Analysis of Land Cover Changes in Pontianak City from Year 2005 to 2020 Using GIS and Remote Sensing

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Abstract: Changes in land cover of an area always change from year to year; changes in land cover can cause negative excess if not managed properly. This study was conducted in Pontianak City to determine changes in land cover that occurred from year 2005 to 2020. Land cover is categorized into three, namely mixed plantation, settlement and bare land. Settlement growth is the most dominant factor in Pontianak City.Changes in land cover from year 2005 to 2020 give the fact that the development of settlement in Pontianak City is very rapid. This is of course in line with the increase in population from year 2005 to 2020.The land cover of Pontianak City until year 2020 is dominated by built-up areas or settlement covering an area of 8073.88 ha or 80.739 km² or 74.866% of the total area of Pontianak City, namely 107.844 km². Mixed plantation is 19.997%, which is 2156.9 ha or 21.57 km² and bare land is 5.137%, which is 553,957 ha or 5,540 km².

Keywords: land cover, mixed plantation, settlement, bare land

Introduction

The condition of land cover from year to year always changes due to the increase in population, the increase in population causes the need for land to be built to increase, whether it is used for housing, offices, markets, road networks, ports, airports, and so on. In other words, changes in land cover, which initially turned forest into rice fields, plantations, initially plantations turned into housing and so on, or changes in land cover from vegetated land cover to land cover without vegetation.

This change in land cover can make an area vulnerable to flood hazards, because land cover that has more vegetation will absorb the rainwater that falls so that only a small portion of rainwater flows into the channel, while land cover that has no vegetation will drain more. Rain water to the channel. The fact that what happens is the area of land cover which has vegetation from year to year always decreases in size.
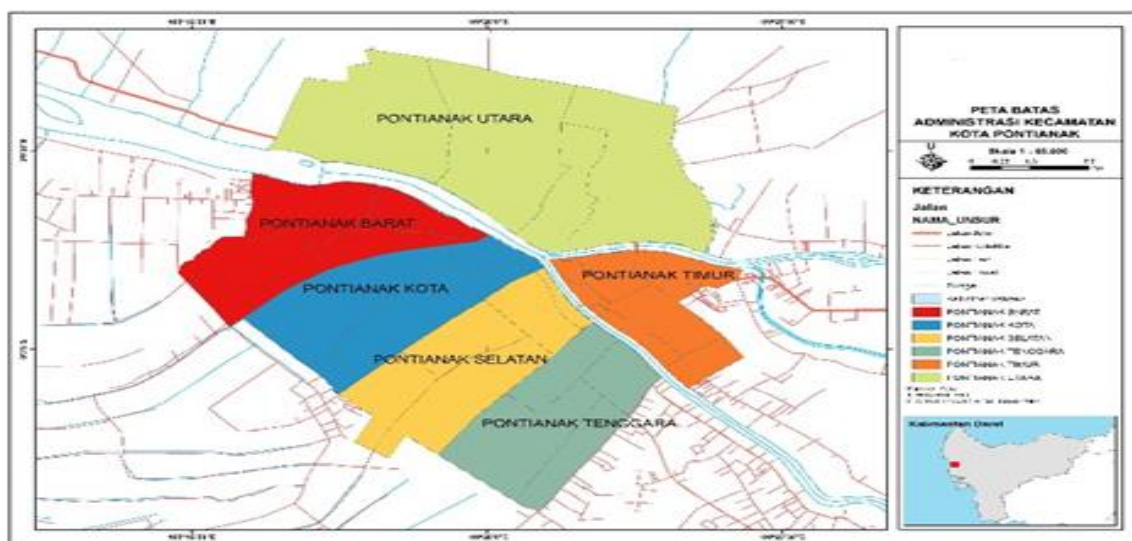
Study Area

**Figure 1 Map of the research location (Pontianak City) West Kalimantan Indonesia**

The location of this study is Pontianak City, West Kalimantan Province, Indonesia, which is located between 00 02 '24' 'North Latitude and 00 05' 37 " South Latitude and between 1090 16 '25' 'East Longitude to 1090 23' 01 ' 'East Longitude, with an area of 107.8 km2, consists of 6 districts and 29 villages.

Materials and Methods

In this study, using Landsat TM dan Landsat 8 OLI Path / row 121/060 imagery from 2005 to 2020 which was downloaded from the website www.glovis.usgs.gov, corrections were made, geometric corrections and radiometric corrections. Corrections were carried out using Envi 4.5 software. Then Image Composite, for the purposes of analysis, 3 bands / channels were selected to be combined according to the spectral characteristics of each channel / band and adjusted to the research objectives. Research on monitoring the conditions of land cover change was chosen band / canal 4, 3 and 2 (natural color) in landsat 8. This is because the bands / canals are sensitive and have high reflection values on vegetation, bare land, and water elements (Hardjowigeno, 1993). Then Clip Image with Area Boundary, This process clips / cuts the image that has been composited with an area boundary map of the Pontianak city. In the ArcGis10.3 program it can be done using the data management command or Data management tools. Training Area (Sample Points), the image of the recording year 2005-2020 was digitally processed using the Supervised Classification method. In this research, the method used is the maximum likelihood classifier method. In this method, various factors are considered, including the opportunity for a pixel to be classified into a particular class or category. Then Image Classification, Merging, with image classification tools in the training sample area dialog box then Labelling. The last, Accuracy Analysis. According to Kubangun et al. (2015) Validation values from 0.81 to 1.00 indicate a very good suitability. A very good validation value indicates a very good suitability to the actual land cover conditions.

Result and Discussion

Based on the interpretation, the settlement is 41 km², mixed plantation area is 28 km², and bare land is 39 km². The total area of the city of Pontianak is about 108 km².
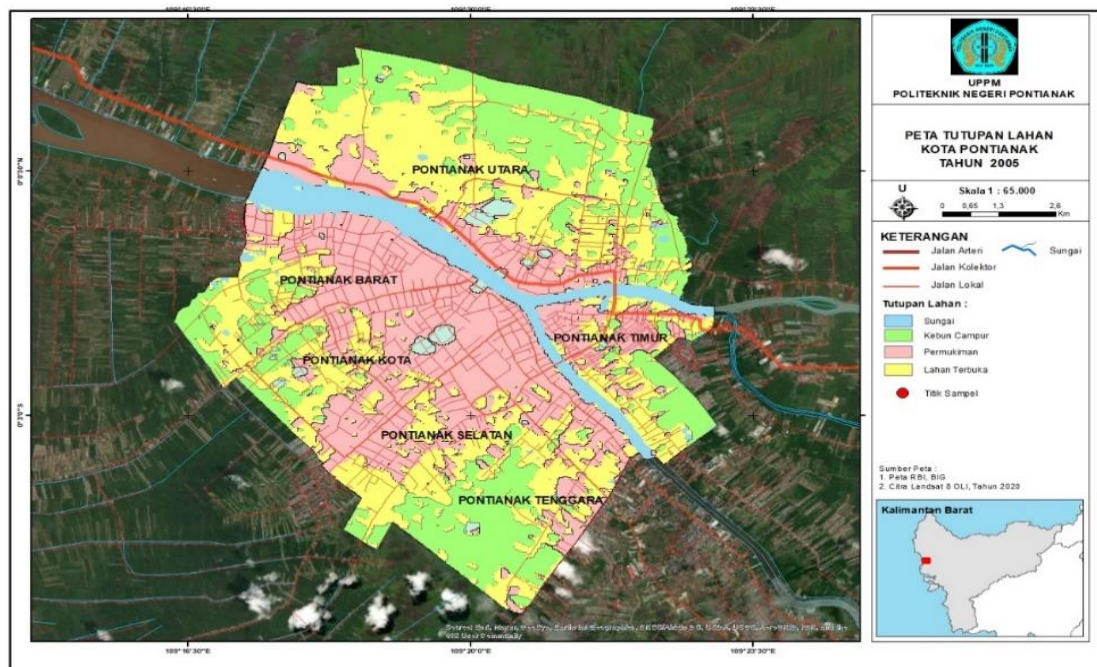
Figure 2. Land cover of Pontianak City, year 2005

Land cover In the 2020, it can be seen that the settlement has reached 80.74 km², mixed plantation which was originally 28 km² decrease to 21.57 km² , while bare land has only 5.54 km2 from 39 km².
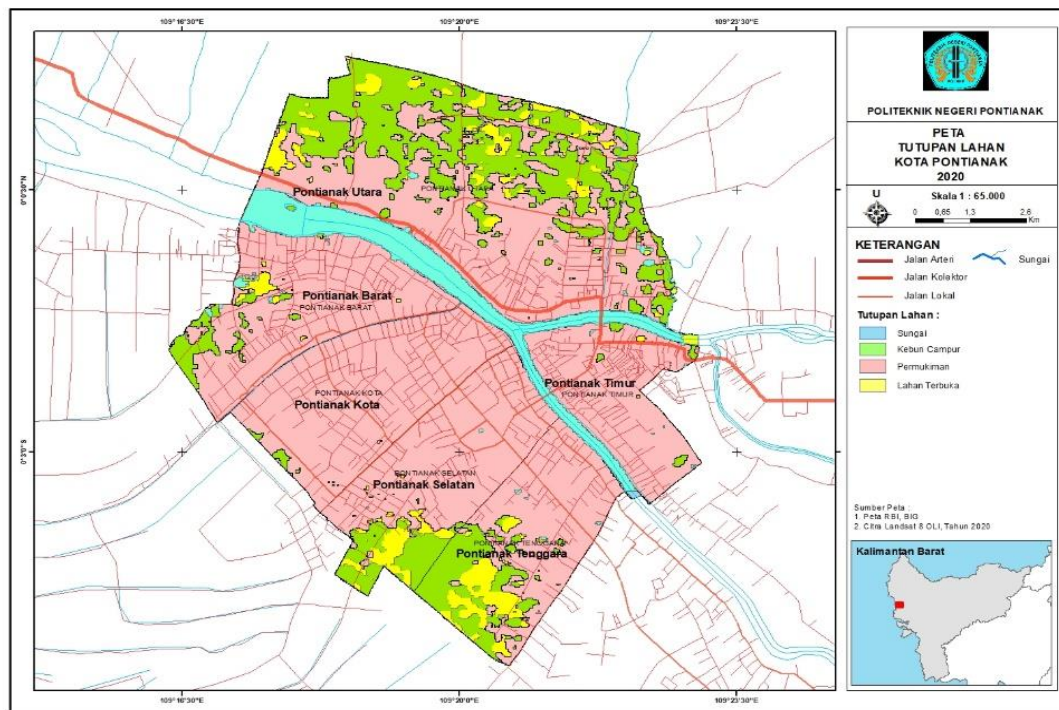
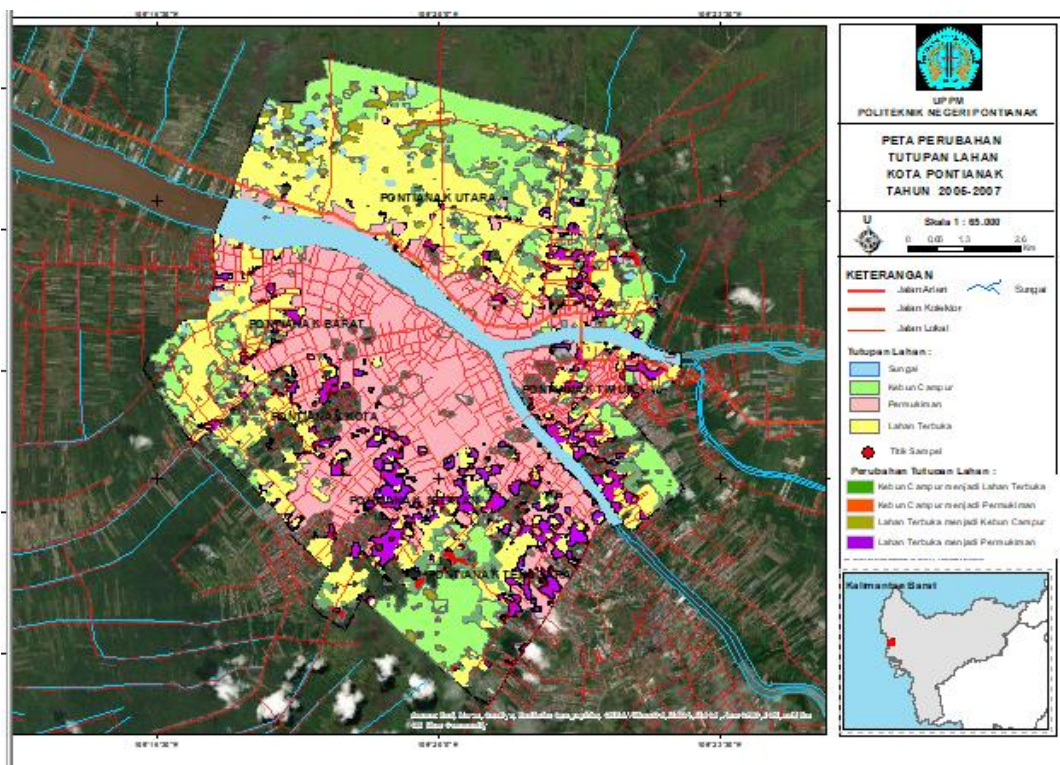**Figure 3. Land cover of Pontianak City,year 2020**

Figure 4. Changes in Land Cover of Pontianak City, year 2005 - 2007

From Figure 4 above, it is found that: mixed plantation 17 km², settlement 34 km², and bare land 25 km². The change of mixed plantation into 5 km²bare land. Change of mixed plantation to settlement area of 1 km². Change of bare land into mixed plantation and settlements covers an area of 3 km² and 8 km².
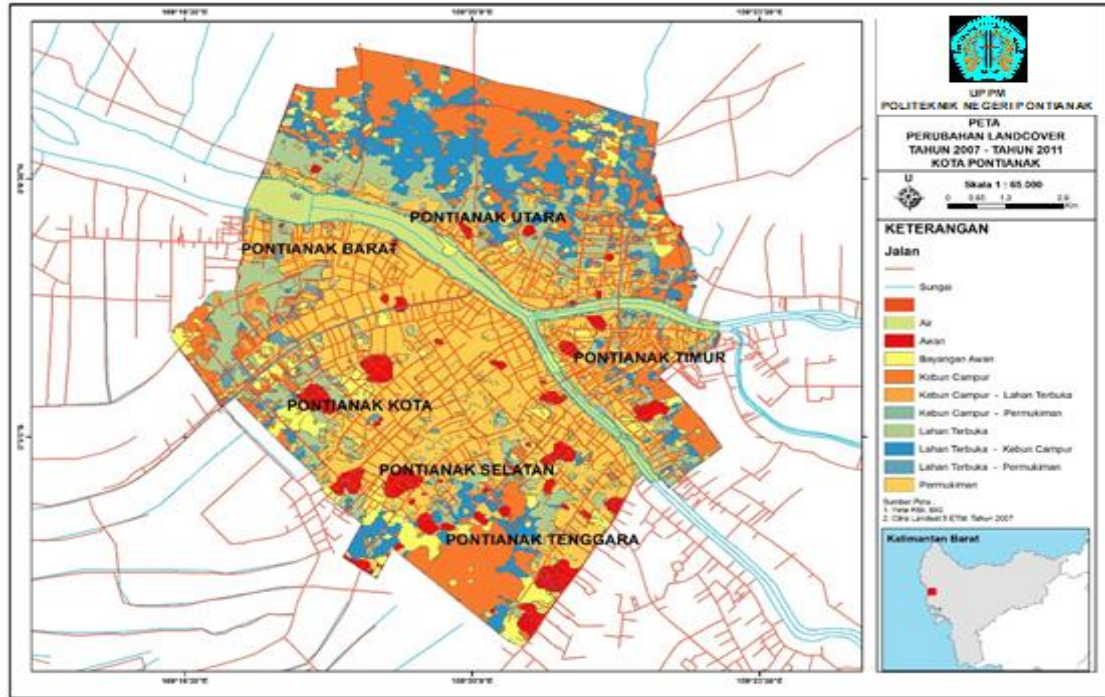
Figure 5. Changes in the Land cover of Pontianak City, year 2007 – 2011

From Figure 5 above, it is found that: mixed plantation is 18 km², settlements are 44 km² and bare land is 16 km². Change of mixed plantation into bare land 1.6 km². Change of mixed plantation to settlement area of 0.17 km². Changes in bare land into mixed plantation and settlements cover an area of 13 km² and 1.51 km².
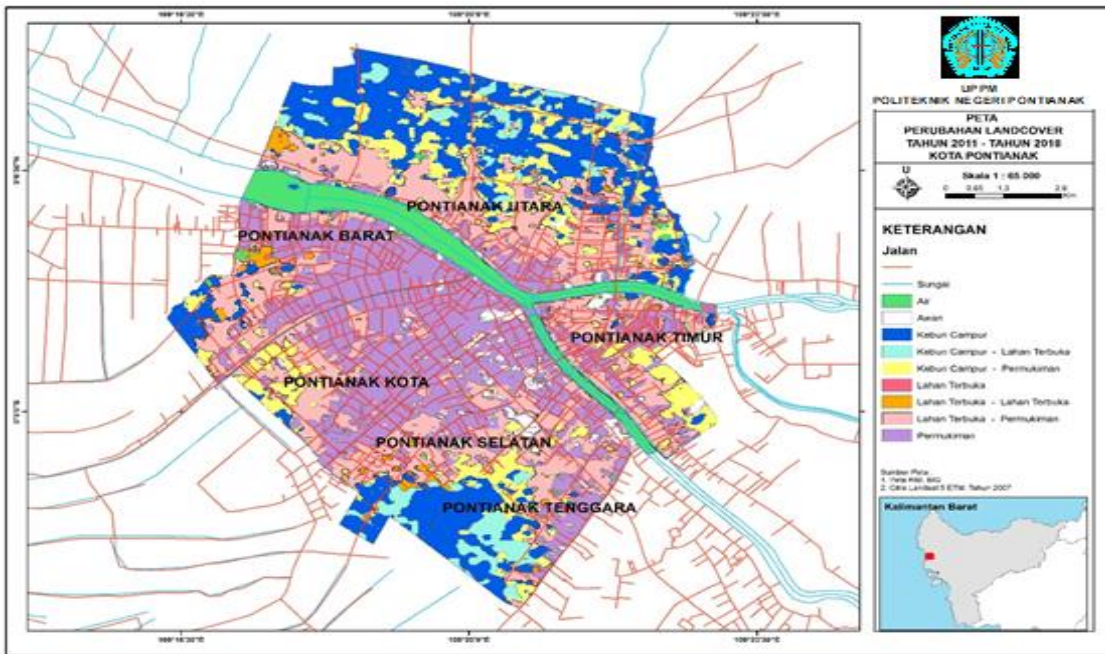

Figure 6. Changes in the Land cover of Pontianak City, year 2011 – 2018

From Figure 6 above, it is found that: mixed plantation is 22 km², settlements are 77 km², and bare land is 6 km². This shows that changes in land cover for residential areas in Pontianak City continue to increase every year.
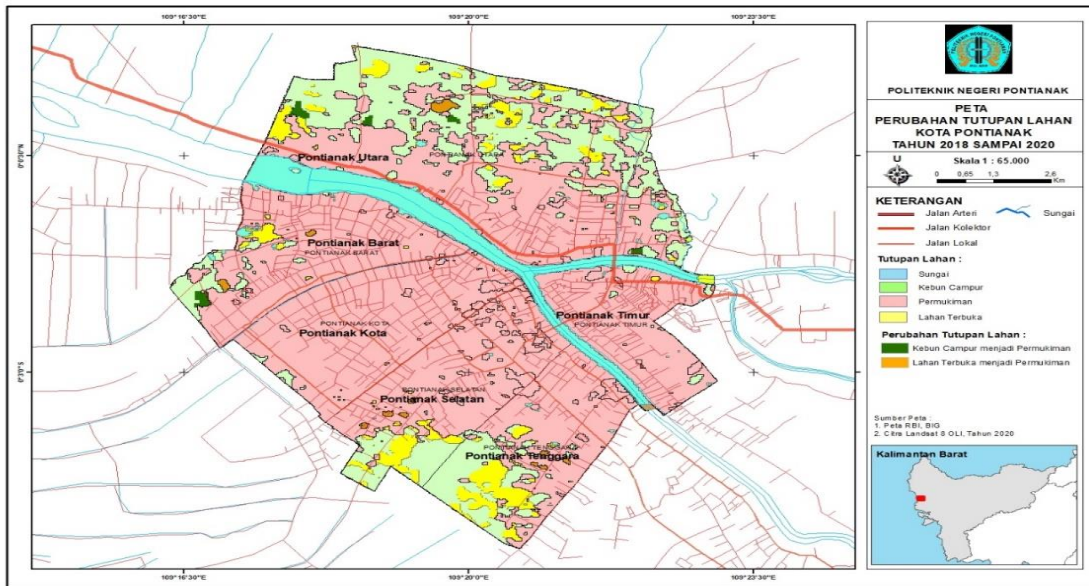
Figure 7. Changes in the Land cover of Pontianak City, year 2018 – 2020

Based on the interpretation of the 2018 and 2020 Landsat images which are then overlaid to see if there has been a change in land within 2 years with GIS technology. In the LC of the water body, there is no change in area, both in 2018 and 2020, the area remains the same, 709.21 hectares. Whereas in mixed plantation land, there is a change in land function, mixed plantation changed to settlements from 2018 to 2020 covering an area of 39.62 hectares, meaning that there is a reduction in the area of mixed plantation by 39.62 hectares and an additional residential area. Then seen from the bare land there is also a change in land function from bare land to 44.75 hectares of settlement, this means that from 2018 to 2020 there is a reduction in the area of bare land to settlements of 44.75 hectares and an increase in residential area. So from the table above, it can be concluded that there is a change in land function from non-built land to built-up land covering an area of 80.74 hectares or 0.8074 km².
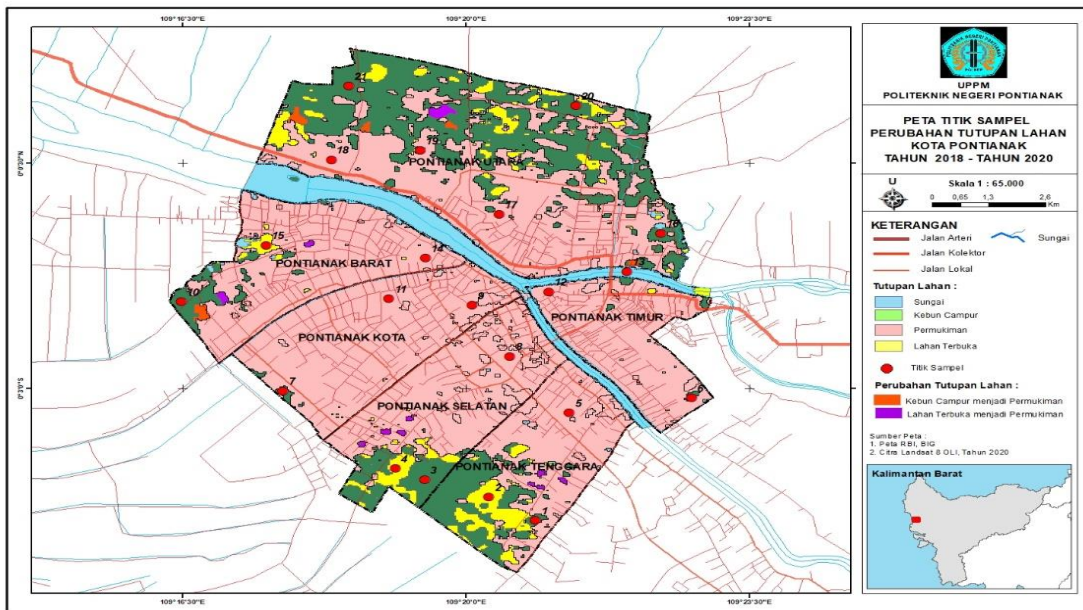

Figure 8. Validation Sample Point of Land Cover Change in Pontianak City,year 2018 – 2020

Based on checking twenty one (21) randomly selected sample points in the field against the results of the Landsat 8 image interpretation, it turns out that there are four sample points that were wrong in the interpretation of the total sample points. This shows that the accuracy obtained is quite good from having a validation value of more than 80% obtained from the number of correct sample points compared to the total number of sample points in times 100, 17/21 * 100% = 80.95%.The clarification is done by checking using high resolution imagery (Google Earth). This value indicates a very good suitability to the actual land cover conditions.

Conclusion

Based on a study of land cover changes in Pontianak City from 2005 to 2020, it shows that bare land is decreasing. This is a natural thing when viewed from the population growth which always increases every year. The increase in population is in line with the increase in residential area or settlement in the city of Pontianak.

Referring to the Spatial Planning Law no. 26 of 2007, in urban spatial planning has clearly directed the plan for the provision and utilization of green open space, both public green open space and private green open space, which further provisions regarding the provision and utilization of green open space are regulated in the guidelines for green open space in urban area. The proportion of green open space (RTH) based on the total area in urban areas is at least 30% consisting of 20% public green open space and 10% consisting of private green open space (Arianti. 2010). This shows that the green area or bare land on the land cover of Pontianak City in 2020 has exceeded the proportion limit so that a policy decision must be made by the Pontianak City government not to expand the residential area anymore.

Acknowledgment

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