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Land Value Capture for Sustainable Urban Development in A Developing City: A Case of Bekasi City, Indonesia

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Abstract

Developing a city into a sustainable initiative will take much work, especially given the urban governments with limited budgets and knowledge. These situations are significant in the Global South countries, particularly in emerging economies like Indonesia. One potential urban finance is land value capture (LVC). This paper aims to investigate the concept of LVC as land-based financing for sustainable urban development and examine which instruments are suitable and appropriate to be implemented in an emerging metropolitan city, Bekasi City, Indonesia. The city was selected due to its high urbanization rate, population growth, and facing urban financial challenges. We adopted a systematic review in the initial study to find the LVC development concept. This study used three literature databases: Scopus, Google Scholar, and Science Direct, and we found 20 relevant documents. It reveals several discussed themes regarding LVC, such as the adoption of LVC instruments, the role of LVC regulation, and its governance. This study also examines some instruments of LVC that are suitable for implementation in Bekasi City, such as selling air rights based on floor area ratio (FAR), betterment levy, and developer exaction. LVC can be an innovative urban financing instrument for sustainable urban development by capturing the improvement in land value initiated by government or private investments in urban infrastructure, transportation, or other public goods.

Keywords: *Bekasi City; land value capture; sustainable urban development; systematic review; urban financing*

1. Introduction

Urban development has been made more accessible by the rapid industrialization and urbanization in developing nations over the past two decades. Under the right circumstances, this urban expansion can lead to more sustainability (Kiamba, 2012). Sustainable development is the framework for the growth and advancement of human endeavors that meet the requirements of the present without jeopardizing the capacity of coming generations to meet their own basic needs. It is a comprehensive approach that balances the economy's growth, community well-being, and environmental preservation[1]. Sustainable urban development (SUD) aims to balance between social fairness, environmental protection, and economic

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prosperity (Uitto, 2019). SUD addresses several aspects of urban life, ranging from transportation (Liu & Xia, 2023), spatial planning, and design to energy and environmental management (Z. Wang et al., 2023).

A flexible and inclusive urban financing approach is required in urban development toward a sustainable city (Rybeck, 2004). To finance the necessary infrastructure and services, Land Value Capture (LVC) is one solution that captures the increases in land prices brought on by urbanization. A development project's value can be captured by monetizing some of its benefits directly or indirectly. It is described as the distinction between the infrastructure's worth before and after enhancements. Value capture thus complements conventional funding options by offering an additional contribution to project funding through this gradual increase in value. Utilizing its current assets and implementing legal and regulatory measures to promote higher development allows the government to improve its entire portfolio and obtain value for money (Flynn, Rao, & Gashi, 2018).

Beyond the benefits to the financing of the public sector, many authors argue that LVC can help boost the economic effectiveness of municipal investments while contributing to social equality, help regulate urban growth and land prices, lessen private developers' uncertainties around the timeline for permitting the project and the development of infrastructure. For example, Yen et al. (2023) identified that development-based LVC is acceptable to incorporate into a TOD strategy. They can specifically aid in promoting equity by expanding the infrastructure for public transportation. Developing a city into a sustainable movement will be complex, especially given the urban governments with limited budgets and knowledge, particularly in emerging economies. Consequently, to become an innovative and sustainable city, it should be supported by innovative and flexible financing sources such as LVC (Kresse, Kang, Kim, & van der Krabben, 2020).

In developing nations, the LVC concept has been widely adopted as an alternative funding source. For instance, Nguyen et al., (2017) attempt to fill a relative gap in the literature on real estate development and property rights in transitional economies, focusing on the "shadow" role of private developers in urban administration at the local level in Ho Chi Minh City, Vietnam. In this study, value capture mechanisms that charge for building rights, commonly known as exactions, supplied half or complete funding for large urban reconstruction projects in numerous cities, including Ho Chi Minh City.

This paper aims to investigate the concept of LVC as an innovative urban financing for sustainable urban development in some countries. Then, we examine and analyse which instruments are suitable and appropriate to be implemented in the case of Bekasi City based on a literature review of prior studies. A systematic literature review is used in this study, focusing on previous research about how LVC can support urban development to attain sustainable cities. While many studies investigate the effectiveness of LVC in financing urban infrastructure, there is a limitation of information on its actual application in emerging economies, particularly in places such as Bekasi City. Furthermore, this study is important because it aims to close these gaps by studying the unique regulatory, financial, and governance frameworks that may allow for effective LVC implementation in Bekasi City, providing fresh insights and viable methods that may be applied from worldwide examples. By bridging this gap, the study will lead to a better understanding of how LVC might be used to promote sustainable urban growth in developing cities.

The paper is structured as follows. Section 2 provides the theoretical concept of LVC and sustainable urban development. Section 3 explains the research methodology, data collection, the data source, the systematic literature review process, and the research case studies. In section 4, this study provides the results from a systematic literature review. It delivers a specific debate point about how the government should consider while implementing LVC, from selecting suitable instruments to the governance of the mechanism of LVC. Finally, section 5 proposes the analysis of implementing LVC in a metropolitan city in Indonesia, such as Bekasi Municipality, based on its current urban development project and the role of regulation as a supporting feature of LVC tools and gives some examples of LVC instruments based on international cases, especially in emerging countries.

2. Methods

Literature reviews provide the groundwork for academic studies. Researchers comprehend the scope and complexity of the existing body of work and discover any discrepancies for further study by reviewing relevant literature (Xiao & Watson, 2017). To develop an innovative perspective and recommend future areas of study, this study examines and puts together the appropriate literature on the LVC as an urban financing instrument for sustainable cities through a systematic literature review. This research adopted a systematic review analysis approach for the literature review from the three databases: Scopus, Google Scholar, and Science Direct. The first step of the review was to develop a search strategy to identify articles related to land value capture implementation for sustainable urban development. The search terms used were based on keywords: Land Value Capture, Sustainable Urban Development, Urban Financing, and Sustainable City. Mendeley reference manager software was used to assist in data compilation.

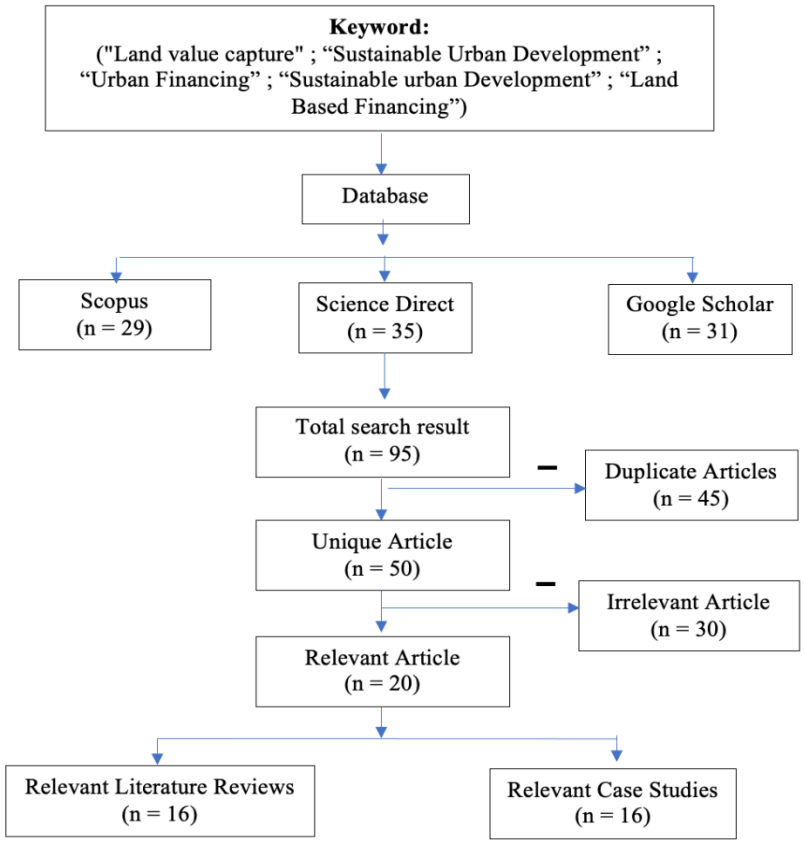

Figure 1. Visualization of the conducted systematic literature research process

Initially, articles were searched in the accessible database using numerous keywords, generating 210 journal articles, working papers, and report projects for review. Nevertheless, after reviewing the abstracts, it became clear that almost all the studies needed to be more relevant to the research LVC in sustainability urban development concepts. Following Quan (2023), to facilitate the extraction of the most relevant research, the search criteria were restricted to keyword searches present in the abstract, keywords, subject terms, and title, and 95 academic articles were gathered. After removing duplicates, 50 unique academic articles have been identified. Each unique study was assessed for relevance by reviewing each abstract and article structure to guarantee that the works chosen addressed particular aspects of LVC as urban development financing for sustainable urban development. This relevancy filtered out 30 relevant articles, leaving 20 relevant articles. From 20 topics of interest generated from the literature research, 16 empirical studies focus on case studies of LVC, and four articles focus on literature review. Figure 2 illustrates the research search procedure.

2.1 Study Area: Bekasi City

This section examines how LVC are applied in the study area and investigates the implementation of LVC with the concept of a sustainable city in a developing country with a high-density population. The selection of case studies took place in Bekasi City. There are several reasons why the author chose this city as a case study:

First, Bekasi City is a part of the Jakarta Metropolitan Area (JMA) consisting of Jakarta, Bogor, Depok, Tangerang, and Bekasi (Jabodetabek) urban areas (Figure 2). As a metropolitan city, the population of Bekasi City reached 2.59 million people in approximately 210 square kilometers. The population density is over 12,300 people per square kilometer (BPS Kota Bekasi, 2023), making it one of Indonesia's highest-density metropolitan cities. With an enormous population, the government of Bekasi City naturally faces some problems and challenges for urban development. For instance, the total length of roads in Bekasi City is 4,459 km, with 71.7% in good condition and 28.3% in fair to poor condition (Highways and Water Resources Office, 2023). The municipal government of Bekasi City is also dealing with another urban issue: the need for appropriate green open space. According to Article 29 of The Spatial Planning Law, providing Green Open Space in a city area is at least 30%, with a proportion of 20% for public green open space and 10% for private green open space. Currently, based on the Spatial Planning Office Work Plan, the obligation to create green open space in Bekasi City is only 9% for public green open (Spatial Planning Office, 2023).

Second, Bekasi City's infrastructure development is accelerating. This may be observed in the several national strategic projects in Bekasi and those covering the city. According to The Committee for Acceleration of Priority Infrastructure Delivery (CAPID/KPPIP), five national strategic projects are located

within or through Bekasi City. These projects are the construction of the Becakayu Toll Road, the Jakarta Cikampek II South Side Toll Road, the South Java Double Track, the High-Speed Rail Jakarta-Bandung, and the Light Rapid Transit (LRT) Jabodetabek. The growing number of national strategic project developments may indirectly boost land value and influence regional economic growth (KPPIP, 2022). In this situation, LVC could be an alternative development finance option for the government to seize the value created by the project directly (Andrés G. Blanco B., Moreno, Vetter, & Vetter, 2017).

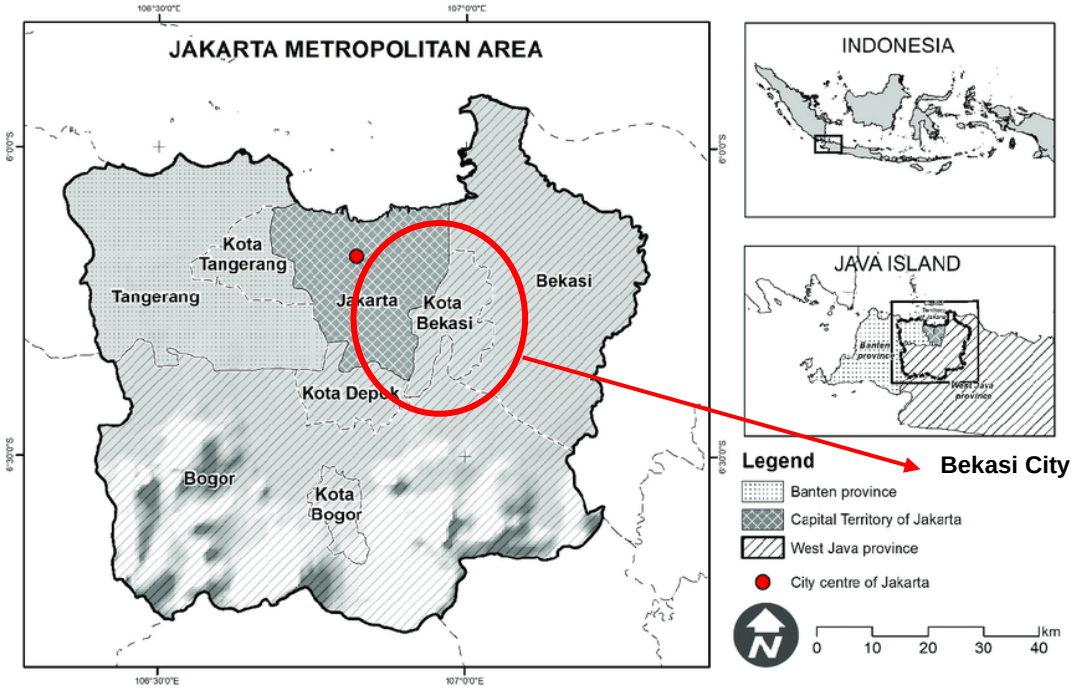

Figure 2. Bekasi City as part of the Jakarta Metropolitan Area

3. Contextual Considerations

3.1 Land Value Capture (LVC)

The term LVC has been used to describe several urban governance instruments that have been put in place to collect land value increments on both public and private land. Precise definitions frequently depend on the specific method (Noring, 2021). According to Wang et al. (2020), LVC is not merely a legal framework instrument utilized by governments. LVC, on the other hand, refers to the procedure that has manifested the allocation of land value in a broader sense, including official and informal methods and interactions. Processes of value capture, which, in broad terms, show who obtains what portion of the land value, can be explained by complicated interactions and consequences between multiple parties, such as governments, land speculators, purchasers, and sellers. LVC is classified into two types: development-based LVC and tax or fee-based LVC. Direct transactions of properties whose values have improved due to public regulatory choices or spending on infrastructure can allow development-based LVC. Tax- or fee-based LVC is enabled by indirect means, such as extortion from property owners via various tax or fee instruments (e.g., property taxes, betterment charges, and special assessments) (Suzuki et al., 2015).

Smolka & Amborski (2000) have identified the instrument for capturing the value that results from investments and other public sector initiatives that affect land value, such as (i) taxes, (ii) fees, and (iii) regulations. Meanwhile, another study categorizes the instrument of value capture on Taxed Based (Chi-Man Hui, Sze-Mun, & Kim-Hin, 2004) into the following instruments: (i) Real estate annual tax; (ii) rental income tax; (iii) tax on speculation gains from land transactions; (iv) conveyance and deceased property tax; (v) betterment levy for lease modifications or planning authorization; and (vi) land auctions and bids. Each instrument has advantages and limitations, and their efficiency and viability depend on various internal and external project variables (Andrés G. Blanco B. et al., 2017). According to SGS Economic and Planning (2016), there are six drivers of land value uplift, namely (i) Amenity values, as reflecting the spatial and environmental characteristics of the site; (ii) Population growth, as a proxy of economic growth; (iii) State level infrastructure provision; (iv) Granting of development rights; (v) Local-level infrastructure provision; and (vi) On-site improvements.

3.2 Sustainable Urban Development

A sustainable city is an urban area designed, developed, and operated to meet the current population's requirements without jeopardizing the capacity of future generations to accommodate their own. It entails converging of economic, social, and environmental factors principles into urban planning and management, focusing on resource efficiency, reduced greenhouse gas emissions, improved quality of life, and social inclusion (Keeble, 1988). Sustainable urban development is a growth perspective that appeared in the

previous century as a result of 'cities' aim to be more responsive to citizen demands, deliver conditions that promote a high quality of life, and preserve and enhance productivity in an increasingly international environment (Angelidou et al., 2018). The term ‘sustainable smart city’ has been proposed in recent years as an alternative to the terms ‘smart city’ and ‘sustainable city’ to guarantee the existence of a sustainability dimension within smart city initiatives, tools, and applications (Ahvenniemi, Huovila, Pinto-Seppä, & Airaksinen, 2017). Connecting the ideas of sustainable cities with smart cities may enhance awareness among planners, technology companies, and policymakers about the possibility of employing Information and Communication Technology (ICT) to promote urban sustainability. Thus, Smart Sustainable Cities may be utilized as a common framework or shared vision for developing new partnerships, economic models, and urban development methods (Höjer & Wangel, 2014).

Dhingra et al. (2016) examine the following objectives that should be achieved in a sustainable city for it to be adaptive, dependable, scalable, accessible, and resilient: (i) Enhance its citizens' quality of life; (ii) To guarantee economic expansion and provide improved job prospects; (iii) Improve the well-being of its citizens by ensuring access to social and community services; (iv) Create an environmentally responsible and long-term development strategy; (v) Ensure that fundamental services and infrastructure, such as public transit, water supply and drainage, telecommunications, and other utilities, are delivered efficiently; (vi) Capability to solve climate change and environmental challenges; (vii) Create an efficient regulatory and local governance structure to ensure inclusive policies.

3.3 LVC towards Sustainability Urban Development

Budget and financial constraints in a municipality can impede the creation of enhancements and the expansion of services requested by the residents (Blanck & Ribeiro, 2021). Nguyen et al. (2017) argued that there is a link between spatial planning and land value since any improvements to communities, local infrastructure, and services result in an increase in the value of any land affected by these changes. LVC has the potential to play an essential role in supporting sustainable urban development through financing, such as encouraging compact and walkable TOD, financing the public infrastructure, and promoting affordable housing (Canelas & Noring, 2022; Jinshuo Wang, D. Ary A. Samsura, 2019). For example, LVC is a popular financing option for TOD in various developed countries. The LVC generates funds for transportation investment, operation, and maintenance, and promoting sustainable urban development (Suzuki et al., 2015).

The value capture is built on a fundamental principle: public activity should result in a public advantage. As the pressures of growing urbanization, failing infrastructure, climate change, and other factors rise, this revenue source has never been more critical to communities' long-term viability. Government activities that boost land values, such as regulation changes that allow for higher permissible size on a property, should also benefit the public. For example, suppose a developer requests permission to build a higher structure than is ordinarily permitted. In that case, it could obligate the developer to include affordable housing units or public green space as compensation. LVC compels owners to repay the value gained due to those changes to the government that established them so that it can subsequently offer new infrastructure and services to the community. Regulatory changes that are well thought out and carefully executed can benefit all parties (Korngold, 2022a). The notion of LVC in urban planning can contribute to city growth toward sustainable cities (Chi-Man Hui et al., 2004; Yen et al., 2023).

The implementation of the LVC policy must be handled carefully and transparently to avoid adverse side effects. LVC rules must also consider the impact on diverse community groups, especially vulnerable groups, and guarantee that the community can gain the advantages of rising land values. When combined with prudence in governance and urban planning concepts, LVC may be a valuable instrument for governments in achieving beneficial fiscal, social, and environmental results (Enrique Silva, Barbara Scholz, 2021).

4. Result and Discussions

4.1 Systematic Review: LVC and Sustainable Urban Development

The ideas of LVC and Sustainable City have been addressed explicitly in urban planning and policy literature of the financing instrument for urban development towards sustainable cities. This section emphasizes the conclusions reached after thoroughly reviewing the academic literature on land value capture as urban financing towards sustainable cities of selected 20 journal articles. Based on this content analysis, three key themes of discussion have been identified, including the instrument of LVC, the role of regulation, and the governance of LVC. In the discussion section, we will examine the instrument of LVC, which could be applied in Bekasi City by adjusting existing regulations to facilitate the implementation of LVC.

Table 1. Literature review of land value capture for sustainable urban development

No	Themes	Study Area/Location	Method	Aim	Source
1	LVC Instruments	North America and Latin America	Research studies and Policy Analysis	This study compares North America's (the United States and Canada) and Latin America's experiences with gains in value capture approaches.	Smolka & Amborski (2000)

No	Themes	Study Area/Location	Method	Aim	Source
		United States	Research studies with case studies and interview with practisers, official, and citizen	This paper investigates alternative land value capture strategies and is intended to bridge the gap between LVC theory and practice by combining research findings and case studies.	Korngold (2022)
		Hong Kong and Singapore	Compared Value Analysis	The study analysed the property taxation regimes in Hong Kong and Singapore to investigate how the two governments capture land value.	Chi-Man Hui et al. (2004)
		Xalapa, Mexico, and Quetzaltenango, Guatemala	Descriptive case studies analysis with case studies and interview with practisers, official, and citizen	The study examines the possibility of land value capture as a financing tool for urban projects in the Inter-American Development Bank's (IDB) Emerging and Sustainable Cities Program (ESC).	Andrés G. Blanco B. et al. (2017)
		Indonesia	A comprehensive review of Indonesia's current policy and regulatory context in terms of its potential to support this novel notion.	The purpose of this research is to support the Indonesian government in establishing a national framework for value capture.	ADB (2021)
		Hyderabad and Mumbai, India	Descriptive case study analysis	This study investigates the concept and implementation of land-based financing mechanisms revenues for infrastructure provision by examining the principal local government and development authorities in Hyderabad and Mumbai, India.	Gandhi & Phatak (2016)
		Taiwan	Descriptive Case Study Analysis	Through the perspective of land-based finance, this study provides a conceptual perspective of Taiwan's "floating" transfer of development rights (TDR).	Mi Shih, Ying-Hui Chian (2018)
		South Africa	Research studies and Policy Analysis	This study aims to examine how land-based financing (LBF) might be utilized to get around South Africa's financial limitations for public infrastructure.	McGaffin, Viruly, & Boyle (2021)
		Sao Paulo, Brazil	Research studies and Policy Analysis	This case study describes the instrument proposed by São Paulo to capture land-value increments.	Biderman (2021)
		Metropolitan Area of Buenos Aires (MABA), Argentina	Research studies and Policy Analysis	This study aims to look into the feasibility of increasing public funding for urban infrastructure projects in the Metropolitan Area of Buenos Aires (MABA), Argentina, by utilizing land value capture (LVC) techniques.	Goytia & Cristini (2020)
		Greece	Descriptive analysis	This article analyses the potential contribution of smart city methods and instruments to environmentally sustainable urban development.	Angelidou et al. (2018)
		66 Cities in European Continent	Descriptive research of a quantitative relational nature with Multiple Analysis Regression	This study aims to test the experimental hypothesis of the impact of innovation financing and collaboration platforms on the evolution of the Smart Urban Development (SUD) level.	Blanck & Ribeiro (2021)
		Brazil, Barcelona, Boston	Study literature with comparative analysis of smart city rankings with case study in Brazil, Barcelona, and Boston	This study shows the different financing tools used to fund smart city projects that use Internet of Things (IoT) technologies.	Hernandez & Pallares (2015)
2	The Role of Regulation	Sao Paulo, Brazil Addis Ababa,	This study using literature review and analysis based on	This paper evaluates three case studies of LVC projects to evaluate their fiscal and equity benefits.	Mahendra et al. (2020)

No	Themes	Study Area/Location	Method	Aim	Source
	in LVC Adoption	Ethiopia Hyderabad, India	secondary data and in-depth interview project case studies		
		Taiwan	Descriptive Case Study Analysis	This study aims to provide a conceptual perspective of Taiwan's "floating" transfer of development rights (TDR) through the perspective of land-based finance.	Mi Shih, Ying-Hui Chian (2018)
		United States	Research studies with case studies and interview with practisers, official, and citizen	This paper investigates alternative land value capture strategies and is intended to bridge the gap between LVC theory and practice by combining research findings and case studies.	Korngold (2022)
		Xalapa, Mexico and Quetzaltenango, Guatemala	Descriptive case studies analysis with case studies and interview with practisers, official, and citizen	The study examines the possibility of land value capture financing for urban projects in the Inter-American Development Bank's (IDB) Emerging and Sustainable Cities Program (ESC).	Andrés G. Blanco B. et al. (2017)
		Indonesia	A comprehensive review of Indonesia's current policy and regulatory context in terms of its potential to support this novel notion.	This research aims to support the Indonesian government in establishing a national framework for value capture.	ADB (2021)
3	The Governance of LVC	Denmark (Aarhus, Aalborg and Køge)	Literature review, interviews with key decision-makers, site inspections, and desk research into official project information.	This article examines three large LVC-based revitalization initiatives in three Danish towns and cities (Aarhus, Aalborg, and Koge) from a governmental action standpoint.	Canelas & Noring (2022)
		Hong Kong and Singapore	Compared Value Analysis	The study analysed the property taxation regimes in Hong Kong and Singapore to investigate how the two governments capture land value.	Chi-Man Hui et al. (2004)
		Bogota & Manizales, Colombia	The study assesses the levy in Bogota and Manizales and interview with citizen	This study analyses the betterment levy as the LVC instrument in Bogota and Manizales and explains why those instruments are well-accepted by society.	Borrero Ochoa (2011)
		Switzerland	Literature review with analysis of planning phases	This study highlights the critical relationship between value capture mechanisms in Switzerland and land value changes brought about by planning.	Hengstermann & Götze (2023)
		New Delhi and Hongkong	This study uses exploratory case studies from experience in New Delhi and Hongkong	The study offers a conceptual model that combines land use and finance to purchase of train infrastructure.	Li & Love (2022)
		Ho Chi Minh City, Vietnam	This paper is based on a combination of literature review and empirical data.	This article examines land privatization and value capture in Vietnam, specifically focusing on the CBD of Ho Chi Minh City (HCMC), Vietnam, and its micro-planning of urban redevelopment.	Nguyen et al. (2017)

Source: Authors' elaboration from several literatures (2023)

Table 1 provides case studies of how LVC was implemented in several cities. The number of case study areas is from 20 cities, which were dominant in the Global South because the implementation of LVC is relatively new in those regions rather than in the Global North (Korngold, 2022; Smolka & Amborski, 2000). Based on an initial study from a systematic literature review, we found three discussed themes regarding LVC: the adoption of LVC instruments, the role of LVC regulation, and its governance. These themes are explained in the following subsections.

4.1.1 LVC Instrument

There are numerous variances in how the LVC instrument is used in emerging and developed countries. Even though various case studies show a mixed usage of the LVC instrument in these nations, both in emerging and developed countries, the application of LVC in developing countries is dominated by development-based LVC instruments. In contrast, tax-based LVC instruments are employed in developed countries. For instance, Sao Paulo has created a one-of-a-kind development-based LVC: selling the air right to build. In Brazil, an owner of private land can only construct air rights above a specific Floor Area Ratio (FAR) if covering the costs of using such rights that influence the area. Selling air rights makes sense since owners should cover the expenses of building infrastructure, as increasing densities require more significant infrastructure investments in proportion to the volume of their air rights use. When the developer wants to build beyond FAR must buy construction rights, known as CEPACs (Certificate of Additional Construction Potential). Those studies (Biderman, 2021) argued that selling building rights in large metropolitan areas is promising, and the sale of density will be successful if there is a demand for density.

Unlike Sao Paulo in Brazil, Vietnam, as an emerging country, combined the LVC instruments as urban financing for infrastructure development. A study by Nguyen et al. (2017) revealed that the local government in Ho Chi Minh City, Vietnam, utilized the mixed LVC instruments, both developer exaction (tax and fee-based LVC instrument) and zoning plan (development-based LVC instrument) in building up the infrastructure. Exactions can take a particular type of land, cash, or other in-kind payment to cover new development expenses—the additional public services required by a new project and the use of existing public resources. A zoning plan can be used when the developer asks for a higher coefficient ratio of FAR while at the same time contributing to the neighborhood's public road access and open space infrastructure.

In developed countries, value capture is viewed as a supplement to property tax, such as in the United States, Canada, Singapore, and Hong Kong. Property taxes are extensively relied upon by local governments to pay public expenditures. For example, Singapore and Hong Kong have adopted similar tax-based LVC instruments. According to Chi-Man Hui et al. (2004), Singapore and Hong Kong use various property taxes such as rates, stamp duty, good and services tax, estate duty, government rent, income tax, profits tax, and property tax. However, stamp duty, estate duty, and property tax are the same instruments of LVC use in both countries. Another instrument used in Singapore and Hong Kong is the betterment levy/development charge. The development charge aims to recover from the landowner a portion of their windfall income from a planning approval granted over and beyond the typical intensity specified in the Master Plan. The difference between implementing the instrument in Singapore and Hong Kong is that Singapore uses the development charge—roughly half of the entire market value—and Hong Kong uses the total market value.

Betterment levies as an LVC instrument are not only implemented in developed countries. Most countries in Latin America, i.e., Colombia, Mexico, Guatemala, and Argentina, have adopted these instruments because these instruments ensure cost-effectiveness, use an equitable distribution strategy, and encourage engagement during execution (Borrero Ochoa, 2011; Garza & Gonzalez, 2021; Goytia & Cristini, 2020; Smolka & Amborski, 2000). In Colombia, Betterment Levies or *contribucion de valorizacion* play an essential role and have been used for a long time for infrastructure investment. It contributes almost 24 percent of municipality revenues (Borrero Ochoa, 2011). In general, the practice of betterment levies in Colombia is like the other countries in Latin America (Smolka, 2013).

LVC implementation is relatively new in Indonesia. A study conducted (ADB, 2021) delivers a comprehensive review of Indonesia's existing policy and regulatory system regarding its capacity to reinforce the new idea and the fiscal frameworks required for successful implementation. However, specific pilot projects have been carried out to implement LVC in different cities such as Jakarta, Palembang, and Makassar, utilizing various LVC instruments and determining and evaluating whether deploying these instruments is feasible in Indonesia.

In all cases, the result of using land value instruments is different. The results may be suitable or even inverse because the employment of inappropriate value-capture instruments may have a negative effect. For instance, in the Quetzaltenango and Xalapa study area, Andres G Blanco B. et al. (2017) have identified the instrument for LVC which will applied in project areas is Tax Increment Financing (TIF). However, considering the regulation of the government tax system, implementing TIF will only cause public distrust in implementing LVC. The government revenue from taxes in Quetzaltenango and Xalapa is meager because taxes are only some of the income contributors to the country. Then, they proposed an alternative LVC instrument: betterment levies. It was proven that betterment levies are suitable to implement because they are fairer for the public.

South Africa is another case study of why choosing a value-capture instrument is crucial. McGaffin et al. (2021) point out that only some LVC instruments used in South Africa are the ultimate solution for solving the country's infrastructure financing deficit. Instead of using the current instrument of LVC, they suggest another instrument, i.e., Tax Increment Financing (TIF), which could support infrastructure finance with some underlined essential preconditions to be executed effectively, such as adequate market demand, a reformed legal system, and required agency.

4.1.2 The Role of Regulation in LVC Adoption

The role of regulation in the implementation of the LVC instrument is critical. Regulations serve as a framework for urban development planning initiatives while offering stakeholders legal protection and stability. The existence of laws on land use and infrastructure financing can promote trust among the public

simply because the public acknowledges where the funding originates from and what the allocated funds will be used for. Good regulation, of course, must have a competent design process and good norms. For instance, in the United States, state law contributes to whether a municipality can use a specific LVC strategy—if it allows for a specific LVC instrument and whether that authority is permissible for advanced land value capture. State-enabling strategies should empower local governments to create and enforce LVC-related rules. Municipal governments often require ordinances to implement these tools (Korngold, 2022). This is the basis for implementing LVC in determining which instruments will be used. The better tools are employed, the better the municipality can provide contemporary infrastructure and services and adequately distribute the rewards and overwhelmed development.

Another example of why the regulation has a significant impact is that in Brazil, as represented by emerging economies, a unified approach to urban land policy regulation has laid the groundwork for deploying CEPACs as LVC tools. Successful LVC in São Paulo was made possible by several factors, including a supportive institutional structure, transparent procedures that ensured investments were implemented, the thriving real estate market in the city, investor interest in joining urban operation areas, and favorable regulatory and policy environments (Mahendra et al., 2020).

The application of LVC is strongly tied to current regulations and spatial planning in some countries. On the other hand, Taiwan implemented the LVC instrument—Transfer Development Rights, or TDR—without any planning, a practice known as "Floating TDR." High levels of development density are a burden on local governments and communities since TDR planning regulation is not implemented. Another consequence of “Floating TDR” is that the developers mainly benefit from the increased land rather than the public (Mi Shih, Ying-Hui Chian, 2018). In Indonesia, the regulation of LVC instruments is currently being drafted and harmonized in the Ministry of Law and Human Rights. Considering that Indonesia has not yet implemented the LVC instrument compared with other Asian countries, such as Vietnam, Japan, Korea, Taiwan, and China, the government ought to accelerate the regulation completion so both government and local government are not burdened with budget development.

4.1.3 The Governance of LVC

Good governance in the execution of LVC is critical to ensuring that this policy runs appropriately and efficiently. Good governance can boost public trust in LVC while also preventing conflicts of interest from arising during policy implementation. Good governance must include numerous components, such as visibility of LVC aims and objectives, selection of appropriate tools, transparent planning and implementation processes, public engagement, and an effective monitoring and evaluation system. Poor governance and a lack of coordination can lead to stakeholder conflicts of interest. As experienced in Delhi, India, when a national government granted land solely to The Delhi Metro Rail Corporation (DMRC) as a transit agency for development-based LVC, the conflict erupted in capital cities with complicated, multiple governing frameworks that lacked cooperation between other government agencies and DMRC results in a failure to acquire the level of revenue gained from LVC (Li & Love, 2022; Suzuki et al., 2015). Success is determined by the project's credibility and the institutional governance competence and ethical standards of the organization managing the LVC instrument (Borrero Ochoa, 2011).

In Singapore, the governance of LVC is under the authority of The Singapore Land Authority (SLA). SLA operates as the government's agent for land sales. Its goal is to maximize the returns from the sale of state land while ensuring the processes follow regulatory standards. It also develops and administers land policies concerning pricing, term, and title constraints (Chi-Man Hui et al., 2004). Denmark has various types of governance of LVC. The government has three ways to capture value through its government authority: partnership with the private sector and the local community. Even though they need to share their LVC profits, it appears to have little effect on the emphasis on making money from LVC (Canelas & Noring, 2022; Noring, 2021). Properly capturing the value of private infrastructure investments for the public can be achieved through cooperative and innovative combined micro-scale planning between developers and local authorities.

4.2 Discussion

This research analyzes and examines which LVC instruments can be implemented in Bekasi City based on the literature study. Instrument determination is carried out by learning from various case studies in metropolitan cities, as given in the preceding part, and it is also carried out based on current laws and regulations addressing spatial planning regulations and other urban development regulations in the government of Bekasi City to support municipality towards sustainable urban development. The city is currently one of the metropolitan cities that support the capital city of DKI Jakarta, with the trade and services sector serving as the primary engine of the regional economy. The government of Bekasi City has the potential to execute land value capture due to its vast number of office buildings, hotels, flats, and shopping facilities such as malls. According to the Spatial Planning Office, over the five years, from 2019 to 2023, the number of permissions for high-rise buildings in Bekasi City reached 141 permissions[2]. With the numerous high-rise buildings, the government has a high potential to benefit from every development carried out by the developers with the right LVC instrument. Thus, public infrastructure development can be achieved without straining regional finances.

[2] Spatial planning office 2023

In this way, it is essential to figure out the instrument of LVC using current regulations in the government of Bekasi City. Several regulations are currently associated with spatial planning in the Government of Bekasi City. These include Regional Regulation No. 05/2016 concerning Detailed Spatial Plan (RDTR) 2015 – 2035; Regional Regulation No. 05/2014 concerning Incentives and Disincentives in Controlling Space Utilization in Bekasi City; Regional Regulation No. 06/2014 concerning Buildings; Regional Regulation Number 05/2021 concerning Provision and Delivery of Public Infrastructure, Facilities and Utilities; Bekasi Mayor Regulation No. 05/2015 concerning Procedures of Incentives and Disincentives in Controlling Space Utilization in Bekasi City; Bekasi Mayor Regulation No. 02/2020 concerning the Implementation of Smart Cities; and Bekasi Mayor Regulation No. 74 of 2021 concerning Technical Instructions for Providing and Delivering Over Infrastructure, Facilities and Utilities.

Regional Regulation No. 05/2016 concerning building and neighborhood blocks or zone management plans. This regulation intends to guide government and community development and realize the integration of development programs in Bekasi City. This rule governs the zoning provisions of each region, as well as the composition of spatial arrangements such as Green Space Ratio (KDH), Building Ratio (KDB), and Floor Area Ratio (KLB). Meanwhile, Bekasi Mayor Regulation No. 05/2015 concerning Procedures Incentives and Disincentives in Controlling Space Utilization in Bekasi City is cascading from the regional regulation No. 05/2014 Incentives and Disincentives in Controlling Space Utilization in Bekasi City. The laws try to manage and design a spatial structure in alignment with the Bekasi Municipality Spatial Plan. The development of space utilization activities is incentivized by spatial planning, whereas the prevention, limitation, or reduction of space utilization activities' development is incentivized by spatial planning disincentives. The government can offer fiscal and non-fiscal incentives and disincentives to regional governments, from one regional government to another, and from the government and/or regional governments to the community. Giving a disincentive can take the shape of fiscal and non-fiscal incentives, as demonstrated by the case when a developer builds more than the Floor Area Ratio (FAR). Betterment fees are one type of fiscal disincentive that can be applied using this regulation.

From the description and literature review in the previous section, the adoption of betterment levies, selling air rights based on FAR area, and developer exaction are considered the instruments of LVC as urban financing towards smart cities in Bekasi City. The betterment levy can be administered using a zoning scheme, with the amount of the charge varying in each zone, as illustrated in Figure 3. The higher the development levy, the closer you reach the project site. Furthermore, the further a beneficiary is located from the project area, the lower the development levy. This is because benefit beneficiaries in zone 1 receive a more considerable gain in land value than those in zones 2, 3, and 4. This approach is implemented using concepts from the study (Andrés G. Blanco B. et al., 2017) and imposing a betterment levy based on cadastral area. This instrument can be used for each project location in Bekasi City by employing the government's zoning restrictions and modifying the urban area units (BWP) in each region.

Nevertheless, there are drawbacks to using the betterment levy method as a tax-based tool, particularly in emerging countries. According to Suzuki et al. (2015), taxes based as an instrument LVC in developing countries are less sophisticated, partly because they necessitate an excellent cadastral system and significant financial investments to construct a computer system and coaching for tax assessment and execution. However, several Latin American developing countries have been able to employ this instrument for a long time since they have adjusted to challenges that may arise when using this strategy.

The following LVC instrument that Bekasi municipal can introduce is selling air rights based on the Floor Area Ratio (FAR)/KLB, as conducted by the Sao Paulo, Brazil municipal government. This tool can be implemented by regional regulation no. 05/2014 Incentives and Disincentives in Controlling Space Utilization in Bekasi City, as well as Bekasi Mayor Regulation no. 05/2015 concerning Procedures Incentives and Disincentives in Controlling Space Utilization. This rule explains what developers must do to build beyond the FAR/KLB. However, it is necessary to determine compensation for the increase in FAR/KLB. Developers who want to build beyond the FAR/KLB, relating to what occurred in Brazil, must obtain CEPACs (Certificate of Additional Construction Potential). Implementing the FAR-based LVC instrument is also more appropriate for use in metropolitan cities like Bekasi City, where city density and increasingly restricted land encourage developers to build taller buildings rather than buy land.

Figure 3. Implementation of Betterment Levies Based on Land Value Zoning in Bekasi City. (Source: Bhumi ATR BPN, Analysis result, 2023)

Finally, a development-based instrument in the form of developer exaction can be used in Bekasi City. A developer obligation, or a developer exaction, is a government mechanism that mandates developers to construct infrastructure or finance investment requirements for public infrastructure development. Local governments can use this strategy instead of FAR-based improvement fees and selling air rights to deploy LVC instruments. Implementing this technology can offer developers an alternative during development tasks. For example, developer exaction can be used for apartment development projects with a development area of at least one hectare, and the developer is required to construct public infrastructure within or outside the development area, or the developer can construct ICT infrastructure to facilitate the smart city concept's implementation. Using Regional Regulation Number 05/2021 concerning the provision and delivery of public infrastructure, facilities, and utilities can support the implementation of this instrument in Bekasi City.

In terms of governance of LVC in Bekasi Municipality, the local government may adopt the model used in Danish cities (Aarhus, Aalborg, and Koge), either by controlling and implementing LVC independently, in partnership with the private sector, or by collaboration with local communities. However, LVC governance must adhere to the restrictions put in place by the central government. Later, to increase transparency in policy implementation, electronic-based implementation and monitoring can be carried out. Beyond that, strong coordination among stakeholders and a communicative approach with the community are required for the LVC to be implemented successfully and enable Bekasi City to achieve sustainable development.

Identifying each instrument's characteristics and conditions or guidelines is crucial before deploying the value capture instrument. Excluding that, it is essential to communicate with the public during the implementation phase to explain the benefits of establishing the LVC system. Institutional establishment, institutional strengthening, and the participation of other parties in the LVC execution are also required for its successful implementation.

5. Conclusion

Many studies have independently investigated LVC as infrastructure funding. However, more attention is needed to be focused on how the LVC might be used as an urban financing instrument to promote sustainable cities. This study presents an overview of LVC instruments that can be employed in developing countries. In addition, this study illustrates how the institutional implementation of LVC in nations that have already implemented it might be leveraged to teach lessons in developing countries' cities. Using a literature review of previous research, we present an overview of LVC implementation in Bekasi City, including instrument selection and institutional implementation through a case study. The adoption of betterment levies, selling air rights based on FAR area, and developer exaction are considered instruments of LVC to use as urban financing in Bekasi City. In terms of governance for LVC, the government of Bekasi Municipality may use the approach utilized in Denmark, either by regulating and implementing LVC autonomously, in partnership with the private sector, or via collaboration with local communities. However, it is necessary to consider the governance of LVC based on other success stories from other countries, especially from developed countries such as Singapore, Japan, and others. Good governance makes LVC implementation more successful and durable, and it ensures that the value created by infrastructure upgrades is leveraged to support more fair and inclusive urban development.

Planners are encouraged, at least in public discourse, to use LVC methods to either participate in the windfalls that landowners gain from urban infrastructure allocation or to induce some redistribution,

particularly in achieving sustainable cities. Institutional establishment, institutional strengthening, and engagement of other parties in the LVC execution are also essential for its successful implementation.

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ADDRESSING THE NECESSITY AND CONTRIBUTION OF URBAN GREEN SPACE IN METROPOLITAN CITIES

MENUNJUKKAN KEBUTUHAN DAN KONTRIBUSI DARI RUANG HIJAU PERKOTAAN DI KOTA METROPOLITAN

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ABSTRACT

Urban Green Spaces (UGS) play are crucial in maintaining environmental quality, enhancing living conditions, and transforming urban areas. This study investigates the factors influencing UGS expansion in Bekasi City, a metropolitan area in Indonesia. Utilizing data from the Spatial Planning Office and Central Bureau of Statistics (2013–2022), multiple regression analysis reveals a positive, although statistically insignificant, correlation between population growth and the UGS area. Conversely, residential area expansion significantly and positively impacts the UGS area, while real estate sector growth negatively influences it. These findings underscore the importance of residential area regulations in promoting green spaces and informing long-term urban planning strategies for Bekasi City.

Keywords: Urban Green Space, Metropolitan City, Urban Policy

ABSTRAK

Ruang Hijau Perkotaan (UGS) memainkan peran penting dalam menjaga kualitas lingkungan, meningkatkan kondisi kehidupan, dan mentransformasi kawasan perkotaan. Penelitian ini menyelidiki faktor-faktor yang mempengaruhi perluasan UGS di Kota Bekasi, sebuah wilayah metropolitan di Indonesia. Memanfaatkan data dari Dinas Tata Ruang Kota Bekasi dan Badan Pusat Statistik Kota Bekasi (2013–2022), dengan menggunakan analisis regresi berganda menunjukkan adanya korelasi yang positif, meskipun secara statistik tidak signifikan, antara pertumbuhan penduduk dan kawasan UGS. Sebaliknya, perluasan kawasan perumahan berdampak signifikan dan positif terhadap kawasan UGS, sedangkan pertumbuhan sektor real estate memberikan pengaruh negatif. Temuan-temuan ini menggarisbawahi pentingnya peraturan kawasan pemukiman dalam mempromosikan ruang hijau dan menginformasikan strategi perencanaan kota jangka panjang untuk Kota Bekasi.

Kata kunci: Ruang Hijau Perkotaan, Kota Metropolitan, Kebijakan Perkotaan

INTRODUCTION

The demand for expanded urban green space (UGS) is a prominent feature of urban policy agendas globally. UGS, defined as urban land partially or completely covered by vegetation, encompasses parks, gardens, cemeteries, and various green infrastructures (De Haas, Hassink, and Stuiver, 2021). It provides significant benefits to human well-being, both physically and mentally, including reduced anxiety, fatigue, and increased resilience (Zhang, Jia, and Zhou, 2022). Moreover, UGS contributes to sustainable development goals by mitigating the negative environmental impacts of urbanization and promoting equitable access to resources, thus

addressing social and health disparities (Tate et al., 2022). The importance of UGS is particularly pronounced in metropolitan areas, where its role and contributions are increasingly recognized.

Urban green spaces (UGS) not only maintain environmental quality and enhance residents' living conditions but also play a pivotal role in transforming urban regions. Through thoughtful design and integration, UGS can contribute to positive transformations such as mitigating urban heat island effects (Graça et al., 2022), reducing flood risk (Zimmermann et al., 2016), and enhancing overall environmental quality (Lynch, 2021). Furthermore, UGS significantly improves residents' living standards by promoting physical and mental well-being (Nath, Zhe Han, and Lechner, 2018). Notably, research by Ioja et al (2014) indicates that increased green space around schools can enhance students' daily exercise, motor fitness, and health outcomes. Additionally, UGS integrated into workplaces can contribute to urban ecological connectivity, further amplifying its positive impact (Serret et al., 2014).

The lack of public space provisions, especially in metropolitan areas, hinders economic activity, exacerbates environmental pollution, and undermines social stability and security. As clearly stated in a World Bank article, "Public spaces are not a 'nice to have,' but a basic need for cities," highlighting their essential role in societal well-being. This is particularly relevant in municipalities facing high spatial demand and limited available space (Kim Sangmoo, 2015).

Wey et al. (2022) discovered that within metropolitan cities in developed countries, understanding the value of UGS in promoting sustainable environmental development, increasing health, and economic success is critical to the development of cities. This high degree of awareness is primarily owing to the community's improved sociodemographic situations. This is also assisted by policies that promote sustainable urban development.

Bekasi City, one of the densest areas in Jabodetabek with a population of 2.62 million in 2023, is experiencing a shortage of UGS due to extensive land conversion. According to Li et al (2022), effective spatial planning, control, monitoring, and utilization regulations to optimize UGS availability and communal use are a necessity. As a metropolitan area, Bekasi City grapples with challenges such as rapid urbanization, air pollution, dwindling residential land leading to substandard housing, traffic congestion, and crime. Following a view from Liu et al (2023), limited land availability further exacerbates the shrinking UGS.

Minister of Public Works and Public Housing Regulation No. 05/PRT/M/2008 mandates 20 m^2 of urban green space (UGS) per capita in urban areas, translating to a requirement of 5,254 hectares for Bekasi City's population of 2.62 million (Table 1). However, as of 2023, Bekasi City's UGS only accounts for 8.23% of its total area (1,704 hectares), according to data from the Bekasi Municipality Spatial Planning Office. This falls significantly short of both the ministerial regulation and Spatial Planning Law No. 26 of 2007, which stipulates a minimum of 30% UGS coverage (6,393 hectares) for cities and districts.

To mitigate the impacts of population growth on urban green spaces (UGS), understanding the relationship between economic and demographic characteristics of cities and green space availability is crucial. Prior research indicates that higher population density correlates with less green space and green space per capita, while higher GDP per capita is associated with a greater percentage of green space coverage. Notably, larger cities, particularly metropolitan areas, tend to have lower percentages of green space and less green space per capita.

This paper examines the factors contributing to urban green space (UGS) expansion in metropolitan cities, with a focus on Bekasi City. Utilizing data from the Bekasi Municipality Spatial Planning Office and the Central Bureau of Statistics (2012–2022), multiple regression analysis is employed to explore the relationship between population, housing area, real estate growth, and UGS increase. The paper is structured as follows: Section 2 presents a theoretical framework for UGS demand based on a literature review and urban land use theories. Section 3 outlines the research methodology, data collection, and sources. Section 4 presents the study's findings, including explanations of factors influencing UGS demand and correlations between variables. Finally, Section 5 concludes the paper with a discussion of the results and their implications.

Table 1. The Number of Necessities of UGS Compared to The Population

No	District	Population	UGS Standard Area/capita (20 m^2 /capita)
1	Bantargebang	111.440	2.228.800
2	Bekasi Barat	286.110	5.722.200
3	Bekasi Selatan	214.220	4.284.400
4	Bekasi Timur	261.480	5.229.600
5	Bekasi Utara	347.840	6.956.800
6	Jatiasih	265.300	5.306.000
7	Jatisampurna	131.290	2.625.800
8	Medan Satria	163.380	3.267.600
9	Mustikajaya	233.680	4.673.600
10	Pondok Melati	132.560	2.651.200
11	Pondokgede	254.110	5.082.200
12	Rawalumbu	225.790	4.515.800
	Jumlah	2.627.200	52.544.000 m^2
			5.254,4 Ha

Source: Analysis, 2024

THEORETICAL CONCEPT

1. The Sustainable City in the Context of SDGs

The UN established the Sustainable Development Goals (SDGs) in 2015, replacing the Millennium Development Goals. The SDGs are 17 set goals that break down into 169 targets and 231 indicators. As part of the 2030 Agenda for Sustainable Development, the UN General Assembly emphasized the importance of sustainable urban development and the need to reduce cities' environmental effects. A sustainable city is designed and operated to meet the needs of its current inhabitants without compromising the ability of future generations to meet their own needs. This necessitates integrating environmental, social, and economic considerations into all aspects of urban development and planning (United Nations, 2022). The United Nations Sustainable Development Goals (UN SDGs) emphasize the significance of green spaces in achieving urban sustainability, mandating universal access to safe, inclusive, and accessible green and public spaces by 2030.

In terms of the Sustainable Development Goals, urban green space has the potential to make a substantial contribution by mitigating the negative environmental effects of urbanization and providing equitable access to resources that reduce social and health disparities. The UGS could contribute to and relate to SDGs 3 (good health and well-being), 11 (sustainable cities and communities), and 13 (the environment action). Nevertheless, studies on UGS are limited in terms of measuring its social and economic impact on the SDGs (Tate et al., 2022).

Understanding the need for UGS becomes critical in various locations experiencing fast urbanization, particularly how UGS can support SGD goals. However, cities in developing nations experiencing rapid urbanization tend to prioritize economic development over creating regulations that promote UGS provision. However, as is well recognized, economic development must take into account sustainability issues, and one method to do so is to design policies that promote UGS (Wey et al., 2022)

UN-Habitat (2010), further asserts that the quantity and quality of public spaces can serve as indicators of mutual benefit. While all public spaces must be socially inclusive, integrated, connected, and safe, urban green spaces are particularly crucial for enhancing environmental sustainability in metropolitan areas through ecological regeneration, restoration of environmental connections, and biodiversity preservation.

2. Urban Green Space

According to Spatial Planning Act No. 26/2007, urban green space (UGS), or green open space, is defined as an elongated, laned, and/or clustered area predominantly covered by vegetation, both naturally occurring and intentionally planted. UGS can be categorized into public and private green spaces. Current regulations mandate that regional governments allocate at least 30% of their area to green open space, with 20% designated as public space. The distribution of public green space must consider population density, service hierarchy, and fiscal resource allocation (Ministry of Agrarian Affairs and Spatial Planning, 2007).

The regional government currently struggles to meet the 20% urban green public space requirement.

A new approach to green space provision is needed in metropolitan areas. Minister of Agrarian Affairs and Spatial Planning Regulation No. 14/2022 addresses this by outlining regional provisions for green open space provision and utilization. This regulation specifies minimum land areas and service ranges for city and sub-district parks, ensuring adequate green space coverage and accessibility for residents.

3. The Urban Growth Theory

Urban growth theory seeks to elucidate the complex phenomenon of urban expansion and adaptation over time. As an economic phenomenon, urban growth is inherently linked to urbanization—the process of population and economic activity concentration in urban areas. However, measuring urban expansion is complicated by the lack of a universally accepted definition of "urban area," which can vary even within countries due to differing local jurisdictions and historical changes. Urbanization can occur through migration from rural areas or overall economic growth, leading to both urban and rural population and output increases. Crucially, sustainable urban centers may not emerge until agricultural productivity reaches a level that enables individuals to transition from farming to non-agricultural pursuits (Rossi-hansberg and Ioannides, 2005).

New urbanism promotes compact, walkable, mixed-use communities to reduce automobile dependency, enhance social interaction, and foster environmental sustainability (Calthorpe, P., & Fulton, 2001). Urban growth theory informs land use planning by providing insights into urban evolution, enabling anticipation of changes, and facilitating the provision of social amenities. Land use planning also plays a crucial role in creating open spaces, either by preserving existing open areas or formally establishing public spaces like parks and playing fields (Cheshire and Sheppard, 2002).

METHODOLOGY

This research utilizes secondary data from the Bekasi Municipality Spatial Planning Office and Central Bureau of Statistics (2013–2022) to examine factors influencing urban green space (UGS) in Bekasi City. The data encompasses total UGS area, population density, housing area, and real estate sector growth as a proxy for Gross Regional Domestic Product (GRDP). Multiple linear regression analyses will be employed to assess the impact of these variables on the overall UGS area. Specifically, the study investigates the following hypotheses:

1. Does an increase in population affect UGS area expansion?
2. Does the expansion of the total dwelling area influence the UGS area increase?
3. Does real estate sector growth impact UGS area expansion?

The regression model has been widely applied in research exploring how much each independent variable impacts the dependent variable and, if the values of all the independent variables are known, can also be used to forecast the dependent variable's value. The dependent variable (Y) and independent variables (X_1, X_2, X_3, ….., X_y) in the model are linear functions (Gujarati, 2003).

The model of multiple linear regression for this study can be generated as follows:

$$Y_i = \alpha + \beta_1 X_{1i} + \beta_2 X_{2i} + \beta_3 X_{3i} + \varepsilon \quad (1)$$

Since there is a difference in unit measurement, the model of multiple linear regression should be transformed into a log-linear model, as follows:

$$lnY_i = \alpha + \beta_1 lnX_{1i} + \beta_2 lnX_{2i} + \beta_3 X_{3i} + \varepsilon \quad (2)$$

Insert the variables into the function, then the multiple linear regression model can be written as follows:

$$ln\ RTH_i = \alpha + \beta_1 lnDPOP_{1i} + \beta_2 lnPERUM_{2i} + \beta_3 GROWTH\_RE_{3i} + \varepsilon \quad (3)$$

where,

Ln RTH = The total area of Urban Green Space

$\beta_1, \beta_2, \beta_3,$ = The coefficient of regression

X_1 = Log-linear of Dense Population

X_2 = Log-linear of the total area of housing

X_3 = Growth of Real Estate sector

α = Constanta

ε = Error

Study Area: Bekasi City

This section explains why urban green space is critical in urban environments, particularly metropolitan areas. Beyond that, this study seeks to determine what factors influence the provision of urban green space. The research took place in Bekasi City. Several underlying causes influenced the selection of this regional delineation:

First, Bekasi City, a metropolitan area covering over 210 square kilometers, has a population of 2.62 million. With a population density of more than 12,300 persons per square kilometer, it is one of the most densely populated metropolitan areas in Indonesia (BPS Kota Bekasi, 2024). The Bekasi City administration inevitably faces certain issues and challenges related to urban growth, given its large population. Among these issues is the availability of urban green space, which is only available for approximately 8.23% of the providing obligation, or about 30%. The occurrence of changes in land use is one of these issues.

Second, the rapid growth of the real estate sector is one of the economic drivers in the Bekasi area. According to BPS Bekasi City (2024), Bekasi City's real estate sector has grown by 24.7 percent during the last five years. Aside from that, infrastructure development in Bekasi City is accelerating, with one reason being the development of priority infrastructure projects around the city. In this circumstance, there is pressure on the provision of urban green space due to the increasingly limited amount of land available for urban growth.

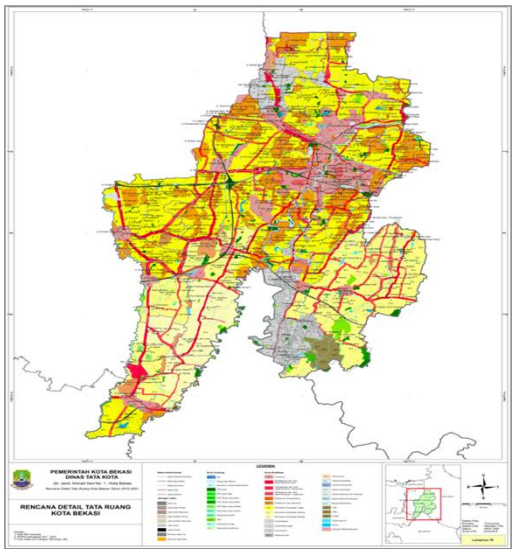

Figure 1. Delineation of Study Area

Source: Spatial Planning Office, Strategic Planning 2018 - 2023

RESULT AND DISCUSSION

The data was analyzed using ordinary least square (OLS). In OLS, a regression analysis must perform the classical assumption test for the regression model to meet the BLUE (Best Linear Unbiased Estimator) criteria. Table 2 illustrates the test determining the presence of a heteroscedasticity problem in the model. This test tool is used to check whether there is an inequality in residual variance from one observation to the next in a regression model. When the residual variance from one observation to the next is constant, this is often referred to as homoscedasticity. (Gujarati, 2003). A model in regression analysis must be homoscedastic, which means that the residual variance must be constant.

To determine whether there is a heteroscedasticity problem, we can compare the prob > chi2 value with a significance value of 5% or 0.05. According to the Breusch-Pagan heteroscedasticity test findings, the prob > chi2 value was 0.7970, greater than the significance threshold of 5% or 0.05. As a result, the regression model does not exhibit heteroscedastic problems.

Table 2. Breusch-Pagan Test for Heteroskedasticity

Breusch – Pagan / Cook – Weisberg test for heteroscedasticity
Ho : Constant variance
Variables: Fitted value of LN_RTH
Chi2(1) = 0.07
Prob > chi2 = 0.7970

Source: Analysis, 2024

The next step of the classic assumption test is the multicollinearity test. The multicollinearity test determines if each independent variable in the regression model has a linear correlation. The variance inflation factor (VIF) value can be used to diagnose multicollinearity concerns. If the VIF value for any independent variable is greater than 10.00, the model has multicollinearity issues (Harlan, 2013).

The VIF value for each independent variable in this regression model is 10.00 based on the results of the VIF test. These findings demonstrate that this regression model is free of multicollinearity issues.

Table 3. Variance Inflation Factor (VIF) Test

. estat vif

Variable	VIF	1/VIF
LN_LHOUSE	1.13	0.887529
GROWTH_RE	1.09	0.916332
LN_POP	1.05	0.948782
Mean VIF	1.09	

Source: Analysis, 2024

Table 4 provides the Shapiro-Wilk Normality test. The normality test examines if the dependent and independent variables in the regression model have a normal distribution. The Shapiro-Wilk normality test method can be used to determine whether the data in the regression model is normally distributed. The normality test evaluates whether the prob>z value greater than the 5% or 0.05 significance level. If the prob>z value is greater than 0.05, the data in the regression model is normally distributed.

Table 4. Shapiro-Wilk Normality test

Variable	Obs	W	V	z	Prob>z
LN_RTH	10	0.85390	2.252	1.517	0.06463
LN_POP	10	0.95714	0.661	-0.683	0.75283
LN_LHOUSE	10	0.92033	1.228	0.359	0.35975
GROWTH_RE	10	0.86029	2.153	1.426	0.07690

Source: Analysis, 2024

```
. regress LN_RTH LN_POP LN_LHOUSE GROWTH_RE

      Source |       SS       df       MS      Number of obs   =        10
-------------+------------------------------   F(3, 6)        =     25.77
       Model |  11.0499241     3  3.68330804   Prob > F        =    0.0008
    Residual |   .85759472     6  .142932453   R-squared       =    0.9280
-------------+------------------------------   Adj R-squared   =    0.8920
       Total |  11.9075188     9  1.32305765   Root MSE        =    .37806

------------------------------------------------------------------------------
      LN_RTH |      Coef.   Std. Err.      t    P>|t|     [95% Conf. Interval]
-------------+----------------------------------------------------------------
      LN_POP |   2.202446   2.201965     1.00   0.356    -3.185569    7.590461
   LN_LHOUSE |   1.008479   .1197061     8.42   0.000     .7155688    1.301389
   GROWTH_RE |  -.0020239   .0402422    -0.05   0.962    -.1004931    .0964452
       _cons |  -34.73834   32.96912    -1.05   0.333    -115.4109    45.93419
------------------------------------------------------------------------------
```

Figure 2. The statistical result of the model

Source: Analysis, 2024

After testing the classical assumptions and ensuring there are no issues with the data or the model, the next step is to conduct an analysis based on these variables using linear regression. The statistical findings of the model are shown in Figure 2. From this result, we will examine whether there is any correlation between independent variables and dependent variables based on the t-test, F-test, and coefficient of determination (R2).

The t-test is used to examine whether there is any partial correlation between independent variables and dependent variables. If the P>|t| <0.05, the independent variables correlate with the dependent ones. Table 1 shows the correlation of independent variables from the t-test value. Based on these findings, it is possible to conclude that only factors LN_HOUSE or the total area of residential have a significant impact on LN_RTH or urban green space comparing to other variables show no meaningful association.

Table 5. The correlation of the independent variable and dependent variable from the t-test value

Independent Variables	Correlate/ No Correlate with Y
LN_POP	No Correlate
LN_HOUSE	Correlate
GROWTH_RE	No Correlate

Source: Analysis, 2024

To find out whether the independent variables have a significant correlation to the dependent variable, it could be seen from the F-test or Prob > F from the statistical result. If the value of prob > F < 0.05, the independent variable affects the dependent variable. Figure 2 shows that the prob > F value is 0.0008 or < 0.05, which means that overall, the independent variable influences the dependent variable.

The coefficient of determination is a measure of "goodness of fit." The coefficient of determination, or R2, is a summary measure of how well the sample regression line fits the data. The R2 value calculates how much of the independent variables in the model explain the influence on the dependent variable. The R2 coefficient is between 0 and 1. The closer it gets to 0, the less the independent variable in the model can fully explain the dependent variable. The closer it gets to one, the more independent variables in the model may explain the dependent variable completely (Gujarati, 2003). The statistical result in Figure 2 describes that the value of R2 is 0.9280, which means that 92.8% of the variable LN_RTH, or urban green space, could be described as independent in the model. Variables outside of the model determine the remaining 7.2%.

DISCUSSION

By integrating the regression coefficient values from the statistical data in Figure 2, we can generate the following regression model for the urban green space variable:

$$Y = -34.738 + 2.202X_1 + 1.008X_2 - 0.002X_3 + \varepsilon \quad (4)$$

The constant value of -34.378 implies that from 2013 to 2022, the number of RTH/UGS, without being influenced by other variables or assuming no change in other variables, declined by 34.73%. The population variable regression coefficient value (X1) is 2.202, which means that a 1% increase in the Bekasi City population will result in a 2.2% increase in the UGS area if all other variables remain constant. The regression coefficient for the total housing area variable (X2) is 1.008, which means that a 1% increase in the total residential area in Bekasi City will result in a 1% increase in the UGS area. Meanwhile, the regression coefficient value for the real estate sector growth (X3) variable is 0.002, implying that a 1% rise in real estate sector growth in Bekasi Municipality will shrink the UGS area by 0.002% if all variables remain constant.

Regression analysis reveals a positive association between population growth and urban green space (UGS) area in Bekasi City, with a 1% population increase corresponding to a 2.2% increase in UGS. However, this relationship is not statistically significant, according to the t-test. Bekasi City, a metropolitan area with a population of 2.6 million, faces a high demand for land to accommodate residential, communal, and ecological needs.

This study's findings, indicating a positive but non-significant correlation between population growth and urban green space (UGS) area, align with Ridayati's (2018) research in Yogyakarta, which also found a positive but non-significant relationship between population and green open space. However, these results contrast with Richards et al.'s (2017) study in Southeast Asia, which revealed a significant association between city size, population density, affluence, and green space coverage. Richards et al. found that while affluent cities tend to have more extensive UGS due to increased citizen demand, larger, densely populated cities with lower affluence often prioritize health and economic development over parks and recreational facilities, resulting in less UGS.

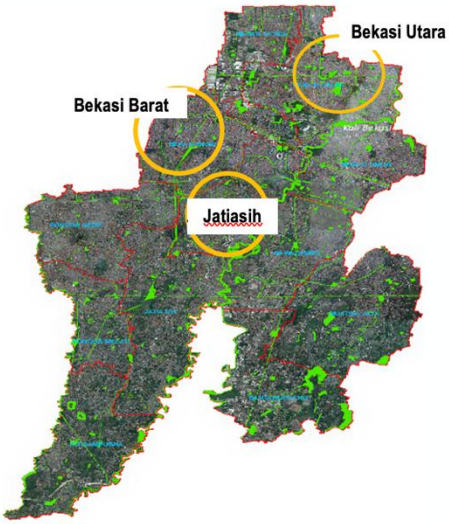

Figure 3. Geographic Distribution of Urban Green Space

Source: Spatial Planning Office, Strategic Planning 2018 - 2023

Figure 3 illustrates the uneven distribution of green space in Bekasi City, primarily concentrated in peripheral areas and less prevalent in the densely populated city center. This disparity is particularly evident in the subdistricts of North Bekasi, Jatiasih, and West Bekasi, which have the highest population densities but varying levels of green space provision. Jatiasih boasts the highest density of green open space (7.46 m^2/person), followed by North Bekasi (6.41 m^2/person), while West Bekasi has the lowest (2.93 m2/person). This is likely due to West Bekasi's location within the metropolitan center and its significant real estate development, including housing, offices, educational institutions, and commercial spaces, which puts pressure on the availability of urban green space.

Despite the study finding a positive correlation between population growth and urban green space (UGS) area in Bekasi City, this relationship was not statistically significant. This discrepancy may be attributed to the observed conversion of designated green spaces into residential and commercial areas, suggesting that the expansion of UGS has not kept pace with population growth driven by urbanization and natural increases. Although the Minister of Public Works and Public Housing Regulation No. 05/PRT/M/2008 mandates 20 m^2 of UGS per capita in urban areas, the limited regional budget may be a significant impediment to achieving the UGS targets set for Bekasi City.

Statistical analysis reveals a strong positive correlation between increased UGS area and residential development in Bekasi City. This is likely due to Bekasi City Regional Regulation Number 6 of 2014, which mandates that developers allocate 20% of new housing areas to green space, adhering to administrative and technical standards outlined in the regional spatial plan. Furthermore, building construction must comply with technical requirements regarding building intensity, specifically the Basic Building Coefficient (KDB), Building Floor Coefficient (KLB), and Green Area Coefficient (KDH), with intensity control based on regional zoning.

While prior research has not established a definitive link between increased housing area and urban green space, this study elucidates the positive and significant relationship within the regulatory context of Bekasi City, where housing developments are mandated to incorporate green spaces within residential areas.

Regression analysis indicates a negative, although insignificant, association between the growth of the real estate sector and the expansion of Bekasi City's UGS area. Specifically, a 1% increase in real estate sector expansion is associated with a 0.002% decrease in total urban green space area, likely due to reduced green space resulting from increased real estate demand. The real estate sector encompasses diverse developments beyond residential areas, including office buildings, warehouses, apartments, shopping centers, and educational institutions. As urban economics theory suggests, expanding real estate sectors often leads to increased land demand. However, unlike residential development, the impact on green space area is less clear, as the composition of building intensity (KDB, KLB, and KDH) varies across different real estate forms and is further influenced by zoning regulations.

Limitations

This study has several limitations. First, the focus on Bekasi City may limit the generalizability of findings to other Indonesian metropolitan areas, as each city possesses unique characteristics and development

dynamics that can influence UGS changes. Second, the reliance on secondary data from the Bekasi City Spatial Planning Service and Central Statistics Agency (2012-2022), while verified and validated, may have limitations in accuracy and representativeness. Additionally, the study's timeframe may not capture changes occurring outside the specified period. Third, this study's analysis is limited to three independent variables—population, total housing area, and real estate growth—potentially overlooking other influential factors such as government policy, geographical conditions, and community participation. This limited scope may hinder a comprehensive understanding of UGS dynamics in Bekasi City. Finally, the study's focus on quantitative analysis of the UGS area neglects qualitative aspects such as accessibility, biodiversity, and social benefits, which are crucial for a holistic understanding of UGS's role in sustainable urban development.

CONCLUSION

This study investigates the dynamics of urban green space (UGS) area changes in Bekasi City. Findings reveal a positive correlation between population density and the number of UGS, yet there is no significant increase in the overall UGS area, indicating insufficient UGS allocation to accommodate population growth. Additionally, a strong positive correlation exists between housing sector growth and green space expansion, attributable to regulations mandating a minimum of 20% green space within residential areas. These findings have substantial implications for long-term urban planning in Bekasi City, underscoring the importance of green space amidst rapid urbanization and informing strategies for its preservation and expansion.

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Carrying Capacity Analysis for Measuring Land Capability in Arid Area

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Abstract: The study of sustainable development in an area must include environmental carrying capacity (ECC). Measurement of environmental carrying capacity is needed to determine the limits of an area's ability to support individual behavior, such as consumption of natural resources and disposal of waste into nature. This study aims to evaluate the ECC analysis based on land capability in dry areas in East Nusa Tenggara as a contribution to spatial planning strategies. The results of this study show that Timor Tengah Selatan Regency, which is dominated by dry areas, has a land capability classification ranging from class I to III, or as much as 42% of the total area that can be exploited for agricultural and plantation activities. This research can be used as input for the 5-year revision cycle of the Timor Tengah Selatan Regency spatial plan so that land allocation in the RTRW is more in line with the land's carrying capacity.
Keywords: environmental carrying capacity, land capability, arid area, Timor Tengah Selatan Regency

1. Introduction

Optimal environmental carrying capacity is a must to be able to achieve sustainable development goals concerning the carrying capacity of space for economic activities carried out by the community [1]. The carrying capacity analysis ensures that human activities do not exceed the ecosystem's capacity and create environmental damage. The limits of an area's ability to tolerate individual behavior in terms of consuming natural resource products and waste disposal are expressed in terms of environmental carrying capacity. A land capability unit is one of the approaches in environmental carrying capacity analysis based on the type of activity and research environment in an ecological space [2].

The land capability analysis could be carried out by considering factors such as rainfall, soil texture, land slope, and potential for erosion. The concept of land capability is founded on the assumption that each land component has a unique capacity to offer ecosystem services. It further claims that a substantial percentage of this capacity is required to maintain soil and land health, with the remainder potentially accessible for various human enterprises [3]. Even though recent studies have shown that the land capability classification criteria are not limited to previous but consider parent material as one of the land capability classifications [4].

As the Minister of Environment and Forestry's Regulation pointed out, there are eight categories of land capability and land categorization, as shown below.

Table 1. Categorization of Land Capability

Land Category	Capability
I - II	Agricultural
III - VI	Various uses but still can be used for agriculture
VII - VIII	Conservation

Source: Regulation of the Minister of the Environment & Forestry No. 17/ 2009

The calculation of land capacity based on carrying capacity must be performed in relatively arid areas. The arid areas are classified as those dominated by dust storms or desert landforms, with scant vegetation and limited water resources[5]. Knowing the condition of the area allows us to analyze to determine whether the land in the area can still be used for the local population, such as agricultural land, given that extreme weather conditions are currently occurring in every region of Indonesia and the arid area it is feared that it will have a significant influence on land capacity [6].

According to a report from BPS-Statistics of Nusa Tenggara Province [7]. Most of the East Nusa Tenggara region is arid due to minimal rainfall and is classified into two types: (i) The climate in dry places is tropical. The arid tropical climate of East Nusa Tenggara is found in the province's western and central regions. This area records rainfall data of 500-1000 mm annually. This region also has a prolonged dry season, lasting 6-8 months; (ii) The arid subtropical climate. The arid area with a subtropical climate in East Nusa Tenggara is in the province's east. This area receives less rainfall than drier places with tropical climates, averaging 250-500 mm

annually. This region also has a lengthened dry season, lasting 8-10 months.

The main objective of this research is to estimate the carrying capacity of the environment in terms of land capability in dry areas in East Nusa Tenggara province as an effort to contribute to developing regional spatial planning strategies. The research questions we want to try to answer by collecting samples from arid areas on Timor Island, Nusa Tenggara Province, are:

a. Regarding land capability, can arid areas in Timor Tengah Selatan Regency still be used for agricultural areas, or can they no longer be used for agricultural areas?
b. If the land cannot be used for agriculture, what type can be used in the arid area of Timor Tengah Selatan Regency?

2. Material and Methods

2.1. Data Collection and Analysis

There are numerous approaches or methodologies to calculate environmental carrying capacity. Wang et al. [8] their studies entitled "Review of Evaluation on Ecological Carrying Capacity: The Progress and Trend of Methodology" described that there are six sub-categories of ECC methodology: Evaluation Index System (EIS), Ecological Footprint (EF), System Dynamics (SD) method, Decision-Making Optimization (DMO) model, Safety Coefficient (SC) method, and Artificial Intelligence (AI) method. Meanwhile, Subekti & Suroso [2], divided the ECC model into nine sub-categories, which are based on (i) Land Capability; (ii) Land Supply and Demand Ratio; (iii) Water Supply and Demand Ratio; (iv) Graphical Model (Logistic Growth; (v) Uni Constraint Model; (vi) IPAT Equation; (vii) Pressure, State, Response (PSR) Model; (viii) Ecological Footprint; and (ix) Ecosystem Service.

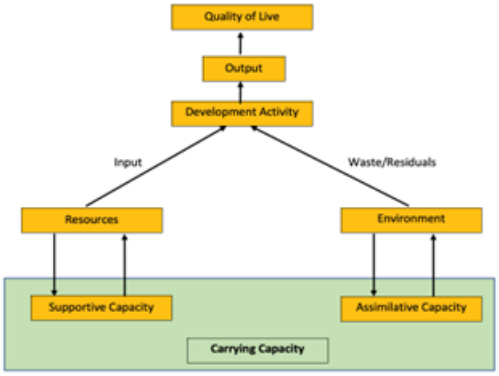

Figure 1. Carrying Capacity
Source: Regulation of the Minister of the Environment Indonesia No.17/2009

In the previous literature discussion, we have identified various models of ECC. This study will adopt land capability analysis to identify ECC in arid areas based on land capability classification. Land capability analysis (LCA) is a tool for determining an area's ECC. LCA is based on the premise that different types of land have varying capacities to support various sorts of human activity. We can establish the greatest degree of human activity that a place may support without producing unacceptable environmental damage by measuring its land capability [9].

According to the Regulation of the Minister of the Environment No.17/2009 about The Environmental Carrying Capacity Determination Guidelines in Spatial Planning, many factors influence a certain area's land capabilities, including soil type, slope, climate, and vegetation. Land capability classification can be grouped into eight (8) classes. The USDA categorization was utilized in this study to classify land capabilities. In order of limitation degree, the categorization system has eight class ranks. Lands classified as Class I-Class IV are suitable for cultivation and other uses, whereas property classified as Class V-Class VIII is generally unsuitable for cultivation. Capability analysis yields three primary categories: capability unit, capability class, and capability subclass. A capability unit is a set of land units with the same land management categories. The capability class divides all land into eight classes based on the risk of soil damage or limiting factors, which increases from Class I to Class VIII. Capability subclasses provide extra information about the capability class's limitations and hazards [3].

The first two classes (class I and class II) are ideal land for agricultural use, and the last two classes (class VII and class VIII) are land that must be protected or used for conservation purposes. Class III to VI can be considered for a variety of additional applications. However, agricultural property in classes III and IV is still accessible to agriculture [10]. Land capability analysis has been widely employed for a variety of reasons around the world, including in Indonesia. In general, land capacity analysis is utilized for preliminary land analysis. Land capability analysis has been used in regional planning, agriculture surveys, plantation surveys, forestry surveys, land usage determination, and land degradation assessment [11]. Land use planners can determine the best use for a certain region and avoid overuse of the land by considering these aspects.

Land Capability Classification is a systematic assessment of land components and grouping them into several categories based on properties potentially constrained in their sustainable use. Land Capability is seen as the capacity of the land itself for a particular type or level of general use [12].

Table 2. Land Capability Class

Land Capability Class	Development Classifications
A	Very Low
B	Low
C	Moderate
D	High
E	Very High

Source: Minister of Public Works Regulation No. 20/PRT/M/2007

Based on the Regulation of the Minister of Public Works No. 20/PRT/M/2007 [13], there are at least 9 indicators of land capability units.

Table 3. Land Capability Unit

No	Land Capability Unit	Indicators									
		Slope	Morphology	Elevation	Soil Type	Altitude	Watershed	Precipitation	Land Use	Land Movement	Earthquake-prone
1	Morphology	■	■								
2	Ease Of Work	■		■	■						
3	Slope Stability	■	■			■					
4	Foundation Stability	■	■		■	■					
5	Water Availability						■	■	■		
6	Drainage	■		■				■			
7	Erosion	■	■		■			■			
8	Waste Disposal	■				■		■	■		
9	Natural Disaster									■	■

Source: Adapted from Wirawan, Kumurur and Warouw [12]

The method used in this study is to analyze the carrying capacity using land capability classification in an arid area, East Nusa Tenggara. The data used in this study came from the Strategic Environmental Assessment (SEA) of the Timor Tengah Selatan Regency, the Regional Spatial Plan Documents of the Timor Tengah Selatan Regency, and other secondary sources such as research reports, regulations, and scientific articles. This study was limited to identifying land capability based on class only due to the limited data and indicators available. Land use, land cover, and mapping data were sourced from technical materials of the Regional Spatial Plan Documents of the Timor Tengah Selatan Regency and analyzed using ArcGIS 10.8 (data analysis) & ArcGIS Pro 3 (layout) software.

2.2. Study Area

This study was conducted in Timor Tengah Selatan Regency, East Nusa Tenggara, Indonesia. As a key part of the island of Timor, Timor Tengah Selatan Regency is located between 9°28' to 10°10' South Latitude and 124°4'00" to 124°49'0" East Longitude. Topographical conditions in the Timor Tengah Selatan Regency include mountainous areas, highlands, and lowlands, including coastal areas.

3. Results and Discussion

Land characteristics in dry climates could be categorized into several types: soil characteristics, vegetation, water resources, and landforms. Arid terrain with a dry climate is commonly characterized as an expanse of land that is never inundated or water-logged for most of the year, with rainfall of 2,000 mm/year and dry months of more than seven months (< 100 mm/month) [14]. According to Mulyani, Nursyamsi, & Irsal [15], in East Nusa Tenggara, the soil characteristics with sediment and volcanoes are the parent materials with the greatest spread, reducing the dominating soil of Inceptisols (Haplustepts) connected with Alfisols (Haplustalfs) and Entisols (Ustortherts) to around 2.1 million hectares.

The features and plant kinds can also identify land characteristics in arid areas. For example, Xu et al. [16] described a kind of plant that can live in a dry climate area. "Populus Euphratica" and other plants in dry areas have a significant ability to adapt to drought and salinity. Still, seedlings lack these advantages and require adequate water and salt. Many herbaceous plants seem the same. After decades or even hundreds of years of natural selection in desert environments, perennial herbaceous plants can live longer due to the unique potential of experiencing wet years.

Due to high temperatures and low humidity, evaporation rates in drylands are frequently higher than precipitation rates. This indicates that there is a net loss of water from the ground surface, decreasing the amount of water available for plant development and other processes [17]. Arid areas with dry humidity levels require substantial attention, particularly those linked to water sources and management because water availability is limited. Heavy rains are the key limiting factor. As a result, it stands to reason that those arid, dry temperatures are associated with enclaves of poverty and food insecurity, particularly in East Nusa Tenggara [15].

Based on Law 32/2009, Environmental Support Capacity (DDLH) is defined as the ability of environmental space to support human activities and other living things to create environmental balance. Some of the potential carrying capacity of the environment in Timor Tengah Selatan Regency include:

3.1. Land Capability

Land use is the dominant function that appears or is assigned to an area. Land use in Timor Tengah Selatan Regency is shown below:

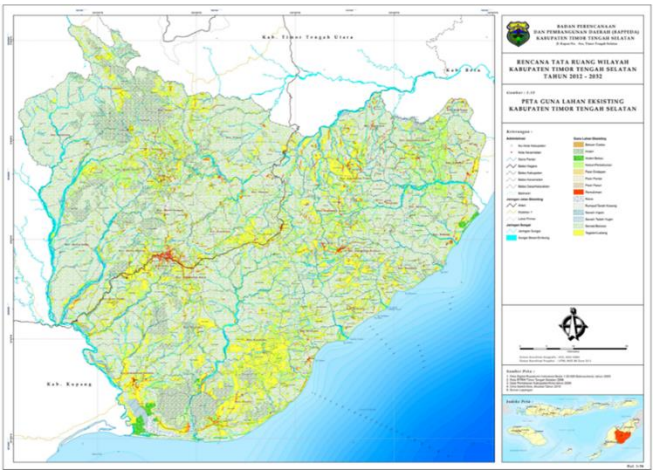

Figure 2. Existing Land Use Timor Tengah Selatan Regency
Source: RTRW Timor Tengah Selatan Regency 2012 – 2032

Land use in Timor Tengah Selatan Regency is dominated by dry forests spread throughout the area. The land use map is the result of an analysis that shows the location of the distribution of various types of land use in the Timor Tengah Selatan Regency area, including settlements, plantations, moorlands, forests, and rice fields. Details, types of land use, area, and percentage of land area can be seen in:

Table 4. Land Use in Timor Tengah Selatan

Land Use Type	Area (Ha)	Percentage of Land Area (%)
Residential Area	7,208.37	1.8
Plantations	18,965.17	4.75
Farm	58,510.07	14.64
Forest	36,174.96	9.05
Mangrove Forest	1,667.77	0.42
Irrigated rice fields	2,548.55	0.64
Rainfed rice fields	918.73	0,23
Swamp	951.79	0,24
River/lake	6,790.61	1,7
Sediment	35.56	0,01
Beach Sand	37.56	0,01
Tidal Sand	0.09	0,00
Schist	192.26	0,05
Grass	14,679.57	3,67
Shrub	250,883.80	62,79
Total	**399,564.30**	**100**

Source: Regional Spatial Planning Plan Timor Tengah Regency, 2018

The data in Table 4 shows that the most significant type of land use is moor/field covering 58,510.07 Ha (14.64%), followed by forest area covering 36,174.96 Ha (9.05%), and plantation covering 18,965.17 Ha (4.75%). After analysis, it is known that the land that has been used only covers 132,784.20 Ha (33.23%) of the land use area, while most of those are still shrubs with an area of 250,883.80 Ha (62.79%) and grass/empty land covering 14,679.57 Ha (3.67%).

In the report on carrying capacity and environmental capacity in different locations [18], it is stated that the potential decline in productivity due to poorly managed land use or excessive intensification needs to be the main focus to avoid land degradation that can be detrimental to long-term food security.

3.2. Food Carrying Capacity

The term "carrying capacity" comes from ecology and refers to the most significant number of species that may survive in any natural environment [19]. The concept of Environmental Carrying Capacity (ECC) is the optimum ability of a country's or region's ecological system to enable economic and social development in a given time [20]. Although it is a complex concept, the environmental carrying capacity is crucial to comprehending how human activity affects the environment.

The potential carrying capacity in Timor Tengah Selatan Regency relies on corn commodities with a land area of 79,033 ha. At the same time, the total rice production (paddy and field rice) of the Timor Tengah Selatan Regency in 2017 reached 20,754 tons from the harvest area. The harvest area for cassava commodities was 7,341 ha, followed by sweet potatoes, peanuts, green beans, and soybean commodities, with a production level of 65 tons/year. The total need for rice equivalent food to meet the needs of the Timor Tengah Selatan population is 57,533.52 tons/year, so the amount of food carrying capacity is 2.30. It can be concluded that Timor Tengah Selatan Regency is statistically capable of food self-sufficiency. Still, on the other hand, it has not been able to realize a decent livelihood for the local community.

This aligns with research from Wijaya et al. [21], which addresses the evaluation of land use sustainability and how it supports the food sector, especially agriculture, given the environmental conditions that are vulnerable to degradation. In addition, on Timor Island, there have been reports of reliance on food imported from outside the region, such as rice and instant noodles, indicating problems with limited local food-carrying capacity [22]This is also a concern for areas that rely on agricultural land to meet their food needs, which is closely linked to sustainable land management and utilization.

3.3. Land Capability Unit Spatial Analysis

Each land capability unit has various levels ranging from high to low based on the calculation of each indicator used. The following is the proportion of area for each class:

Table 5. Land Use in Timor Tengah Selatan Regency

Level	Morphology (%)	Ease Of Work (%)	Slope Stability (%)	Foundation Stability (%)	Water Availability (%)	Erosion (%)	Drainage (%)	Waste Disposal (%)	Natural Disaster (%)
High	12.08	77.74	10.61	22.41	26.74	0.01	51.08	0.001	25.36
Sufficient	40.80	-	33.01	37.38	41.58	46.00	48.92	1.54	-
Moderate	41.60	22.25	37.17	38.65	29.61	-	-	13.48	36.43
Less	5.35	0.01	17.68	1.57	2.07	53.99	0.001	33.52	-
Low	0.17	-	1.53	0.0004	-	-	-	51.46	38.21
Total	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**	**100.00**

Source: Analysis, 2023

The following unit calculations are based on Table 3 with spatial analysis using ArcGIS 10.8 software.

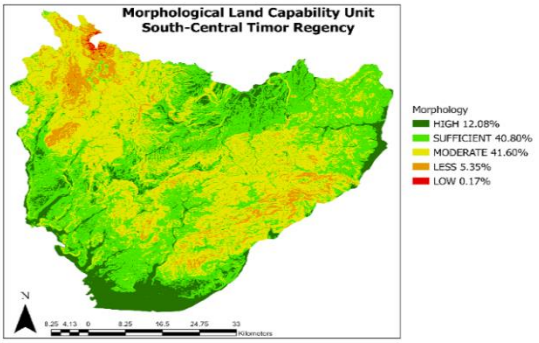

Figure 3. Morphological Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

Morphology refers to the shape of the land surface, such as plains, hills, or mountains. It determines the ability of land to support certain activities, such as agriculture, settlement, or industry. The overlay will integrate morphological layers to identify areas suitable for specific land uses. The indicators used to formulate

this unit are Slope and Morphology. The analysis results in a dominance of land classes with moderate and sufficient values of 41.60% and 40.80%, respectively.

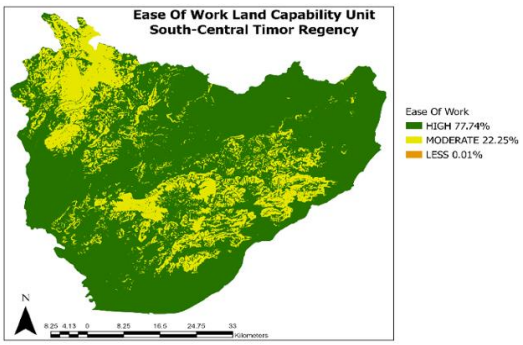

Figure 4. Ease of Work Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

This factor includes the extent to which the land can be worked using existing technology or tools. For example, hard or rocky land may be more challenging to cultivate, while flatter and more fertile land is easier to work on. In an overlay analysis, this becomes important for determining the potential of land for agriculture or development. The indicators for this unit are Slope, Elevation, and Soil Type. This unit has a dominant high-class value, with more than 2/3 coverage.

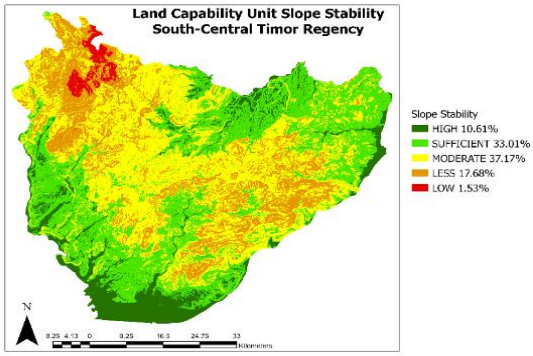

Figure 5. Slope Stability Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

The slope of land affects its stability and susceptibility to erosion. Land with slopes greater than 15% tends to be more susceptible to erosion and unsuitable for some types of agriculture or development. Overlaying slope stability with other factors helps determine whether land use can occur without causing degradation. The indicators for this unit are Slope, Morphology, and Altitude. The map shows that 37.17% of the moderate values are in the central region. Variations in the periphery areas, such as the northern region, are considered low. Meanwhile, the western region, which borders Kupang Regency, is rated high.

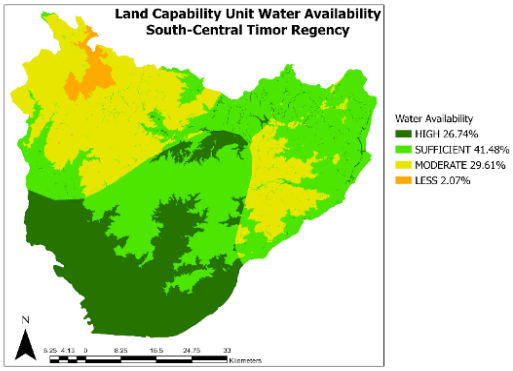

Figure 6. Water Availability Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

Watershed, Precipitation, and Land Use indicate water availability in the land capability unit. Timor Tengah Selatan Regency is predominantly at a sufficient level at 41.48%, with a high level in the western part and a moderate to low level in the northern part. Water availability is an essential factor in agriculture and settlement. In the overlay, the layer depicting water resources will help identify areas that can be used for agricultural activities or urban development.

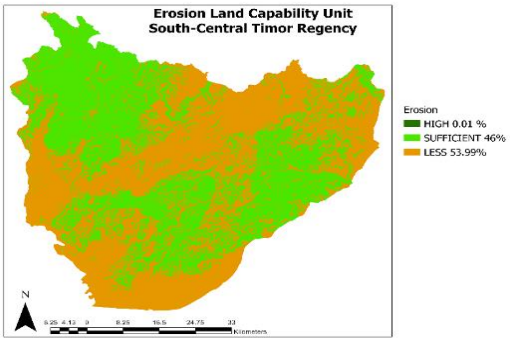

Figure 7. Erosion Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

Erosion indicators are formed by slope, morphology, soil type, and precipitation. Less level covers more than half of the area, meaning that the erosion level in TTS Regency is fairly well managed. Land's erosion potential significantly affects its ability to support agriculture and other land uses. By overlaying erosion data, areas prone to erosion can be seen and need careful protection or management.

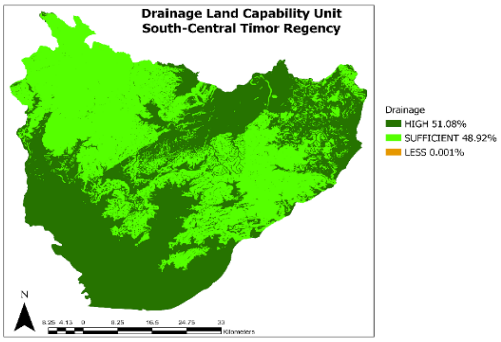

Figure 8. Drainage Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

Drainage-forming factors are assessed using slope, elevation, and precipitation indicators. The area in TTS Regency is quite good, with an almost equal proportion of high and sufficient levels. Land with poor drainage can cause flooding problems and damage to building structures or crops. This drainage overlay is vital for mapping areas requiring special development or agricultural planning attention.

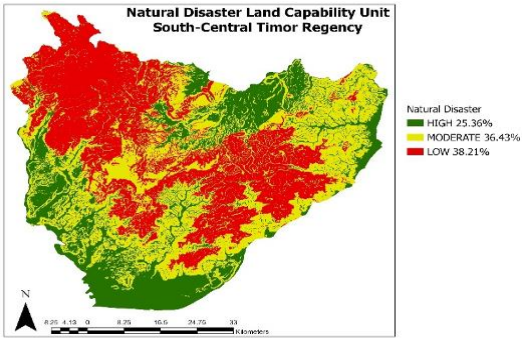

Figure 9. Natural Disaster Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

The land overlay must consider natural disasters such as earthquakes, landslides, and floods. Mapping disaster-prone areas helps in safe land use planning.

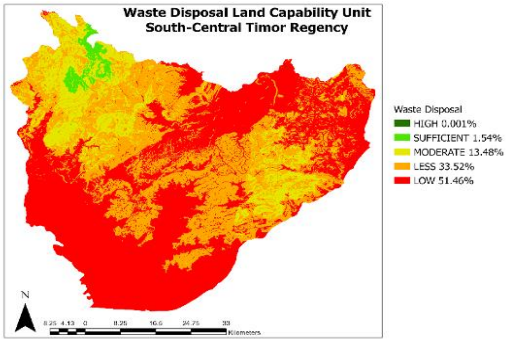

Figure 10. Waste Disposal Land Capability Unit in Timor Tengah Selatan Regency
Source: Analysis, 2023

Waste Disposal indicators are derived from Slope, Altitude, Precipitation, and Land Use. The map shows that low levels cover the majority of areas. This indicates that Timor Tengah Selatan Regency can properly manage waste generated by households and industries. Waste management, both solid and liquid, also affects the carrying capacity of the land. This overlay helps ensure that land used for industrial or residential activities has proper waste disposal systems to maintain environmental quality.

The seven analyzed Land Capability Units will become a mapping that provides a complete picture of land capability in Timor Tengah Selatan Regency and its impact on environmental quality [23], [24]. Permen PU No. 20/PRT/M/2007 examines land capability classification according to its designation. At the same time, Permen LH No. 17/2009 emphasizes the assessment of the ecological impact of land use based on the seven indicators that have been analyzed spatially.

3.4. Land Capability Analysis

LCA was conducted by overlaying/intersecting the nine (9) LC maps analyzed previously to obtain a total weighted value derived from the score multiplied by the weighted value from Regulation No. 20/PRT/M/2007.

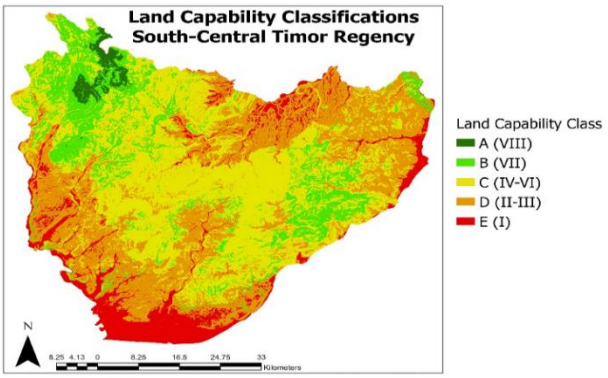

Figure 11. Land Capability Classifications in Timor Tengah Selatan Regency
Source: Analysis, 2023

Below is a description of the final results of the land capability classification in Timor Tengah Selatan Regency.

Table 6. Land Capability Class & Development Classifications in Timor Tengah Selatan Regency

Total Weighted Value	Land Capability Class		Development Classifications	Area (Ha)	%
	Regulation No 20/PRT/M/2007	Regulation No 17/2009			
48 - 70	A	VIII	Very Low	6,079.99	1.54
71 - 92	B	VII	Low	59,310.60	15.00
93 -114	C	IV - VI	Moderate	159,052.10	40.24
115 - 136	D	II-III	High	128,898.52	32.61
137 - 160	E	I	Very High	41,936.17	10.61
	TOTAL			**395,277.38**	**100.00**

Source: Analysis, 2023

The Regulation of the Minister of Public Works No. 20/PRT/M/2007 [13] classified land into five classes, including:

a. Classes A & B are lands included in protected/conservation areas, so they must be preserved. This is why their development classifications are low and very low, with a development intensity of 0%.
b. Class C is land included in the buffer zone, has conditions for its use, and is suitable for agriculture and plantations with a maximum development intensity of 20%.
c. Class D & E is land included in the development area and the cultivation zone with a maximum development intensity between 50-70%.

Meanwhile, in the Regulation of the Minister of Environment No. 17/2009 [10], the land is classified into eight classes, including:

a. Class I & II are lands suitable for agricultural land use (annual and perennial crops)
b. Classes III-VI can be considered for other uses (cultivation zones) or can also be used for agricultural/plantation land use
c. Class VII & VIII are lands that must be protected/have a conservation function (grasslands, trees, and natural vegetation)

After Land Capability analysis, it was found that although Timor Island's characteristics are arid, identified by the limited productivity of rice fields, no rivers flowing throughout the year to irrigate rice fields, minimal rainfall, and water volume in local dams [22], most of the Timor Tengah Selatan Regency area occupies a buffer zone suitable for agriculture and plantation activities at 40.24%.

However, this is not necessarily a positive thing because a report from the Rainforest Journalism Fund [22] confirmed that the condition of Food Carrying Capacity in Timor Tengah Selatan Regency has experienced a crisis due to a shift in staple food consumption from corn & tubers to rice. Dependence on rice has become a dilemma because the natural conditions of NTT do not optimally support rice production to meet local food needs. Access to rice is limited, causing children to no longer recognize local foods such as corn and tubers. They prefer instant noodles, biscuits, and rice [25], [26]

4. Conclusion

Land capability analysis has been widely employed around the world for a variety of reasons. The calculation of land capacity based on carrying capacity must be performed in relatively arid areas to find out if the arid area is still possible for agricultural activities. From this study, it can be concluded that the Timor Tengah Selatan Regency, which is dominated by arid areas, has land capability classifications ranging from class I to class III, or as much as 42% of the total area that may be exploited for agriculture and plantation activities. Water availability and drainage limit land capacity in the Timor Tengah Selatan Regency. The most prevalent land uses are shrubs, farmland, woods, and plantations. Meanwhile, land use for residential areas accounts for only 1.8% of the entire area of Timor Tengah Selatan Regency. This research can be applied as input for the 5-year revision cycle of the Timor Tengah Selatan Regency spatial plan so that land areas in the spatial plan align with the land's carrying capacity.

Therefore, it can be concluded that the land capability in TTS can still be analytically capable of supporting agricultural and plantation activities in fulfilling local food needs. Still, the main factor of climate and weather change in NTT Province causes a high dependence on food supply from outside the region, and the lack of water availability has caused local conflicts related to access to water [27]. The high level of mining activity in TTS also impacts agricultural and plantation productivity through groundwater pollution [28].

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Menciptakan Ruang Terbuka Hijau dengan Persepsi Keamanan sebagai Elemen Inklusif

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ABSTRAK. Berbagai penyelesaian permasalahan di wilayah perkotaan yang timbul akibat percepatan urbanisasi telah coba dilakukan salah satunya adalah dengan pendekatan pengembangan berkelanjutan. Dalam *Sustainable Development Goals* poin ke-11, pembangunan di wilayah perkotaan diarahkan untuk mengembangkan ruang-ruang kota yang inklusif, aman, tangguh, dan berkelanjutan. Salah satu ruang perkotaan yang penting bagi kehidupan masyarakat adalah ruang terbuka hijaunya yang dalam proses penyediaannya pun tak luput dari tujuan inklusif yaitu terciptanya ruang yang aman dan berkelanjutan. Penelitian ini bertujuan untuk mencari titik temu antara bagaimana merencanakan penyediaan ruang terbuka hijau kawasan perkotaan yang inklusif serta meningkatkan persepsi keamanan bagi penggunanya. Metode yang dilakukan dalam penelitian ini adalah tinjauan literatur sistematis. Literatur yang telah dikumpulkan berdasarkan kesamaan tujuan penelitiannya kemudian dikomparasi hasilnya untuk ditarik kesimpulannya sebagai hasil dari penelitian ini. Hasil tinjauan literatur menunjukan bahwa ruang publik yang inklusif dan aman adalah dua hal yang berkaitan. Salah satu cara untuk meningkatkan inklusivitas di ruang terbuka hijau adalah dengan merancang fasilitas-fasilitas keamanan di dalamnya. Selain itu, proses perencanaan ruang terbuka hijau yang aman, secara tidak langsung akan meningkatkan kinerja sosial ruangnya sehingga dalam penyediaannya akan tercipta ruang hijau yang inklusif.

Kata kunci: ruang terbuka hijau, inklusif, persepsi aman

ABSTRACT. *Various solutions to urban problems caused by increased urbanisation have been tried, including a sustainable development strategy. Point 11 of the Sustainable Development Goals calls for urban development to focus on creating inclusive, safe, resilient, and sustainable settings. Green open space is a vital urban environment for people's lives, and providing it does not mean sacrificing inclusive aims, such as establishing safe and sustainable spaces. This research aims to find a common ground between how to plan the provision of inclusive urban green spaces and enhance its users' safety perception. This study employed a comprehensive literature review approach. The collected literature is based on commonalities in study objectives, and the outcomes are compared to conclude this research. According to the literature review results, inclusive and safe public places are connected concepts. Designing security facilities in green open spaces can help to improve inclusion. Furthermore, developing safe green open spaces indirectly improves the space's social performance, creating inclusive green spaces.*

Keywords: green open space, inclusive, perception of safety

PENDAHULUAN

Urbanisasi atau proses perpindahan penduduk ke wilayah perkotaan menyebabkan berbagai macam permasalahan. Permasalahan-permasalahan yang muncul mencakupi ruang lingkup ekonomi, sosial, dan lingkungan (Rebolledo-Leiva et al., 2023). Dampak dari urbanisasi akan memengaruhi proses pembangunan di perkotaan. Pembangunan di wilayah perkotaan pada awalnya diharapkan mampu menciptakan kesejahteraan dan kemakmuran bagi seluruh lapisan masyarakatnya. Namun, kondisi seperti ini sangat sulit untuk

dicapai. Semakin banyak penduduk yang pindah ke kota, di satu sisi dapat meningkatkan ekonomi perkotaan, namun di sisi lain hal ini dapat memberikan ancaman terhadap tingkat daya hidup yang memengaruhi kenyamanan masyarakat. Berbagai permasalahan lain juga timbul seperti masalah lingkungan berupa bencana alam, kebutuhan air bersih, polusi, pemanasan global, dan lain-lain. Dari segi permasalahan sosial yaitu munculnya ekslusivitas yang dapat berdampak pada berkurangnya kesempatan kerja dan masalah kesejahteraan ekonomi yang tidak merata (Gupta & Vegelin, 2016).

Untuk mengatasi berbagai permasalahan tersebut, kota-kota di berbagai negara menerapkan rencana pembangunan berkelanjutan dan mem*branding* kotanya dengan *sustainable city* sebagai cita-cita yang ingin dicapai. Pembangunan berkelanjutan ini dipakai untuk menjadi program jangka panjang untuk menyelematkan lingkungan mereka. Permasalahan dalam membangun kota sudah menjadi perhatian banyak pihak dan sudah dilakukan berbagai usaha untuk membuat rencana pembangunan yang berkelanjutan. Pada tahun 2015, PBB menetapkan tujuan pembangunan berkelanjutan (SDGs) dengan tugas utama untuk memastikan, melindungi, mendorong, dan memanfaatkan ekosistem darat dan pengelolaan hutan secara berkelanjutan (Li et al., 2023). Bersamaan dengan dibentuknya SDGs, PBB juga membuat Agenda Perkotaan Baru *(New Urban Agenda)* yang berisi tentang visi pembangunan berkelanjutan dalam konteks urbanisasi. Di dalam agenda perkotaan baru ini ditambahkan satu visi lain yang sebelumnya diusung dalam permbangunan berkelanjutan, yaitu tata ruang kota. Agenda perkotaan baru menekankan pada kondisi spasial seperti apa yang dapat mendukung keberlanjutan kota. *New Urban Agenda* diambil dari hasil konferensi *United Nations' Habitat III* mengenai kerangka kerja yang berpengaruh dalam perkembangan kota secara universal. Kolaborasi antara SDGs dan NUA menjadikan pembangunan kota lebih komprehensif, inklusif, dan tangguh (van der Hoeven & Hitters, 2020).

Akibat dari urbanisasi dan pertumbuhan penduduk yang terkesan tiba-tiba menyebabkan banyak kota tidak memiliki rencana pembangunan yang sistematis dalam menghadapi urbanisasi dan akhirnya melenceng dari perencanaan yang seharusnya (Iqbal, 2021). Urbanisasi selalu dikaitkan dengan koversi lahan untuk mendukung aktivitas perkotaan. Kaitannya adalah karena pertambahan penduduk berarti akan semakin banyak lahan yang dibutuhkan sedangkan lahan yang tersedia sifatnya statis (tetap). Pesatnya perkembangan kota akan berbanding lurus dengan kebutuhan ruang publiknya. Semakin pesat perkembangan kota, maka semakin tinggi juga intensitas kebutuhan ruang untuk mewadahi aktivitas penduduknya, terutama ruang publik (Hantono, 2020).

Salah satu ruang publik yang menjadi infrastruktur wajib di wilayah perkotaan adalah ruang terbuka hijau yang kemudian disebut sebagai Ruang Terbuka Hijau Kawasan Perkotaan (RTHKP). Dalam Permen PU Nomor 5 Tahun 2008 tentang Pedoman Pedoman Penyediaan Dan Pemanfaatan Ruang Terbuka Hijau Di Kawasan Perkotaan, disebutkan bahwa ruang terbuka hijau merupakan jalur atau kelompok ruang publik yang sifatnya terbuka dan menjadi media tempat tanaman bertumbuh baik yang secara alami ataupun sengaja ditanam. Penyediaan ruang terbuka hijau di wilayah perkotaan bertujuan untuk menjadi kawasan resapan air, menciptakan keseimbangan antara lingkungan alam dan lingkungan binaan, serta memberikan keamanan, kenyamanan, kesegaran, keindahan, dan kebersihan bagi kota. Infrastruktur ruang hijau kota menjadi salah satu elemen perencanaan kota yang dijadikan media untuk beradaptasi terhadap perubahan iklim, melindungi keanekaragaman hayati, meningkatkan kesejahteraan masyarakat, dan menciptakan ruang untuk interaksi sosial serta berekreasi (Calderón-Argelich et al., 2023).

Selain menyediakan jasa ekosistem, ruang terbuka hijau juga harus menyediakan jasa sosial-budaya yang meliputi ruang rekreasi dan relaksasi, ruang interaksi antara manusia dan alam, dan ruang yang memberi kontribusi positif terhadap kesehatan mental dan fisik penggunanya (de la Barrera et al., 2016). Sesuai dengan bentuknya sebagai ruang publik, maka ruang terbuka hijau memiliki fungsi sosial yang disebut "kinerja sosial" (Dollah et al., 2023). Kinerja sosial ruang publik diharapkan

mampu menyediakan ruang bagi semua orang untuk dijadikan tempat berekspresi dan berinteraksi secara terbuka di ranah publik yang dapat diakses oleh seluruh kelompok. Ruang terbuka hijau sebagi infrastruktur publik sudah seharusnya bersifat inklusif agar dapat dijangkau oleh seluruh lapisan masyarakat (Il'alamien & Kameswara, 2020).

Banyak peneliti yang mulai menyadari adanya kesenjangan dalam mengakses ruang terbuka hijau. Pembangunan kota yang selalu mengejar sisi keberlanjutan, ketahanan, dan kesehatan kadang melupakan visi yang mempertimbangkan kesenjangan sosial dalam perencanaan infrastruktur biru dan hijau (Calderón-Argelich et al., 2023). Beberapa penelitian memperlihatkan adanya kecenderungan ruang yang bersifat *"exclusive and under control"* terhadap penyediaan ruang terbuka hijau. Sehingga menimbulkan kekhawatiran mengenai keadilan dan persamaan hak dalam mengakses ruang terbuka hijau terutama untuk menunjang poin sebagai layanan kesehatan, sosial, dan psikologis masyarakat (Zahoor et al., 2023).

Ruang terbuka hijau kawasan perkotaan yang inklusif menjadi salah satu poin dalam tujuan *Sustainable Development Goals* yang menyebutkan adanya keinginan untuk membangun kota yang inklusif, aman, tangguh, dan berkelanjutan. Ruang terbuka hijau yang inklusif artinya penyediaannya harus berfokus pada aksesibilitas dan kualitasnya (Dobson & Harris, 2019). Aksesibilitas di sini dimaksudkan sebagai pencapaian ruang terbuka hijau dalam penyediaan media interaksi antar semua golongan kelompok sosial, etnis, dan usia yang berbeda, sehingga dapat menciptakan keseimbangan peran sosial dalam hal ruang terbuka hijau (Barreira et al., 2023). Sedangkan penilaian kualitas ruang terbuka hijau dapat dilihat dari penyediaan fasilitas di dalamnya. Peningkatan fasilitas di ruang terbuka hijau juga akan berdampak pada semakin besarnya interaksi yang dapat dihadirkan (Semakin baik fasilitas yang tersedia, maka semakin besar interaksi yang bisa dihadirkan di sana (Dollah et al., 2023).

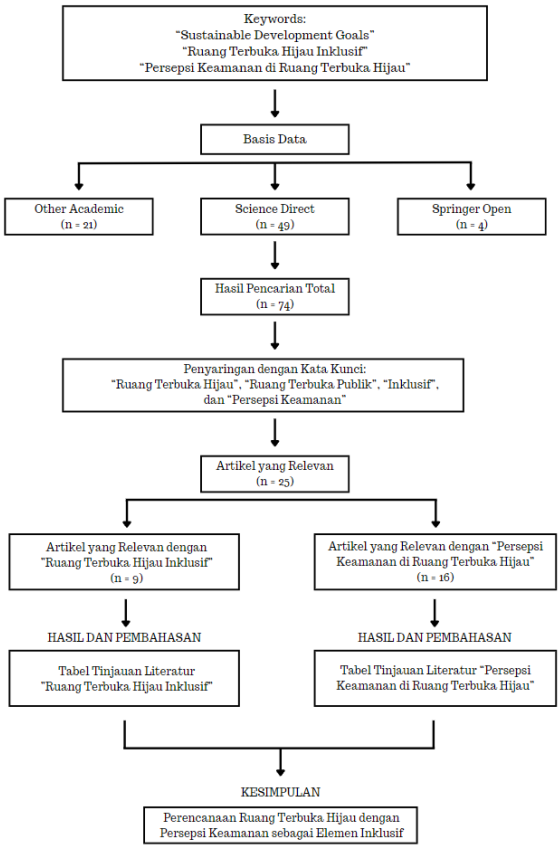
Selain hambatan pada proses perencanaannya, penyediaan ruang terbuka hijau sebagai ruang publik yang inklusif juga dihambat oleh adanya ketakutan terhadap kejahatan yang dapat membatasi penggunaan ruang terbuka hijau. Oleh karena itu dibutuhkan pengaturan ruang terbuka hijau yang dapat meningkatkan persepsi keamanan penggunanya (Evensen et al., 2021). Poin keamanan merupakan nilai penting untuk mengakses ruang terbuka hijau. Ketika suatu ruang terbuka hijau dianggap tidak aman, maka akan berpotensi mengurangi minat masyarakat untuk mengaksesnya. Meningkatkan kemanan ruang terbuka hijau dapat menghasilkan perbaikan yang siginifikan dalam hal keadilan mengakses ruang terbuka hijau (Williams et al., 2020). Memasukan preferensi pengguna ruang terbuka hijau ke dalam proses perencanaannya dapat meningkatkan poin kemanan ruang terbuka hijau tersebut. Mempertimbangkan permintaan pengguna juga dapat meningkatkan kualitas ruang terbuka hijau karena hal ini akan memengaruhi kesesuaian desainnya (Campagnaro et al., 2020).

Jika penyediaan ruang terbuka hijau harus bersifat inklusif atau dapat diakses oleh semua lapisan masyarakat, bagaimana dengan penjaminan rasa aman dan nyaman bagi para penggunanya? *Filter* seperti apa yang harus diterapkan untuk tetap menghadirkan rasa aman dan nyaman di dalam ruang publik yang inklusif? Penulisan makalah ini bertujuan untuk menelaah kembali konsep inklusivitas di ruang terbuka hijau, terutama kawasan taman kota yang berada di pusat wilayah kota. Kemudian mengaitkannya dengan aspek keamanan dan kenyamanan di ruang publik. Pembahasan dalam makalah ini akan ditinjau dengan tinjauan sistematis literatur menggunakan kata kunci-kata kunci yang berkaitan dengan topik di atas.

METODE PENELITIAN

Metode yang digunakan dalam penulisan makalah ini adalah tinjauan literatur mengenai perencanaan ruang terbuka hijau dengan persepsi keamanan sebagai elemen inklusif. Metode tinjauan literatur digunakan dalam banyak bidang ilmu karena dianggap dapat melestarikan dan mengembangkan ilmu pengetahuan, teramasuk penelitian (Schryen & Sperling, 2023). Tinjauan literatur dipahami sebagai proses pengumpulan informasi dari hasil-hasil

penelitian sebelumnya yang berhubungan dengan topik penelitian. Hasil-hasil penelitian sebelumnya akan dijadikan bahan perbandingan dan dijabarkan menjadi hasil penelitian berdasarkan tujuan yang ingin dicapai. Penelitian ini menggunakan metode tinjauan literatur dengan cara mengumpulkan hasil-hasil penelitian sebelumnya yang relevan menggunakan kata kunci *Sustainable Development Goals,* ruang terbuka hijau inklusif, dan persepsi keamanan di ruang terbuka hijau. Kemudian, dari banyaknya makalah penelitian yang muncul berdasarkan kata kunci di atas dipilah berdasarkan bacaan abstraknya dan memunculkan bahan kompilasi tinjauan literatur yang lebih terfokus dengan topik. Selanjutnya dari 74 jurnal, penulis membaca keseluruhan tiap-tiap jurnal untuk menemukan jurnal mana yang berisi kerangka informasi yang paling relevan dengan tujuan topik penelitian. Lalu didapatkan 25 jurnal yang akan dikompilasi dan dianalisis untuk menjawab pertanyaan penelitian.



Gambar 1. Diagram Tinjauan Literatur
Sumber: Indah Rahmahdini et al., 2023.

HASIL DAN PEMBAHASAN

Bagian ini akan membahas hasil-hasil tinjauan literatur dari 25 literatur terpilih. Bagian ini akan membahas komparasi temuan dari berbagai literatur yang dipilih kemudian menyimpulkannya menjadi satu pembahasan yang utuh. Pembahasan hasil kajian literatur akan dibagi menjadi dua poin yaitu, kajian mengenai ruang terbuka hijau yang inklusif dan persepsi keamanan di ruang terbuka hijau.

Ruang Terbuka Hijau yang Inklusif

Tabel 1. Tabel Tinjauan Literatur Ruang Terbuka Hijau yang Inklusif

No	Sumber	Temuan
1	Gupta, J., & Vegelin, C. (2016). Sustainable development goals and inclusive development. *International Environmental Agreements: Politics, Law and Economics*, *16*(3), 433–448. https://doi.org/10.1007/s10784-016-9323-z (Gupta & Vegelin, 2016).	Pembangunan inklusi ditujukan untuk alasan moral, hukum, ekonomi, sosial, keamanan, dan lingkungan hidup. Pembangunan inklusi ditekankan pada peningkatan akses terhadap produk pembangunan, peningkatan kapasitas, dan partisipasi politik. Karena pembangunan berkelanjutan dengan tujuan inklusivitas biasanya hanya berbicara tentang hak kaum marjinal, peningkatan hak-hak perempuan, dan kesenjangan, namun tujuan pembangunan berkelanjutan tidak membahas lebih lanjut mengenai instrumen kebijakan yang dapat mengatasi hal tersebut.
2	Il'alamien, K., & Kameswara, B. (2020). Inklusivitas Ruang Publik Berdasarkan Persepsi Pengunjung (Studi Kasus: Lapangan Gasibu, Taman Lansia, dan Jalur Pedestrian Jl. Ir. H. Djuanda). *Ftsp*. https://eproceeding.itenas.ac.id/index.php/ftsp/article/view/376 (Il'alamien & Kameswara, 2020).	Ruang kota yang bersifat publik dan inklusif harus memiliki empat kategori aksesibilitas yaitu akses fisik, akses sosial, akses untuk bisa aktif dan berdiskusi, dan akses terhadap informasi. Inklusivitas berkaitan dengan kesetaraan dalam mengakses fasilitas publik untukk semua kategori pengguna, baik laki-laki mau pun perempuan, tua mau pun muda, serta penyandang disabilitas mau pun bukan. Selain itu,

		ketersediaan fasilitas dan sistem penerangan sangat memengaruhi tingkat keamanan dan inklusivitas ruang publik.
3	Dollah, A. S., Nirwana, Mustafa, M., & Januarti Putri, A. M. (2023). The social performance of the Green Open Space (GOS) in Karebosi Field Complex. *Social Sciences and Humanities Open*, *8*(1), 100540. https://doi.org/10.1016/j.ssaho.2023.100540 (Dollah et al., 2023).	Di dalam penelitian ini dijelaskan hubungan antara perencanaan dan pengelolaan ruang terbuka hijau perkotaan dengan peningkatakan aksesnya oleh masyarakat, dimana semakin baik ruang terbuka hijau perkotaan maka semakin banyak orang yang akan menghabiskan waktunya berkumpul di ruang terbuka hijau.
4	Calderón-Argelich, A., Anguelovski, I., Connolly, J. J. T., & Baró, F. (2023). Greening plans as (re)presentation of the city: Toward an inclusive and gender-sensitive approach to urban greenspaces. *Urban Forestry and Urban Greening*, *86*. https://doi.org/10.1016/j.ufug.2023.127984 (Calderón-Argelich et al., 2023).	Dalam proses perancangan kota, terutama ruang hijau perkotaan, ada banyak sekali kesenjangan yang terjadi. Kesenjangan ini terjadi kepada golongan marjinal dan grup sosial yang rentan. Selain itu, kesenjangan yang sering terjadi adalah feminisme tentang bagaimana kecenderungan wanita atau perempuan mengakses ruang terbuka hijau.
5	Hardiansah, E. (2015). Pengantar Edisi Khusus 55 Tahun Pendidikan Planologi: Pembangunan Kota Inklusif di Era Desentralisasi. *Jurnal Perencanaan Wilayah Dan Kota*, *26*(1), 1–6. https://doi.org/10.5614/jpwk.2015.26.1.1 (Hardiansah, 2015).	Terjadi perubahan paradigma pembangunan ke arah yang lebih inklusif. pendekatan inklusif dijadikan reaksi sebagai dampak dari pertumbuhan penduduk dan kepedulian terhadap kelompok marjinal. Topik mengenai pentingnya pembangunan inklusi muncul karena kesadaran bahwa manfaat infrastruktur perkotaan tidak bisa dinikmati oleh semua orang.
6	Ntakana, K., Mbanga, S., Botha, B., & Ariyan, L. (2023). Inclusive urban space production model for sustainable development in South Africa. *Heliyon*, *9*(6), e16391. https://doi.org/10.1016/j.heliyon.2023.e16391 (Ntakana et al., 2023).	Penelitian ini membahas mengenai fenomena ekslusi yang menjadi ciri khas perkotaan di Afrika Selatan. Ekslusi menjadi *visual* permanen yang membatasi ruang gerak dan membuat kesenjangan antar masyarakat. Penelitian ini dibuat untuk melihat bagaimana partisipasi semua pihak sangat penting untuk meningkatkan produksi ruang kota yang inklusif keberlanjutan. Partisipasi dari berbagai pihak sangat berperan dalam peningkatan ruang kota yang inklusif. Faktor-faktor yang berperan dalam pembangunan inklusif: • Pemerintah • Sektor privat • Persepsi pengguna • Karakteristik pengembangan kota • Pemberdayaan pembangunan ekslusif • Strategi pembangunan perkotaan • Kriteria berkelanjutan Hasil penelitian menunjukan bahwa pembangunan inklusif tidak mutlak mengartikan keberlanjutan, tetapi sebuah kota tidak dapat dikatakan *sustain* jika tidak inklusif.
7	Dobbs, C., Vásquez, A., Alegría, V., & Cifuentes-Ibarra, M. (2023). Assessing multiple dimensions of distributional justice: Access, biodiversity and landscape structure of green spaces for multiple social groups of the Metropolitan Region of Santiago de Chile. *Urban Forestry and Urban Greening*, *84*(December 2022). https://doi.org/10.1016/j.ufug.2023.127948 (Dobbs et al., 2023)	Isu global mengenai ruang terbuka hijau adalah bahwa ruang terbuka hijau belum tersedia untuk semua kalangan. Padahal ruang terbuka hijau adalah elemen penunjuk nilai kesejahteraan dan kesehatan masyarakat, sehingga penyediaannya harus berfokus pada aksesibilitas dan kualitasnya.
8	De Haas, W., Hassink, J., & Stuiver, M. (2021). The Role of Urban Green Space in Promoting Inclusion: Experiences From the Netherlands. *Frontiers in Environmental Science*, *9*(July), 1–11.	Terdapat peran RTH dalam pengeksludan sosial dan peran strategi penghijauan kota dalam meningkatkan keadilan sosial bagi kelompok tertentu yang dikecualikan, seperti orang tua dengan demensia, orang dengan mental issue, dan

	https://doi.org/10.3389/fenvs.2021.618198 (De Haas et al., 2021)	lingkungan yang miskin. Hasi penelitian mengidentifikasi 4 wacana yang memungkinkan straetgi dan pengukuran inklusi dalam mengakses ruang terbuka hijau. Kesuksesan promosi inklusi dalam hal ini diambil dari identifikasi hal-hal yang membuat ruang terbuka hijau ekslusi ditambah dengan pengaruh inisiatif *private actors dan public action.*
9	Dobson, J., & Harris, C. (2019). *Space to thrive A rapid evidence review of the benefits of parks and green spaces for people and communities Space to thrive-A rapid evidence review 1*. (Dobson & Harris, 2019)	Tulisan ini merangkum tinjauan singkat mengenai manfaat kesehatan, kesejahteraan, dan sosial dari ruang terbuka hijau. Tulisan ini menyoroti adanya risiko ekslusi terhadap akses RTH karena pendominasian RTH oleh kelompok tertentu atau perasaan tidak aman saat mengakses RTH. Sehingga, dalam tulisan ini dimunculkan *evidence gaps* kesenjangan akses ruang terbuka hijau serta prinsip-prinsip dalam merencanakn RTH yang inklusif.

Ruang terbuka hijau publik adalah ruang publik kota yang memberi manfaat kesehatan, kesejahteraan, dan media interaksi penduduk perkotaan (De Haas et al., 2021). Ruang terbuka hijau merupakan salah satu elemen kota berkelanjutan. Studi mengenai hubungan antara ruang terbuka hijau dan kota telah banyak dikaji dan dikembangkan karena berpengaruh terhadap kepuasan masyarakat. Ruang terbuka hijau memiliki berbagai fungsi, yaitu memberi peran dalam ekosistem perkotaan, fungsi ekonomis, dan memberi kinerja sosial bagi masyarakat (Dollah et al., 2023). Ruang terbuka hijau sebagai ruang publik kota merupakan ruang interaksi untuk semua masyarakat secara terbuka dan tanpa pembatasan. Tujuan ruang terbuka hijau sebagai ruang publik yang terbuka membuat ruang terbuka hijau secara alamiah harus bersifat inklusif (Il'alamien & Kameswara, 2020). Maka, ruang, terutama ruang publik adalah saluran interaksi sosial dan budaya dan harus bersifat inklusif atau tersedia untuk semua orang.

Ruang perkotaan yang inklusif merujuk pada ruang perkotaan yang sifatnya publik. Ruang publik diartikan sebagai ruang yang disediakan untuk kepentingan umum dan dapat diakses secara gratis oleh semua masyarakat (Bambó Naya et al., 2023). Inklusi adalah kebalikan dari ekslusi, dimana keduanya ini diangkat dari sesuatu "yang pada umumnya ada" di masyarakat. Secara umum, ekslusi dalam hal ini adalah pembatasan kesempatan untuk berpartisipasi dalam aktivitas masyarakat pada umumnya. Sedangkan inklusi adalah proses untuk meningkatkan kemampuan partisipasi semua kalangan masyarakat dalam mengakses sumber daya yang disediakan dalam kota (De Haas et al., 2021). Cara yang bisa dilakukan untuk membangun kota yang inklusif adalah dengan menghilangkan faktor ekslusinya. Dibutuhkan kerja sama antara pihak pemerintah, sektor privat, dan persepsi pengguna untuk mengidentifikasi faktor pendorong ekslusi yang menghasilkan hambatan pembangunan inklusi sebagai kriteria keberlanjutan kota. Keseluruhan proses ini dapat membantu mempromosikan pembangunan inklusif (Ntakana et al., 2023).

Namun, pada saat ini masih terjadi pengeksludan dalam mengakses ruang terbuka hijau. Semakin banyak bukti yang menemukan bahwa manfaat ruang terbuka hijau di perkotaan belum bisa dirasakan oleh semua orang (ekslusi). Pembangunan kota di masa sekarang bukan bukan tentang kurangnya sumber daya, tetapi faktor pesebarannya yang lemah (Gupta & Vegelin, 2016). Distribusi ruang hijau perkotaan yang merata penting dalam menjaga dimensi keadilan sosial di lingkungan perkotaan (Enssle & Kabisch, 2020). Pembangunan ruang terbuka hijau di perkotaan selain dibuat untuk memberi manfaat lingkungan, tetapi juga untuk memperkuat tatanan sosial di perkotaan. Fungsi untuk memperkuat tananan sosial perkotaan diimplementasikan dengan pemberian kesempatan seluas-luasnya kepada masyarakat untuk berpartisipasi dalam kegiatan di ruang publik kota (Dollah et al., 2023).

Ruang terbuka hijau perkotaan dibuat untuk mendukung interaksi antar berbagai kelompok sosial masyarakat dan menjaga ikatan sosial di antara mereka. Penelitian sebelumnya menunjukan ada banyak sekali faktor yang memengaruhi

inklusivitas dalam mengakses ruang terbuka hijau antara lain hubungan penggunaan ruang terbuka hijau dengan unsur keragaman demografi kota (densitas populasi, umur, jenis kelamin, komposisi etnik, dan lain-lain), fitur fisik, dan karakteristik komunitas (de la Barrera et al., 2016). Ada banyak faktor yang memengaruhi ruang terbuka hijau menjadi tidak inklusif. Menurut Martinez & Madureira, n.d., faktor-faktor yang memengaruhi inklusivitas di ruang terbuka hijau adalah kualitas dari fasilitas yang tersedia, rasa aman, aksesiblitas, dan kenyamanan saat menggunakan ruang terbuka hijau. Struktur fisik ruang hijau dan fasilitas di dalamnya yang memengaruhi penggunaan ruang terbuka hijau. ketersediaan fasilitas bagi penyandang disabilitas, kualitas dan pemeliharaan pencahayaan, dan variasi infrastruktur lainnya menjadi kebutuhan spesifik yang perlu diadakan di ruang terbuka hijau (de la Barrera et al., 2016). Peningkatan kualitas fasilitas ruang terbuka hijau juga dapat membantu meningkatkan kinerja sosialnya (Dollah et al., 2023). Kualitas dan penataan ruang terbuka hijau akan memengaruhi persepsi keamanan pengguna saat mengakses ruang terbuka hijau. Rasa takut terhadap kejahatan di ruang publik mencegah sebagian orang untuk menggunakan ruang terbuka hijau publik (Evensen et al., 2021).

Persepsi Keamanan di Ruang Terbuka Hijau

Tabel 2. Tabel Tinjauan Literatur Persepsi Keamanan di Ruang Terbuka Hijau

No	Sumber	Temuan
1	De la Barrera, F., Reyes-Paecke, S., Harris, J., Bascuñán, D., & Farías, J. M. (2016). People's perception influences on the use of green spaces in socio-economically differentiated neighborhoods. *Urban Forestry and Urban Greening*, *20*, 254–264. https://doi.org/10.1016/j.ufug.2016.09.007 (de la Barrera et al., 2016)	Kualitas fisik ruang hijau seperti pemeliharaan, pencahayaan, keragaman infrastruktur, dan ketersediaan fasilitas bagi penyandang disabilitas yang menjadi faktor pertimbangan seberapa tingkat ruang terbuka hijau akan diakses oleh banyak orang. Selain itu, persepsi terhadap ruang terbuka hijau yang tidak aman juga menjadi pertimbangan masyarakat lebih memilih ruang hijau privat dibanding ruang hijau publik.
2	Agency, E. E. (2022). Who benefits from nature in cities? Social inequalities in access to urban green and blue Key messages: *European Environment Agency*. https://www.eea.europa.eu/publications/who-benefits-from-nature-in/who-benefits-from-nature-in (Agency, 2022)	Kerentanan dalam mengakses ruang hijau dan biru ini dipengaruhi oleh persepsi keamanan yang dipengaruhi oleh kualitas pemeliharaan fasilitas dan intensitas interaksi antar pengguna ruang hijau dan biru. Partisipasi kelompok rentan dalam perencanaan ruang hijau juga dapat menunjang kehidupan sosial mereka lebih inklusi, memastikan bahwa kebutuhan spesifik dipertimbangkan, dan menumbuhkan kepercayaan mereka terhadap ruang hijau dan hiru perkotaan.
3	Mahrous, A. M., Moustafa, Y. M., & Abou El-Ela, M. A. (2018). Physical characteristics and perceived security in urban parks: Investigation in the Egyptian context. *Ain Shams Engineering Journal*, *9*(4), 3055–3066. https://doi.org/10.1016/j.asej.2018.07.003 (Mahrous et al., 2018)	Hubungan antara persepsi keamanan dan karakter fisik dapat mendorong lebih banyak orang mengunjungi ruang hijau perkotaan, sehingga dapat memberikan panduan dan referensi bagi perancang dan pengelola kota. Tujuan lainnya dari penelitian ini adalah untuk melihat karakter fisik manakah yang mempunyai kekuatan pendorong untuk persepsi keamanan dan bagaimana cara memanipulasi karakter fisik ruang hijau perkotaan untuk meningkatkan persepsi keamanan. Persepsi keamanan dalam penelitian ini digambarkan sebagai perasaan bebas dari kejahatan. Penelitian ini menganalisa beberapa faktor mengenai ancaman keamanan di ruang terbuka hijau dan memberikan cara untuk mengurangi faktor ancaman tersebut.
4	Iqbal, A. (2021). Inclusive, Safe and Resilient Public Spaces: Gateway to Sustainable Cities? *Intech*, (Urban Transition-Perspectives on Urban Systems and Environments), 18. https://www.intechopen.com/books/ad	Ruang publik kota terhubung dan dipengaruhi oleh kejahatan dan ketakutan kejahatan. Dalam agenda 2030 untuk pembangunan berkelanjutan, semua orang diharapkan mempunyai akses terhadap ruang terbuka hijau yang aman. Namun, sayangnya tidak semua ruang terbuka hijau dan ruang publik dianggap aman. Menjadikan

	vanced-biometric-technologies/liveness-detection-in-biometrics (Iqbal, 2021)	lingkungan perkotaan aman merupakan salah tujuan pembangunan berkelanjutan (poin 11). Rasa takut terhadap kejahatan dianggap sebagai masalah sosial yang lumrah terjadi di perkotaan. Sehingga, keadilan akses ruang publik tanpa rasa takut dapat diminalisir dengan desain tata letak dan struktur fisik pada ruang publik. Hal ini dapat berpengaruh terhadap persepsi keselamatan di ruang publik.
5	Kusuma, Y., Aryanti, T., & Megayanti, T. (2023). Mewujudkan Livable City: Persepsi Tentang Ruang Terbuka yang Aman dan Tidak Aman di Kota Bandung. *Review of Urbanism and Architectural Studies*, *21*(1), 32–42. https://doi.org/10.21776/ub.ruas.2023.021.01.4 (Kusuma et al., 2023)	Rasa tidak aman dan terancam dianggap sebagai penurunan kualitas hidup perkotaan. Persepsi mengenai tempat yang aman adalah tempat yang memiliki tata guna dan fungsi yang jelas serta memiliki fasilitas lengkap dan pelayanan yang nyaman. Faktor lokasi yang memiliki tingkat visibilitas tinggi juga memengaruhi perasaan aman para pengguna. Dalam penelitian ini dapat disimpulkan prinsip-prinsip dan karakteristik seperti apa yang harus dimiliki ruang terbuka agar bisa dianggap aman.
6	Bambó Naya, R., de la Cal Nicolás, P., Díez Medina, C., Ezquerra, I., García-Pérez, S., & Monclús, J. (2023). Quality of public space and sustainable development goals: analysis of nine urban projects in Spanish cities. *Frontiers of Architectural Research*, *12*(3), 477–495. https://doi.org/10.1016/j.foar.2023.01.002 (Bambó Naya et al., 2023)	Tujuan utama dari penelitian ini adalah untuk mengusulkan sebuah metodologi yang membantu mengevaluasi kualitas ruang publik seperti *green coridor* dan *city parks* kemudian menentukan hubungannya dengan kondisi keselamatan, aksesibilitas, dan inklusivitas yang ditawarkannya. Tulisan ini berfokus pada tujuan pembangunan berkelanjutan dimana PBB pada tahun 2015 mengeluarkan 17 poin sasaran pembangunan berkelanjutan, salah satunya "menyediakan akses universal terhadap ruang publik yang aman, inklusif, hijau dan khususnya bagi perempuan dan anak-anak, orang lanjut usia, dan orang-orang penyandang disabilitas". Dalam penelitian ini dapat ditemukan bahwa merubah kondisi ruang publik menjadi lebih aman dan lebih memadai untuk digunakan akan menghasilkan inklusivitas.
7	Malek, N. A., Mariapan, M., & Rahman, N. I. A. A. (2015). Community Participation in Quality Assessment for Green Open Spaces in Malaysia. *Procedia - Social and Behavioral Sciences*, *168*, 219–228. https://doi.org/10.1016/j.sbspro.2014.10.227 (Malek et al., 2015)	Penelitian ini memvalidasi skala pola penggunaan ruang terbuka hijau di Malaysia dengan mengambil sampel dari 414 pengguna taman sehari-hari dianalisis menggunakan Analisis Faktor Konfirmatori (CFA) untuk memvalidasi instrumen. Hasil penelitian ini mengindikasikan bahwa terdapat hibungan antara kualitas ruang terbuka hijau dengan pola penggunaan dan kepuasan penggunanya. Hasil penelitian ini juga sejalan dengan penelitian Wrigley's sebelumnya yang menyoroti penyediaan berbagai fasilitas di ruang terbuka hijau untuk berbagai jenis kelompok pengguna dan peningkatan keamanan akan meningkatkan penggunaannya.
8	Evensen, K. H., Hemsett, G., & Nordh, H. (2021). Developing a place-sensitive tool for park-safety management experiences from green-space managers and female park users in Oslo. *Urban Forestry and Urban Greening*, *60*(February), 127057. https://doi.org/10.1016/j.ufug.2021.127057 (Evensen et al., 2021)	Penelitian ini menyoroti tentang bagaimana rasa takut akan kejahatan dapat menjadi faktor pembatas penggunaan ruang terbuka hijau yang dapat menurunkan potensi pemanfaatan ruangnya oleh masyarakat. Namun, proses perencanaan ruang terbuka hijau di negara-negara Nordik masih jauh dari pengetahuan dan praktik dalam menilai persepsi pengguna dalam meningkatkan keamanan. Oleh karena itu dibutuhkan penggunaan teknologi dapat membantu pengawasan di ruang terbuka hijau. Penelitian ini dibuat untuk mengembangkan alat bernama SAFE untuk pengguna dan pengelola taman.
9	Luo, P., Miao, Y., & Zhao, J. (2021). Effects of auditory-visual combinations on students' perceived safety of urban green spaces during the evening.	Tujuan dari penelitian ini adalah untuk lebih memahami interaksi pendengaran-visual yang dapat menimbulkan efek perasaan aman. Latar belakang penelitian ini adalah tentang Persepsi keamanan yang menjadi faktor penting dan

	Urban Forestry and Urban Greening, *58*(June 2020), 126904. https://doi.org/10.1016/j.ufug.2020.126904 (Luo et al., 2021)	penentu daya tarik suatu tempat terutama ruang hijau perkotaan. Hasil penelitian menemukan bahwa ruang terbuka hijau memiliki persepsi keamanan yang rendah pada malam hari, sehingga membuat orang enggan mengunjungi lokasi tersebut. Literatur ini menyebutkan bahwa *soundscape* (efek suara) dapat menyampaikan rasa aman pada suatu tempat. hal ini dapat memberikan panduan berharga untuk meningkatkan persepsi keamanan ruang hijau perkotaan dengan memanfaatkan efek suara seperti suara air, burung, dan musik tradisional.
10	Pérez-Tejera, F., Anguera, M. T., Guàrdia-Olmos, J., Dalmau-Bueno, A., & Valera, S. (2022). Examining perceived safety and park use in public open spaces: The case of Barcelona. *Journal of Environmental Psychology*, *81*(September 2021). https://doi.org/10.1016/j.jenvp.2022.101823 (Pérez-Tejera et al., 2022)	Tujuan penelitian ini untuk mengukur persepsi keamanan di taman kota dengan variabel sosiodemografi, data kejahatan, dan indikator keselamatan kota. Penelitian ini meninjau persepsi keamanan dari enam ruang terbuka publik berdasarkan skor kuesioner. Peninjauan ini diharapkan dapat menghilangkan pemanfaatan ruang terbuka publik yang ekslusi. Penelitian ini menyimpulkan bahwa mempromosikan kembali ruang terbuka publik dan penggunaan taman kepada berbagai kelompok masyarakat terutama perempuan, orang tua, remaja, penyandang disabilitas dapat membantu meningkatkan persepsi keamanannya.
11	Campagnaro, T., Vecchiato, D., Arnberger, A., Celegato, R., Da Re, R., Rizzetto, R., Semenzato, P., Sitzia, T., Tempesta, T., & Cattaneo, D. (2020). General, stress relief and perceived safety preferences for green spaces in the historic city of Padua (Italy). *Urban Forestry and Urban Greening*, *52*(April), 126695. https://doi.org/10.1016/j.ufug.2020.126695 (Campagnaro et al., 2020)	Studi ini menyoroti persepsi umum tentang menghilangkan stres dan keselamatan preferensi responden yang terkait bergantung pada karakteristik lokasi yang berbeda. Persepsi mengenai rasa aman dan penghilang stres terikat dengan karakteristik lokasi yang berbeda. Penelitian ini dapat memberi masukan untuk kota dengan pengembangan berbasis historic dapat menggunakan vegetasi khas dan memasukan elemen-elemen sejarah kota di dalam ruang terbuka hijaunya untuk meningkatkan persepsi keselamatan dan penghilang stres.
12	Williams, T. G., Logan, T. M., Zuo, C. T., Liberman, K. D., & Guikema, S. D. (2020). Parks and safety: a comparative study of green space access and inequity in five US cities. *Landscape and Urban Planning*, *201*(March 2019), 103841. https://doi.org/10.1016/j.landurbplan.2020.103841 (Williams et al., 2020)	Terdapat indikasi ketidakadilan dalam mengakses ruang hijau publik yang diukur menggunakan tiga indikator: kedekatan, luas areal yang tertimbang kemacetan, dan kedekatan dengan kendala kejahatan. Keamanan merupakan poin penting dalam mengakses ruang terbuka hijau. Penelitian ini menyimpulkan bahwa upaya untuk meningkatkan keamanan di ruang terbuka hijau akan menghasilkan dampak peningkatan akses terhadap ruang terbuka hijau.
13	Lis, A., & Iwankowski, P. (2021). Where do we want to see other people while relaxing in a city park? Visual relationships with park users and their impact on preferences, safety and privacy. *Journal of Environmental Psychology*, *73*(June 2020). https://doi.org/10.1016/j.jenvp.2020.101532 (Lis & Iwankowski, 2021)	Preferensi pengguna taman dipengaruhi oleh seberapa jauh jarak orang lain dari kami (jarak) dan sejauh mana mereka terlihat (obstruksi). Hasil penelitian ini menunjukan bahwa orang-orang akan merasa aman apabila semakin banyak orang yang dilihat dan berada di sekitar mereka. Persepsi dari para pengguna menginginkan ruang publik yang inklusif namun tetap menciptakan batasan-batasan yang jelas. Sehingga, ruang publik yang inklusif dan dapat diakses oleh semua orang dapat terasa tetap aman dengan adanya batasan tak kasat mata yang didesain.
14	Machielse June, W., & Jansson, U. (2015). *Perceived safety in public spaces A quantitative investigation of the spatial and social*	Penelitian ini menyoroti bagaimana efek dari karakteristik ruang publik yang merujuk pada *"open space"* dapat memengaruhi persepsi keamanan bagi penggunanya. Karakteristik ruang publik di sini digambarkan sebagai filter

	influences on safety perception among young adults in Stockholm. www.humangeo.su.se2 (Machielse June & Jansson, 2015)	yang akan memengaruhi individu untuk merasa aman atau tidak. Dari hasil survey yang dilakukan dengan mempertanyakan "Dalam hal apa persepsi keselamatan mempengaruhi penggunaan masyarakat ruang oleh orang dewasa muda?", didapatkan kesimpulan bahwa faktor lingkungan fisik maupun non fisik yang membentuk ruang terbuka hijau sangat memngaruhi penggunaannya dan intensitas aksesnya.
15	Zhao, J., & Huang, Y. (2021). Physical Characteristics of Urban Green Spaces in Relation to Perceived Safety. *Journal of Urban Planning and Development*, *147*(4). https://doi.org/10.1061/(ASCE)UP.1943-5444.0000742 (Zhao & Huang, 2021)	Untuk melihat hubungan antara karakter fisik dan perasaan aman, peneliti mengambil sample dari 30 tempat yang merepresentasikan keberagaman urban green space di Xouzhou dengan melibatkan 717 partisipan menggunakan metode snowballs. Untuk meningkatkan persepsi keamanan dan mendorong lebih banyak orang untuk mengunjungi ruang hijau perkotaan, penelitian ini berupaya untuk membangun model kuantitatif yang menggambarkan hubungan antara persepsi keselamatan dan karakteristik fisik, sehingga dapat menjadi acuan dalam perencanaan ruang perkotaan. Hasil dari penelitian ini adalah acuan desain karakter fisik seperti apa yang dapat meningkatkan keamanan di ruang terbuka hijau.
16	Martinez, J. A., & Madureira, M. (n.d.). *Characteristics of urban green space (UGS) to promote the diversity of users in a compact urban development*. (Martinez & Madureira, n.d.)	Penelitian ini bertujuan untuk mengidentifikasi karakteristik ruang hijau perkotaan untuk jenis perkotaan yang kompak dan lingkungan sekitarnya yang mengedepankan keberagaman pengguna. Metode yang digunakan adalah mengobservasi dua taman di Amsterdam dengan karakteristik pengguna dan lingkungan yang berbeda. Temuan penelitian ini mengindikasikan pengguna ruang terbuka hijau yang berasal dari beragam kelompok sosial dan umur. Mereka mengakses ruang terbuka hijau dengan alasan menikmati susana hidup dan keamanan dari kehadiran orang-orang di sekitar mereka. Dalam tulisan ini juga dijelaskan bagaimana hubungan perasaan aman dan inklusivitas serta fakto-faktor yang membentuk inklusivtas di ruang terbuka hijau.

Dalam tujuan pembangunan berkelanjutan, membuat perencanaan ruang-ruang kota yang aman akan meningkatkan tingkat kelayakan hidup di perkotaan dan membuat masyarakat bebas dari rasa takut saat mengakses ruang publik kotanya (Kusuma et al., 2023). Membuat ruang-ruang kota yang aman berarti memastikan akses terhadap ruang publik yang aman dan terjangkau bagi semua orang. Perubahan perkembangan kota membuat ketahan kota dalam menyediakan ruang-ruang kota yang aman menjadi semakin sulit diwujudkan. Rasa takut untuk mengakses ruang publik perkotaan adalah salah satu degradasi kualitas hidup di perkotaan. Faktor keamanan saat mengakses ruang publik perkotaan tidak hanya berkaitan dengan kejahatan yang sebenarnya, namun lebih berkaitan dengan kerentanan dan subjektivitas dalam merasakan perasaan tidak aman (Iqbal, 2021). Perasaan aman mengacu pada persepsi atau emosi yang dihasilkan dari faktor risiko ancaman terhadap keamanan atau keselamatan. Rasa takut atau kecemasan terhadap ancaman kejahatan dianggap sebagai masalah yang lebih besar dari kejahatan itu sendiri. Hal ini dapat berpengaruh terhadap perilaku masyarakat, seperti menghindari tempat atau fasilitas tertentu (Mahrous et al., 2018).

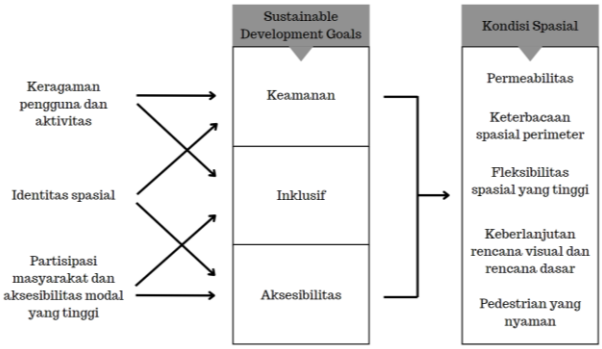
Menurut Luo et al. (2021), persepsi keamanan akan menentukan daya tarik suatu tempat. Rendahnya persepsi keamanan di ruang terbuka hijau perkotaan akan membuat orang enggan mengunjunginya. Masalah persepsi keamanan menjadi salah satu hambatan iklusivitas taman hijau yang mengurangi penggunaan manfaatnya. Hasil penelitian yang dilakukan oleh Pérez-Tejera et al. (2022) menunjukan bahwa bagi beberapa individu, persepsi keselamatan dapat menjadi faktor penghindaran terhadap ruang terbuka hijau publik.

Maka, diperlukan promosi terhadap keamanan bagi pengguna ruang terbuka hijau terutama bagi perempuan, orang tua, anak muda, anak-anak, dan penyandang disabilitas. Peningkatan fasilitas-fasilitas di ruang publik selain dapat meningkatkan kinerja sosialnya, tetapi juga dapat meningkatkan persepsi keamanan para penggunanya. Terutama peningkatan fasilitas-failitas fisik modan pengambilan keputusan desain ruang terbuka hijau berdasarkan persepsi pengguna akan meningkatkan rasa aman saat berada di ruang terbuka hijau (Martinez & Madureira, n.d.).

Sebuah kota dikatakan layak huni apabila masyarakatnya merasa aman tinggal di kota tersebut. Maka, pemahaman mengenai hubungan antara karakteristik fisik dan persepsi keamanan dapat menjadi kontribusi untuk meningkatkan daya kehidupan di perkotaan. Berdasarkan hasil penelitian Mahrous et al. (2018), ada beberapa faktor dalam ruang terbuka hijau yang berkaitan dengan persepsi keamanan, yaitu:

1. Pada siang hari pengguna ruang terbuka hijau lebih suka mengakses taman dengan vegetasi yang terawat, memiliki aksesibilitas yang baik, dan *visible.*
2. Sedangkan pada malam hari pengguna ruang terbuka hijau lebih suka mengakses taman dengan sumber penerangan yang baik. Persepsi keamanan pada malam hari meningkat apabila sumber penerangan di taman tersebut semakin terang dan taman lebih berwarna.
3. Persepsi keamanan saat mengakses ruang terbuka hijau juga biasanya berkaitan dengan jenis kelamin, yaitu perempuan merasa lebih khawatir mengakses ruang terbuka hijau dibandingkan laki-laki.

Menurut Bambó Naya et al. (2023), hubungan inklusivitas dan kondisi pemanfaatan ruang terbuka hijau dapat digambarkan sebagai berikut.



Gambar 2. Diagram Hubungan Inklusivitas dan Kondisi Pemanfaatan Ruang Terbuka Hijau
Sumber: Indah Rahmahdini et al., 2023

Masyarakat sangat menyayangkan adanya hambatan dalam persepsi keamanan di ruang terbuka hijau yang dapat mengurangi pemanfaatan ruang hijau yang dapat menjadi kontak antara manusia dengan alam serta menjadi media beraktivitas di luar ruangan. Persepsi keamanan ini biasanya berkaitan dengan faktor sosial-demografi seperti usia dan jenis kelamin, faktor atribut/fasilitas lingkungan, serta ancaman bahaya di malam hari (de la Barrera et al., 2016). Langkah-langkah yang dapat diterapkan untuk meningkatkan persepsi keamanan di ruang terbuka hijau publik menurut Mahrous et al. (2018) adalah:

1. Menghubungkan karakter fisik dan perasaan aman akan memberi arahan mendesain keamanan ruang terbuka hijau perkotaan.
2. Pemeliharaan vegetasi yang baik dan akses ruang hijau serta membuat ruang terbuka hijau permeabel dapat mengurangi risiko ancaman di ruang terbuka hijau.
3. Peningkatan sumber penerangan dapat meningkatkan persepsi keamanan ruang terbuka hijau di malam hari.

Menurunnya persepsi keamanan di ruang terbuka hijau berarti membatasi jumlah kunjungan penggunanya. Oleh karena itu, mendesain ruang terbuka hijau yang aman adalah salah satu usaha untuk membuat ruang terbuka hijau menjadi inklusif. Meningkatkan aksesibilitas pengguna ruang terbuka hijau membuat para pengguna merasa aman, karena berada dalam situasi ketika mereka melihat orang lain di area tersebut dalam meningkatkan perasaan aman (Lis & Iwankowski,

2021). Selain itu, mengadopsi preferensi pengguna dalam mendesain dan mengatur ruang terbuka hijau penting untuk mengetahui skenario keamanan seperti apa yang mereka inginkan. Persepsi mengenai keamanan dan kebutuhan ruang terbuka hijau bergantung pada reaksi pengguna dan lokasi (Campagnaro et al., 2020).

KESIMPULAN

Pembangunan kota ke arah yang lebih inklusif dibutuhkan untuk menuju pembangunan yang berlanjutan dan untuk memastikan akses ruang-ruang kota yang merata. Salah satu ruang vital perkotaan adalah ruang terbuka hijaunya. Sampai saat ini, pembangunan perkotaan di berbagai belahan dunia terus mengusahakan penyediaan akses ruang terbuka hijau untuk menunjang manfaat ekologi, sosial, dan ekonomi di wilayahnya. Penyediaan ruang terbuka hijau kawasan perkotaan harus bisa diakses oleh semua golongan atau sifatnya harus inklusif. Dalam poin ke 11 *Sustainable Development Goals* disebutkan "bahwa menyediakan akses universal terhadap ruang publik yang aman, inklusif, hijau dan khususnya bagi perempuan dan anak-anak, orang lanjut usia, dan orang-orang penyandang disabilitas". Jadi selain inklusif, ruang terbuka hijau perkotaan juga harus "aman" diakses terutama bagi mereka golongan rentan seperti perempuan, anak-anak, dan penyandang disabilitas.

Maka jika dilihat dari berbagai studi kasus dan penelitian sebelumnya, dapat disimpulkan bahwa inklusivitas dan persepsi rasa aman di ruang publik adalah dua sisi yang berikatan. Saat mendesain ruang terbuka hijau yang inklusif, maka secara tidak langsung juga menciptakan ruang publik yang aman. Pun ada banyak cara untuk mencapai kedua tujuan tersebut secara bersamaan, seperti pengambilan keputusan desain ruang yang kolaboratif dan peningkatan fasilitas. Semakin aman sebuah ruang terbuka hijau, maka semakin tinggi peluangnya untuk diakses lebih banyak orang. Semakin banyak orang yang mengakses ruang terbuka hijau, maka semakin tinggi persepsi kemanan ruangnya.

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