An assessment on land typology and achievement of government target for green space area development according to spatial plan 2005-2015 of Makassar city

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Abstract. This study aimed to identify green open spaces in Makassar City and evaluate the achievement of Makassar City green open space target based on the 2005-2015 spatial planning document. This research was conducted by collecting, managing primary data and secondary data in the form of spatial and attribute data. Analog spatial data was converted into digital spatial data using the Geographic Information System by digitizing the map using the Arcgis 10.3 application. Following the desk work, a field survey was conducted to determine the existing condition of the field. Based on the evaluation of the city spatial plan, this study introduced 17 typologies of land coverages. The evaluation of green area in 2017 revealed there were 3 zones with green area that were larger than the target set by the Makassar City spatial plan for 2005-2015. They are the maritime area zone, and research and cultural development zone. However, there were other zones whose green areas found in this study to be smaller than the target according to Makassar City spatial plan 2005-2015. These zones were the city center and port areas, industrial and warehousing zones, global business zone, settlement, airports, sports, education and business and tourism zones.

1. Introduction

Urban development has become a global trend that occurs almost in all parts of the world. The consequence of this development has been observed in the fact that several land uses with natural settings have been converted into built areas as well as other anthropological related functions [1]. Indonesia has many developing cities which experience this kind of growth. As the biggest city in eastern Indonesia Makassar is experiencing urbanization. The population growth and infrastructure construction in response to economic development and business facilities requirements have resulted in massive land use shifts. Land typology which mostly suffer from conversions are open green areas [2]. Makassar City with its very rapid level of economic development and residential areas has difficulty meeting the green open space target mandated by the Minister of Domestic Affairs Regulation on Urban Green Open Space [3]. Based on the results of identification by the Regional Environment Agency, it was known that by the end of 2015 the number of green open space of Makassar City was 8.31%, which not met the minimum provision of green space regulated in spatial planning regulations [4].

The process of regional development which is increasingly prominent influences the spatial planning around the Makassar City area. The expansion of urban areas in suburban areas has an
impact on the formation of new centers of activity that require wider space and strategic locations. The effect of development on the environment in general will change the physical state of the man-made environment. In the process, it will always be accompanied by the conversion of land from the agricultural and forestry sectors to non-agricultural and non-forestry sector lands. This land use conflict will cause damage and reduce environmental harmony. The government of Makassar indeed have programs and efforts to improve the ecology of the city by proposing green space provision in different part of the city [5].

2. Green open space

Green open space in urban spatial planning requires serious attention from all related parties, considering the ecological aspect in supporting the current urban concept of sustainable cities, hence the sustainable city structuring concept need to embed the ecological aspect as serious consideration for its existence. The presence of green open space in urban areas balance the urban ecosystem as it also functions to increase the carrying capacity of the environment to the community [6].

Green open spaces in Indonesia known to be public and private. Public green open space is green open space owned and managed by the regional government of the city for the benefit of the general public such as urban forests, urban parks, public cemetery parks, and green lanes along roads, rivers and coasts. While the private green open spaces are home gardens, building yards, etc belongs to individual or institutional properties [3, 7].

Some ecological roles of green space such as a contributor to fresh breathing space, visual beauty as the lungs of cities, water sources in the soil, erosion prevention, refuge for animal and wildlife [8]. Tahir [9] added that green open space has 3 basic functions, namely: a) social value, as facilities for the public gathering and recreation, education and sporting, and most importantly strengthening community ties among residents; b) physical value, related with its ecological services; and c) aesthetic value, as the existence of urban green space become integrated part in the arrangement of urban architecture.

3. Makassar City Regional Spatial Plan for 2005-2015

Regional Spatial Planning formerly called the General Spatial Plan is the result of spatial planning which is a structural manifestation and pattern of spatial use where humans and other creatures live and carry out activities and maintain their survival. This spatial plan is divided based on the level i.e. national, provincial, and regency/city. The legal basis for regional spatial planning is Regulation no. 24 of 1992 concerning spatial planning [10].

City Spatial Planning is a policy direction and strategy for spatial uses of a city area. Regulation of the Minister of Public Works No.17/PRT/M/2009 concerning guidelines for the preparation of urban spatial planning is a follow up of the implementation of the provisions of the Article 18 paragraph (3) of Regulation No. 26 /2007 concerning Spatial Planning. The functions of the Regional Spatial Plan are: a) Reference in the preparation of the Regional Long-Term Development Plan and the Regional Medium-Term Development Plan (RPJMD); b) Reference in spatial use / development of urban areas; c) Reference to realize the balance of development in urban areas; d) Reference of investment locations within the city area carried out by the government, community, and private sector; e) Guidelines for preparing detailed spatial plans in urban areas; f) Basis for controlling the use of space in the structuring/development of urban areas which includes the determination of zoning regulations, licensing, granting incentives and disincentives, as well as the imposition of sanctions; g) Reference in land administration [7].

In 2005, Makassar city council proposed long term spatial for period 2005 – 2015. According to the plan, the city have spaces that classified into areas of development and areas of integrated zones for specific purposes. In terms of green space development, there were three considered aspects to synchronize the existing and potential spaces with the spatial plan of the city, they are: city zoning, area of specific purpose development, and direction for green area development [11]. Figure 1 shows the zoning based on the target for green space land coverage by year 2016 [12].
This paper aimed to investigate the achievement of this target by comparing the government plan on the green space coverage (%) by the end of the long term plan (2015) with the condition of green space coverage based on the city’s 2016 aerial photograph. Evaluation of the achievement of the green area is an evaluation that emphasizes aspects of the suitability of the spatial planning that has been determined in the Makassar City Spatial Planning document with the existing reality. It is probable that there is a gap between the proper spatial arrangement and the spatial arrangement as is. Therefore this study require to include remote sensing technology data, namely aerial photographs, satellite imagery of Landsat TM (Thematic Mapper), ETM (Enhanced Themetic Mapper), SPOT (Satellite Pour I’Observation de la Terre) or other satellite imagery. Remote sensing imagery in the form of satellite imagery is a repetitive picture of the earth's surface. The function of this satellite image is that it can record the condition of the earth's surface at any given time period and is able to provide the latest data and spatial information that is very precise and accurate. Therefore, changes that occur on the surface of the earth can be detected and monitored at any time. The available data can be pictorial or digital which is then processed to obtain the required information. The information obtained can be combined with supporting data into one Geographic Information System (GIS).
4. Methodology
This research scope was Makassar City area covering 14 administrative districts and 143 sub districts. Data processing employed Geographic Information System (GIS) software (ArcGIS 10.3). Primary data was digital maps generated with the Geographic Information System (GIS) and secondary data collected from relevant agencies such as the Makassar City Planning Board (Regional Planning Development Agency) and statistics of Makassar City.

The determination of land typology refers to the Minister of Home Affairs No. 1 of 2007 Chapter III concerning the Formation and Types of Green Open Spaces in Urban Areas. The typology could help distinguish each digitized spaces around the city. The results will divide several classifications for land use in the city of Makassar. The digitization formed polygons which were divided into several regions and districts. The preparation of attributes was carried out to identify the area of land/space that has been digitized.

Ground Check was carried out with the aim to find out the existing condition of the field. The ground survey was performed by sampling a few places that are considered to represent each class of land cover classification. These spaces were residential areas, urban forests, urban parks, rice fields, gardens and others. Each survey location representing each land cover class was taken by its coordinates using GPS to be verified with image data.

Data analysis was performed by overlaying the digitized maps with the government plan maps. It made possible to assess the suitability of the government spatial plan of green space with the actual conditions. The deviation in the Makassar City spatial planning document occurred if the specified therein did not correspond to reality or there was a difference between the spatial structure and the planned spatial plan and the existing spatial structure and spatial pattern. Evaluation of the difference is based on green cover areas determined by the city government.

5. Result and Discussion

5.1. Typology of spaces identified in this study
The determination of typology refers to the Minister of Home Affairs No. 1 of 2007 Chapter III concerning the formation and types of green open spaces in urban areas, in the regulation there are 23 land covers. Based on the evaluation of the green open space Regional Spatial Plan 2005-2015 Makassar City obtained 17 land cover classes as presented in table 1.

| No | Space typology | Description | Sample image |
|----|----------------|-------------|--------------|
| 1  | Urban parks    | Area planted with various exotic plants and various additional components that are beneficial for humans. | ![Sample Image](image1.jpg) |
| 2  | Urban forests  | Area covered with flush trees that has been officially determined by the government as urban forest | ![Sample Image](image2.jpg) |
|   | Residential green space | Space that is overgrown with plants in residential areas or around housing |
|---|-------------------------|-------------------------------------------------------------------------|
| 4 | Government facilities green space | Areas covered with plants around government-owned areas such as offices and the military facilities |
| 5 | Education facilities green spaces | Areas covered with plants around the education facilities such as schools and campuses |
| 6 | Business facilities green spaces | Planted areas around the business facilities area such as hotels, shopping centres, shops, etc. |
| 7 | Cemetaries | Green area within the cemetery complex |
| 8 | Industrial site green spaces | Planted areas around industrial areas, including storage centres and/or ports. |
| 9 | Sports fields | Planted areas around sports fields and facilities |
|   |       |                                                                 |
|---|-------|-----------------------------------------------------------------|
|10 | Home gardens | Areas that are intentionally overgrown with useful plants around residential areas |
|11 | Road corridors | Green areas along roads |
|12 | Paddy fields | The area designated for rice plants |
|13 | Bushes | Areas covered with weeds and wild plants |
|14 | Lakes | Surrounding greeneries of a lake |
|15 | Wetland | Areas of marshes and swamps |
|16 | Other corridors | Green area along river lines, power lines, etc |
The results of the 2017 Makassar City land evaluation of the Makassar City area revealed that the most dominant land typology was aquacultures with an area of 1635.78 ha, paddy fields with an area of 1010.46 ha in second place and in third place was bushes with an area of 386.6 ha. Table 2 present the full result of land coverage based on the typology, while the distribution is shown in figure 2.
5.2. Green layout plan based on the Makassar City spatial planning document (RTRW) for 2005-2015

Makassar City Green Planning is regulated in the Makassar City Regional Regulation No. 6 of 2006 concerning Makassar City Regional Spatial Planning 2005-2015. The regulation in article 12 regarding "Area Development Strategy" point I number 4 which reads: Develop and organize green open space areas in all regions with high standards and with a minimum green cover ratio of 50% (fifty percent) or above the optimal standard of 47% (forty-seven percent). This distribution is regulated in more detail in the Makassar City technical guidelines 2005-2015. The guidelines stipulate that green open space is an area or area of land surface that is dominated by plants that are fostered for the protection of certain habitats, and/or urban/environmental facilities, and/or safety networks for infrastructure, and/or agricultural cultivation. Green open space planning aims to maintain the integrity and quality of the environment and can function ecologically, socially, architecturally and with aesthetic value (objects and the environment).

Table 2. Distribution of land typologies by district in Makassar City in 2017.

| Sub Districts | Tipologi (Ha) |
|---------------|---------------|
|               | Danau          | Urban forests | Industrial/Corridors | Road/paths | Homes/Buildings | Sport/Fields | Zanatera/Governmenal Districts | Education/Business | Bushes | Paddy fields | Bushes | Other corridors | Urban Parks | Aquaculture | Total |
| BIRING KANAYA | 5.18           | 7.17          | 12.83             | 132.55      | 1.25          | 4.48         | 6.7               | 69.39             | 1.35   | 4.84         | 27.76  | 199.79         | 22.89       | 3.64         | 0.84  | 159.28 | 659.94 |
| BONTOLA       | 4.99           |              |                  | 0.45        | 0.58          | 2.27         | 3.03              | 1.16             |       |             | 2.28   | 3.18           |             |             |       |       | 17.94 |
| MAKASSAR      | 0.49           | 2.51         |                  | 0.12        | 4.27          | 1.39         | 2.58              |                 | 0.78   | 0.03         | 0.06   | 12.23         |             |             |       |       |       |
| MAJANG        | 0.16           | 4.9          |                  | 4.64        | 1.14          | 0.45         | 0.11              |                 |       |             | 1.25   | 12.65         |             |             |       |       |       |
| WAGI          | 0.29           | 0.15         | 6.48             | 9.3          | 4.27          |              |                  | 1.19              | 6.97   | 7.38         | 12.36  | 0.4           | 0.41       | 40.83        |       |       |       |
| TAMALANREA     | 1.25           | 9.64         | 5.92             | 12.38       | 14.68         | 0.84         | 2.48              | 18.66             | 33.39  | 2.75         | 4.49   | 3.83          | 1.6        | 44.09        | 109.84 | 1.68 | 187.31 | 454.83 |
| RAPPOCINI     | 0.63           | 3.03         | 11.18            | 1.45        | 5.08          | 0.64         | 7.44              | 37.37             | 5.81   | 12.7         | 2.61   | 56.01         | 1.3        | 0.07         | 14.71  | 160.03 |       |
| TALLO         | 2.7            | 5.57         | 8.55             | 2.29        | 6.28          | 2.79         | 8.72              | 3.1               | 3.87   | 3.27         | 30.28  | 11.88        | 0.29       | 241.49       | 331.08 |       |       |
| TAMALATE       | 14.35          | 9.27         | 30.06            | 0.28        | 6.9           | 2.85         | 0.56              | 29.99             | 30.25  | 52.69        | 4.15   | 99.08        | 120.56     | 84.56        | 908.09 | 1366.64 |       |
| UNGG Pandang  | 14.56          | 2.92         | 11.96            | 1.01        | 1.87          | 33.08        | 9.79              | 4.1               | 360.68 | 66.53        | 47.31  | 100.78       | 75.3       | 672.17       |       |       |       |
| UNGG Tanah    | 2.24           | 3.81         |                  | 0.22        | 0.26          | 1.48         | 0.07              |                  |       |             | 8.01   | 360.09       | 120.56     | 84.56        | 908.09 | 1366.64 |       |
| WAGI          | 0.26           | 0.69         |                  | 0.78        | 2.67          | 1.22         |                  |                   |       |             | 5.62   | 360.09       | 120.56     | 84.56        | 908.09 | 1366.64 |       |

TOTAL 234.54 29 61.78 87.28 218.05 27.15 23.52 45.56 276.51 81.94 48.19 82.33 1010.5 386.6 308.65 21.79 1635.78 4577.13

Table 3. Green area plan based on Makassar city spatial plan 2005-2015

| No | Green Area Target | Regional coverage zones | Target area (ha) |
|----|-------------------|-------------------------|------------------|
| 1  | Area minimum of 20% green area | City Center and Harbor | 3158.15 |
| 2  | Area minimum of 30% green area | Industry | 3171.42 |
| 3  | Area minimum of 40% green area | Warehousing | 360.98 |
| 4  | Area minimum of 47% green area | Maritime | 327.74 |
| 5  | Area minimum of 50% green area | Global Business | 9508.89 |
| 6  | Area minimum of 60% green area | Settlement | 558.36 |

Source: Government spatial planning document, 2005 [11] 17085.54
Percentage of green area targets is assumed that there are several area targets to be achieved and there are several area targets to maintain green areas. As is the case in the downtown area where land use is dominated by physical buildings and there is very little for green area. In addition there are also several areas that must be maintained so that there is no degradation of green areas.

5.3. Achievement of Makassar City Government Green Plan Target
Table 4 shows a comparison between the area of the green area plan that has been determined by the city government in the 2005-2015 Regional Spatial Plan with the form of deviations in the field referring to the results of digitization of Makassar City satellite imagery in 2017. Deviations were identified when the percentage of area determined in the Makassar City spatial plan 2005-2015 was not in accordance with the results of the digitization of the Makassar City green area in 2017.

| No | Green area targets     | Area (ha)   | Land coverage in the form of green area 2017 (ha) | Percent (%) |
|----|------------------------|-------------|-----------------------------------------------|-------------|
| 1  | Minimum 20% Green Area | 3158.15     | 357.4                                          | 11.32       |
| 2  | Minimum 30% Green Area | 3171.42     | 941.1                                          | 29.67       |
| 3  | Minimum 40% Green Area | 360.98      | 226.04                                         | 62.62       |
| 4  | Minimum 47% Green Area | 327.74      | 105.62                                         | 32.23       |
| 5  | Minimum 50% Green Area | 9508.89     | 2579.17                                        | 27.12       |
| 6  | Minimum 60% Green Area | 558.36      | 367.8                                          | 65.87       |
|    | Total                  | 17085.54    | 4577.13                                        | 26.79       |

Source: Data After processing, 2017

Based on the table above it can be seen that the area of at least 40% and 60% of the green area is still greater than the targets set by the Makassar City government, which are 62.62% and 65.87% and for areas of at least 20%, 30%, 47%, and 50% of the green area is smaller than the area that Makassar City government has targeted, namely 11.32%, 29.69%, 32.23 and 27.12%. The actual green area of Makassar City identified by this study in 2017 is seen in figure 3.
6. Conclusion
Based on the evaluation of green open space set by Makassar City regional spatial plan 2005-2015 there were 3 areas which found to have larger green area than the target set by the Makassar City government for 2005-2015. The first one was the Maritime Area which sets a minimum of 40% green area, the identified green area in 2017 was 62.62%. The research and cultural zone, were designated a green area of at least 60%, with a result of identification in 2017 was 65.87% of the green area.

There were 10 zones whose green areas in 2017 did not meet the target set by the Makassar City Government 2005-2015 plan. These zones were city center area and the port which targeting a green area of at least 20%, and achieved only 11.32%. Industrial and warehousing areas which targeted a minimum of 30 green areas, in 2017 achieved only 29.67%. The global business zone which sets a target of minimum 47% green area achieved only 32.23% in 2017. Airports, sporting, education, business and tourism zones achieved only 27.12% as opposed to the target of minimum 50% green area.

The results of this study is expected to be informative for consideration of Makassar City Government policy in meeting the minimum requirements of green open space in the urban areas of

![Figure 3. Actual green area coverage of Makassar City in 2017](image-url)
Makassar. Through the identification of the achievement of the proportion of Green Open Space in the Makassar City area, it is expected that consideration will be given to providing new green open space, in order to offset the rapid growth of urban population and maintain environmental harmony from the adverse effects of urban growth.

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