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

# MENUNJUKKAN KEBUTUHAN DAN KONTRIBUSI DARI RUANG HIJAU PERKOTAAN DI KOTA METROPOLITAN

**Aang Anggara**

1. Bekasi Spatial Planning Office, Jl. Ahmad Yani No. 1, Bekasi, 17141
2. School of Architecture, Planning, and Policy Development (SAPPD), Bandung Institute of Technology, Bandung, Indonesia

aang.distarubekasi@gmail.com

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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

$\alpha$ = Constanta

$\varepsilon$ = 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.

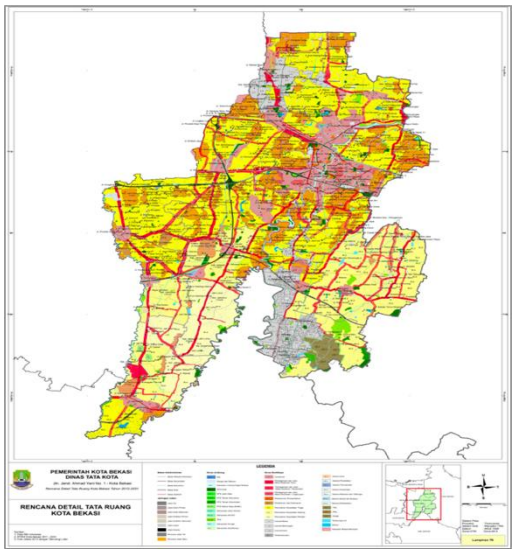


**Figure 1. Delineation of Study Area**

*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.

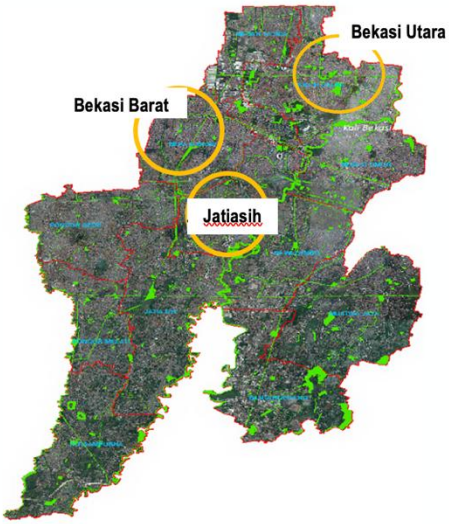


**Figure 3. Geographic Distribution of Urban Green Space**

*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.

## REFERENCE


BPS Kota Bekasi (2024) *Bekasi Municipality in Figures 2024*.

Calthorpe, P., & Fulton, W. (2001) *THE REGIONAL CITY : PLANNING FOR THE END OF SPRAWL*.

Cheshire, P. and Sheppard, S. (2002) 'The welfare economics of land use planning', *Journal of Urban Economics*, 52(2), pp. 242–269. Available at: https://doi.org/10.1016/S0094-1190(02)00003-7.

Graça, M. *et al.* (2022) 'Designing urban green spaces for climate adaptation: A critical review of research outputs', *Urban Climate*, 42(February). Available at: https://doi.org/10.1016/j.uclim.2022.101126.

Gujarati, D.N. (2003) *BASIC ECONOMETRICS*.

De Haas, W., Hassink, J. and Stuiver, M. (2021) 'The Role of Urban Green Space in Promoting Inclusion: Experiences From the Netherlands', *Frontiers in Environmental Science*, 9(July), pp. 1–11. Available at: https://doi.org/10.3389/fenvs.2021.618198.

Harlan, J. (2013) *Introduction to STATA*.

Iojă, C.I. *et al.* (2014) 'The potential of school green areas to improve urban green connectivity and multifunctionality', *Urban Forestry and Urban Greening*, 13(4), pp. 704–713. Available at: https://doi.org/10.1016/j.ufug.2014.07.002.

Kim Sangmoo (2015) *Public spaces - not a "nice to have" but a basic need for cities*, *World Bank Group*. Available at: https://blogs.worldbank.org/endpovertyinsouthasia/public-spaces-not-nice-have-basic-need-cities (Accessed: 20 November 2023).

Li, J., Dang, A. and Song, Y. (2022) 'Defining the ideal public space: A perspective from the publicness', *Journal of Urban Management*, 11(4), pp. 479–487. Available at: https://doi.org/10.1016/j.jum.2022.08.005.

Liu, W. *et al.* (2023) 'Spatiotemporal distribution and driving factors of regional green spaces during rapid urbanization in Nanjing metropolitan area, China', *Ecological Indicators*, 148(March). Available at: https://doi.org/10.1016/j.ecolind.2023.110058.

Lynch, A.J. (2021) 'The role and potential of residential open space in a suburban green space network', *Urban Forestry and Urban Greening*, 58(February 2020). Available at: https://doi.org/10.1016/j.ufug.2020.126971.

Ministry of Agrarian Affairs and Spatial Planning (2007) *Undang-Undang Nomor 26 Tahun 2007 tentang Penataan Ruang*. Indonesia: Ministry of Law and Human Right.

Nath, T.K., Zhe Han, S.S. and Lechner, A.M. (2018) 'Urban green space and well-being in Kuala Lumpur, Malaysia', *Urban Forestry and Urban Greening*, 36(February), pp. 34–41. Available at:

https://doi.org/10.1016/j.ufug.2018.09.013.

Richards, D.R., Passy, P. and Oh, R.R.Y. (2017) 'Impacts of population density and wealth on the quantity and structure of urban green space in tropical Southeast Asia', *Landscape and Urban Planning*, 157, pp. 553–560. Available at: https://doi.org/10.1016/j.landurbplan.2016.09.005.

Ridayati, R. (2018) 'Pengaruh Jumlah Penduduk Terhadap Penggunaan Lahan Ruang Terbuka Hijau Publik Kota Yogyakarta Menggunakan Regresi', *Kurvatek*, 2(1), pp. 7–13. Available at: https://doi.org/10.33579/krvtk.v2i1.553.

Rossi-hansberg, E. and Ioannides, Y.M. (2005) *Urban Growth*, *Urban Growth*.

Serret, H. *et al.* (2014) 'Potential contributions of green spaces at business sites to the ecological network in an urban agglomeration: The case of the Ile-de-France region, France', *Landscape and Urban Planning*, 131, pp. 27–35. Available at: https://doi.org/10.1016/j.landurbplan.2014.07.003.

Tate, C. *et al.* (2022) 'The Contribution of Urban Green and Blue Spaces to the United Nation's Sustainable Development Goals: An Evidence Gap Map', *SSRN Electronic Journal*, 145(November 2023). Available at: https://doi.org/10.2139/ssrn.4264138.

UN HABITAT (2010) 'Overview and Key Findings Acknowledgements'.

United Nations (no date) *Sustainable Cities and Human Settlements*. Available at: https://sdgs.un.org/topics/sustainable-cities-and-human-settlements (Accessed: 7 December 2023).

Zhang, Z., Jia, Z. and Zhou, Z. (2022) 'Can urban green space cure homesickness? Case study on China poverty alleviation migrants in Anshun, Guizhou', *Urban Forestry and Urban Greening*, 68(July 2020). Available at: https://doi.org/10.1016/j.ufug.2022.127478.

Zimmermann, E. *et al.* (2016) 'Urban Flood Risk Reduction by Increasing Green Areas for Adaptation to Climate Change', *Procedia Engineering*, 161, pp. 2241–2246. Available at: https://doi.org/10.1016/j.proeng.2016.08.822.