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ANALYSIS OF THE EFFECT OF GREEN COVERAGE IN THE MAKASSAR STATE UNIVERSITY AREA JL. A.P. PETTARANI MAKASSAR CITY

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ABSTRACT
The availability of Green Open Space, especially in urban areas, is currently very much needed due to the function of vegetation, which is the main element of green open space, has many benefits such as reducing carbon emissions (CO2) in the air and changing the microclimate (reducing surface temperature). This study aims to analyze the effect of vegetation on surface temperatures around the area of Makassar State University Jl. A.P. Makassar City Pettarani by comparing the area of built and green areas in the study site and analyzing the carbon absorption capacity of existing vegetation. The method used is analysis with Geographic Information Systems in processing high-resolution image data. The results showed that the amount of green cover in the study location was able to reduce CO2 produced by the built area by 17.74%. The carbon absorption of the vegetation can be increased by increasing the amount of green space both horizontally and vertically. The need for vegetation also needs to be increased by 2.75 hectares to reduce the surface temperature to reach the Makassar City thermal comfort limit of 25-27 ^{o}C.

KEYWORD: green coverage, green open space, CO_2, land surface temperature

INTRODUCTION
Vegetation as the main constituent of Green Open Space has great benefits to improving the physical quality of the city as well as to the people who inhabit urban space. Trees as one type of vegetation found in urban areas have many benefits, such as improving air quality, increasing urban biodiversity and helping regulate microclimates, all of which are considered as the basis of components of urban ecosystems (Derkzen, van Teeffelen, & Verburg, 2015).

Urban heat island is a condition where an area has a warmer temperature than the surrounding area in the urban area. One of the causes of the occurrence of heat islands in urban areas is the number of buildings, dense urban structures and lack of vegetation (Aghamohammadi et al., 2018). In addition, according to (Roth & Chow, 2012) the factors causing the occurrence of urban heat islands differ in each layer, namely in the soil (subsurface); surface (measured using remote sensing); in air volume between buildings (urban canopy layers); and on buildings (in layers of urban boundaries)

Some studies that shown the influence of vegetation, especially trees in reducing surface temperatures. The results of the study (Aboelata & Sodoudi, 2019) showed that trees can reduce daily air temperatures by 0.2 - 0.4 oK. Another study showed that the difference in average temperatures in the suburbs and the center of Semarang ranged from 1-2 oC due to the high land built up in the city center and the lack of vegetation cover (Almira, Delarizka; Bandi, 2016).

Other studies also show that densely populated areas emit higher carbon levels than less populated areas. Whereas for every square meter of total floor area, 16.51 tCO2 / m2. Carbon year is released from buildings every year (Chang, Yang, & Lin, 2019). In addition, according to (Femy, Tati Budiarti, Nizar Nasrullah, 2017) in his study, each addition of vegetation cover by 1% will reduce the air temperature by 0.0249 oC.

The results of a study conducted by (Kurniati & Rahmi, 2019) showed that the vegetation in Makassar City in 2018 was in the medium vegetation density class range of 0.3-0.6. The highest decrease in the number of vegetation areas was in Panakukang Subdistrict, namely 1.42 km2 for 5 years from 2013 to 2018.

Furthermore, the decline in vegetation was in Rappocini District which was the location of the object of research by 0.62 km2.

Based on this, the study was prepared in order to analyze the effect of vegetation on surface temperatures around the area of Makassar State University Jl. A.P. Makassar City Pettarani by comparing the area of built and green areas at the study site and analyzing the carbon absorption capacity of existing vegetation.

RESEARCH METHODOLOGY

Research sites

The location of the study is in the area of Makassar State University Jl. A.P. Pettarani Kec. Makassar City Rappocini. The study focused on the Phinisi Tower complex and its surroundings as the center of the activities of Makassar State University. Measurements were made in the green area and the built-up area in the Makassar State University Campus area.

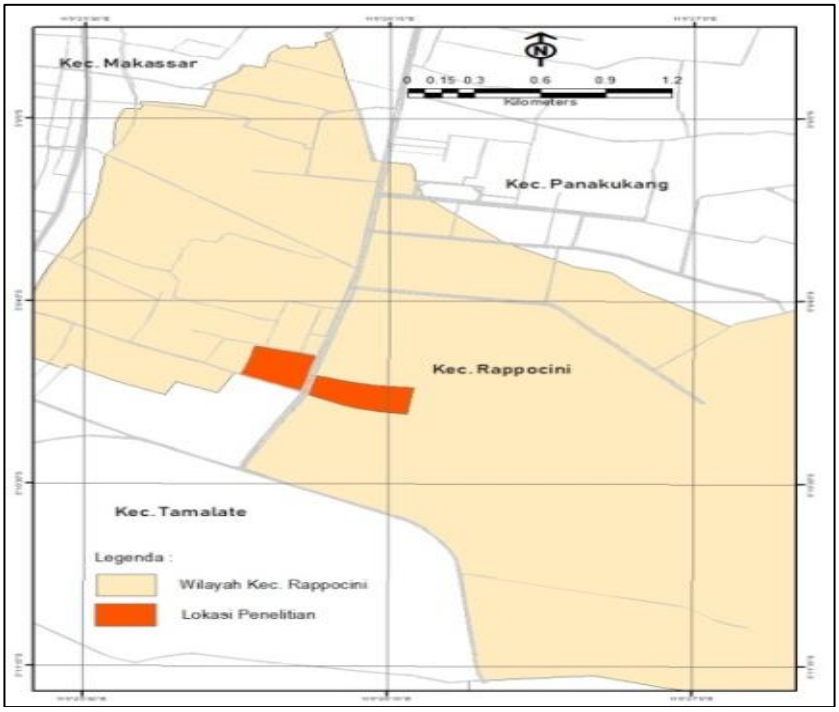

Figure 1. Map of Research Locations in Kec. Makassar City Rappocini

DATA AND METHODS

The data used in this study is the data from the measurement of green cover (green coverage) using high-resolution Geo Eye satellite images less than 10 m recording in July 2019. The Green Area measured is the area with canopy cover both by tree vegetation and shrub plants. While the built area is an area that is covered by buildings not included in open spaces such as parking areas and roads.

Analysis of areas for green cover and built-up areas is done through the application of Geographic Information Systems using the ARCGIS 10.2 application. and ArcView 3.3. In addition, the calculation of the amount of carbon is based on the results of calculations (Ervianto, 2011) which found that the equivalent CO_2 emissions per m^2 of building is 124.60 kg CO_2 / m^2.

The ability of vegetation to absorb carbon dioxide (CO_2) can be calculated using the formula:

CO_2 Absorption = CO_2 Absorption Rate x Area of Vegetation cover …… (1)

Carbon absorption for tree vegetation is 569.07 tons / ha / yr based on the study (Prasetyo, 2002).

RESULTS AND DISCUSSION

3.1. Green Cover of Universitas Negeri Makassar Area

Makassar State University with an area of about 11.3 hectares which is divided into western campus and east campus separated by Jl. A.P. Pettarani The UNM campus area has a green cover of 2.70 hectares which

is divided into two locations namely 0.74 hectares of the western campus and 1.96 hectares of the eastern campus. Distribution of green cover areas at the study site can be seen in **Figure 2**.

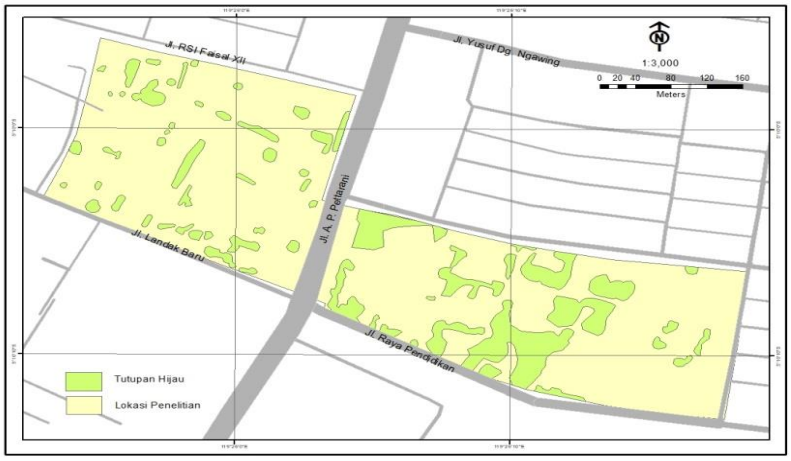

Figure 2. Map of Green Cover on UNM Campus Jl. A.P. Pettarani

3.2. Makassar State University Area Built Area

The total area built on the Makassar State University campus consists of a 3.57 hectare western campus and an east campus of 3.39 hectares with a total area of 6.95 hectare.

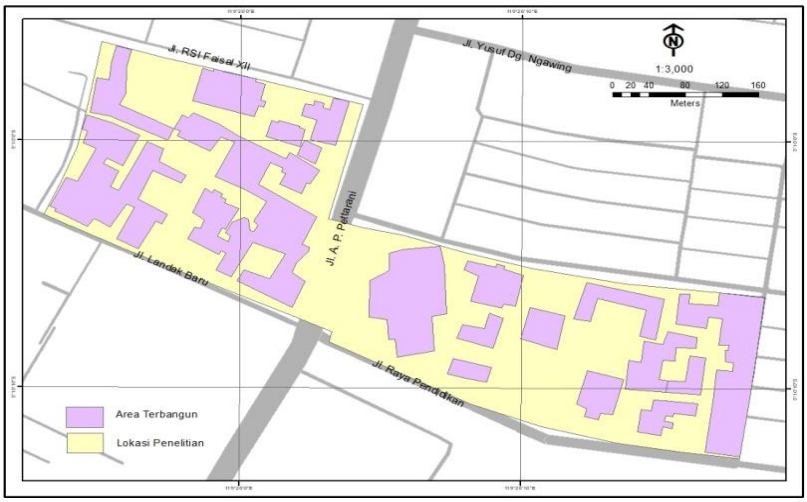

Figure 3. Map of the Built Area on UNM Campus Jl. A.P. Pettarani

3.3. Carbon Absorption by Vegetation

Based on the data analysis of the area developed in the area of the Makassar State University Campus Jl. A.P. Pettarani, the amount of carbon (CO_2) produced was 8,659.70 tons / ha. The results of the analysis of carbon absorption of existing vegetation at the study site amounted to 1,536.49 tons / ha / year. Based on the results of these calculations, it can be concluded that the existing vegetation / green space is able to absorb carbon produced by buildings by 17.74%. The amount of carbon (CO_2) that can be reduced in this study does not include those produced by motor vehicles.

Reducing the amount of carbon in the UNM Campus Area can be optimized by increasing the number of Green Open Spaces, both horizontally and vertically. The need for green cover to reduce the amount of carbon emissions can also be done through the selection of vegetation that has a high carbon absorption. Increasing the amount of vegetation up to 12.52 hectares can reduce all CO_2 emissions generated by buildings.

3.4. Change in surface temperature

Based on the results of the study (Femy, Tati Budiarti, Nizar Nasrullah, 2017) the addition of the amount and area of green cover at the study site can reduce the surface temperature of 1-3 ^{o}C. Makassar City surface temperature in 2018 ranges between 28 - 31 ^{o}C. Based on research that has been carried out previously, it shows that the threshold value of UHI in 2018 of 29.54 ^{o}C exceeds the thermal comfort temperature of Makassar City, which is 25-27 ^{o}C.

Therefore, increasing the amount of green cover to reduce the temperature to a thermal comfort of 27 ° C is needed. Based on the results of the analysis, it can be concluded that the addition of green cover or green space area of 1.1 hectares can reduce the temperature by 1 oC, so a green cover of 2.75 hectares is needed to reduce the temperature to reach the upper limit of the thermal comfort temperature of Makassar City.

CONCLUSION

Based on the results of research that has been carried out, it can be concluded as follows:

1. UNM Campus Area Jl. A.P. Pettarani still needs additional vegetation cover in the form of Green Open Space to reduce the amount of carbon emissions generated by existing buildings.
2. Increasing the amount of vegetation also affects the decrease in surface temperature around the UNM Campus Area.
3. The amount of vegetation cover needed to reduce CO2 produced by existing buildings is 12.52 hectares, while to reduce surface temperature to achieve thermal comfort requires 2.75 hectares.

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