Planning for Urban Green Area and Its Importance for Sustainability: The Case of Jakarta

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Abstract. Population growth and rapid development in Jakarta have caused a reduction in the amount of Green Open Space (GOS) in urban areas. Based on data in 2017, the public GOS managed by the Forestry Agency is only 4.65% and the private GOS cannot be counted until now. Although the target of public GOS achievement is 20%, but the green plan is only 7,514.08 ha. The aim of this study is to analyze the extent and distribution of GOS and compare it with green plan. This study used the method of Geographic Information Systems to determine the extent and distribution by comparing the GOS area in year 2011 and 2018. The next step is reviewing the green plan zone according to Jakarta Spatial Planning 2030. Based on the results of this study, it can be concluded that the area of GOS in 2011 was 3,816.34 ha (5.84%) and it decreased in 2018 to 3,473.94 ha (5.31%). The distribution of GOS spreads in 5 administrative cities, with the largest area being in the East Jakarta. The result of the comparison of GOS in 2018 with the green plan shows that there is a lack of green areas of 4,040.13 ha.

1. Introduction
Most urban areas are home to more than half of the world's population [1]. More than half of the world's population lives in urban areas and by 2050 it is estimated that two out of three people live in cities in less developed countries [1]. Today many megacities are formed, namely cities with a population of more than 10 million, even up to 30 million [2]. Growing development in urban areas is often at the expense of green landscapes that are converted into concrete and asphalt buildings causing limited water absorption into the soil [1]. Population growth in urban areas has been the cause of environmental problems [3].

Sustainable development is the middle way to promote development that is adapted to the sustainability of landscape ecology [4]. Sustainability indicators for urban development must include more parameters of public space and urban green open space (GOS), as well as an index that reflects the satisfaction and perception of its citizens towards their environment [5]. Urban planners must consider green space management in a variety of ways to meet the needs and expectations of all population segments (children, families, the elderly, etc.) [5].

Green city is a city that has reached and moved towards long-term environmental sustainability [6]. In the future, city planners face difficulties in choosing between protecting green cities, urban economic growth, and social justice [7]. Greater London has become a green city where around 40–
50% of its land area is GOS and has been made using the UK Government Generalized Land Use Database [8]. The existence of small parks scattered in the city is important to form space and habitat [2].

Law Number 26 of 2007 concerning Spatial Planning mandates the availability of open space for at least 30% of the total area of the city where 20% is public GOS and 10% is private GOS. Jakarta faces the problem of land availability related to development activities that take place intensively so that the built area tends to grow rapidly. Besides the problem of land availability, the price of land in Jakarta is also one of the obstacles in the provision of GOS. In addition, there is a potential for GOS that can be developed under the authority of the Central Government.

The masterplan covers local area authority and regulates land use and infrastructure patterns throughout the region through zoning or land allocation maps where the plan regulates all or part of the local area authority and shows zoning of specific location details for buildings, land use and infrastructure [9]. Based on Regional Regulation Number 1 of 2008 concerning the Regional Medium-Term Development Plan (RPJMD) in 2007-2012, Jakarta was directed to compile the GOS Masterplan. However, until now Jakarta does not have the masterplan.

The topic of the problem of GOS lately has become important because along with the increasing population, the number of available GOS is also reduced. At present the problem of GOS limited area becomes the most urgent issue in urban planning, especially in Jakarta. Based on data in 2017, the public GOS managed by the Forestry Agency is only 4.65% (3,080.89 ha). Although the target of public GOS achievement in Jakarta is 20%, but the green plan zoning stipulated in Regional Regulation 1 of 2012 is only 11.7% (7,749.36 ha).

The study aims to analyse the need of GOS’s planning for urban sustainability. The objective of this study is to investigate the planning document stipulated the GOS Masterplan, about how the plan of GOS in Jakarta is. Based on the background that has been described before, the research problems is, how many is the number and how is the distribution of GOS in Jakarta?

2. Methods

2.1. Study area

Jakarta Province is a special area that functions as the Capital of the Republic of Indonesia and at the same time as an autonomous region at the provincial level. Geographically, the total area of Jakarta is 7,660 km², with a land area of 662 km² (including 110 islands scattered in the Kepulauan Seribu) and an area of the ocean of 6,998 km². In terms of government administration, Jakarta Province is divided into 5 (five) administrative cities and 1 (one) administrative district namely South Jakarta, East Jakarta, Central Jakarta, West Jakarta, North Jakarta, and Kepulauan Seribu Regency. In detail, the administrative boundary map of Jakarta Province can be seen in Figure 1.

2.2. Method

The method of this study used Geographic Information Systems (GIS) to determine the extent and the distribution by comparing the GOS area in year 2011 and 2018. The next step is comparing and reviewing the green plan zone according to Jakarta Spatial Planning 2030. The framework of this study can be seen in Figure 2.
3. Result and Discussions

3.1. Land Use/Cover Change (Built-Up Area Development)
Land use change is generally affected by both natural factors, such as geographical and soil characteristics, and socioeconomic factors, such as population growth, development plans, land use control, zoning and other related laws [13]. From 1995 to 2012, the built up area in Jabodetabek grew
rapidly. Jakarta is dominated by built land represented by the designation of buildings, road infrastructure and other infrastructure [13].

Based on the Academic Study of Jakarta Spatial Planning 2030, satellite image interpretation provides information that around 66.62% of Jakarta's mainland area is built land, while 33.38% can be interpreted as land that has not been built, among which is still natural, such as urban forest, lane green, cemeteries, agricultural land, parks, vacant land and more. The allocation for housing occupies the largest proportion, which is around 48.41% of the main land area of Jakarta, followed by the allocation of industrial buildings, offices and trade with around 15, 68%.

3.2. Green plan based on spatial plan Jakarta 2030

Jakarta has a green plan including public and private GOS which is outlined in Regional Regulation Number 1 of 2012 concerning the Spatial Planning Jakarta 2030. The percentage of the green plan amounts to only 11.4% (7,514.08 ha). Jakarta's green plan can be seen in Figure 4. Referring to Chapter V of the General Policy Direction of Regional Development for Environmental Affairs in the Field of Environment in Regional Regulation Number 1 of 2008 concerning Regional Medium Term Development Plans (RPJMD) for 2007 - 2012, the government is directed to prepare GOS Masterplan. In addition to these directives, referring to Article 79 of Regional Regulation 1 of 2012, Jakarta is also directed to make Governor's regulation on GOS and its development. Green plan zoning can be seen in figure 2.

![Figure 3. Green plan in Jakarta](image)

Source: Regional Regulation No. 1 of 2012 [10]

Although the drafting of the GOS Masterplan has been mandated according to the regulation, until now the government does not have the masterplan nor the Governor's regulation on GOS and its development. The absence of the GOS Masterplan has caused not to have applicable and measurable
long-term guidelines and plans in achieving the 30% GOS target by 2030. Based on Law Number 26 of 2007 concerning Spatial Planning, the provision of GOS based on the area in urban areas is a minimum of 30% consisting of 20% of public GOS and 10% of privat GOS. The government also targets the same amount of GOS achievement as Act No. 26 of 2007 as outlined in Part Two of Spatial Planning Policy Article 6 paragraph (5) letter b of Regional Regulation 1 of 2012 concerning Regional Spatial Planning (RTRW) Jakarta 2030. Although the target of public GOS achievement in Jakarta is 20%, but the green plan zoning stipulated in Regional Regulation 1 of 2012 is only 11.4% (7,514.08 ha).

3.3 GOS in Jakarta

Jakarta has no definite data related to the number of public owned and managed GOS. The government also does not have GOS Private achievement data in Jakarta. There are differences in the number of GOS by several units in Jakarta. Data from Forestry Agency in 2017 stated that data on the management of Public GOS in Jakarta up to semester 1 of 2017 was only 4.65%. This is different from the data held by Environmental Agency in 2017 stating that the achievement of Jakarta's GOS in 2015 was 11.97%. Meanwhile, based on the data from Public Works, Spatial and Land Affairs Agency, the number of GOS in Jakarta in 2018 is 7.89%. GOS achievement data by agency in Jakarta can be seen in Table 1.

The realization of the GOS is still far from the target of 20% of public GOS fulfillment by 2030. In addition, this difference is a problem related to the determination of the base line of the GOS achievement in Jakarta. Each agency in Jakarta has a different calculation method in calculating the number of GOS. GOS base line is needed in determining future GOS achievement targets and it must be included in the GOS masterplan.

Table 1. GOS Achievement by each agency in Jakarta

| No. | Agency                          | Wide (ha) | Percentage (%) | Information                 |
|-----|--------------------------------|-----------|----------------|-----------------------------|
| 1.  | Forestry                        | 3,080.89  | 4.65           | GOS Public (Year 2017)      |
| 2.  | Environmental                   | 7,927.83  | 11.97          | GOS Public & Private (Year 2015) |
| 3.  | Public Works, Spatial and Land Affairs | 5,096.69 | 7.89           | GOS Public (Year 2018)      |

Source: Researcher, 2018

Based on the results of the GIS analysis, the width of GOS in Jakarta in 2011 and 2018 can be shown in Figure 4 and Figure 5. The results of comparison of land use found that there was a decrease in the number of GOS in Jakarta as many as 342.40 ha in a period of seven years. The decrease in the number of GOS in Jakarta was mostly found in the green line as many as 255.11 ha and followed by cemetery as many as 148.71 ha. The decrease in GOS in the green line was caused by the construction of infrastructure and public facilities such as MRT, LRT, and pedestrian arrangement. In addition, there was also an addition of city/environment park zones of 44.88 ha. The details of comparisons for each of the GOS’s zone in year 2011 and 2018 are shown in Table 2.
Figure 4. GOS in Jakarta in 2011
Source: Researcher, 2019
Figure 5. GOS in Jakarta in 2018
Source: Researcher (2019)

Table 2. Comparison of the 2011 and 2018 green zones

| No. | Zone                     | Sub Zone            | Code | 2011 (ha) | 2018 (ha) | Ratio (ha) |
|-----|--------------------------|---------------------|------|-----------|-----------|------------|
| 1.  | City forest              | City forest         | H1   | 211.13    | 235.13    | 23.99      |
| 2.  | City/environment park   | City/environment park | H2  | 580.04    | 624.92    | 44.88      |
| 3.  | cemetery                 | Cementary           | H3   | 513.87    | 365.16    | (148.71)   |
| 4.  | Green line               | Green line          | H4   | 1,812.99  | 1,557.88  | (255.11)   |
|     |                          | Green high voltage  | H5   |           |           |            |
|     |                          | Green railroad tracks |     |           |           |            |
| 5.  | Recreational green       | Recreational green  | H7   | 698.3     | 690.86    | (7.44)     |
| 6.  | Open green cultivation   | Open green cultivation | H8  |           |           |            |

Deviation | 3,816.34 | 3,473.94 | (342.40)

Source: Researcher, 2019

Map of GOS in year 2018 has overlaid with a green plan map on the Jakarta Spatial Planning 2030. The comparison of the existing GOS in 2018 in Jakarta is still far from the target of the green plan which is 4,040.13 ha. The biggest difference is in the green line zone, consist of 2,974.64 ha and followed by city/environment parks with 1,069.73 ha. Urban forests in Jakarta have exceeded from the existing targets in green plan. It is found that urban forests in Jakarta have not all been included in the green plan listed on the Jakarta Spatial Planning 2030. Details of the comparison of each GOS zone in year 2018 with the green plan of the Jakarta Spatial Planning 2030 can be seen in Table 3.
Table 3. Comparison of the 2011 and 2018 green zones

| No. | Zone Sub Zone | Code | Green Plan (ha) 2011 | 2018 (ha) | Ratio (ha) |
|-----|---------------|------|----------------------|-----------|------------|
| 1.  | City forest  | H1   | 17.58                | 235.13    | 217.55     |
| 2.  | City/environment park | H2 | 1,694.65              | 624.92    | (1069.73)  |
| 3.  | Cemetery     | H3   | 605.87                | 365.16    | (240.71)   |
| 4.  | Green line Green high voltage | H4 | 3,818.46              | 1,557.88  | (2,260.58) |
|     | Green railroad tracks | H5 | 445.79                |           | (445.79)   |
|     |               | H6   | 268.27                |           | (268.27)   |
| 5.  | Recreational green | H7 | 663.46                | 690.86    | 27.4       |
| 6.  | Open green cultivation | H8 | 7,514.08              | 3,473.95  | 4,040.13   |

Deviation: 7,514.08 - 3,473.95 = 4,040.13

Source: Researcher, 2019

4. Conclusion
The base line data on GOS is needed as a basis for making GOS masterplan. The absence of GOS masterplan has no applicable and measurable guidance and long-term plan in achieving 30% GOS target by 2030. The target of green public open space in Jakarta is 20%, but the green plan zonation stipulated in Jakarta Spatial Plan 2030 is only 11.4%. GOS in urban area is one of the important elements of the urban landscape for sustainability.

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References
[1] Miller GT and Spoolman SE 2012 *Environmental Science Fifteenth Edition*. Cengage Learning. Boston. USA
[2] Cunningham WP and Cunningham MA 2008 *Environmental Science A Global Concern Tenth Edition* (New York: Mc Graw Hill Higher Edition)
[3] Pebley AR 1998 Demography and the Environment. *Demography*, Vol. 35(4) 377-389
[4] Enger ED and Smith B F 2009 *Environmental Science: A Study of Interrelationship Twelfth Edition* (New York: Mc Graw Hill Higher Edition)
[5] Chiesura A 2004 *Landscape and Urban Planning* 68 129–138
[6] LindfieldM and Steinberg F 2012 *Green Cities*. Urban Development Series Asian Development Bank. Manila. Filipina
[7] Campbell, S 2016 The Planner’s Triangle Revisited: Sustainability and the Evolution of a Planning Ideal that Can’t Stand Still J. Am. Plan. Assoc 82 388–397
[8] PocheeHand Johnston I 2017 Understanding design scales for a range of potential green infrastructure benefits in a London Garden City *Building Serv Eng Res Techno* 38728–756
[9] Albrechts L 2004 Environment and Planning B: Planning and Design 31 743-758
[10] Regional Regulation No. 1 of 2012 about Jakarta Spatial Plan 2030