Districts. In this area, agricultural land has been converted into residential and service areas due to population growth and expansion of economic activity. This finding is in line with research by Firman (2017) which states that the growth of urban areas in Indonesia tends to be followed by the conversion of agricultural land to non-agricultural land, especially in urban fringe areas.

2. Implications for Regional Development

a. Urban Area Growth

Changes in land use have a direct impact on the growth of urban areas. Rapidly developing residential areas have led to an increase in the need for basic infrastructure, such as roads, clean water, and sanitation. Field observations show that in several areas such as Songka and Pontap, residential development has occurred faster than the provision of infrastructure, resulting in development inequality.

These results support a study by Hudalah and Firman (2012) which states that urbanization in medium-sized cities in Indonesia tends to be faster than the ability of city planning to provide infrastructure.

b. Decrease in Local Food Security

The conversion of agricultural land into built-up areas has also had an impact on decreasing local food productivity. The Palopo City Agriculture Service recorded a decrease in the area of rice fields by 140 hectares in the last 10 years. This threatens food security and increases dependence on food supplies from outside the region. Sitorus's study (2014) emphasized that the conversion of agricultural land has reduced regional food production capacity, which in the long term can weaken local economic stability.

c. Environmental Problems

Changes in land use have also caused environmental degradation, such as increased risk of flooding, increased local air temperatures, and decreased groundwater quality. The results of the soil infiltration test showed that the land that had been concreted experienced a decrease in water absorption by up to 60%. This finding is in line with research by Setiawan and Santosa (2018) which found that changes in land cover significantly affect the hydrological capacity of the area, increasing the risk of disasters such as flooding and landslides.

3. Mitigation Strategy and Policy Recommendations

To reduce the negative impacts of changes in land use, strategic steps are needed, including:

- Stricter enforcement of spatial planning regulations, especially related to sustainable agricultural zoning.
- Development of vertical residential areas in the city center to reduce horizontal expansion into fertile land.
- Community involvement in spatial planning through a participatory approach.

This strategy is in line with the smart growth approach developed by Newman & Kenworthy (2006), namely controlled, sustainable, and inclusive urban growth.

Discussion

Urbanization and Land Conversion Trends

Land use changes in Palopo City reflect the urbanization phenomenon that is common in medium-sized cities in Indonesia. The significant increase in built-up land indicates the expansion of the city area towards the outskirts, which is driven by population growth and housing needs. Firman (2017) noted that urbanization in Indonesia is generally characterized by rapid conversion of agricultural land, especially in the transitional areas between cities and villages (urban fringe), as is the case in Palopo.

Inequality in Infrastructure Development

The imbalance between the growth of built-up areas and the availability of basic infrastructure indicates weak spatial control. This has the potential to cause a backlog of basic services and reduce the quality of life of the community. Hudalah & Firman (2012) stated that secondary cities in Indonesia tend to experience spatial growth that is faster than their governance and infrastructure financing capabilities.

Threats to Local Food Security

The conversion of agricultural land to non-agricultural land has serious impacts on food security, both in the short and long term. The decline in local production creates dependence on supplies from outside the region, which can trigger food price volatility.

Sitorus (2014) shows that changes in agricultural land function reduce regional production capacity and weaken national food security if not controlled.

Environmental Degradation and Disaster Risk

The conversion of vegetative land into impervious surface increases the potential for flooding, reduces groundwater quality, and increases surface temperatures (urban heat island). A temperature increase of 1.8°C in densely populated areas indicates a significant microclimate change. Research by Setiawan & Santosa (2018) supports that changes in land cover have a strong correlation with changes in the hydrological and thermal functions of an area.

Spatial Planning Recommendations

Facing these dynamics, a sustainable development approach is needed. Recommendations include:

- Protection of agricultural land through strict zoning in the RTRW.
- Development of vertical settlements in the city center.
- Revitalization of old city areas to accommodate population growth.

The application of the Smart Growth principle as proposed by Newman & Kenworthy (2006), namely dense, efficient and environmentally friendly urban growth.

CONCLUSION

Land use change in Palopo City is an unavoidable phenomenon due to population growth, economic development, and the increasing need for infrastructure. This study shows that land use change that occurs, especially the conversion of green and agricultural land to residential, industrial, and commercial areas, has a broad impact on various aspects of regional development, both in terms of economy, social, environment, and spatial planning. From an economic perspective, land use change has driven the growth of the trade, services, and industrial sectors, which have contributed to increased investment and job creation. However, this development has also created inequality between the rapidly developing city center and the underdeveloped suburbs. Meanwhile, from a social perspective, settlement expansion has increased public access to housing but on the other hand it also causes various problems, such as traffic jams, population density, and land ownership conflicts.

Environmental impacts are one of the main concerns in land use changes in PALOPO City. The reduction in green open spaces and water catchment areas has increased the risk of flooding, worsened air quality, and caused temperature increases due to the urban heat island effect. If not managed properly, these impacts can further worsen the city's environmental conditions in the future. In addition, changes in land use that are not in accordance with spatial plans also cause an imbalance in infrastructure development, so that some areas experience limited access to basic services such as transportation, drainage, and sanitation.

To overcome these challenges, a more targeted and sustainable land use change management strategy is needed. The Palopo City Government must strengthen regulations and supervision of land use changes so that they remain in accordance with the established spatial plan. The use of technology such as Geographic Information Systems (GIS) can help in monitoring land more effectively. In addition, the development of environmentally friendly infrastructure based on the **green city** concept must be a priority, such as improving the public transportation system, developing green open spaces, and implementing a sustainable drainage system to reduce the risk of flooding. Community and private sector participation is also very important in managing land use changes. Communities must be involved in the spatial planning process, while the private sector needs to be encouraged to invest in sustainability-oriented projects. In addition, a green economy approach can be a solution to reduce pressure on land by developing more environmentally friendly creative industry, technology, and ecotourism sectors.

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