

EVALUATION OF THE SUITABILITY OF GREEN OPEN SPACE LAND AGAINST MEDAN CITY SPATIAL PLANNING

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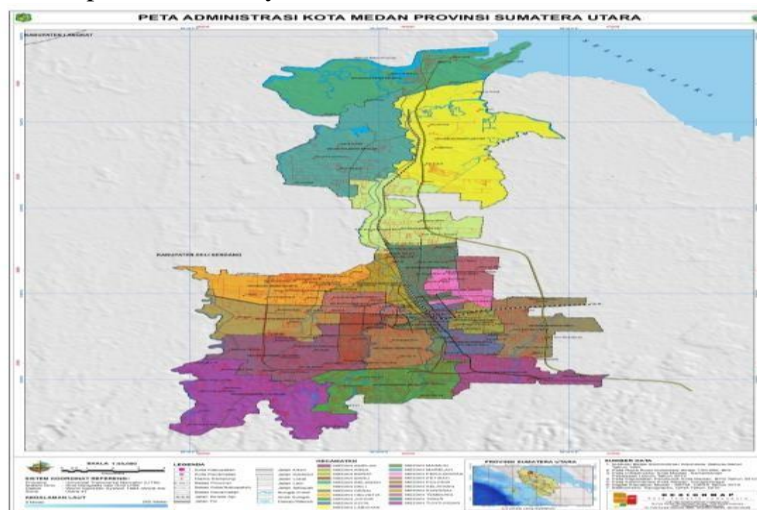
Abstract

This study aims to evaluate the suitability of Green Open Space (RTH) land in Medan City based on the established Regional Spatial Plan (RTRW). Along with the rapid development of urbanization, land conversion, and increasing space needs in urban areas, Medan City faces challenges in maintaining and allocating RTH according to applicable standards. In this study, an analysis of land distribution in various sub-districts in Medan City was conducted to identify the suitability between the existing RTH area and the provisions of the RTRW. Data is processed using Geographic Information System (GIS) technology to produce accurate spatial visualization related to RTH allocation. The results of the study show that several sub-districts have green open space areas that are still below the standards set in the RTRW. Factors contributing to this mismatch include urbanization pressure, land conversion for industrial and residential purposes, and lack of supervision in the implementation of the RTRW. To address this problem, the study recommends strategies to increase green open space suitability through strengthening regulations, utilizing GIS technology for land monitoring, incentives for land owners, multi-sector collaboration, and adaptive RTRW revisions. With the implementation of this strategy, it is hoped that Medan City can improve the suitability of green open space according to the RTRW, which not only provides ecological benefits, but also supports sustainable urban development and improves the quality of life of the community.

Keywords: *Green Open Space, RTRW, Medan City, Geographic Information System, City Continuity*

INTRODUCTION

Medan City, as the capital of North Sumatra Province, has an area of 26,510 hectares or equivalent to 265.10 km², which only covers 3.6% of the total area of North Sumatra Province. Compared to other districts or cities in this province, Medan City has a relatively small area but is inhabited by a large population. Arnowo, H. (2023). This condition causes high pressure on land use and the need for green open spaces (RTH) as a balancer for the environment, here is a map of Medan City:



Administrative Map of Medan City

Source: <https://petatematicindo.wordpress.com>

Green open spaces play an important role in creating a healthy environment, reducing air pollution, controlling microclimates, and improving the quality of life of urban communities. The Medan City Government has prepared a Regional Spatial Plan (RTRW) which regulates land allocation for various uses, including green open spaces. However, along with the rapid rate of urbanization and population growth, there is a potential for a mismatch between the land allocation for green open spaces stipulated in the RTRW and real conditions in the field. Arifin, DRF (2023). Changes in land use for residential, industrial, and commercial facilities often shift the area that should be allocated as green open spaces. The following is a table of the area of sub-districts in Medan City.

Table: Area and Percentage of District Area in Medan City, 2023

No	Subdistrict	Total Area (km ²)	Percentage to Subdistrict's Area (%)
1	The Field of Fortune	25.16	8.92
2	Johor Field	16.73	5.93
3	Sandpaper Field	10.65	3.78
4	Denai Field	9.37	3.32
5	Medan Area	4.24	1.50
6	City of Medan	5.75	2.04
7	Maimun Field	3.02	1.07
8	Polonia Field	8.77	3.11
9	New Field	5.43	1.93
10	Field at a glance	16.45	5.83
11	Sunggal Field	13.26	4.70
12	Helvetia Field	13.05	4.63
13	The Broken Field	5.28	1.87
14	West Medan	6.34	2.25
15	East Medan	8.89	3.15
16	Field of Struggle	4.54	1.61
17	Tembung Field	7.85	2.78
18	Medan Deli	18.83	6.68
19	Labuhan Field	35.09	12.44
20	Medan Marelan	30.03	10.65
21	Belawan Field	33.27	11.80
	FIELD (Total)	281.99	100.00

The distribution of sub-district areas in Medan City shows significant variation in the allocation of areas per sub-district. The sub-districts with the largest areas are Medan Labuhan (12.44%), Medan Marelan (10.65%), and Medan Belawan (11.80%), each of which contributes more than 10% to the total area of the city. In contrast, sub-districts such as Medan Maimun, Medan Area, and Medan Perjuangan have a relatively small percentage of area, with each contributing less than 2%. Problems related to regional spatial planning arise from this disparity in land allocation, especially in the context of green open space (RTH), Harefa, KO (2024). With varying areas, some sub-districts may find it more difficult to meet the RTH target according to the RTRW. Smaller sub-districts tend to be denser with commercial and residential activities, so space for RTH is increasingly limited. For example, sub-districts with small but dense areas such as Medan Kota and Medan Petisah face higher development pressures, which complicates the procurement of RTH land.

This disparity reflects the need for a spatial planning approach that takes into account the distribution of area and population density per sub-district. Sub-districts with larger areas, such as Medan Labuhan and Medan Belawan, need to be utilized to expand the city's green areas, while smaller sub-districts need to find alternatives to improve environmental quality through city parks or green facilities in built-up areas. This is important to achieve an even environmental balance throughout the city, Salatalohy, A., et al. (2023). Evaluation of land suitability for green open space against RTRW is very important to identify the extent to which the implementation of spatial planning policies has been in accordance with the environmental and social needs of the community. With this evaluation, it can be seen whether green open space in Medan City is sufficient to balance urban density and support a good quality of life for its citizens. This study also forms the basis for more sustainable and adaptive spatial planning to changes in community and environmental needs in the future. Siahaan, ISPG (2023). In the context of the rapid development of Medan City, a number of problems related to the suitability of green open

space (RTH) with the regional spatial plan (RTRW) have begun to emerge. One of the main problems is the limited land for RTH. With a limited area and an increasing population, the allocation of land for RTH is increasingly being squeezed by the need for land for housing, industry, and commercial facilities. This land limitation makes it difficult to meet the minimum standards for RTH set by the government, which is 30% of the total area of the city, where 20% must be managed by the government and 10% by the community. In addition, there is a mismatch in the implementation of the RTRW. Although the Medan City RTRW has determined the allocation of land for RTH, the reality in the field often does not match the plan. Land that should be allocated as RTH often changes function to built-up land due to high development pressure. This mismatch is caused by weak supervision and limited budget and resources to control land conversion. The lack of RTH also has a negative impact on environmental quality in Medan City.

Increasing urban temperatures (urban heat island effect), air pollution, and lack of water absorption resulting in flood risks are some of the impacts felt by the community due to limited green space. This condition reduces the quality of life of the community and increases the burden on city infrastructure in dealing with environmental problems. In addition, low public awareness and participation in maintaining and developing green space is a challenge in itself, Sulistyono, H. (2021). Public participation in the provision of green space, such as environmental parks or green areas around residential areas, is still minimal due to the lack of socialization and education regarding the importance of green space for the health and balance of the city's ecosystem. The government also faces obstacles in procuring new land for green space. Increasingly expensive land prices and high competition to utilize land for commercial interests are obstacles in efforts to expand green space in strategic areas. Tri Aryanto, T., & Taryono, I. (2022).

This research was conducted due to various problems related to spatial planning and the environment in Medan City. One of the main problems is the limited land for green open space (RTH). Rapid urbanization and population growth have increased the need for land for housing, industry, and commercial facilities, thus urging the existence of RTH. This condition makes it difficult to meet the minimum standards for RTH set by the government, which is 30% of the total area of the city, where 20% is managed by the government and 10% by the community. In addition, although the Medan City Spatial Plan (RTRW) has regulated the allocation of land for RTH, the reality in the field is often not appropriate. High development pressures often cause land that should be designated for RTH to turn into built-up areas. This is exacerbated by weak supervision and limited budget and resources needed to control changes in land function.

The lack of green open space also has a negative impact on environmental quality in Medan City. The impacts include increasing urban temperatures (urban heat island effect), high air pollution, and a lack of water catchment areas which increase the risk of flooding. This condition reduces the quality of life of the community due to the reduction in green areas that can be used as recreation areas and function to maintain the balance of the city's ecosystem. These problems indicate a gap between the need for green open space and the implementation of the Medan City RTRW. The need for analyze and understand the management of sustainable city development based on regional regulations (RTRW/RDTR), a study conducted by Sugiarto, A. (2024). Therefore, integrated efforts are needed between the government, society, and the private sector to realize a greener and more sustainable city in accordance with existing spatial planning policies.

Formulation of the problem

- 1) What is the level of suitability of the land used as green open space (RTH) in Medan City to the established regional spatial planning plan (RTRW)?
- 2) What are the factors that cause a mismatch between the allocation of green open space land in the RTRW and actual conditions in the field?
- 3) What strategies can be implemented to improve the suitability of green open space land with RTRW provisions to support the sustainability and quality of life of the community?

Research purposes

- 1) Analyzing the level of suitability of green open space (RTH) in Medan City based on the established RTRW.
- 2) Identifying factors that cause discrepancies between the allocation of green open space land in the RTRW and actual conditions in the field.
- 3) Formulate strategies to improve the suitability of green open space land with the RTRW, thereby supporting sustainable urban development and improving the quality of life of the community.
- 4)

LITERATURE REVIEW

1. Green Open Space (RTH) Concept

Green Open Space (GOS) is an essential element in environmentally friendly and sustainable urban planning. GOS includes various types of open land, such as city parks, botanical gardens, and city forests, which have ecological, aesthetic, and social benefits. GOS not only functions as a space for recreation, but also as a pollutant absorber, temperature regulator, and habitat protector. According to the Ministry of Public Works and Public Housing (2015), GOS is designed to create a balance in the urban ecosystem, improve air quality, and become a place for social interaction for the community. Based on Law Number 26 of 2007 concerning Spatial Planning, the Indonesian government mandates that every city must provide at least 30% of its area as GOS, consisting of public and private GOS. The implementation of this policy is a complex challenge because the need for land for other sectors such as housing and commercial is often prioritized.

2. The Importance of RTRW in Green Space Planning

The Regional Spatial Plan (RTRW) serves as the main guideline in managing urban spatial planning, including planning and determining green open space. The RTRW functions to determine zoning and allocate areas suitable for green open space development, while considering space requirements for other sectors such as industry, housing, and transportation. A study by Rahmawati et al. (2020) emphasized that the RTRW not only functions as a legal guideline for land use, but also as a preventive instrument to reduce land conflicts. With the RTRW guideline, local governments can carry out more comprehensive planning in determining suitable locations for green open space development, which is in line with national spatial planning policies. Good RTRW implementation can create harmonious urban spaces and optimize sustainable land use, while supporting the health of urban ecosystems.

3. Evaluation of the Conformity of Green Open Space to the RTRW

Evaluation of the suitability of green open space land to the RTRW is carried out to determine whether the development of existing green open space is in accordance with the established spatial plan. This evaluation is important to identify the government's success in providing green open space according to its needs and ecological functions. One method that is widely used in this evaluation is spatial analysis with the help of Geographic Information Systems (GIS). With GIS, the government can analyze the distribution and suitability of green open space locations in relation to the RTRW zoning. Research by Anggraini & Sari (2022) shows that Medan City faces various challenges in meeting green open space needs in accordance with the RTRW, especially due to the rapid conversion of land into residential and commercial areas. Land suitability is an important indicator in assessing the effectiveness of the RTRW, which allows the government to assess whether the addition of green open space has been in a strategic location according to community needs.

4. Challenges and Opportunities in Developing Green Open Space in Medan City

Medan City has great potential in developing green open space, but is faced with various challenges, including land conversion and conflicts of interest between sectors. Land conversion from open areas to residential or commercial areas often reduces the planned green open space area. In addition, limited supervision of land use in the city is one of the inhibiting factors in achieving green open space targets. A study by Saputra (2021) highlights the importance of cross-sector collaboration in maintaining and expanding green open space amidst the pressure of rapid urbanization. Coordination between the government, private sector, and community is an important element in achieving a good balance between economic development and environmental sustainability, research byMilanie, F. (2023, December). The use of technology such as GIS can assist in participatory mapping involving the community to identify strategic locations for the addition of new green open spaces. This community participation is important to ensure the sustainability of the green open space program and create a more inclusive urban space.

5. Strategy for Optimizing Green Open Space Land Suitability

To improve the suitability between green open space and RTRW, a strategy is needed that can support adaptive planning to changes in environmental conditions and social needs. The first strategy that can be implemented is to periodically revise the RTRW to be more responsive to changes in land needs and address land conversion issues. In addition, incentive policies are needed for land owners who provide green areas, such as providing tax incentives or reducing development permit fees for land that continues to function as green open space. A study conducted by Widodo et al. (2023) suggests the importance of monitoring land use and increasing community participation in managing green open space. Community participation in the management and

maintenance of green open space not only increases environmental awareness but also encourages the development of green open space that is more inclusive and in accordance with local needs. The suitability of green open space land with the RTRW in Medan City is very important to create a sustainable and environmentally friendly city layout. Evaluation of land suitability using GIS technology allows local governments to monitor the distribution and suitability of green open space with the established RTRW. By utilizing technology, strengthening spatial regulations, and encouraging community participation, Medan City can increase the number and quality of available green open space, thereby providing long-term ecological, social, and economic benefits for the city's residents. Optimal green open space suitability with the RTRW will support the health of the urban ecosystem and improve the quality of life of Medan City residents.

RESEARCH METHOD

This research The approach in this research uses qualitative descriptive methodology. The selection of a qualitative approach is in accordance with the research theme which is descriptive in nature. The data collection procedure involves four basic types, namely observation, interviews, documents, and visual images (Creswell, 2013). Qualitative descriptive methods are used to obtain secondary data through library methods or document and literature studies. Secondary data are collected from various sources, including books, theses, journals, legislation, the internet, lecture materials, and mass media. Meanwhile, primary data is obtained through in-depth interviews with sources who are experts or related officials who have competence in the field that is the focus of the research, namely the evaluation of the suitability of green open space land to the Medan City RTRW. Data analysis was carried out descriptively with a thematic approach which includes data reduction, data presentation, and drawing conclusions.

RESULTS AND DISCUSSION

1. Level of Suitability of Green Open Space (RTH) Land in Medan City Based on the Established RTRW

Medan City has a total area of approximately 281.99 km², which is divided into several sub-districts with different areas and percentages of the total city area. Based on the Regional Spatial Plan (RTRW), each sub-district should provide Green Open Space (RTH) to meet the minimum percentage required by law, which is approximately 30% of the total city area. However, research shows a disparity between the provisions of the RTRW and the reality on the ground, especially in sub-districts that are already densely populated or experiencing rapid land conversion.

Analysis by District

- 1) Sub-districts with Significant Area but Low Green Open Space Availability:
Districts such as Medan Tuntungan (8.92%), Medan Johor (5.93%), Medan Sunggal (4.70%), and Medan Helvetia (4.63%) have quite large areas, but the percentage of areas allocated for green open space is still below the target of 30% mandated by the RTRW. The problems in this area are related to the high level of urbanization and demand for residential land, so that green open space is a priority that is often overlooked in local spatial planning.
- 2) Districts with High Urbanization Pressure:
Medan Area (1.50%), Medan Kota (2.04%), Medan Maimun (1.07%), and Medan Petisah (1.87%) sub-districts show very low percentages of green open space allocation. The high pressure of infrastructure and commercial development in these areas has caused the green open space area to decrease. This condition indicates that areas that are already very dense tend to have difficulty in providing sufficient green areas, in accordance with RTRW standards.
- 3) Industrial Areas with Green Open Space Challenges:
Medan Labuhan (12.44%), Medan Marelan (10.65%), and Medan Belawan (11.80%) sub-districts are sub-districts with significant areas and are industrial and port areas. Despite their size, the percentage of green open space in these sub-districts often does not meet the RTRW standards because land use is prioritized for industrial and logistics activities. The main challenge in developing green open space in these areas is the environmental impact of increasingly high industrial activities, where green open space should be able to function as an ecological balancer.
- 4) Urban Areas with Limited Land for Green Open Space:
Sub-districts such as Medan Baru (1.93%), Medan Barat (2.25%), and Medan Timur (3.15%) have limitations in providing land for green open space, even though they are located in the city center. Green open space development in these areas may be more feasible through incentive policies or collaboration between local governments and the private sector to create smaller public green areas that still provide ecological benefits.

The results of the analysis of the level of land suitability for green open space in Medan City show that although there are sub-districts with adequate land area, the allocation for green open space is still not optimal in accordance with the provisions of the RTRW. The main challenges that hinder the fulfillment of green open space standards in many areas of Medan include land conversion, rapid urbanization, and the growth of the industrial sector. To overcome this, there are several recommendations that can be implemented. First, optimizing mapping technology through the use of GIS and spatial analysis can help the city government identify strategic areas for the development of new green open space or conservation of existing green areas. Second, multi-sector collaboration between the government, private sector, community, and environmental organizations is needed to maintain and manage green areas sustainably, especially in already densely populated sub-districts. Third, the implementation of incentive policies for developers or land owners who are willing to maintain their land as green open space or convert part of the property into a green area that can be accessed by the public is very important in increasing the area of green open space in the city. Adaptive and periodic revisions to the RTRW need to be carried out so that the Medan City RTRW can adjust to changes in land use and green open space needs along with the growth of the city. By implementing these steps, it is hoped that Medan City can increase the proportion of green open space in accordance with the RTRW and achieve the goal of becoming a healthier and more environmentally friendly city.

2. Factors that cause a mismatch between the allocation of green open space land in the RTRW and actual conditions in the field.

The discrepancy between the allocation of Green Open Space (RTH) land stipulated in the Regional Spatial Plan (RTRW) and the actual conditions in Medan City is caused by various interrelated factors. One of the main factors is the high rate of urbanization and population growth, which increases the demand for land for residential, commercial, and industrial purposes. This growth has caused significant changes in land use, where many green areas are converted into areas that are more economically profitable but less supportive of the city's ecological function. This can be seen in areas with rapid development such as Medan Johor, Medan Selayang, and Medan Marelan, where the conversion of green land into housing or commercial facilities is often not in accordance with the established RTH plan.

In addition, the lack of supervision of the implementation of the RTRW and weak enforcement of regulations are factors that contribute to the mismatch between planning and conditions in the field. Weak supervision often allows for uncontrolled changes in land use and a lack of legal action against violations of land use. This is often exacerbated by the existence of economic and political interests that play a role in spatial decision-making, thus influencing priorities in the provision of green open space. Economic factors, especially the high commercial value of land in several sub-districts, are also obstacles in maintaining green open space areas. In rapidly developing areas, land values tend to increase, and landowners prefer to convert green areas for more profitable purposes, such as housing, retail, or industry. This can be seen in the areas of Medan Polonia, Medan Petisah, and Medan Sunggal which have strategic locations and high land values, making them the main targets for development outside the provisions of green open space.

Lack of public awareness of the importance of green open spaces for environmental quality also has an impact on low support for green area protection. In fact, public participation and collaboration with the private sector can play an important role in maintaining the sustainability of green open spaces. The lack of campaigns and socialization regarding the ecological and health benefits of green open spaces has resulted in low levels of participation in green open space conservation efforts in Medan. The inconsistency of the allocation of green open space land in the Medan City RTRW with actual conditions is caused by a combination of rapid urbanization factors, weak supervision and law enforcement, economic pressures, and low public awareness. To overcome this, a collaborative strategy is needed that involves re-planning the RTRW, strengthening regulations, and increasing public participation to maintain ecological balance and quality of life in Medan City.

3. Formulate strategies to improve the suitability of green open space land with RTRW, and support sustainable urban development.

To improve the suitability of Green Open Space (RTH) land with the Regional Spatial Plan (RTRW) and support sustainable urban development in Medan City, a comprehensive strategy is needed that includes aspects of planning, regulation, technology, and community participation. This approach not only aims to meet ecological needs, but also to create a healthy environment and improve the quality of life of the community.

Table 1. Analysis of strategies to improve the suitability of Green Open Space (RTH) land in Medan City with RTRW:

No	Strategy	Description	Objective	Required Actions	Expected Impact
1	Strengthening	Tighten regulations	Maintaining the	Create additional	Reduce the rate of

	Regulation and Law Enforcement	and supervision to protect and develop green open space. Provide strict sanctions for inappropriate conversion of green land.	allocation of green open space land in accordance with the RTRW.	regulations, implement a strict control system on building permits, and impose sanctions for violations.	inappropriate green land conversion, increase compliance with RTRW.
2	Optimizing Technology for Land Identification and Monitoring	Using GIS and remote sensing technology to monitor land changes in real-time and identify potential areas for green open space.	Facilitate the planning and supervision of green open space.	Development of land database, training of GIS monitoring officers, and integration of spatial data into the RTRW system.	Identification of optimal green areas, accurate monitoring of land use changes, early detection of land use changes.
3	Multi-Sector Collaboration for Green Open Space Management and Development	Involving the private sector, communities, and environmental institutions in the management and development of green open spaces.	Support sustainable green space management and increase environmental awareness.	Collaboration with developers, forming cross-sector teams for green open space management, as well as environmental awareness campaigns.	Increasing the area of green areas, community involvement in managing green open spaces, and reducing pollution.
4	Incentives for Land Owners to Provide and Maintain Green Open Space	Providing incentives for land owners who maintain or develop green open spaces, such as tax breaks and subsidies.	Encourage participation in the provision and maintenance of green open space.	Develop incentive policies, socialize them to land owners, and evaluate the impact of incentives on RTRW compliance.	Voluntary expansion of green open space, improvement of ecological balance, and greening of the city.
5	Adaptive and Responsive RTRW Revision to City Dynamics	Periodic evaluation and revision of the RTRW to suit social, economic and environmental changes.	Providing green open space that suits the needs of the city and the community.	Evaluation of green open space needs, urban growth studies, and public consultation regarding the revision of the RTRW.	Increasing the relevance of RTRW, aligning green open space with city development, and improving environmental quality.

This table summarizes the proposed strategic steps to improve the suitability of green open space land in Medan City with the RTRW, support sustainable development, and create a better quality of life for the community.

It is important for the government to strengthen regulations related to the protection and development of green open space and tighten supervision of changes in land use. This step includes the application of strict sanctions for violations of the provisions of the RTRW which result in the conversion of green land without permission. The government also needs to implement a strict control system for every development permit that has an impact on green areas. Strengthening these regulations can reduce the risk of illegal conversion of green land and ensure the allocation of green open space in accordance with the RTRW.

The use of Geographic Information System (GIS) and remote sensing technology can help the government monitor the condition of green open space land in real time. This technology allows for accurate mapping of areas and helps identify potential land for green open space development. With integrated spatial data, green open space planning can be more targeted, and the government can quickly take steps if there are indications of land conversion that violate the RTRW. Furthermore, multi-sector collaboration is needed to realize sustainable green space management and development. The government can work together with the private sector in green space

projects, such as the development of city parks or public green areas. In addition, community organizations and environmental institutions can support public awareness and education about the importance of green space.

This cross-sector collaboration not only expands the scope of green areas in various sub-districts, but also increases public awareness of environmental conservation. In addition, providing incentives to landowners who are willing to maintain or develop green areas can also be an effective strategy. These incentives can be in the form of tax breaks or subsidies, which can encourage landowners to maintain their land as green open space. This step allows for voluntary fulfillment of green open space and encourages landowner involvement in maintaining the balance of urban ecology. The Medan City RTRW needs to be evaluated and revised periodically to adjust the need for green open space with the evolving social and environmental dynamics. This revision can ensure that the RTRW remains responsive to population growth, urbanization, and current environmental conditions, while reflecting the city's commitment to improving environmental quality and public health. Through the implementation of these strategies, Medan City is expected to be able to improve the suitability of green open space land with the RTRW. Increasing the proportion and quality of green open space not only provides ecological benefits, such as reducing pollution, water absorption, and reducing the city's hot temperature, but also supports the creation of a comfortable and healthy environment for the community. Joint efforts between the government, private sector, and community are expected to realize a sustainable, green, and comfortable Medan city for future generations.

CONCLUSION

The suitability of green open space land in Medan City is not yet fully optimal in fulfilling the provisions of the RTRW. There are a number of sub-districts that, despite having adequate land area, their allocation for green open space is still below the established standard. Several factors causing this inconsistency include urbanization pressure, land conversion for industrial and housing activities, and lack of supervision and enforcement of regulations on land use. The use of GIS-based mapping technology and remote sensing as well as multi-sector collaboration has proven to be important factors that can improve the planning and supervision of green open space in Medan City. Implementation of incentive strategies for landowners, stronger regulatory enforcement, and revision of the RTRW that is more adaptive to urban changes are also identified as strategic steps to improve the green open space mismatch.

With a comprehensive strategy, Medan City is expected to increase the proportion of green open space in accordance with the RTRW, which in turn will support sustainable urban development and improve the quality of life of the community. This conclusion emphasizes the importance of strong regulatory roles, technology utilization, and community participation in sustainable green open space development.

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