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Analysis of Land Use Change And The Suitability For Regional Spatial Planning (RTRW) In Kolaka District

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ABSTRACT

Land use changes that occur due to population pressure and land conversion that are not in accordance with the RTRW will affect the sustainability of the development of an area. In the period 2003 to 2013, it is known that land changes occurred in Kolaka sub-district, namely that the production forest experienced a reduction in area of 266.26 Ha of the total land area, which was converted into dry land. Some possibilities include land conversion from forest area to plantation land by residents. Meanwhile, in the period 2013 to 2023, Production Forests became land with a very large degraded area, where an area of 1884.48 ha was converted into wetlands, dry lands, and as limited production forests. The condition of this land use change was then analyzed for its suitability to the 2012 - 2023 RTRW of Kolaka Regency. It was found that 75.53% or an area of 10,579.55 ha of the existing area was still suitable, while the unsuitable area was 24.47% or an area of 3426.91 ha.

INTRODUCTION

Land is an area on the earth's surface with certain properties which include the biosphere, atmosphere, soil, geological layers, hydrology, plant populations, animals and the results of past and present human activities to a certain level. These characteristics have a significant influence on human land use now and in the future (Kusrini et al., 2011; Wahyuni et al., 2014) Land is an important resource in fulfilling life's needs that has certain functions and structures (Nuraeni et al., 2017). Land use is the end result of every form of human activity intervention on land on the earth's surface which is dynamic and functions to fulfill life's needs, both material and spiritual(Laka et al., 2017). Land use in Indonesia is increasing along with technological advances and increasing land conversion, the number and activities of humans are increasing

rapidly causing land to become a scarce resource so that changes in land use and land cover cannot be avoided due to the increasing number of people so that the need for land use will also increase.

Land conversion, in the sense of land use changes, is basically unavoidable in the implementation of development, rapid population growth and increasing demands on people's needs for land, often result in conflicts of interest over land use and the occurrence of inconsistencies between land use and its allocation plan, while land is limited and cannot be increased except through reclamation activities (Eko & Rahayu, 2012).

Based on the survey results, the land conversion that occurred in Kolaka District was caused by the increase in the number of residents converting land into residential land and other service activities. An increase in population can cause an increase in need or demand for land (Indrianawati & Mahdiyyah, 2019). Apart from that, based on the Regional Spatial Plan, as the capital of the Regency, Kolaka District is designated for the economic and office services sectors, public facilities, education, residential, agriculture and plantations. The population increase in Kolaka District since 2008-2022, where in 2008 the population was 30,064 people with a percentage of 12.42%, in 2014 with a population of 40,792 people the percentage was 17.3% and in 2022 the population amounting to 41,429 people with a percentage of 16.83%. The increasingly rapid increase in population will have an impact on the increasing need for land use, especially in the aspect of residential development (BPS Kab. Kolaka, 2023).

The impact that occurs due to high changes in land use not only results in land decreasing in quality and productivity, but also endangers the socio-economic status of the community. As a result of these impacts, critical land is currently an important concern for various parties (Kubangun et al., 2016). Another impact is the increasingly limited availability of land in an area which underlies changes in land function becoming uncontrolled, which will result in changes to the environmental order in the form of decreasing environmental quality, environmental degradation or environmental damage as well as reduced natural resources (Bashit, 2019). According to Gandri et al., 2019), the development of residential areas due to land conversion can cause the land to become watertight and have a very high run off rate which can cause decreasing of infiltration which can cause flooding, as is the case in Kendari City.

In determining development policy, especially in the city of Kolaka, which is held by the government, there are efforts to regulate city development by issuing the Kolaka Regency Spatial Planning and Regional Planning (RTRW) document which is stated in Kolaka Regency Regional Regulation No. 44 of 2022 concerning Detailed Spatial Planning for the Kolaka Urban Area, Kolaka Regency for 2022-2042 and several other regulations that regulate Spatial Planning and Regional Planning, including: Law of the Republic of Indonesia No. 26 of 2007 concerning Spatial Planning and Government Regulation of the Republic of Indonesia no. 21 of 2021 concerning the Implementation of Spatial Planning on the Dynamics of Land Change. For this reason, the development and construction of Kolaka District needs to consider its suitability to the development regulations so that the development of Kolaka District, especially

Kolaka District, can carry out its development in accordance with its provisions so that it does not exceed the threshold and environmental carrying capacity.

Based on the description above, it is necessary to analyze changes in land use that occur and relate them to the suitability of land in Kolaka sub-district over several annual periods based on the RTRW in Kolaka Regency.

METHODS

Location and Time

This research was carried out in Kolaka District, Kolaka Regency with coordinates 4°03'42.6"S - 121°36'55.3"E and will be carried out from June to July 2023 (Figure 1)

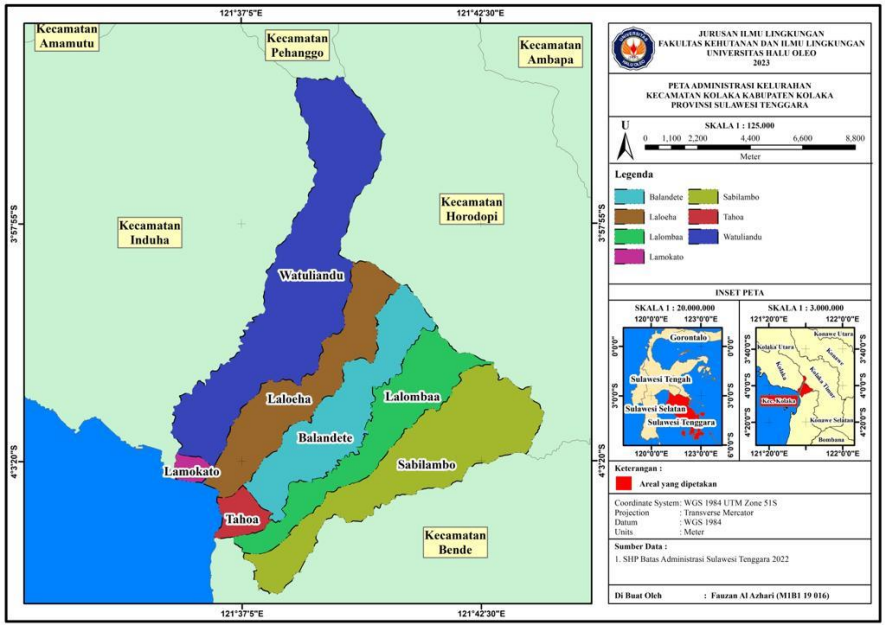

Figure 1. Study Area

Material

The data used in this research is shown in table 1

Tabel. 1 Tools and Material o

Tool and Material	Source
Regional Administration Map	**Bapedda of Kolaka Disrict**
Land Use Map year 2003, 2013, 2023	**KLHK RI**
Kolaka Regency RTRW map (2012-2032)	**Bapedda of Kolaka Disrict**
GPS	-
ArcGis 10.4	-
Microsoft Excell	-

Method of Colloecting Data

The collection methods are observation techniques and literature reviews, and data acquisition from remote sensing satellites. Observation is carried out to collect data which is

carried out through observation, accompanied by recording the condition or behavior of the target object. Literature review to collect accurate data and information by reviewing books, literature and various reports related to this research.

Data Analysis

Analysis of Land Use Change

Analysis of land use changes was carried out by comparing land use in Kolaka District in 2003 with land use in 2013 and land use in Kolaka District in 2013 with land use in 2023 using crosstabs with Arcgis 10.4 and Microsoft Excel.

Analysis of suitability of land use for RTRW

Land suitability analysis for RTRW uses quantitative descriptive analysis methods by interpreting the results from map overlays. The land use map resulting from the interpretation of the image/existing map/actual land use map is then overlaid with the potential land use map using the ArcGis 10.4 analysis tool. The data needed to carry out this analysis is spatial pattern plan data, land use maps for 2003, 2013 and land use maps for 2023.

RESULTS AND DISCUSSIONS

Based on the results of research on "Analysis of Land Use Changes and Conformity to Regional Spatial Planning (RTRW) in Kolaka District, Kolaka Regency" obtained some information in the form of classification of land use suitability in 2003, 2013 and 2023. This research presents how land use is planned in Kolaka District, Kolaka Regency. A detailed description of the findings in this research is explained as follows:

Land Use in 2003, 2013 and 2023 Kolaka District

Based on the results of research in Kolaka District, the land use of Kolaka District in 2003 was obtained (Table 2). Table 2 shows that land use in 2003 had an area of 14006.46 ha. The land use with the largest area in Kolaka District in 2003 was Production Forest with an area of 7927.98 ha or 56.60% of the total area of Kolaka district. The land use with the smallest area is ponds with an area of 3.93 ha or 0.03%. Spatial land use in 2003 can be seen in Figure 2.

Table 2. Kolaka District Land Use in 2003

No	Land Use 2003	Area (Ha)	Persentage (%)
1	Water Body	119.94	0.86%
2	Protected Forest	1715.40	12.25%
3	Production Forest	7927.98	56.60%
4	Wet Land	285.07	2.04%
5	Dry Land	3470.06	24.77%
6	Settelments	484.07	3.46%
7	Ponds	3.93	0.03%
	Total	**14006.46**	**100.00%**

Source : Data Analysis, 2023

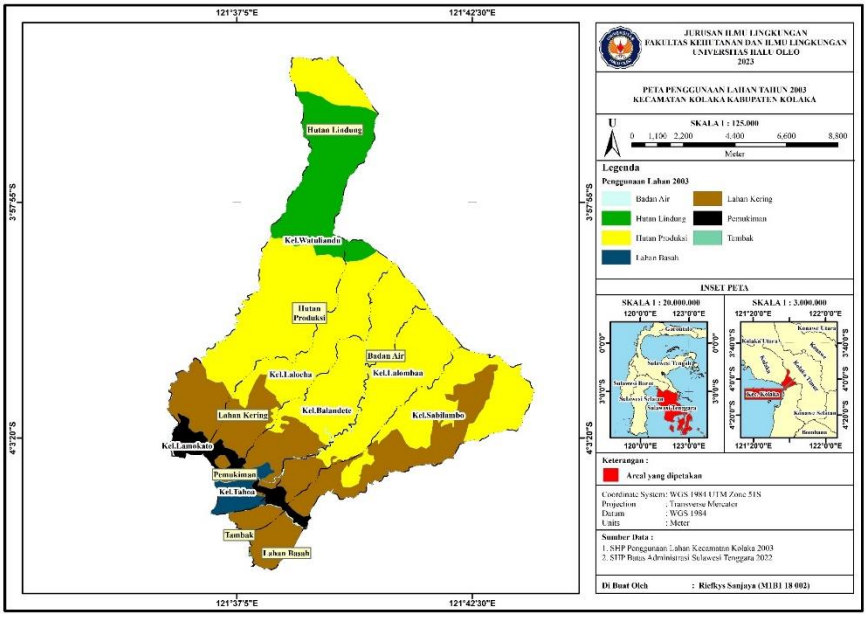

Figure 2. Land Use Map 2003

Based on Table 3. Land use in 2013 Kolaka District has an area of 14006.46 ha. The land use with the largest area in Kolaka District in 2013 was Production Forest with an area of 7661.72 ha or 54.70% of the total area of Kolaka District. The land use with the smallest area is Pond with an area of 3.93 Ha or 0.03%. The land use map of Kolaka District in 2013 can be seen in Figure 3.

Table 3. Kolaka District Land Use in 2013

No	Land Use 2013	Area (Ha)	Persentage (%)
1	Water Body	119.94	0.86%
2	Proceted Forest	1715.40	12.25%
3	Production Forest	7661.72	54.70%
4	Wetlands	285.07	2.04%
5	Drylands	3736.32	26.68%
6	Settelments	484.07	3.46%
7	Ponds	3.93	0.03%
	Total	**14006.46**	**100.00%**

Source : Data Analysis, 2023

Table 4 shows that the 2023 land use of Kolaka District has an area of 14006.46 Ha. The land use with the largest area in Kolaka District in 2023 is Agriculture with an area of 5777.24 ha or 41.25% of the total area of Kolaka District. The land use with the smallest area is Pond with an area of 3.93 Ha or 3.42%. The land use map of Kolaka District in 2023 can be seen in Figure 4.

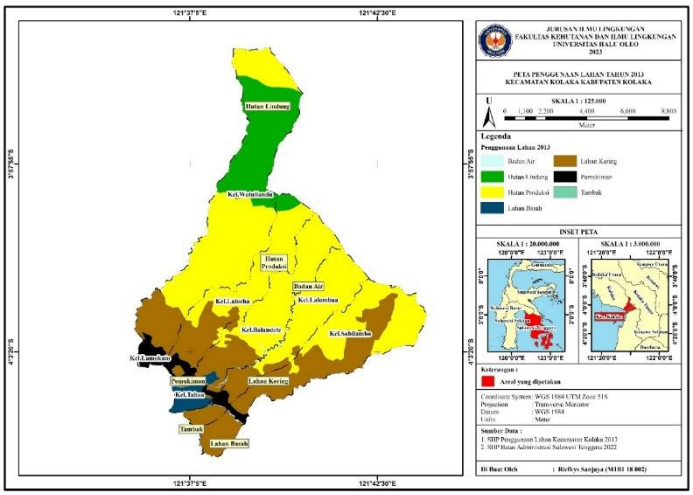

Figure 3. Land Use in 2013

Table 4. Kolaka District Land Use in 2023

No	Penggunaan Lahan 2023	Luas (Ha)	Persentase (%)
1	Water Body	119.94	0.86%
2	Proctected Forest	1715.40	12.25%
3	Production Forest	5777.24	41.25%
4	Wetlands	367.88	2.63%
5	DryLands	4807.74	34.33%
6	Settlements	735.31	5.25%
7	Ponds	3.93	0.03%
8	Limited Production Forest	479.02	3.42%
	Total	**14006.46**	**100.00%**

Source : Data Analysis, 2023

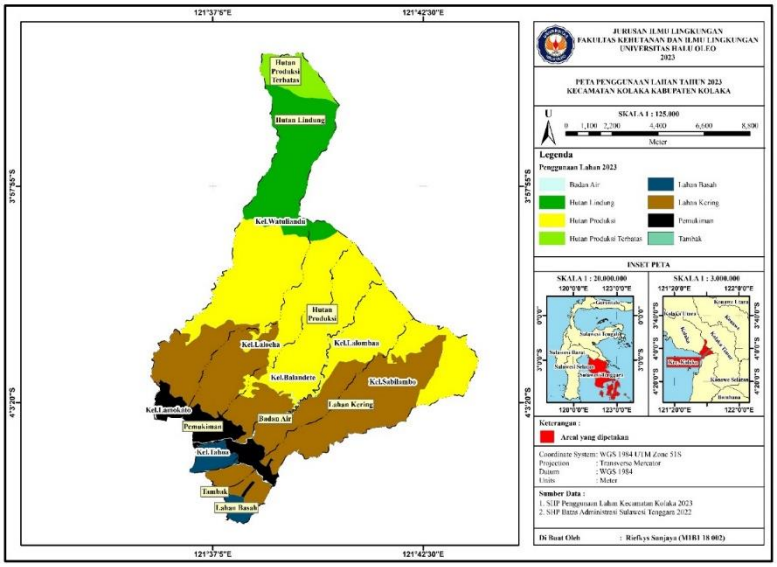

Figure 4. Land Use in 2023

Land Use Change in Kolaka District 2003 – 2013 and 2013 – 2023

Land use change in Kolaka District were analyzed through crosstab analysis, table 4 shows changes in land use in the 2003 and 2013 periods, while changes in land use in the 2013 and 2023 periods are shown in Table 5.

Table 4. Land Use Changes in Kolaka District Land Use in 2003-2013

No	Land Use	Are (Ha)	Persentasge(%)
1	Water Body	0.00	0.00%
2	Protected Forest	0.00	0.00%
3	Production Forest	-266.26	-3.36%
4	Wet Land	0.00	0.00%
5	Dry Land	+266.26	+7.67%
6	Settelments	0.00	0.00%
7	Ponds	0.00	0.00%

Source : Data Analysis, 2023

Based on Table 4, it shows changes in land use in Kolaka District from 2003 to 2013. This occurred in 2 types of land use, namely Production Forest and Dry Land. Land use in the form of Production Forest experienced a decrease in area of -266.26 Ha (-3.36%) while land use in the form of Dry Land experienced an increase in area of +266.26 Ha (+7.67%).

Table 5. Land Use Changes in Kolaka District Land Use in 2013-2023

No	Land Use	Area (Ha)	Persentage (%)
1	Water Body	0.00	0.00%
2	Protected Forest	0.00	0.00%
3	Production Forest	-1884.48	-24.60%
4	Wet Land	+82.81	+29.05%
5	Dry Land	+1071.41	+28.68%
6	Settelments	+251.23	+51.90%
7	Ponds	0.00	0.00%
8	Limited Production Forest	+479.02	+100.00%

Source : Data Analysis, 2023

Based on Table 5, it shows that changes in land use in Kolaka District from 2013 to 2023 occurred in 5 types of land use, namely Production Forest, Wetland, Dry Land, Residential, Limited Production Forest. The highest land use changes occurred in Production Forest areas which experienced The area decreased by Dry Land Ha (-24.60%) while the lowest change in land use occurred in Wet Land which experienced an increase in area of +82.81 Ha (+29.05%). Changes in land use from 2003 to 2013 were quite significant in production forest and dry land areas, where production forests experienced a reduction in area of 266.26 ha or 3.36% of the total area while dry land had an increase (+) of +266.26 ha or + 7.67%.

Based on Table 5, changes in land use in Kolaka District from 2013 to 2023 saw significant changes in production forests which experienced shrinkage or reduction of -1884.48 ha or -24.60%. Then wetlands experienced an increase of +82.81 or +29.05%. The cause of the lack of production forest area is a complex problem that can be caused by a number of natural and anthropogenic factors. One of the factors causing the shrinking of production forest areas is deforestation. Unsustainable deforestation can reduce the forest's ability to maintain forests (Kolladi R, 2014)

From 2013 to 2023, Kolaka District experienced an additional limited production forest area of +479.02 ha or +100.00%. The increase in limited production forest areas is caused by several factors and the causes can be different in various regions. Population growth, urbanization, economic development, urban planning policies, infrastructure and accessibility as well as the need for public services are causes of increasing residential areas(Pendrill et al., 2019). Dry land also experienced an additional area of +1071.41 or +28.68%. land use changes in 2023 are very significant. This confirms that requirement of land will greatly increase from 2023.

Kolaka District Regional Planning Plan for 2012-2032

Based on the research results, it is known that the 2012-2032 regional planning plan in Kolaka District, Kolaka Regency can be seen in Table 6

Table 6. RTRW Pattern for 2012-2023

No	RTRW 2012-2032	Luas (Ha)	Persentase (%)
1	Protection Forest	1715.40	12.25%
2	Production Forest	8393.10	59.92%
3	Limited Production Forest	480.05	3.43%
4	Nature Reserve Forest	22.15	0.16%
5	Wetlands	389.73	2.78%
6	DryLands	1789.08	12.77%
7	Settelments	1136.58	8.11%
8	Ponds	80.36	0.57%
	Total	**14006.46**	**100.00%**

Source : Data Analysis, 2023

The RTRW Spatial Pattern for 2012-2032 Kolaka District has an area of 14006.46 Ha. The RTRW Spatial Pattern for 2012-2032 with the largest area in Kolaka District is Production Forest with an area of 8393.10 Ha or 59.92% of the total area of Kolaka District. The land use with the smallest area is ponds with an area of 22.15 Ha or 0.16%. The 2012-2032 RTRW Spatial Pattern Map for Kolaka District can be seen in Figure 5.

The total area of the spatial pattern in the 2012-2032 regional spatial plan is 14,006.46 ha. Meanwhile, the spatial pattern in the 2012-2032 regional spatial plan is classified into 8 (eight), namely protected forest with an area of 1715.40 ha or 12.25%, production forest with an area of 8393.10 ha or 59.92%, limited production forest with an area of 480.05 ha or 3.43%, nature reserve forest with an area of 22.15 or 0.16%, wetland with an area of 389.73 ha or 2.78%, dry land with an area of 1789.08 ha or 12.77%, residential areas with an area of 1136.58 ha or

8.11% and ponds with an area of 80.36 ha or 0.57%. Spatial Patterns for the 2012-2032 RTRW with the largest area in Kolaka District are production forests with an area of 8393.10 ha or 59.92% of the total area of Kolaka District. The land use with the smallest area is nature reserve forest with an area of 22.15 ha or 0.16%.

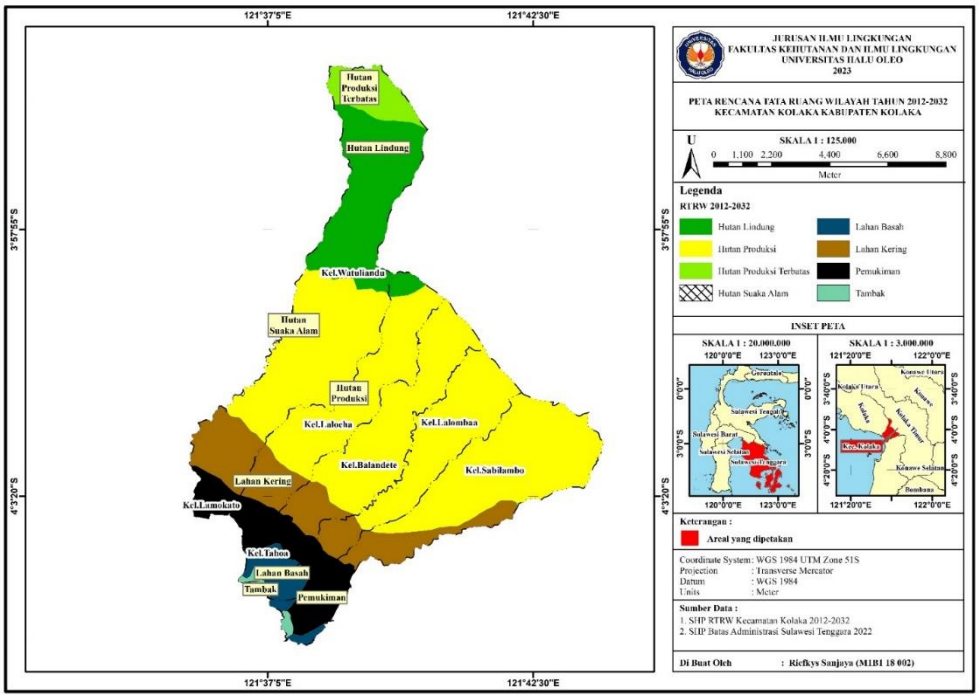

Figure 5. Kolaka District Spatial Planning Plan for 2012-2032

Suitability of Land Use for Kolaka District RTRW

Analysis of the suitability of land use in 2003, 2013 and 2023 to the RTRW of Kolaka District in 2012-2032 was carried out by analyzing the results of the overlay between land use in 2003, 2013 and 2023 with the RTRW of Kolaka District in 2012-2032 to determine the appropriate classification of land use and not in accordance with the Kolaka District RTRW for 2012-2032 can be seen in Table 7.

Table 7. Compatibility of Land Use in 2023 with RTRW Kolaka District 2012-2032

No.	Classification	LU 2023 (Ha)	RTRW 2012-2032 (Ha)	Suitable (Ha)	Persentage(%)	Non Suitable (Ha)	Persentage (%)
1	Protected Forest	1715.40	1715.40	1715.40	12.25%	0.00	0.00%
2	Production Forest	5777.24	8393.10	5728.66	40.90%	2664.44	19.02%
3	Limited Production Forest	479.02	480.05	479.02	3.42%	1.03	0.01%
4	Nature Reserve Forest	0.00	22.15	0.00	0.00%	22.15	0.16%
5	Wetlands	367.88	389.73	235.89	1.68%	153.84	1.10%
6	Drylands	4807.74	1789.08	1710.70	12.21%	78.38	0.56%
7	Settelments	735.31	1136.58	707.79	5.05%	428.79	3.06%
8	Ponds	3.93	80.36	2.09	0.01%	78.27	0.56%
9	Water Body	119.94	0.00	0.00	0.00%	0.00	0.00%
	Total	**14006.46**	**14006.46**	**10579.55**	**75.53%**	**3426.91**	**24.47%**

Based on Table 7, the total suitability area for land use in Kolaka District in 2003-2013 and 2023 which is in accordance with the 2012-2032 RTRW is 10579.55 ha or 75.53% of the total area in Kolaka District. Meanwhile, land use in Kolaka District in 2003-2013 and 2023 which is not in accordance with the 2012-2032 RTRW is 3426.91 Ha or 24.47%. Land use in Kolaka District is mostly used for production forests and dry land agriculture. Due to urban development and regional development, land use changes occur. This change in land use reflects the dynamic movement of society as a result of development both by the community itself and initiatives from the government. Judging from Table 5.7, the total suitability area for land use in Kolaka District in 2003-2013 and 2023 which is in accordance with the 2012-2032 RTRW is 10579.55 ha or 75.53% of the total area in Kolaka District. Meanwhile, land use in Kolaka District in 2003-2013 and 2023 which is not in accordance with the 2012-2032 RTRW is 3426.91 or 24.47%.

Land use in Kolaka District is influenced by two main factors, namely; Accessibility is a pattern that follows the distribution of facilities so that residents tend to approach these facilities without paying attention to the physical conditions of the land that could interfere with safety. Apart from that, land use patterns are also influenced by existing road network patterns so that highly productive land if developed as built-up land is not supported by a road network such as plantation land, which is located on the coast which is a flat area so that land use does not seem optimal based on The physical condition of the existing land is in anticipation of demand for urban development land, so that the area is used as a coconut plantation by the local community. Changes in land use can influence regional development towards new urban areas, where the main driving factor of land-use change is human activities guided by policy(Zhang et al., 2022). It is known that the land use changes that occurred in Kolaka sub-district contained several inconsistencies with the RTRW, so it is very necessary to carry out an assessment for future developments, however Land-use planning practice and policy are still lacking a landscape perspective that takes into account landscape history integrated with land suitability(Franco & Magalhães, 2022).

CONCLUSIONS

Land use in 2003 had a total area of 14006.46 ha which was dominated by production forests of 7927.98 ha or 56.60%, while land use in 2013 had the same area and was dominated by production forests of 54.70% or an area of 7661.72 ha and land use in 2023 had an area of The same area is dominated by dry land farming at 41.25% or an area of 5777.24 ha.

Suitability of Land Use in Kolaka District 2003, 2013 and 2023 with the Kolaka District Spatial/Territory Plan (RTRW) for 2012-2032 with an area of 14,006.46 ha, and which is in accordance with the 2012-2032 RTRW, 75.53% or with an area of 10,579.55 ha, Meanwhile which is not suitable is 24.47% or with an area of 3426.91 ha, so it can be said that the suitability of land use in Kolaka District 2003, 2013 and 2023 with respect to the Kolaka District Spatial/Regional Planning (RTRW) for 2012-2032 is more likely to be in conformity

REFERENCES

Bashit, N. (2019). ANALYSIS OF CRITICAL LAND BASED ON CANOPY TREE DENSITY USING SENTINEL 2 IMAGE. *Elipsoida, Jurnal Geodesi Dan Geomatika*, *2*(1), 32–40.

BPS Kab. Kolaka. (2023). *KABUPATEN KOLAKA DALAM ANGKA 2023*.

Eko, T., & Rahayu, S. (2012). Land Use Change and Their Suitability towards RDTR in the Peri-Urban Region Case Study: Mlati District. *Jurnal Pembangunan Wilayah Dan Kota*, *8*(4), 330–340.

Franco, L., & Magalhães, M. R. (2022). Assessing the ecological suitability of land-use change. Lessons learned from a rural marginal area in southeast Portugal. *Land Use Policy*, *122*, 106381. https://doi.org/10.1016/j.landusepol.2022.106381

Gandri, L., Jawardi Purwanto, M. Y., Sulistyantara, B., & Medrial Zain, A. F. (2019). Pemodelan Bahaya Banjir Kawasan Perkotaan(Studi Kasus di Kota Kendari). *Jurnal Keteknikan Pertanian*, *7*(1).

Indrianawati, & Mahdiyyah, nadhiya D. (2019). The Impact of Population Growth on Transfer Functions of Agricultural Land in Cirebon Regency 2010-2016. *Jurnal Online ITN :Reka Geomatika*, *2019*(1), 21–29.

Kolladi R. (2014). Impact of Climate Change on Water Resources. *Journal of Earth Science & Climatic Change*, *05*(03). https://doi.org/10.4172/2157-7617.1000185

Kubangun, S. H., Haridjaja, O., & Gandasasmita, K. (2016). Land Use/Cover Change Models to Identify the Critical Land in Bogor Regency, Cianjur Regency, and Sukabumi Regency. *Majalah Ilmiah Globe*, *18*(1), 21–32.

Kusrini, Suharyadi, & Hardoyo, S. R. (2011). Land use changes and influencing factors in GunungPati District, Semarang City. *Majalaah Geografi Indonesia*, *25*(1), 25–40.

Laka, B. M., Sideng, U., & Amal. (2017). Land Use Change in Sirimau District, Ambon City. *Jurnal Geocelebes*, *1*(2), 43–52.

Nuraeni, R., Pandapotan Sitorus, S. R., & Panuju, D. R. (2017). An Analysis of Land Use Change and Regional Land Use Planning in Bandung Regency. *Buletin Tanah Dan Lahan*, *1*(1), 79–85.

Pendrill, F., Persson, U. M., Godar, J., Kastner, T., Moran, D., Schmidt, S., & Wood, R. (2019). Agricultural and forestry trade drives large share of tropical deforestation emissions. *Global Environmental Change*, *56*, 1–10. https://doi.org/10.1016/j.gloenvcha.2019.03.002

Wahyuni, S., Guchi, H., & Hidayat, B. (2014). Analysis of Land Use and Land Cover Change year 2003 and 2013 in Dairi Regency. *Jurnal Online Agroekoteknologi*, *2*(4), 1310–1315.

Zhang, S., Guan, Z., Liu, Y., & Zheng, F. (2022). Land Use/Cover Change and Its Relationship with Regional Development in Xixian New Area, China. *Sustainability*, *14*(11), 6889. https://doi.org/10.3390/su14116889