Mapping the green open spaces system in the sub-district of Tangerang, Tangerang City of Banten

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Abstract. Law of the Republic of Indonesia Number 26 of 2007 concerning Spatial Planning states that the proportion of green open space in a city area is at least 30 (thirty) percent of the area of an urban area. Tangerang city as one of the cities in the Greater Jakarta area with an area of 17,729,746 hectares, has 13 districts. One of them is Tangerang District which has the most extensive and diverse green open space compared to other districts, but it has not reached 30 percent. In addition, the existing green open space is not connected to one another, so it has not formed a system that can increase the green open space. This study is to find out whether green open space in Tangerang sub-district has the opportunity to form a green space system, in an effort to increase its area. Examination of the green space system can be done by looking at the landscape structure and land use. The overlay method is used to determine the opportunities and green space system that is suitable for Tangerang sub-districts. The results showed that the green open space in Tangerang sub-district had the opportunity to be developed as a green open space system with a linear pattern.

1. Introduction
City green open space, whether in the form of city parks, environmental parks or green roads, is one element of the urban landscape that is often planned after a finished plan. As a result, between green open space and other elements of urban planning is often not integrated and does not build a system of urban green open space. Such conditions almost affect all cities in Indonesia, so that green open spaces tend to only be solitary spaces or urban green islands, without having meaning and forming a city landscape structure.

One of the cities in the Greater Jakarta area known as the City of a Thousand Parks with a variety of types and functions is the city of Tangerang [1]. Tangerang City, with an area of 17,729,746 hectares, has 13 sub-districts, and one of the 13 sub-districts, namely Tangerang District, is a sub-district that has quite a variety of green open spaces but has not been integrated so that it has not formed a regional green open space system. This research was conducted to map the possibility of forming a green open space system in Tangerang sub-district using an ecological approach.

2. Literature review
2.1. Definition of green open space based on law
- According to the Law of the Republic of Indonesia Number 26 Year 2007 concerning Spatial Planning in clause 1 Number 31 "Green open space is an area of lengthening / pathway and / or
grouping, the use of which is more open, a place to grow plants, both those that grow naturally and intentionally planted” [2].

- According to Ministry of Public Works Regulation Number: 05 / PRT / M / 2008 concerning Guidelines for Provision and Utilization of Green Open Space in Urban Areas in Clause 1 Number "Green open space is an area of lengthening / pathway and / or grouping, the use of which is more open, a place to grow plants, both those that grow naturally and intentionally planted” [3].

2.2. **Definition of green open space based on theory**

- Green open space is one of the elements of urban open space intended for greening the city to realize comfort and beauty for an urban space [4].
- Green open space is part of a city open space that has multiple functions for various social needs of the community and for the natural needs of a city [5].
- Green open space is a physical setting whose formation is influenced by demographic, socio-economic factors and the uniqueness of the city landscape, as well as the functions and themes of the park itself [6].

In this study, what is meant by green open space is a part of urban open space that physically has a role, function and multiple benefits and is dominated by plants, must be owned by each city / district with a portion of 30% of the total area.

2.3. **Green open spaces system based on ecology**

During this time the existence of green open space has not been integrated with urban planning, consequently green open space is still partial and one another has not formed a system. Green open space system, in which it has various sub-systems that are interrelated to one another so that it becomes a unified whole as the landscape of a city, so that sustainability is the main indicator [7].

The system of green open space is a development of the urban landscape system, with the city of green open space system there are no more isolated parks, all will be sustainable and can even unite between spaces open green in urban and rural areas [8]. These conditions can increase the percentage of area, role and function of green open space, so that each park can be interconnected and form a green belt. Green open space system can be developed in the form of green lanes and parks, depending on the shape of the existing landscape structure [9].

Green open space as a system is a combination of natural and built green open spaces (artificial), then conceptually the system of green open space has several patterns that combine natural patterns with artificial patterns. Some green open space system patterns are as follows [8]:

2.3.1. **Zig-zag pattern.** Integrating natural structures with artificial structures of the city. The form of green open space can be in the form of green paths, small parks and green land or fields (Figure 1).

![Figure 1. Example for zig-zag pattern](image-url)
2.3.2. **Linier pattern.** Developed from geometric concepts that follow road patterns. In this pattern the road's green lane and road islands become connecting units to form a green open space system (Figure 2).

![Figure 2](image.png)

**Figure 2.** Example for linier pattern in Kansas City, Missouri [8].

2.4. **Green open spaces as a landscape structure**
Ecologically Green Open Space can act as a landscape structure of a city. Landscape structure consists of, patches, corridors, dominant (matrix) and network [11]. Landscape structure is, arrangement or pattern of space or composition of various elements in the form of landscape [9]:

- Patches are islands, road islands and agricultural areas, urban forests, single tree, clustered and hills. Patches can be measured and analyzed based on area, location and amount.
- Corridor is a barrier from an area, can be a green line of the road, green line along the railroad and green channel canal. Corridors can be measured and analyzed based on area, location and pattern both linearly, zigzag and meandered.
- Dominant (matrix) is a major landscape element, has a relatively larger area compared to other landscape structures. Can be in the form of forestry, settlement and green areas (field, etc.). The matrix can be measured and analyzed based on area and location.
- Network is a link, can be in the form of green roads or other green lines. Networks can be measured and analyzed based on area, location and pattern in the form of linear, zigzag or meandering.

2.5. **Integrating data – map overlay**
According to Irwansyah, Data integration is the ability to combine data from two or more different sources, using map overlay techniques, so the results can be used for analysis results. Overlay is the technique of overlapping or combining of several maps to produce new data or new layers [12].

3. **Methods**

3.1. **Research methods**
This research is a qualitative study, with a descriptive category, which is to study primary and secondary data. The results of the study were identification maps based on land use and ecology, which were carried out with assistance of GIS ARC View 3.10. The results of the identification were then subdued so as to be able to provide recommendations for the possibility of developing an open green space system as an effort to increase the percentage of green open space in Tangerang sub-district, Tangerang City of Banten to 30%. 

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3.2. Tools and materials
The tools and materials used in conducting this research were drawing tools, cameras, laptops and computer application programs (Microsoft Word, AutoCAD and ARC View 3.10), basic maps of Tangerang District, Government Website, namely: www.kec-tangerang.tangerangkota.go.id and other notes.

4. Results and discussion

4.1. Results

4.1.1. General description of the area. The research was conducted in Tangerang District, Tangerang City, Banten, which has an area of 14.53 km², and consists of 14 urban villages, with 15% of which is green open space (RTH), while the remaining 85% is in the form of trade and service areas and housing areas. Tangerang District is a sub-district that has the most extensive and varied green open space (RTH), compared to other sub-districts in Tangerang City, and is one of the 2 sub-districts through which the Cisadane River passes (Figure 3).

![Figure 3. Map of research site in Tangerang sub-district, Tangerang City of Banten.](Source: Dinas Pemerintahan Kota Tangerang, tahun 2018)

4.1.2. Land use. Tangerang sub-district with an area of 14.53 km², based on the land use 15% is a green open space, and the remaining 85% is in the form of trade and service area (Dinas PUPR Kota Tangerang, Tahun 2018). The types of green open space in Tangerang sub-district are quite diverse, including: Agricultural lands ± 4 ha; Padi field ± 10 ha; Grazing lands ± 8 ha; Greenways ± 18 ha; Railroad green belt ± 45 ha; River green belt ± 86 ha; Green field ± 17 ha; Yard ± 13; Urban park ± 10 ha and Neighborhood park ± 7 ha. Green open space in Tangerang sub-district is dominated by river green belt and railroad green belt in the form of linear pattern (Figure 4).

From the land use map, using GIS ARC VIEW 3.10, the ecological description of the Tangerang sub-district is obtained in the form of an ecological map (Figure 5):

- Green Open Space Patches, in the form of mixed garden, rice field and shrubs area ± 22 ha or 1,52 % with the distribution in 7 villages and there are many in Cikokol as many as 5 green open space,
- Green Open Space Corridor, in the form greenways, railroad green belt and river green belt area ± 149 ha or 10, 26 % with the distribution in 5 villages and there are many in Tanah Tinggi as many as 2 green open space,
- Green Open Space Dominant (Matrix), in the form of open field and yard area ± 2 ha or 2,06 % with the distribution in 7 villages, there are many in Kelapa Indah as many as 2 green open space,
• Green Open Space Network, in the form of greenways and railroad green belt area ± 63 ha or 4.34 % with the distribution in 2 villages, there are many in Tanah Tinggi as many as 2 green open space.

\[ \text{Figure 4. Land use map Tangerang Sub-District, Tangerang City of Banten.} \]

\[ \text{Figure 5. Ecological map Sub-District Tangerang, Tangerang City of Banten based on land use.} \]

4.2. Discussion

4.2.1. Findings. From the results by overlay using land use map and ecological map (landscape structure) with GIS Arc View 3.10 shows that, green space in Tangerang sub-district is dominated by corridors and networks in the form of mixed gardens, river green belt, greenways, railway green belt and yard.

In addition, not all green open spaces villages can be developed as a system. Out of 14 villages, only 3 (three) villages have potential green space to be developed as a system (Tabel 1 and Figure 6):

- Cikokol Village area 18 ha in the form of mixed garden 2 ha and river green belt 16 ha.
- Tanah Tinggi Village area 9 ha in the form of greenways 9 ha and railway green belt 10 ha.
- Kelapa Indah Village area 5 ha in the form of yard green open spaces.

\[ \text{Table 1. System potential data of green open spaces in Tangerang Sub-District, Tangerang City of Banten.} \]

| No. | Location (Village) | Land use          | Ecologi (Landscape Structur) | Pattern  | Area |
|-----|--------------------|-------------------|------------------------------|----------|------|
| 1.  | Cikokol Village    | mixed garden      | Patches                      | Linier   | 2 ha |
| 2.  | Tanah Tinggi Village | Green ways       | Corridor & Network           | Linier   | 9 ha |
| 3.  | Cikokol Village    | River green belt  | Corridor                     | Linier   | 16 ha|
| 4.  | Tanah Tinggi (Village) | Railway green belt | Corridor & Network          | Linier   | 10 ha|
| 5.  | Kelapa Indah (Village) | Yard             | Matrix                       | Linier   | 5 ha |
|     |                    |                   |                              |          |      |
|     |                    |                   |                              |          | Total 42 ha (15%) |

From Table 1 it can be seen that the appropriate green open space system for Tangerang Sub-District, Tangerang City of Banten is a linear pattern, which is dominated by the form of corridors and networks, besides that linear patterns are easier to connect between one green open space and another open green space [13]. The linear green space system is expected to increase the green space area to 30% without changing pre-existing characteristics.
4.2.2. Recommendation. Out of 14 Villages, only 3 (three) villages have potential green space to be developed as a system; in Cikokol Village 18 ha in the form of kebun campur (mixed gardens) 2 ha and sempadan sungai (riparian) 16 ha, Tanah Tinggi Village in (9 ha) in the form of jalur hijau jalan (green lane road) 9 ha and jalur kereta api (railway) 10 ha, and Kelapa Indah village 5 ha in the form of pekarangan (yard). These three villages will be recommended as further research, to find out whether the green space system in Tangerang sub-district with a linear pattern can significantly increase the area of green space from 15% to 30%.

5. Conclusion

From the research findings, it can be seen that several types of green open space can be converted ecologically into landscape structures, namely in the form of patches, paths, networks and matrix. The four forms of landscape structure can be developed into a green space system, depending on the dominance of green space in an area. In the Tangerang sub-district, the green open space is dominated by corridors and networks in the form of mixed gardens, river green belt, greenways, railroad green belt with linear patterns. Not all villages in Tangerang sub-district can be developed as a green space system, only 3 (three) villages that have green open space can be developed. Thirdly, the aforementioned abundance can be recommended as a follow-up study to find out whether the green spaces system can increase the area of green open spaces for an area. The application of linear patterns in the green space system is the most efficient because it can use minimal land, but can connect between green open space, so green open space is not seen as a space, but as an element of landscape structure, which plays an ecological role in forming a green open space system.

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