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3398 Words

CHARACTER COUNT

18051 Characters

PAGE COUNT

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FILE SIZE

1.3MB

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Changes in Land cover using the NDVI (*Normalized Difference Vegetation Index*) Method in Kedamaian Subdistrict, Bandar Lampung City as Urban City

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Abstract. Land cover change occurs naturally, but in urban areas, Land cover change usually occurs more rapidly than in rural areas. Therefore, it is necessary to analyse Land cover changes using spatial data to determine Land cover changes that occurred in urban areas such as Bandar Lampung City in 2000 and 2020. This study uses Landsat 7 and 8 imagery processed by the NVDI (Normalized Difference Vegetation Index) analysis method with an arithmetic formula to determine the vegetation index NDVI = (NIR-RED) / (NIR + RED). After obtaining the land cover map from the results of the NDVI analysis, a ground check was carried out at 30 location points to determine the actual condition of the field and calibrate the data from NDVI analysis and actual condition. In this study, it was found that the results of Land cover from 2000 to 2020 experienced changes, namely in open land/settlements increased by 74% or 217 ha, shrub land decreased by 27% or 32 ha, low vegetation land decreased by 4.8% or 7 ha, and vegetation land is decreasing by 72.5% or 100 ha. Based on the results of ground checks, changes in Land cover are caused by the construction of settlements, housing, and industrial estates due to an increase in population and urban growth.

1. Introduction

Urban areas experience changes in Land cover due to the development process that occurs. Land cover change is an unavoidable phenomenon in relation to the transformation process in allocating natural resources from one use to another [1]. The regional hierarchy is determined by the number of residents, the number, and the type of public service facilities. In general, it can be said that the higher the population and the greater the number and types of facilities in an area, the higher the hierarchy owned by the region's local community. Therefore, it is necessary to make communication efforts from various parties (community, local government, businessmen) to reach an agreement regarding the rules of Land cover change that minimize environmental damage[2].

Land cover change analysis by utilizing temporal-spatial data is instrumental, especially determining the locations where Land cover changes occur [3]. For the purposes of regional development, local governments tend to expand the region towards the countryside. After the area developed, many migrants joined and settled in the area with the consequence that new activities emerged that demanded the provision of land for non-agricultural activities [4]. Land cover change is usually related to regional development, and it can even be said that Land cover change is a consequence of regional development.

The level of regional development shows the number of service facilities, namely the existing infrastructure facilities and infrastructure. The more existing infrastructure facilities tend to be an attraction for development activities.

Based on the above explanation, remote sensing is one solution for monitoring a green space area. It can be used to find out information about the green condition in the specific location, both species and vegetation density, which is very complex using data from satellite imagery. The vegetation index is used to describe the intensity of plants in an area in the image. The vegetation index is a mathematical combination between the red band and the NIR band (Near-Infrared Radiation), which has long been used to indicate the presence and condition of vegetation [5]. The calculation of NDVI (Normalized Difference Vegetation Index) is based on the principle that green plants are very effective at absorbing radiation in the visible light spectrum (PAR or *Photosynthetically Active Radiation*), while green plants reflect near-infrared radiation [6].

This study aims to determine the distribution of Land cover and Land cover changes in 2000 and 2020 in the Kedamaian subdistrict, Bandar Lampung City, Indonesia. Some research has already done using NDVI to analyze the Land cover change [7, 8, 9]. In this case, it is necessary to use Landsat satellite imagery which will be processed to determine the value of the vegetation index, area, and vegetation density class using the NDVI method in the Kedamaian subdistrict. So that the results of this research are expected to provide information about changes in Land cover in the Kedamaian subdistrict, Bandar Lampung City.

2. Research Methodology

Observations were made in the District of Kedamaian, Bandar Lampung City. The research was conducted from October – December 2020. Data analysis was carried out at the Soil Survey and Land Evaluation Laboratory, Department of Soil Science, Faculty of Agriculture, University of Lampung.

The materials used consist of Landsat 8 imagery data for 2020, Landsat 7 image data for 2000, data on administrative boundaries for the Bandar Lampung region in 2020, and field survey data for 2020. The supporting tools used include a computer set with ArcGIS 10.3 software for spatial analysis, Microsoft Excel for data processing, and Android devices with the Avenza Map application.

The implementation phase broadly consists of the preparation phase, data collection, data analysis, field checking, interpretation of results, and preparation of reports. At the preparatory stage, regional topic selection, literature study, and determination of the method used for data analysis were carried out. At the data collection stage, data were collected consisting of several sources, namely earth explorer, the center for planning and development of the Bandar Lampung region, including spatial data in the form of a map of the city's administrative boundaries of Bandar Lampung. The analytical methods used in the data analysis stage include spatial analysis, NVDI (Normalized Difference Vegetation Index) analysis, and comparative Land cover analysis. At the field checking stage at 30 location points, the Avenza Map application on Android devices is used to determine the field checkpoints' condition. After the field checking stage, the result interpretation stage is carried out.

The results of the NDVI were then used in the Land cover calculation to determine the high percentage of Land cover. The analysis stages consisted of 2 stages, Land cover classification and Land cover change analysis. The analysis is based on Geographic Information System (GIS), following the research needs in spatial terms. The method used is the Normalized Difference Vegetation Index (NDVI) landscape-scale method.

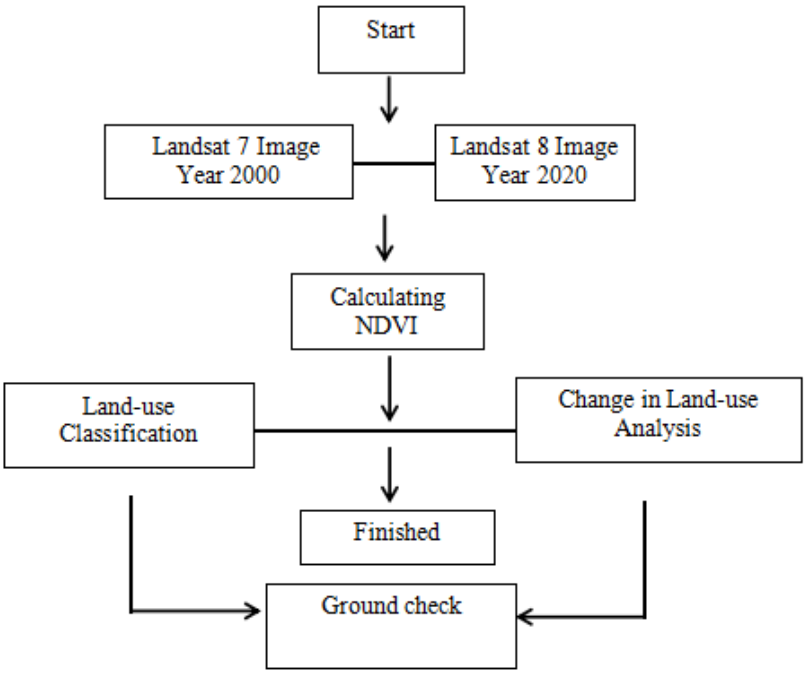


Figure 1. Research's Flowchart

3. Results and Discussions

Land cover in the Kedamaian subdistrict is spatially presented on a Land cover map in the Kedamaian subdistrict. The results of the interpretation of Land cover in the Kedamaian subdistrict from Citra Landsat grouped Land cover into four types of Land cover, namely, open land/settlement, shrubs, low vegetation, and medium vegetation.

Table 1. Land cover of Kedamaian subdistrict in 2000.

Land cover	Symbol	Index	Area	
			Ha	%
Cloud		-0,13 – -0,08	11	1,6
Open land/settlement		-0,08 – 0,01	294	41,5
Shrub land		-0,01 – 0,11	120	16,9
Low vegetation		0,11 – 0,32	146	20,6
Medium vegetation		0,32 – 0,52	138	19,5
Total			709	100

The Landsat 7 image analysis results in 2000 using the NDVI method showed that the use of open land was 294 ha, shrubland was 120 ha, low vegetation was 146, and medium vegetation was 138. There was cloud cover in some areas of 11 ha. The most significant Land cover is on open land/settlement. This figure 2 is still relatively low in urban areas. This happened because, in 2000, the Kedamaian subdistrict had not yet experienced division. Kedamaian subdistrict used to cover the subdistricts of Tanjung Karang Timur and Sukarame. The high use of open/residential land is due to the use of Land coverd as a residential area considering that Bandar Lampung City is the capital city of Lampung Province.

In shrub Land cover, low and moderate vegetation in 2000 was relatively high in urban areas. This is because, in 2000, population growth was still low. In 2000 the population in Bandar Lampung City was 743,109 people [10]; when compared to the population in 2020 of 1,051,500 people, the population is still relatively low, so that the use of open land/settlements is still relatively stable.

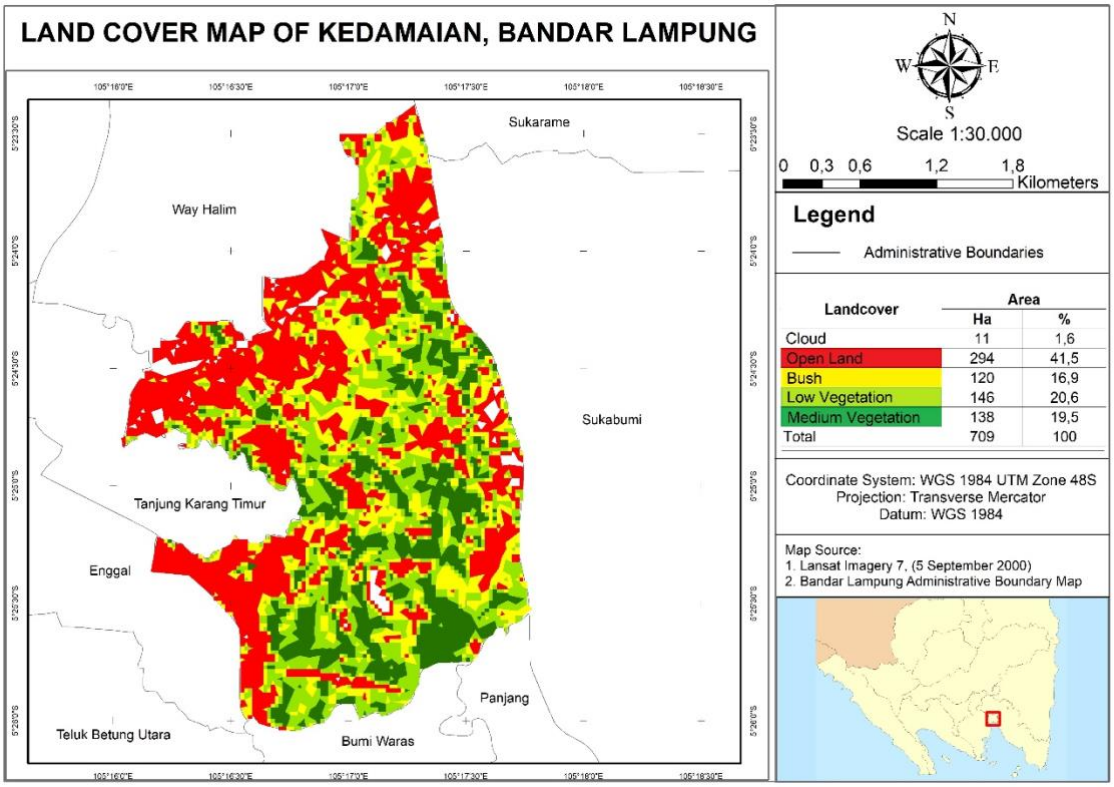


Figure 2. Land cover map of Kedamaian subdistrict in 2000.

Table 2. Land cover area of Kedamaian subdistrict in in 2020

Land cover	Symbol	Index	Area	
			Ha	%
Cloud		0,024 – 0,03	0	0
Open land/settlement		0,03 – 0,25	469	63,9
Shrub land		0,25 – 0,35	88	11,99
Low vegetation		0,35 – 0,45	139	18,93
Medium vegetation		0,45 – 0,58	38	5,18
Total			734	100

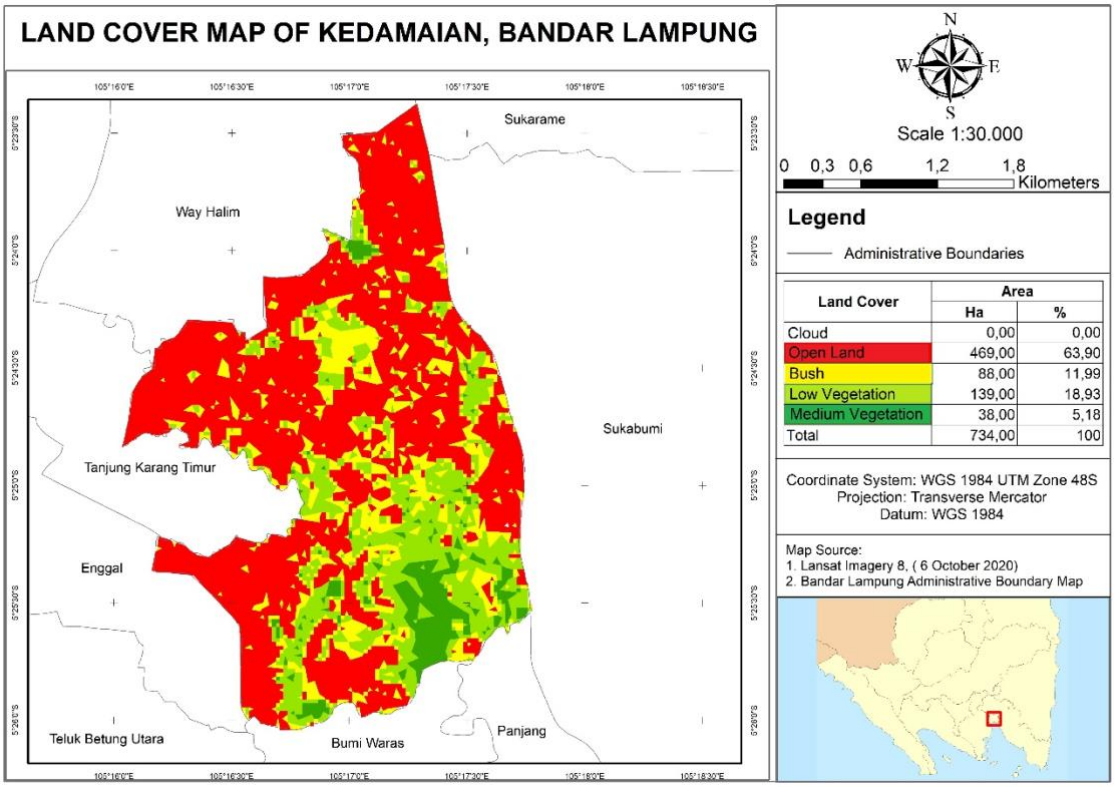


Figure 3. Land cover map of Kedamaian subdistrict in 2020.

Land cover in the Kedamaian subdistrict has undergone significant changes over the past 20 years. The Land cover map of the Kedamaian subdistrict in 2000 and 2020 is presented in Table 3. Land cover that has increased in the area is open land/settlement, and Land covers that have decreased in the area are shrubs, low vegetation, and medium vegetation.

The type of Land cover that has increased in area in Kedamaian District is the use of open land/settlements. In the 2000-2020 period, there was an increase of 217 ha, spread throughout the Kedamaian District. In the type of Land cover that experienced a decrease in area in the period 2000 - 2020, namely the use of shrubland which decreased -32 ha, low vegetation by -101 ha, medium vegetation by -100 ha.

Table 3. Land cover area 2000-2020 and its changes

Land cover	Year 2000 (ha)	Year 2020 (ha)	Change 2000 – 2020 (ha)	Change 2000 – 2020 (%)
Open land/settlement	294	469	217	74
Shrub land	120	88	-32	-27
Low vegetation	146	139	-7	-4,8
Medium vegetation	138	38	-100	-72,5

The analysis of Landsat 8 imagery in 2020 using the NDVI method obtained 469 ha of open Land cover, 88 ha of shrubs, 139 ha of low vegetation, and 38 ha of medium vegetation. The most significant Land cover is in open land/settlement by 469 ha or an increase of 217 ha compared to 2000. The increase in Land cover as open land/settlements is due to the increasing number of residents, thereby increasing residential development, opening up work areas and industrial areas. This implies that the conversion of

agricultural land will be accompanied by changes in the community's economic, cultural, and political orientation, which are also generally irreversible. The development of an area is generally always followed by population growth [11]. This significant increase occurred due to the increasing number of residents in the Kedamaian District. In 2019 the Kedamaian subdistrict had a population of 55,533 people or an increase of 19.24% compared to 2010 [12].

In shrub land cover, the area decreased by 32 ha and medium vegetation by 100 ha. Based on the results of field checks at several points on the 2000 Land cover map, several residential buildings, housing, open land, offices, and industrial areas were found at the field check points in 2020. This indicates that the conversion of shrub land and vegetation land to residential area and urban development.

The decrease in the area of Land cover for shrubs, low vegetation, and moderate vegetation is due to the increase in urban growth so that the conversion of land functions as residential areas and industrial areas is getting higher. This is due to the rapid increase in Land cover change or urbanization resulting in the conversion of green land or agriculture into buildings. The process of Land cover by humans from time to time continues to change along with the development of civilization, and human needs will be higher for land needs. Changes in Land cover occur due to population growth and the development of life demands; the need for housing, which requires space as a container, is increasing.

According to Hartini et al. [11], the increase in land use as open land/settlements is due to the increasing number of residents, thereby increasing residential development, opening up jobs and industrial areas (see figure 4). This implies that the conversion of agricultural land will be accompanied by changes in the community's economic, cultural, and political orientation, which are also generally irreversible. The development of an area is generally always followed by population growth.

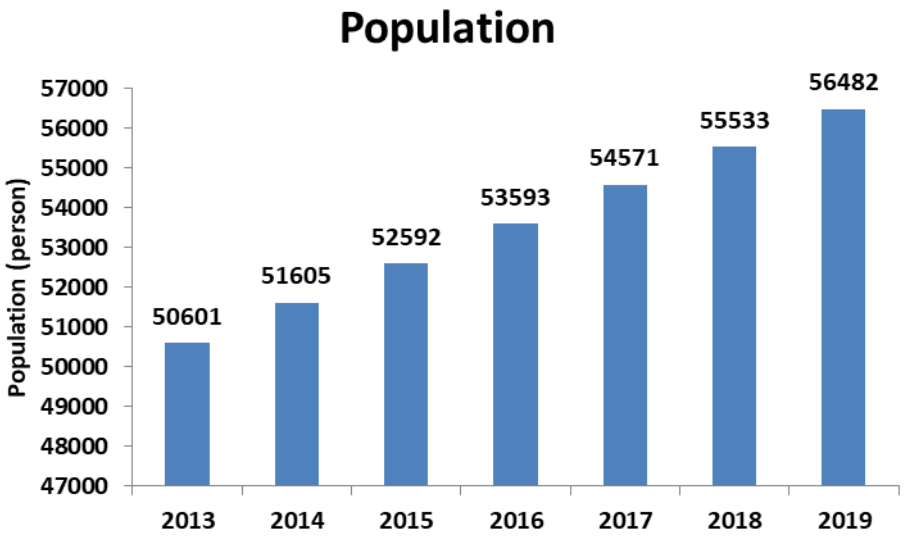
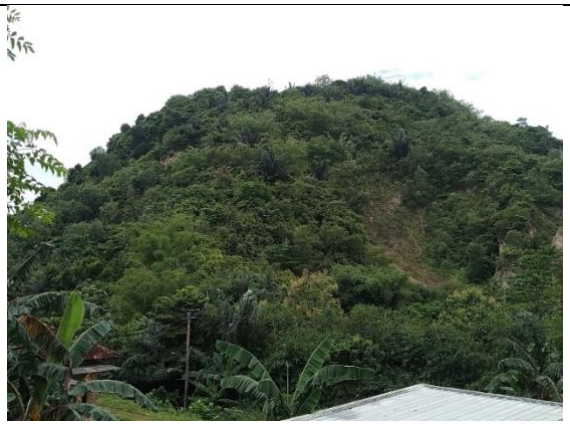


Figure 4. Graph of Population Increase.

Based on the results of field checks (figure 5) at several points, residential buildings, housing, open land, offices, and industrial areas were found at the field checking points. According to Tian & Li [13], changes in non-agricultural Land cover are characterized by the growth of industrial estates. Industrial growth is one of the things that causes urbanization to accelerate further the growth and development of cities [14]. Migration of workers to industrial areas will speed up the urbanization process, which is automatically followed by changes in the surrounding Land cover.

Open land/settlement	
	
Coordinate : -5.415194°, 105.293516° Condition : Industrial Area	Coordinate : -5.413508°, 105.288794° Condition : Housing Area
Low vegetation	
	
Coordinate : -5.428539°, 105.278369° Condition : Graveyard	Coordinate : -5.409622°, 105.292008° Condition : Corn Field
Medium vegetation	
	
Coordinate : -5.422436°, 105.290686° Condition : Hill	Coordinate : -5.417189°, 105.290479° Condition : Teak Forest

Source: Analysis, 2020

Figure 5. Field condition as a results of ground check based on vegetation density

Figure 6. Google earth image of residential area 1 2020 [15].

Figure 7. Google earth image of residential area 2 2020 [15].

Figure 8. Google earth image of industrial estate area 2020 [15].

Rapid population growth and the increasing demands of community needs for land often result in conflicts of interest over Land cover and a mismatch between the Land cover and the designation plan. Limited land in urban areas also causes the city to develop physically towards the outskirts of the city. Regarding the Land cover, suburban areas are areas that experience many changes in Land cover, especially changes in agricultural Land cover to non-agriculture due to the influence of the development of nearby cities [16].

This population growth has implications for increasing the need for quality and quantity of facilities and infrastructure so that the increase in open land/settlements follows urban growth. Urban growth is a multidimensional spatial and population process in which cities and urban settlements are considered the center of population focus because of specific economic and social facilities, which are vital components in meeting human needs [17]. Urban growth is accelerated by increasing urban population, followed by changes in the rural economy and increasingly urban lifestyles as the workforce increases in the non-agricultural sector.

4. Conclusion

The conclusions of this research are: The Kedamaian subdistrict experienced a very large increase in Land cover as open/settlement land from 2000 – 2020. This can be seen from the analysis of Landsat images using the NDVI method, which increased the value of the increase in open/settlement Land cover increasing to 74% or 217 ha. The decrease occurred in shrub Land cover by 27% or 32 ha, low vegetation by 4.8% or 54 ha, and medium vegetation by 72.5% or 100 ha. This increase in the use of open land/settlements is due to an increase in population and urban growth as residential and industrial areas.

Authorships

Ali Rahmat and Azan Noer Ramadhan are main authors of this article.

References

[1] Sugiharto. 2007 *Pembangunan dan Pengembangan Wilayah*. Universitas Sumatera Utara Press. Medan.
[2] Munibah K, Sitorus SRP, Rustiadi E, Gandasasmita K, and Hartrisari 2010 Dampak perubahan penggunaan lahan terhadap erosi di DAS Cidanau, Banten. *Jurnal Tanah dan Iklim* **32** pp 55-69
[3] As-Syakur AR, Suarna IW, Adnyana IWS, Rusna IW 2010 Studi perubahan penggunaan lahan di DAS Badung. *Jurnal Bumi Lestari* **10** 2 pp 200-207
[4] Ashari. 2003 Tinjauan tentang alih fungsi lahan sawah ke non sawah dan dampaknya di Pulau Jawa. *Forum Penelitian Agro Ekonomi FAE* **21** 2 pp 83-95
[5] Lillesand T. M., and Kiefer R.W., 2000 *Remote Sensing and Image Interpretation*. Second Edition, John Wiley & Sons, New York.
[6] Ryan, L. 1997 *Creating a Normalized Difference Vegetation Index (NDVI) image Using MultiSpec*. University of New Hampshire.
[7] Muhaimin, A.R., Ramadhani, W.S., Rahmat, A. 2021 Analisis Perubahan Penggunaan Lahan di Kecamatan Tanjung Karang Timur, Kota Bandar Lampung dengan Menggunakan Metode NDVI. *Open Science and Technology* **1** 1 pp 1-7
[8] Ramadhani, W.S., Pratama, D.L., Rahmat, A., Istiawati N.F. 2021 Analisis Perubahan Penggunaan Lahan di Kecamatan Kedondong, Kabupaten Pesawaran dengan Pemanfaatan Citra Landsat. *Open Science and Technology* **1** 1 pp 58-69
[9] Pangestu, R., Santika, N., Ramadhani, W S., Rahmat, A., Mutolib, A., Nurhaji, S. 2021 Land Use Change Analysis Using NDVI Approachment in Terbanggi Besar, Central Lampung at 2000 and 2020 *Applied Research in Science and Technology* **1** 1 pp 46-57
[10] Badan Pusat Statistik Bandar Lampung. 2000 *Bandar lampung Dalam Angka Tahun 2000*. Badan Pusat Statistik. Bandar Lampung
[11] Hartini, S., Harintaka, dan Istarno 2008 Analisis konversi ruang terbuka hijau menjadi penggunaan perumahan di Kecamatan Tembalang Kota Semarang. *Jurnal Media Teknik* pp 470-478
[12] Badan Pusat Statistik Bandar Lampung 2020 *Bandar lampung Dalam Angka Tahun 2020*. Badan Pusat Statistik. Bandar Lampung.

[13] Tian, L., Ge, B., & Li, Y 2017 Impacts of state-led and bottom-up urbanization on Land cover change in the peri-urban areas of Shanghai: Planned growth or uncontrolled sprawl? *Cities* **60** Part B pp 476– 486
[14] Pawan. 2016 Urbanization and Its Causes and Effects: A Review. *International Journal of Research and Scientific Innovation* **3** 9 pp 110–112
[15] Google Inc. 2020 *Google Maps: Kedamaian Subdistrict Location Map, Bandar Lampung City*. In *https://maps.google.com/*
[16] Rahayu, S. 2009 Kajian konversi lahan pertanian di daerah pinggiran kota yogyakarta bagian selatan (studi kasus di sebagian daerah kecamatan umbulharjo). *Jurnal Pembangunan Wilayah dan Kota* **5** pp 365-372
[17] Dadras, M., Shafri, H. Z. M., Ahmad, N., Pradhan, B., & Safarpour, S. 2015 Spatio-temporal analysis of urban growth from remote sensing data in Bandar Abbas city, Iran. Egyptian. *Journal of Remote Sensing and Space Science* **18** 1 pp 35–52

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