

## SUSTAINABILITY OF URBAN AREA DEVELOPMENT BASED ON THE AVAILABILITY OF GREEN OPEN SPACE IN MEDAN CITY

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### Abstract

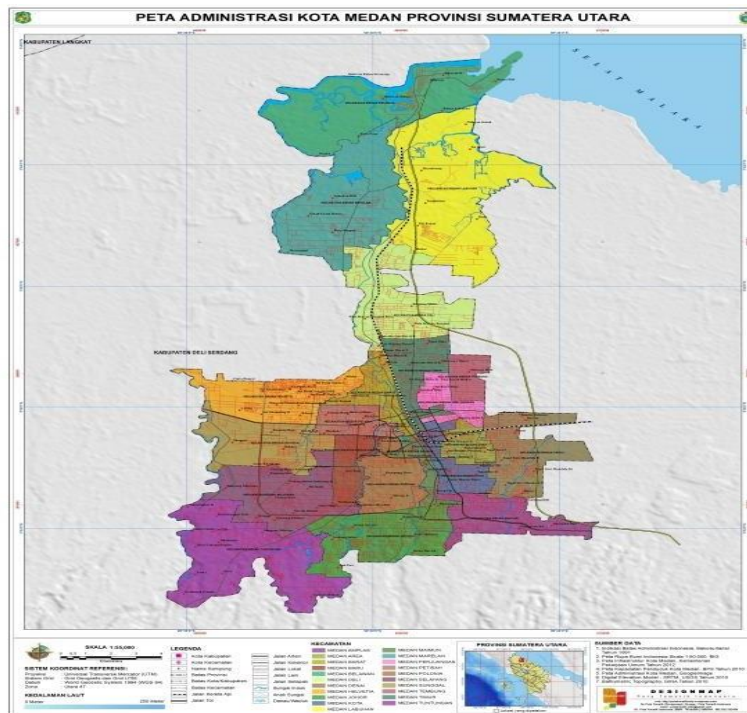
The sustainability of urban development in Medan City is greatly influenced by the availability of Green Open Space (RTH) that can support environmental quality and the quality of life of the community. Medan City, as a city with a high level of urbanization and increasing population density, faces challenges in providing sufficient green space. The mismatch between the allocation of RTH in the Regional Spatial Plan (RTRW) and the existing land use conditions, as well as the limited space for RTH development in densely populated areas, are the main factors in the decline in environmental quality. Limited RTH reduces the ability of urban ecosystems to manage air pollution, temperature, and rainwater absorption. In addition, limited RTH also has a negative impact on the physical and mental health of the community. Therefore, efforts to increase the availability of RTH need to be carried out with an approach that involves the development of vertical green spaces, small city parks, rehabilitation of abandoned spaces, and improvement of spatial planning policies. This study aims to analyze the importance of the role of RTH in the sustainability of urban area development and the solutions that can be applied to achieve it, in order to create a greener, healthier, and more sustainable city environment.

**Keywords:** *Sustainability, Urban Development, Green Open Space, Medan City, City Area.*

### INTRODUCTION

The development of the Medan City Area as the capital of North Sumatra Province is experiencing rapid population growth and development. With an area of 265.10 km<sup>2</sup>, the city faces high pressure on urban land to meet various needs, ranging from housing, commercial, to public infrastructure. One of the main challenges in this development process is maintaining the availability of Green Open Space (RTH), which is an important component in creating a healthy and sustainable living environment. RTH plays a role in reducing air pollution, regulating microclimates, and improving the quality of life of urban communities, which is increasingly needed amidst the intensification of human activities (Arnowo, 2023).

The Medan City Government has regulated the allocation of green open space through the Regional Spatial Plan (RTRW), but conditions in the field often show inconsistencies with the planning. Rapid urbanization and increasing land needs for the housing and commercial sectors often shift the areas that should be allocated as green open space. Several sub-districts with small areas and high population densities, such as Medan Kota and Medan Petisah, have limitations in providing adequate green open space. On the other hand, sub-districts with larger areas, such as Medan Labuhan and Medan Belawan, have more potential to expand the city's green areas, but also face the challenge of land conversion (Harefa, 2024).



Administrative Map of Medan City  
Source: <https://petatematikindo.wordpress.com>

In this context, the distribution of green open space availability in Medan City is very crucial to achieve sustainable urban development. A balanced distribution of green open space across sub-districts can help create a healthier and more environmentally friendly city, as well as improve the quality of life of the community. Therefore, this study focuses on the analysis of the sustainability of urban area development in Medan City based on the availability of green open space, to identify solutions that can support ecological balance and the need for green space in each sub-district, along with sustainable urban growth (Salatalohy et al., 2023).

The distribution of sub-district areas in Medan City shows significant variation in the allocation of areas per sub-district. Sub-districts with the largest areas, such as Medan Labuhan (12.44%), Medan Marelan (10.65%), and Medan Belawan (11.80%), each contribute more than 10% to the total area of the city. In contrast, sub-districts such as Medan Maimun, Medan Area, and Medan Perjuangan have relatively small contributions, with each area percentage below 2%. This disparity in land allocation creates problems in regional spatial planning, especially in the context of providing Green Open Space (RTH). Sub-districts with smaller areas tend to have higher population densities, as well as the dominance of commercial and residential activities that continue to grow. This results in limited space for the development of green open space. For example, sub-districts such as Medan Kota and Medan Petisah, which have limited areas but are densely populated, face higher development pressures, making it difficult to provide land for green open space in accordance with the targets set in the Regional Spatial Plan (RTRW). In this condition, it is important to review spatial planning policies in order to create solutions that allow for more efficient and sustainable land use.

The main problem in urban development in Medan City is how to maintain environmental sustainability amidst rapid urbanization and increasing land needs. The availability of green open space in Medan City is currently uneven across sub-districts, resulting in environmental quality disparities between regions. Several sub-districts, such as Medan Kota, Medan Petisah, and Medan Area, which are relatively small in area but have high population density, face serious limitations in providing green open space as stipulated in the RTRW. This disparity causes problems in providing space for recreational activities, health, and improving air quality in dense areas, which actually require more green open space (Arnowo, 2023; Arifin, 2023).

On the other hand, sub-districts with larger areas, such as Medan Labuhan and Medan Belawan, have the potential for wider green open space development. However, land use in these areas is still constrained by use for the industrial sector, new settlements, and other commercial activities. As a result, development pressure on green areas is increasing and complicating the fulfillment of the city's green open space targets. This problem shows the potential for a mismatch between the spatial planning that has been prepared and the real green open space needs

in the field. Rapid urbanization and high demand for residential and commercial land often shift the priority of green land use. In addition, the lack of supervision of the implementation of the RTRW and uncontrolled land conversion add complexity to efforts to maintain the availability of green open space in Medan City (Harefa, 2024). Thus, there is an urgent need to re-evaluate spatial planning and policies, especially in the context of fair and effective allocation of green open space (Salatalohy et al., 2023). The Medan city government needs to formulate a strategy that not only considers planning on paper, but also the real conditions in each sub-district which have different characteristics. Innovative approaches, such as the development of small city parks, vertical green areas, and optimization of existing open spaces, can be a solution for sub-districts that have limited land. This strategy is important to ensure the sustainability of urban development in Medan City, which not only considers the need for development land but also the quality of the environment that will support the lives of city residents as a whole.

### **Formulation of the problem**

- 1) What are the factors that influence the discrepancy between the allocation of green open space in the RTRW and the actual conditions in the field in Medan City?
- 2) How does the limited Green Open Space (RTH) impact the environmental quality and quality of life of the community in sub-districts with high population density and limited land area such as Medan Kota and Medan Petisah?
- 3) What efforts can be made to increase the availability of Green Open Space (RTH) in areas with limited land, especially in denser and rapidly developing sub-districts?

### **Research purposes**

- 1) Identifying factors that influence the mismatch between the allocation of green open space in the RTRW and land use conditions in Medan City.
- 2) Assessing the impact of limited green open space on environmental quality and community quality of life, especially in sub-districts with high population density and limited land area.
- 3) Propose solutions and efforts that can be made to increase the availability of green open space, including the development of vertical green spaces or small city parks in dense areas.
- 4)

### **LITERATURE REVIEW**

#### **1. The concept of green open space (RTH) in urban areas**

Green Open Space (GOS) is an important element in sustainable urban area planning. GOS not only functions as a place for recreation, but also has a significant ecological role, such as reducing air pollution, regulating micro-temperature, absorbing carbon dioxide, and providing habitat for biodiversity. In many cities, GOS is also used for rainwater management and flood risk reduction (Tzoulas et al., 2007). Therefore, the availability and distribution of GOS in urban areas are the main indicators in assessing the sustainability of a city. Green open space also contributes to social welfare by providing space for social interaction, recreation, and physical activities for urban communities. Sufficient green open space in urban areas can improve quality of life by reducing stress, promoting healthy lifestyles, and providing better accessibility for outdoor activities (Maas et al., 2006). However, along with the rapid urban development, land for green open space is increasingly limited, which causes an imbalance between the need for green land and land use for infrastructure and settlement development.

#### **2. Planning Approach to Increase the Availability of Green Open Space**

To address the disparity in the provision of green open space, various planning approaches have been developed. One of them is by introducing the concept of vertical green space, which allows the development of green open space in limited areas. The use of vertical gardens and rooftop gardens of tall buildings in urban areas can be an innovative solution to expand green open space in densely populated cities (Niemelä, 2014). In addition, the use of empty land or unused land in urban areas as green open space can also be an alternative to increase the availability of green open space. The importance of collaboration between government, communities, and the private sector is also key to achieving sustainable development goals. City governments can integrate greening and green space protection policies into spatial planning that is more responsive to environmental and social needs (Gössling, 2015). Thus, planning that considers the potential of each region in providing green space, as well as monitoring uncontrolled land conversion, will support the achievement of more sustainable urban areas.

### 3. Green Open Space Policy and Implementation in Medan City

Medan City has regulated the allocation of green open space through the Regional Spatial Plan (RTRW), which regulates the division of land for various uses, including for green open space. However, in the field, the implementation of this policy is often hampered by the rate of urbanization and the increasing need for land for housing and industry. Therefore, a more flexible approach is needed in planning and managing green open space in this city, including through the development of city parks, vertical green spaces, and other green facilities in densely populated areas. Periodic evaluation of the RTRW policy is also important to ensure consistency between planning and reality on the ground (Harefa, 2024).

### 4. Sustainability of Urban Area Development

Sustainable urban development refers to efforts to meet the needs of the present generation without compromising the ability of future generations to meet their own needs. In the urban context, sustainable development involves the integration of economic growth, environmental protection, and social welfare. Sustainable urban development focuses not only on improving infrastructure and public services, but also on managing natural resources and reducing negative impacts on the environment. This concept is important in designing cities that have a high quality of life, reduce the impacts of climate change, and minimize environmental degradation (Jabareen, 2006). Rapid urbanization and increasing population density are putting great pressure on natural resources in large cities. This requires a sustainable approach to spatial planning that can support the balance between development and environmental conservation. The emphasis on sustainability in urban development ensures that urban activities do not compromise the balance of the ecosystem and maintain the quality of life for its inhabitants (UN-Habitat, 2016).

## RESEARCH METHOD

The approach in this study uses a 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). The qualitative descriptive method is 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 sustainability of urban area development based on the availability of green open space in the city of Medan. Data analysis was carried out descriptively with a thematic approach which includes data reduction, data presentation, and drawing conclusions.

## RESULTS AND DISCUSSION

### 1. Factors influencing the mismatch between the allocation of green open space in the RTRW and land use conditions in Medan City.

For the analysis of factors influencing the mismatch between the allocation of Green Open Space (RTH) in the Regional Spatial Plan (RTRW) and land use conditions in Medan City, we need to consider various aspects related to the distribution of land area in each sub-district as well as the characteristics and dynamics of land use. Based on data on the area of sub-districts in Medan City in 2023, several factors influencing the mismatch are:

#### 1). Variation in Area Between Districts

The factors in the table show a very significant variation in area between sub-districts. Sub-districts such as Medan Labuhan (12.44%), Medan Belawan (11.80%), and Medan Marelan (10.65%) have large areas, while sub-districts such as Medan Maimun (1.07%) and Medan Area (1.50%) have small areas. The effect on sub-districts with large areas has greater potential to provide green open space, but sub-districts with limited areas (such as Medan Kota and Medan Petisah) are more difficult to meet the allocation of green open space according to the RTRW. Therefore, planning and allocation of green space need to consider these differences in order to meet the green open space standards by considering population density and existing land use.

#### 2). Population Density and Denser Land Use

Factors in Sub-districts with smaller areas tend to be denser with commercial activities, housing, and public facilities, such as Medan Kota and Medan Petisah. This density reduces the availability of space for green open space. The effect in sub-districts with high density, there is often competition between infrastructure



development and the need for green open space. Green open space is becoming increasingly limited because more land is used for urgent settlements and commercial facilities.

### 3). Changes in Land Function

Factors on Along with the development of the economy and urbanization, many lands that have been designated for green open space in the RTRW are converted into commercial or residential areas. This often happens without good planning, and this inconsistency is increasingly evident in high-density areas. The impact of inconsistency of land use that is not in accordance with the initial plan, especially in areas with high economic needs, causes a reduction in the area that should be allocated for green open space.

### 4). Lack of Supervision and Law Enforcement

Factors on less strict supervision of development outside the spatial plan can cause a mismatch between the allocation of green open space in the RTRW and the reality on the ground. Non-compliance with spatial regulations and policies can reduce the area of land available for green open space. The effect of without adequate supervision, land that should be green open space can be used for other activities such as housing development and shopping centers, which further burdens the city's ecosystem.

### 5). Limited Resources and Budget

Factors in Medan City Government may face limitations in terms of human resources and budget to facilitate the procurement and maintenance of green open space. This is more pronounced in sub-districts with small areas and high levels of development. Impact on Inability to provide green open space in the middle of a dense city can worsen the mismatch between RTRW and conditions on the ground. Sub-districts with limited area and high infrastructure needs will have difficulty providing sufficient green open space, especially if there is not enough budget or resources to realize it.

### 6). Economic Growth and Infrastructure Demand

Factors on Demand for infrastructure, especially for housing, industry, and public facilities, often outweigh the need for green open spaces in some sub-districts. With increasing population and economic activity, land that was originally allocated for green open spaces can be diverted to more productive uses. Impact on In large sub-districts such as Medan Labuhan and Medan Belawan, more land is used for industrial and commercial development, while in smaller sub-districts, more land is used for housing. This imbalance causes a shift in green open space allocation that is not in accordance with the initial plan in the RTRW.

### 7). Limited Community and Stakeholder Participation

Factors on Low participation of the community and stakeholders in the planning and management of green open spaces can hinder efforts to maintain green open spaces in accordance with the RTRW. Lack of awareness of the importance of green open spaces also plays a role in this discrepancy. The impact on the community and related parties if not involved in the management of green open spaces, then the allocation of green open spaces in the RTRW can be ignored, especially when development and economic needs are urgent. This imbalance can worsen the quality of life in urban areas. The discrepancy between the allocation of green open spaces in the RTRW and the condition of land use in Medan City is influenced by various factors, including differences in area between sub-districts, population density, changes in land use, limited resources, and lack of supervision and community participation. All of these factors need to be considered in efforts to align spatial plans and the needs of sustainable city development, so that green open spaces can be realized optimally throughout Medan City.

## **2. The impact of limited green open space on environmental quality and the quality of life of the community, especially in sub-districts with high population density and limited land area.**

The limited Green Open Space (RTH) in Medan City, especially in districts with high population density and limited area, has a significant impact on the quality of the environment and the quality of life of the community. In densely populated districts with limited area, green open space is becoming increasingly rare and limited. This has a major impact on various aspects of life, both in terms of environment, social, and health. Impact on Environmental Quality. Limited green space reduces the ability of the city environment to provide important ecological functions, such as rainwater absorption, reducing air pollution, and providing habitat for flora and fauna. In dense areas, such as Medan Kota and Medan Petisah, limited green space causes high levels of air pollution and noise. Green space functions as a natural buffer that helps lower air temperature through the process of

evapotranspiration and provides oxygen. Without sufficient green space, city air temperatures will increase, causing the urban heat island effect, where temperatures in urban areas are higher than in the surrounding areas. This has the potential to worsen air quality and exacerbate the impacts of local climate change. Impact on Public Health. Limited green open space can have a negative impact on public health, both physically and mentally. Minimal green open space reduces opportunities for people to do physical activities outdoors, such as walking, exercising, or relaxing in the park. In fact, outdoor activities have many benefits for body health, such as reducing the risk of heart disease, diabetes, and obesity. In addition, green spaces also function as a place to relax and reduce stress, which is very important for mental well-being. Losing access to green open spaces can worsen levels of stress, anxiety, and mental disorders among urban residents. Impact on Community Quality of Life. Green open spaces not only play a role in maintaining environmental quality and health, but also improving the overall quality of life of the community. Green open spaces are places for social interaction, recreation, and community. In districts with high population density and limited land area, the lack of green open spaces can lead to isolation of community groups, which has an impact on reducing social quality.

Without sufficient access to green spaces, people tend to feel stressed and have less space to socialize or develop local culture. In addition, the lack of green open spaces can increase discomfort and decrease the aesthetic value of the area, which in turn can reduce the attractiveness of the area as a place to live or work. Impact on Infrastructure and Water Management. Limited green open space can worsen water management in urban areas. Green open spaces play an important role in absorbing rainwater and reducing the risk of flooding. Without sufficient green open spaces, high-density areas often experience drainage problems, which can lead to waterlogging and flooding. This will further worsen the quality of life of the community, especially during the rainy season, and add to the burden on urban infrastructure. Overall, the limited green open spaces in densely populated sub-districts and limited areas in Medan City have a broad impact on environmental quality and the quality of life of the community. Therefore, there needs to be real efforts to increase the availability and sustainability of green open spaces as part of an environmentally friendly and sustainable city planning policy.

### **3. Solutions and efforts that can be made to increase the availability of green open space include the development of vertical green spaces or small city parks in densely populated areas.**

To increase the availability of Green Open Space (RTH) in Medan City, especially in areas with high population density and limited land area, various solutions and efforts need to be implemented. One approach that can be taken is the development of vertical green spaces and small city parks, in addition to other broader steps. Here are some solutions and efforts that can be taken:

#### **1. Development of Vertical Green Space**

Vertical green space is a concept that transforms limited space in urban areas into green space by utilizing building walls, buildings, or other vertical structures. This can be done through several methods:

**Vertical Garden:** Vertical gardens can be applied to high-rise buildings in urban areas. The outer walls of the building can be decorated with plants that not only beautify the view, but also function to reduce air temperature and absorb carbon dioxide. Vertical garden technology, such as hydroponic green walls, can be used to grow plants without using soil, thus minimizing land requirements. **Roof Gardens:** The use of building roofs for gardens or parks planted with various types of plants can also help increase the availability of green space. Roof gardens function as green areas that can be used by residents or the community for recreation and relaxation, and have ecological benefits in reducing air pollution and improving air quality.

#### **2. Small City Park**

In dense urban areas, the development of small city parks or local green open spaces is very important. Small city parks can be placed in strategic points that are easily accessible to the public, even in areas that do not have large open spaces. These small city parks can be in the form of:

**Community Parks:** Parks that involve active participation from the community in their maintenance. The community can collaborate to plant plants, maintain cleanliness, and hold community activities in the park. This will improve social quality and strengthen bonds between residents. **Pocket Parks:** Pocket parks are small parks built on narrow and limited land, such as at road intersections or unused vacant land. Although small, these parks still have important ecological functions and can provide space for people to relax and enjoy nature.

#### **3. Rehabilitation and Utilization of Abandoned Spaces**

In some urban areas, there are unused or abandoned lands that can be utilized as green open spaces. The government can identify and convert these lands into parks or green spaces. For example, former factory land,

empty land on the side of the road, or former parking lots can be converted into city parks or green spaces that can be utilized by the community.

#### 4. Green Infrastructure Development in Housing and Office Projects

Every new housing and office project should be required to provide a portion of the land to be used as green open space. This can be realized in the form of community parks, greenways, or other open spaces. The government can provide incentives for developers who include green spaces in their projects. In addition, areas that have been built can also be rearranged to include green elements in city infrastructure, such as parks, small parks in residential areas, and greenways connecting public areas.

#### 5. Reorganization of Public Spaces and Roads

The provision of green open space is not only limited to parks, but can also be expanded to the arrangement of public spaces and streets in the city. Planting large trees and providing green paths along main roads can be an effective solution to increase green space. In addition, street parks can be a comfortable transit place for pedestrians and bicycles, while providing ecological and aesthetic benefits.

#### 6. Community Education and Participation

Efforts to increase the availability of green open space must actively involve the community. The government can organize educational programs that teach the importance of green space and how the community can participate in maintaining it. By increasing awareness, the community can be more supportive of policies that prioritize sustainability and involvement in green space projects. One of them is encouraging the community to use their yards as mini parks or city gardens.

#### 7. Improvement of Government Policy and Supervision

The Medan City Government needs to strengthen policies and supervision in spatial planning that support the provision of green open space. Strict supervision of land conversion from green open space to development areas must be carried out to ensure that the allocation of green open space is maintained according to plan. In addition, policies that support the development of vertical green spaces and small city parks can be integrated into zoning regulations and incentives for developers who invest in green open space development. Increasing the availability of green open space (RTH) in Medan City requires a multifaceted approach, starting from the development of vertical green spaces, small city parks, to the reorganization of public spaces. In addition, community involvement, better supervision, and policies that support the development of RTH will be very important to create a greener, healthier, and more sustainable city.

## CONCLUSION

The availability of Green Open Space (RTH) in Medan City, especially in sub-districts with high population density and limited area, requires serious attention to improve the quality of the environment and the quality of life of the community. The mismatch between the allocation of RTH in the RTRW and the condition of land use is influenced by various factors such as variations in area between sub-districts, changes in land function, population density, limited resources, and lack of supervision. The limitations of RTH have a significant impact on environmental quality, public health, and quality of life, such as increasing air pollution, decreasing the quality of physical and mental health, and limited social space for the community. To address this issue, several solutions and efforts that can be implemented include the development of vertical green spaces, small city parks, rehabilitation of abandoned land, and the development of green infrastructure in housing and office projects. Reorganization of public spaces and roads, education and community participation, and increased policies and supervision by the government are also very necessary to create a greener, healthier, and more sustainable city. Increasing the availability of green open space must be done holistically and involve various parties, including the community, government, and developers. With the right steps, Medan City can create a more comfortable, healthy, and sustainable urban environment for its citizens.

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