Settlement mapping analysis as land use change monitoring in Bogor Regency sub urban area

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Abstract. Settlements are one of the basic human needs that need to be fulfilled. The development of settlements has implications for changes in land use. The high urban population affects the need for settlements in East Cilebut Village as a suburb area which is included in the peri-urban area. East Cilebut Village has the highest population density in Sukaraja District. Physical changes to the area in East Cilebut Village occurred in 2015 and 2020 with the emergence of new settlements. The research was conducted as a form of monitoring the changes in land use into settlements in East Cilebut Village. Monitoring was carried out by mapping settlement blocks in 2015 and 2020. The growth of settlement area was identified through Google Earth satellite imagery in 2015 and 2020. Data processing techniques were carried out by interpreting and on-screen digitizing satellite imagery using ArcGIS. The results of data processing were analyzed descriptively by presenting the data in the form of graphs and maps. Changes in settlement area occurred from 2015 to 2020. The settlement area in 2020 was higher than 2015. The results of data processing are expected to provide advice on settlement development policies for the local government.

Keywords: Settlement, Mapping, Land Use

1 Introduction

Settlements are basic human needs that need to be fulfilled and have implications for land use change (Luhukay, Sela, & Franklin, 2019). Government Regulation Number 12 of 2021 concerning the Implementation of Housing and Settlement Areas on Article 1, explains that settlement is part of a settlement environment consisting of more than one housing unit that has infrastructure, facilities, public utilities, and has supporting activities for other functions in urban areas or rural areas (Peraturan Pemerintah Republik Indonesia, 2021). Decree of the Minister of Settlement and Regional Infrastructure No. 403/KPTS/M/2002 concerning Technical Guidelines for the Development of Simple Healthy Homes explains that the per capita space requirement is 9 m^2 (Keputusan Menteri Permukiman dan Prasarana Wilayah, 2002). The distribution of Indonesia's urban population is mostly concentrated in big cities such as Jakarta, Bogor, Depok, Tangerang, and Bekasi (Santosa, 2021). High land values in urban areas lead to changes in land use on the outskirts of the city into settlements (Siahaan, Soma, & Zefri, 2019).

Bogor Regency, as the hinterland of DKI Jakarta, acts as a settlement enclave with a rapid suburbanization process in the Peri-Urban Area (*Wilayah Peri-Urban* or WPU) (Syahbandar, 2018). Peri-Urban areas experience slow physical development around the city due to limited land that is not in accordance with the needs of residents in the city (Hapsari & Aulia, 2018). Physical growth in Bogor Regency occurred in Sukaraja District, one of which was in East Cilebut Village. East Cilebut Village has the smallest area in Sukaraja District, which is 1.3 km^2. Based on data from the Statistics Indonesia (*Badan Pusat Statistik/BPS*) of Bogor Regency, East Cilebut Village has a high population, so the population density in East Cilebut Village is also relatively high due to its small area. The population in 2015 was 21,551 people (Badan Pusat Statistik Kabupaten Bogor, 2016) and in 2020 as many as 21,304 people (Badan Pusat Statistik Kabupaten Bogor, 2021). The population density in East Cilebut Village in 2015 reached 16,578 people/km^2 and in 2020 it reached 16,388 people/km^2. Other villages in Sukaraja sub-district reach less than 10,000 people/km^2.

This study aims to map the growth of settlement area as a monitoring measure for changes in land use in East Cilebut Village. Monitoring was carried out by mapping settlements in East Cilebut Village in 2015 and 2020. The results of this study are expected to provide

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recommendations for policy suggestions for settlement development to the local government.

2 Method

The unit of analysis in this study is a settlement block that is limited by roads and surrounding land uses. The data used in the research is Google Earth satellite imagery which is downloaded through the Google Earth Pro software. The data is processed using ArcGIS software by doing georeferencing first. The georeferenced images are interpreted and digitized on-screen into vector data of settlement area to produce a settlement map. The graph of the processing results is processed using Microsoft Office Excel to display the area of settlements in 2015 and 2020. The flow of data processing is as shown in Figure 1. The results of data processing are analyzed descriptively by comparing changes in settlement land use in 2015 and 2020. The results are presented in the form of graphs and maps, to make it easier to understand the results of data processing.

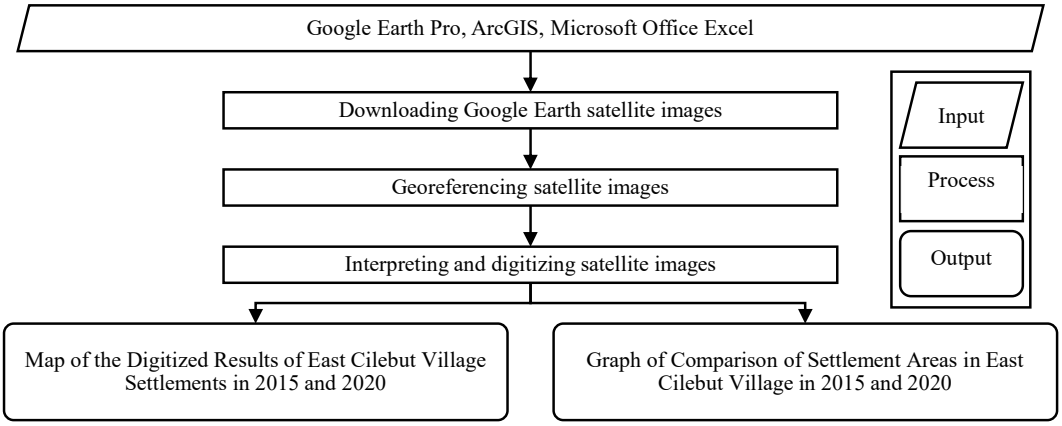


Fig. 1. Flowchart of processing satellite image data into maps and graphs for descriptive analysis.

3 Result and discussion

The area of settlements in East Cilebut Village changed in 2015 and 2020. The area of settlements in 2015 was 812,231.3383 m^2. The area of settlements in 2020 is 853,105.6936 m^2. The comparison of the two settlement areas can be seen as shown in Figure 2. The comparison of the two settlement areas shows an expansion of the settlement area in 2020. This shows that there is a change in land use into settlements in East Cilebut Village.

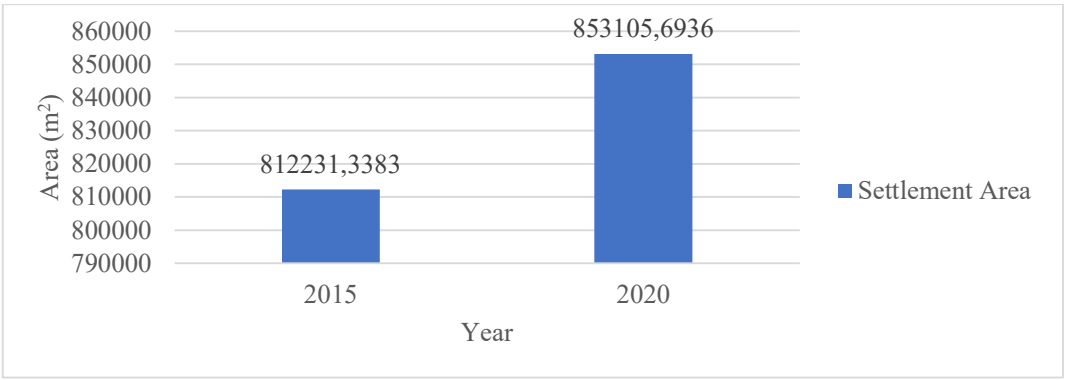
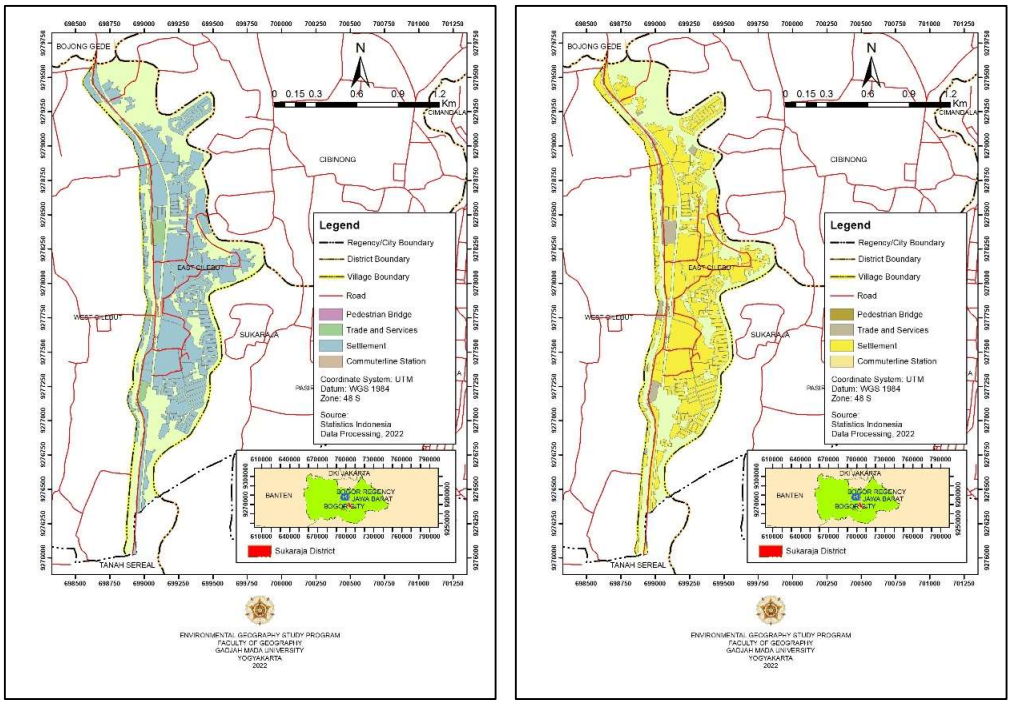


Fig. 2. Graph of comparison of settlement area in East Cilebut Village in 2015 and 2020.

Settlement blocks are identified based on the results of interpretation and digitization. The results of the interpretation show that changes in the area of settlement blocks occur because there are settlement blocks that are increasingly expanding and new settlement blocks appear. Changes in the area of the settlement area as shown in Figure 3.



(a) (b)

Fig. 3. (a) Map of digitized settlements in East Cilebut Village in 2015; (b) Map of digitized settlements in East Cilebut Village in 2020.

4 Conclusion

The trend of growing settlement area in 2015 and 2020 shows that the need for settlements is increasing. This is inversely proportional to total population and population density figures in East Cilebut Village which slightly decreased from 2015 and 2020. The results show a temporary area based on interpretations that can be measured digitally using satellite imagery. Data collection on settlement areas needs to be carried out by government institutions directly in the field. Data collection is needed to produce spatially more accurate settlement area data. This is because there are still shortcomings in interpretation. Vegetation such as trees can cover some buildings which makes data on settlement area not fully accurate if it only relies on interpretation. Measurement of settlement area is very necessary for regional development plans and for the purposes of advanced settlement research.

The writers would like to express our deep gratitude towards Directorate of Research Universitas Gadjah Mada under Final Project Recognition (RTA) grant Batch I TA 2022 No 3550/UN1.P.III/Dit-Lit/PT.01.05/2022.

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