

Assessment of the quality of public Green Open Space (GOS) in the urban fringes in response to urban sprawl phenomenon (case study District of Tanah Sareal, Bogor City)

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Abstract : The growth of urban areas in Bogor City physically marked by rapid growth in the urban fringe, where its growth tend to be widespread and dispersed randomly as well getting out of control (urban sprawl phenomenon). Urban sprawl resulted in the loss of green space and has caused many environmental impacts associated with the reduction of public green open space. The public green open space (GOS) in urban fringe area are essential for guiding sustainable urban development in response to urban sprawl phenomenon. The objective of this study is to assess the quality of public GOS in district of Tanah Sareal Bogor City. Analysis were done by using Worldview 2 imagery year 2015 through NDVI method. The study demonstrated that in the current area of GOS still meets the rules, but the quality level of public (GOS) are varies where the best quality is public GOS in Kelurahan Sukaresmi and the worst is public GOS in district of Kedungwaringin.

Keywords: NDVI, public green open space (GOS), urban sprawl, urban fringe

1. Introduction

Urban sprawl is an expansion of urban areas characterized by the increase of built up areas as the result of land conversion from non-urban use into urban use. Due to the population growth and development of urban activities, the land development has to be undertaken in the surrounding urban area called by urban fringe area [1]. The growth of urban areas in Bogor City physically marked by rapid growth in the urban fringe, where it's growth tend to be widespread and dispersed randomly as well getting out of control (urban sprawl phenomenon). It's caused to inefficiency and misery in land use [2]. The urban sprawl phenomenon is the growth of new residential areas on the urban fringe of the city to accommodate population growth, industry, housing developments and commercial activities. Urban fringe areas will be under increasing urban activity pressure due to the urban sprawl phenomenon resulting in environmental degradation, congestion, infrastructure crisis and disaster risks where the process of urban fringe development leads to unsustainability [3]. The growth trend of urban fringe will continue in the future, as population growth remains high [4]. Currently, urban spatial layout is still potentially as a provider of urban space but has not functioned optimally with due regard to ecological balance and sustainability [5]. It takes an effort to response the negative impact of the urban sprawl phenomenon.



Urban areas require public Green Open Space (GOS) to meet the needs of the community in conducting activities while controlling the comfort of microclimate and the aesthetic harmony of the city. Urban public GOS can essentially preserve the quality of the environment through prevention efforts or anticipate environmental problems without reducing urban development activities to meet human needs so as to achieve sustainable urban development [6]. Based on Law No. 26 year 2007 in order to realize a quality environment is done through the management of urban green open space (GOS) in accordance with the needs of the city [7]. GOS consists of public GOS and private GOS. The proportion of GOS in urban areas shall be at least 30 (thirty) percent of the total urban area. The proportion of public GOS in urban areas shall be at least 20% (twenty) percent of the total urban area while private GOS is 10% (ten) percent.

Based on the background, this study aims to identify the availability of public GOS and analyze the quality of public GOS in the urban fringe areas of Bogor City in order to response of urban sprawl phenomenon. The public GOS are essential for guiding sustainable urban development in urban fringe areas.

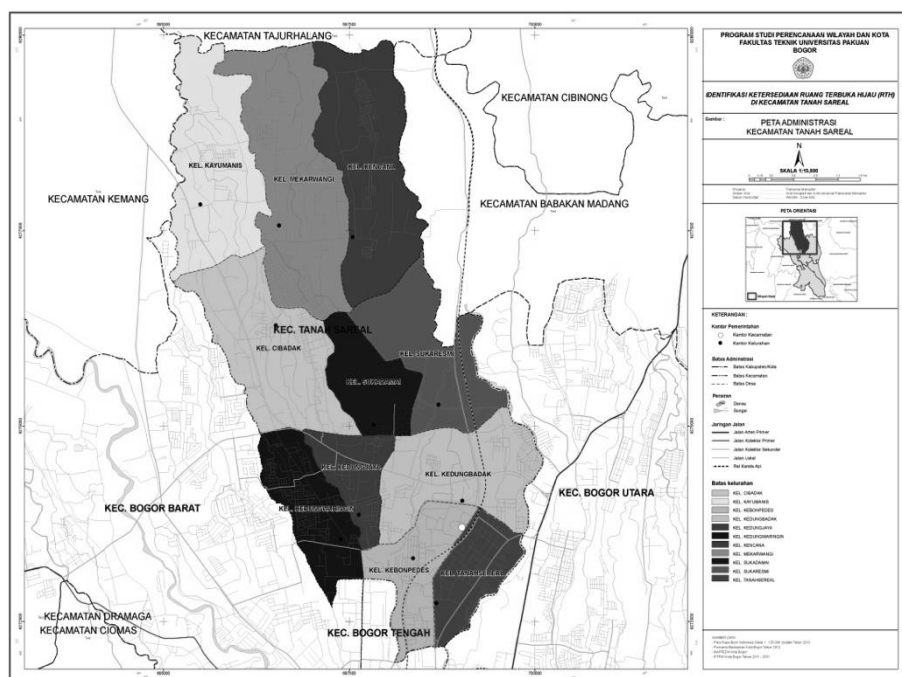


Figure 1. Research Location

2. Methodology

2.1. Research Location

The study was conducted in the administrative area of district of Tanah Sareal (figure 1). The location was selected with the most rapidly occurrence of the urban sprawl phenomenon is along the main transport corridor and urban fringe areas in Bogor City. District of Tanah Sareal covers 11 (eleven) kelurahan of total area 2329,70 ha (Kelurahan Cibadak, Kayu Manis, Kebon Pedes, Kedung Badak, Kedung Jaya, Kedung Waringin, Kencana, Mekarwangi, Sukadamai, Sukaresmi and Tanah Sareal).

2.2. Methods

Methods use through analyzes of Worldview 2 Imagery coverage of year 2016 and Landsat 8 Imagery coverage of year 2016 which is based on Geographic Information System (GIS) software and Erdas Imagery software.

The NDVI Method (Normalize Deference Vegetation Index) is used to assess the quality of public GOS where it describes the greenish level and translates into a vegetation cover class showing the vegetation density [8]. This method is a mathematical combination between red band and NIR band that has long been used as an indicator of the existence and condition of vegetation [9]. Vegetation land cover is classified into 5 (five) classifications based on the greenish density level. Each classification is given weight value vegetation cover where weight value 1(one) for very thin greenish density, weight value 2 (two) for thin greenish density, weight value 3 (three) for medium greenish density, weight value 4 (four) for thick greenish density and weight value 5 (five) for very thick greenish density.

The quality of public GOS is grouped into 5 (five) classifications are as follow: very bad category for greenish density value with interval 0-12, bad category for greenish density value with interval 13-25, enough category for greenish density value with interval 26-37, good category for greenish density value with interval 38-50, and very good category for greenish density value with more than 50.

3. Result and Discussion

District of Tanah Sareal's GOS in year 2016 is 717,79 ha or 35,23% from total area, where the biggest GOS composition is field of 500,7 ha (21,6%) and the smallest is the office yard of 0.4 ha or (0.02%), see Table 1.

Table 1. Type and Area of Green Open Space District of Tanah Sareal Year 2016

Type GOS	Area (ha)	(%)
Office park	0,41	0,02
Fields	500,70	21,58
Sport fields	13,17	0,57
Road	8,86	0,38
Shrub	27,12	1,17
Road border	7,14	0,31
Railway border	21,61	0,93
River border	16,58	0,71
SUTET border	0,22	0,01
Urban parks	0,85	0,04
Vacant land	204,12	8,80
Public cemetery	17,01	0,73
Total	717,79	35,23

Source: Analyzes GIS 2016

The Public GOS in the study areas covered 10 (ten) type where dominated by the public GOS type of border ie Railway border, river border, road border and SUTET border. The total area of public GOS in the study area is only 85,44 ha or 3.68% of the total area of district of Tanah Sareal, presented in Table 2. Based on Undang-undang No. 26/2007 on spatial arrangement which requires every city area must have at least 30% of GOS from its total area, consisting of 20% public GOS and 10% private GOS. Currently, the availability of GOS in the research area is still 35.23% of the total research area. This condition still meets the applicable area requirements. Based on Perda Kota Bogor No. 8/2011 on Spatial Planning (RTRW) Bogor City Year 2011 - 2031, district of Tanah Sareal physical development directed to the use of residential land, trade and services, as well as municipal service facilities. Currently the

growth of built area in the area of western Bogor City shows the existence of acceleration and changes are quite [high]. This condition shows the occurrence of urban sprawls phenomenon in the study area

To maintain the stability of the quality of the Environment and provide comfort of community activities one is through the availability of public GOS by 20% of the total area. Availability of GOS in the district of Tanah Sareal is conducted to know the percentage of area of eksisting public GOS. Looking at the above guidelines, it can be said that public GOS in District Tanah Sareal at year 2016 is still very less. which means that in the district of Tanah Sareal is needed public GOS of 464,14 ha to fulfill public GOS requirement 20%. While currently the provision of Public GOS in the district of Tanah Sareal is only 85.44 ha (3.68%), it is still needed for 378,7 ha to fulfill 20% public GOS. Represented in Table 2.

Table 2. The Type of Public GOS in the District of Tanah Sareal Year 2016

No	Clasification	Type	Area (ha)
1	GOS of Urban park and urban forest	Taman Kota	0,85
		Lapangan Olahraga	13,17
2	GOS of road border and median	Pulau Jalan	8,9
		Sempadan Jalan	7,1
3	GOS of Rail way border	Sempadan Kereta	21,61
4	GOS of river border	Sempadan Sungai	16,58
5	GOS of line high voltage electricity network	Sempadan SUTET	0,22
6	GOS of public cemetery	TPU	17,01
Total of Public GOS (Ha)			85,44
Total area of District of Tanah Sareal (Ha)			2320,70
Persentase of Public GOS (%)			3,68
Total needs of Public GOS (Ha)			464,14
Deficit of Public GOS(Ha)			378,7

Source : analysis results.

Efforts to fulfill the public GOS in the district of Tanah Sareal consider the availability of spaces where the pressure from urban sprawl phenomena is higher, therefore the assessment of the condition of vegetation/greenish quality of public GOS is very helpful to maintain and improve the environmental quality. The greenish quality of public GOS in every sub-district in the district of Tanah Sareal represented in Table 3.

Table 3. The area of greenish density level of public GOS

No	Kelurahan	The area of greenish density level (ha)					Total (ha)
		Very thin	Thin	Medium	Thick	Very thick	
1	Kel. Cibadak	1,83	0,88	0,61	0,27	0,42	4,01
2	Kel. Kayumanis	0,72	0,81	1,45	4,38	3,5	10,86
3	Kel. Kebonpedes	2,88	1,5	6,9	0,96	-	12,24
4	Kel. Kedungbadak	3,64	1,51	2,34	2,55	1,67	11,71
5	Kel. Kedungjaya	0,81	0,09	0,01	-	-	0,91
6	Kel. Kedungwaringin	0,28	0,07	0,01	-	-	0,36
7	Kel. Kencana	0,73	0,51	0,58	0,27		2,09

Source : Analysis Result

8	Kel. Mekarwangi	2,08	2,2	1,34	1,33	0,05	7,00
9	Kel. Sukadamai	0,3	0,5	0,19	0,13	0,01	1,13
10	Kel. Sukaesmi	1,2	1,39	2,52	3,24	7,37	15,72
11	Kel. Tanahsereal	4,16	3,95	6,81	3,37	1,12	19,41
Total		18,63	13,41	22,76	16,5	14,14	85,44
Proportion of total area Kec Tanah Sareal (%)		0,80	0,58	0,98	0,71	0,61	3,68

Assessment on the quality condition of public GOS in the District of Tanah Sareal based on table 4, that the sub district that has good quality condition of public GOS (very thick greenish) is located in the district of Sukaresmi with the value of 61,35 and the district of Tanah Sareal with the value of 51,57; while sub district that has worst quality condition of public GOS is located in the district of Kedungwaringin with the value of 0.45.

The distribution and score of greenish density level of public GOS in the district Tanah Sareal represented in Figure 2 and Table 4.

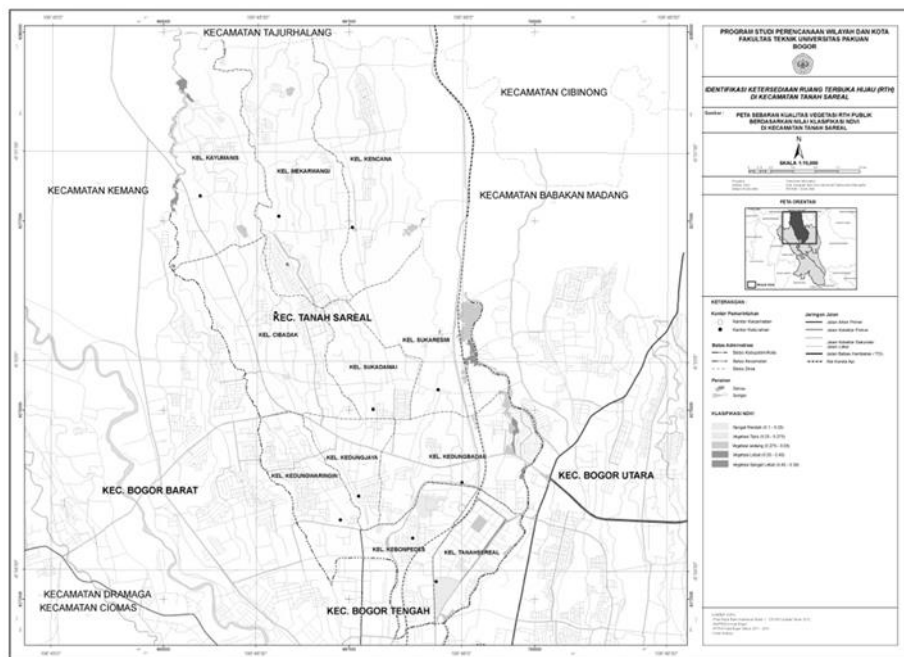


Figure 2. The distribution of public GOS greenish density level

Most of the urban fringe areas of Jabodetabek including the district of Tanah Sareal are experiencing rapid development and lead to unsustainability [5], especially for the environmental dimension. This is indicated by the decrease in GOS [11]. The public GOS can be a controlling environmental sustainability dimension because it can maintain the quality of the environment.

Currently district of Tanah Sareal's public GOS is still not sufficient, given the difficulties in meeting the needs, public GOS then can be done by improving the quality of public GOS through replanting so that the level of vegetation density becomes increased. In the district of Tanah Sareal there are 2 (two) districts that must be maintained the quality of vegetation density of public GOS because it has good quality and 5 (five) districts that must be improved the quality of vegetation density of public GOS because it has very bad condition. Considering that the public GOS in the district of Tanah Sareal is dominated by the type of GOS border (river border, road border, rail way border and Electricity

Transmission Tower border), then by maintaining and improving the quality of this public GOS the function and objective of public green space is achieved. Based on the results of this study is expected to improved the quality of public GOS in the urban fringe through the local government policy to controlling the land

use by detail planning and zoning regulation.

Table 4. The quality of public GOS greenish density level

District	Score for greenish density level					Quality of public GOS
	Very thin	Thin	Medium	Thick	Very thick	
	1	2	3	4	5	
Kel. Cibadak	1,83	1,76	1,83	1,08	2,1	8,6 (Very bad)
Kel. Kayumanis	0,72	1,62	4,35	17,52	17,5	41,71 (Good)
Kel. Kebonpedes	2,88	3	20,7	3,84	0	30,42 (Medium)
Kel. Kedungbadak	3,64	3,02	7,02	10,2	8,35	32,23 (Medium)
Kel. Kedungjaya	0,81	0,18	0,03	0	0	1,02 (Very bad)
Kel. Kedungwaringin	0,28	0,14	0,03	0	0	0,45 (Very bad)
Kel. Kencana	0,73	1,02	1,74	1,08	0	4,57 (Very bad)
Kel. Mekarwangi	2,08	4,4	4,02	5,32	0,25	16,07 (Bad)
Kel. Sukadamai	0,3	1	0,57	0,52	0,05	2,44 (Very bad)
Kel. Sukaresmi	1,2	2,78	7,56	12,96	36,85	61,35 (Very good)
Kel. Tanahsereal	4,16	7,9	20,43	13,48	5,6	51,57 (Very good)

Source : analysis results

4. Conclusion

Urban sprawl phenomenon that occurred at urban fringe areas of Bogor City especially in the district of Tanah Sareal has caused many environmental impacts associated with the reduction of green open space. In an effort to compensate for the pressure of urban sprawl phenomenon in the district of Tanah Sareal is through improving the quality of GOS. Currently, the need for public GOS in the district Tanah Sareal is still lacking and there are 5 (five) districts with bad public GOS condition, then by improving the quality of public GOS is expected to overcome the environmental problems. Local government policy (detailed plan and zoning regulation) is needed to control the availability and quality of green open spaces in response to the urban sprawl phenomenon. Further research is needed on the techniques and types of efforts that must be done in order to improve the quality of this public GOS.

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