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### **VEGETATION CHANGES ANALYSIS USING NDVI (NORMALIZED DIFFERENCE VEGETATION INDEX) METHOD IN KALIANDA SUBDISTRICT, LAMPUNG SELATAN DISTRICT, INDONESIA**

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#### **Abstract**

Each year, the population in Kalianda subdistrict, Lampung province keeps increasing. The increase in population means that the need for living space also increasing, this can lead to land cover conversion from a vegetation area to a residential area. To find how much the change in land conversion over the year, a spatial analysis over the period of 18 years was needed. So that it is expected to be able to manage spatial planning to cope with disasters in Indonesia. This research uses Landsat 7 and 8 images that have been calculated using the Normalized Difference Vegetation Index (NDVI) method. The results show that between 2010 - 2019, there is an increase in land cover changes in open land/house/building/no vegetation around 814 ha (6.9%), in low vegetation increase 975 ha (8.4%). However, in the medium vegetation was decreasing around 1123 ha (9.5%). Overall observation sample of the ground check is following the actual condition of land cover in Kalianda Sub-district. The data show that in the Kalianda subdistrict, land management is necessary to suppress land cover changes so that it won't lead to environmental disasters.

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## INTRODUCTION

Each year the population in several regions in Indonesia keeps increasing. Lampung province is one of them. Based on BPS data (Badan Pusat Statistik, 2019), Kalianda subdistrict has the third-highest population after Natar and Jati Agung Districts. In 2017, the population in Kalianda subdistrict was around 88,681 people, increasing to 89,527 people in 2018, and in 2019 the number reached up to 90,385 people. The increase in population will lead to land cover conversion. Winarti & Rahmad (2019) explain that the increase in population growth resulted in the need for more residential areas, and it will cause the conversion of land cover. One of the areas in South Lampung that already experienced a change in land cover is Kalianda District. Based on the results of BPS data (2021), it shows that the human development index in the South Lampung area has increased with the passing years. Peng, Xu, Cai, & Xiao (2011) stated that an increase in population can put great pressure on local resources and the environment, thereby increasing land cover change. As the population increases, the need for a more open area for housing, buildings, and infrastructure increases to meet human needs. Adiyaksa and Djojomartono (Adiyaksa & Djojomartono, 2020) explain that the need for land tends to increase along with the increase in population and the development of the economic structure. This tends to change the function of agricultural land to non-agriculture.

The beginning of the development in the South Lampung Regency is marked by the development of highway roads, residential housing, and other infrastructure. Adhiatma, Widiatmaka, & Iskandar Lubis (2020) explained that infrastructure development which is quite extensive in South Lampung can affect the rate of conversion of paddy fields and reduce food supply in the South Regency. The lack of a map for monitoring land

cover change in South Lampung makes it necessary to do a spatial analysis of changes in land cover.

Therefore it is necessary to map the land cover changes using the NDVI (Normalized Difference Vegetation Index) method. Aburas, Abdullah, Ramli, & Ash'aari (2015) explained that the NDVI method is one of many methods used to detect land cover and land cover changes. NDVI is calculated by combining the band red and band NIR of the sensor system. In addition, Lenney, Woodcock, Collins, & Hamdi (1996) stated that NDVI is highly correlated with density and vegetation cover. Driptufany, Guvil, & S (2019) explains that NDVI is a method used in comparing the greenness of vegetation in satellite image data.

Lufilah, Makalew, & Sulistyantara (2017) explain that this is a remote sensing technology and Geographic Information System (GIS). Parwati et al (2012) added that the NDVI method is very suitable for detecting changes from vegetation to non-vegetation. Pangestu et al (2021) added that use change is calculated from several years, which is seen based on the area of land cover each year. Purwanto (2016) explained that NDVI is a spectral sharpening image transformation in analyzing vegetation-related images. Processing the satellite image using the NDVI method is expected to be able to determine changes in land cover that have occurred in Kalianda subdistrict. Driptufany et al. (2019) stated that NDVI is the result of processing the vegetation index from the Landsat image of the red channel and infrared channel which shows the level of chlorophyll concentration in leaves and correlates with vegetation density. Setya, Wiryani, & Jumari (2019) explained that changes in land cover and land coverage led to an increase in the area of open land/non vegetation and a decrease in the use of vegetation. Based on the above explanations, NDVI can be used to analyze the land cover change in some areas. NDVI is used to determine

vegetated and non-vegetated conditions. Moreover, using the NDVI method is an easy way for preliminary assessment for some land cover and the source is free/open access. So that by knowing changes in land cover, it is expected to be able to manage regional planning in the context of disaster management.

## METHODS

The research was conducted in Kalianda sub-district, South Lampung District in 2020. The tools and materials used in this study were, laptop with the ArcGIS 10.3 application, the Avenza Maps application, Landsat 7 data (6 February 2001), and Landsat 8 (17 August 2019). Landsat was taken from the United States Geological Survey (USGS) website (United States Geological Survey (USGS), 2021) with a cloud cover category below 10%. The NDVI is a calculation that used the following algorithm (Pangestu et al., 2021).

$$NDVI = \frac{(\text{band NIR} - \text{band Red})}{(\text{band NIR} + \text{band Red})}$$

Information:

1. In Landsat 7 the NIR (Near Infrared) band is band 4 and the Red band is band 3
2. In Landsat 8 the NIR (Near Infrared) band is band 5 and the band Red is band 4.

Mukhlisin & Soemarno (2020) explained, that the NDVI Algorithm utilizes the physical phenomenon of reflected light waves from leaves. The NDVI index value was observed on a scale between -1 to 1. Driptufany et al. (2019) explained that the pixel value of NDVI 0-1 is a vegetation class, and -1-0 indicates non-vegetation. Based on the results of the NDVI analysis, the land cover area is calculated every year. Furthermore, from these changes an analysis of land cover changes from 2001 and 2019. Furthermore, NDVI data is compared with the composite band natural maps to

compare land cover. Based on the results of the comparison between the NDVI index value with natural data, it produces a land cover index class (Table 1).

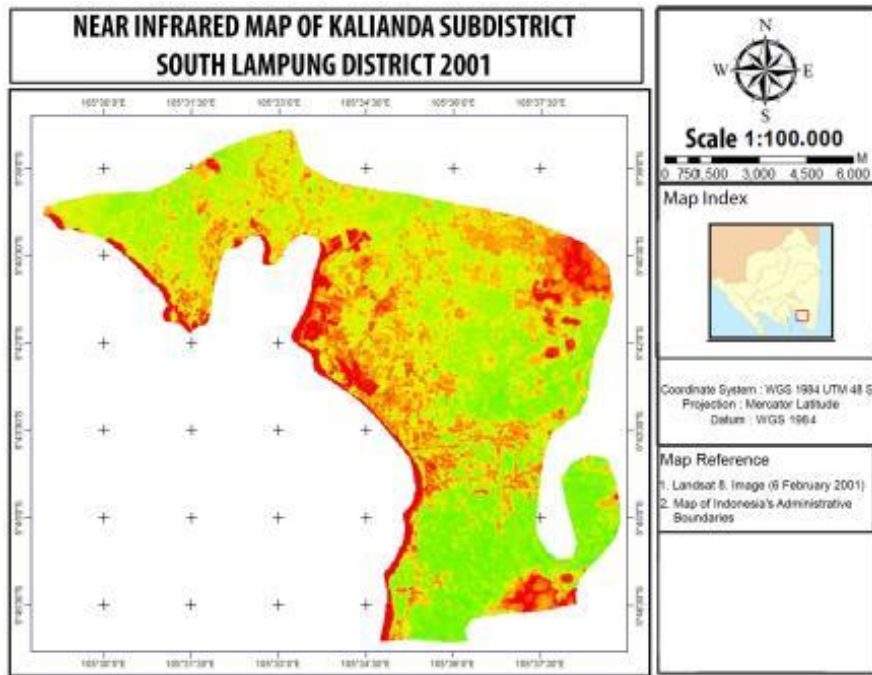
Observations of land cover using primary data and secondary data. Secondary data is obtained from surveys and field observations to get an overview of field conditions. The results of the NDVI analysis will divide into four categories, White: representation clouds. Red: representation open land/ non vegetation/ housing/ building. Light green: representation low vegetation such as shrubland, seasonal crops, bush. Dark green representation the medium vegetation such as a tree with high density (Pangestu et al., 2021).

To determine the accuracy of land cover, a survey was needed to make sure of the real condition. The location surveys were conducted in several points that were randomly selected. However, before randomly we already select the point that can representation four categories at least every category there is 10 point. Then from 40 points, 30 sampling points were selected randomly using a formula in Microsoft Excel and spread throughout the observation area.

## RESULT AND DISCUSSION

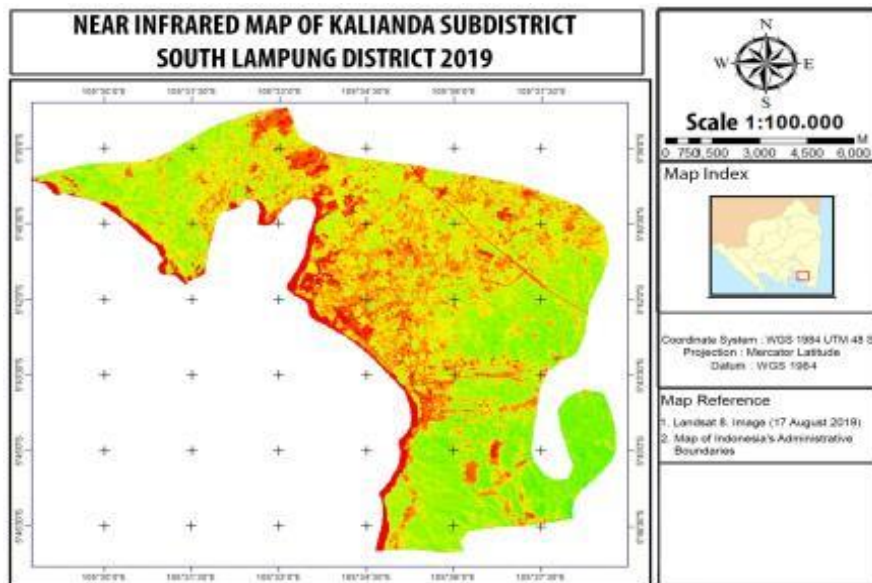
The results showed that there was a change in land cover in open land/non-vegetation, low vegetation, and medium vegetation in the years 2001 and 2019. In 2001, the highest land use was in medium vegetation at 4457 Ha, followed by low vegetation land cover 3655 Ha. In that year, the open land/non vegetation had the lowest area of 2783 Ha. The land cover map is shown in Figure 4.

However, in 2019 there was a significant change in open land/non vegetation use. Open land/non vegetation has increased to 3597 hectares. In addition, the use of low vegetation land has increased to 4630 Ha. While the medium vegetation land has decreased to 3334 hectares. This indicates a change from



**Figure 1.** Near-infrared Map of Kalianda Sub-district 2001

Source: Primary Data Analysis, 2020



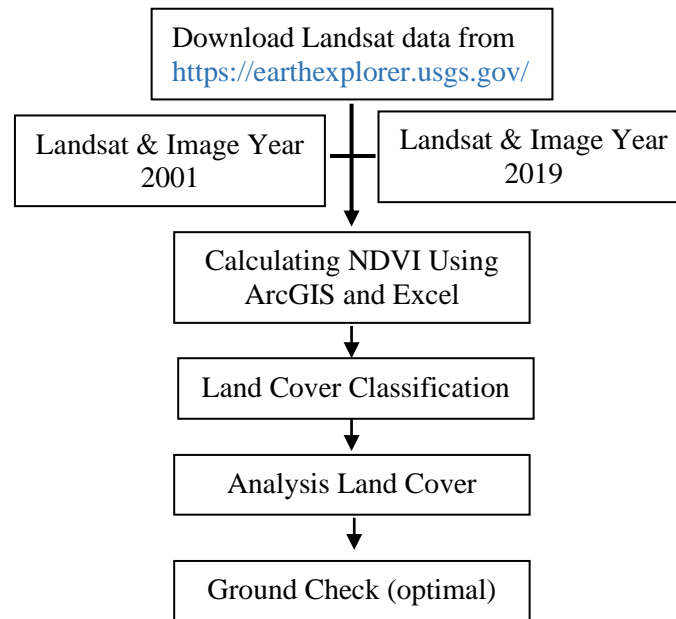
**Figure 2.** Near-infrared Map of Kalianda sub-district 2019

Source: Primary Data Analysis, 2020

**Table 1.** Classification of Land Cover in Kalianda sub district

Color	Classifications	NDVI Index
White	Clouds	>-0,07
Red	Open land/ non vegetations	-0,07- 0,05
Light Green	Low Vegetation	0,05 – 0,175
Dark Green	Medium Vegetation	0,175 – 0,5

Source: Primary Data Analysis, 2020



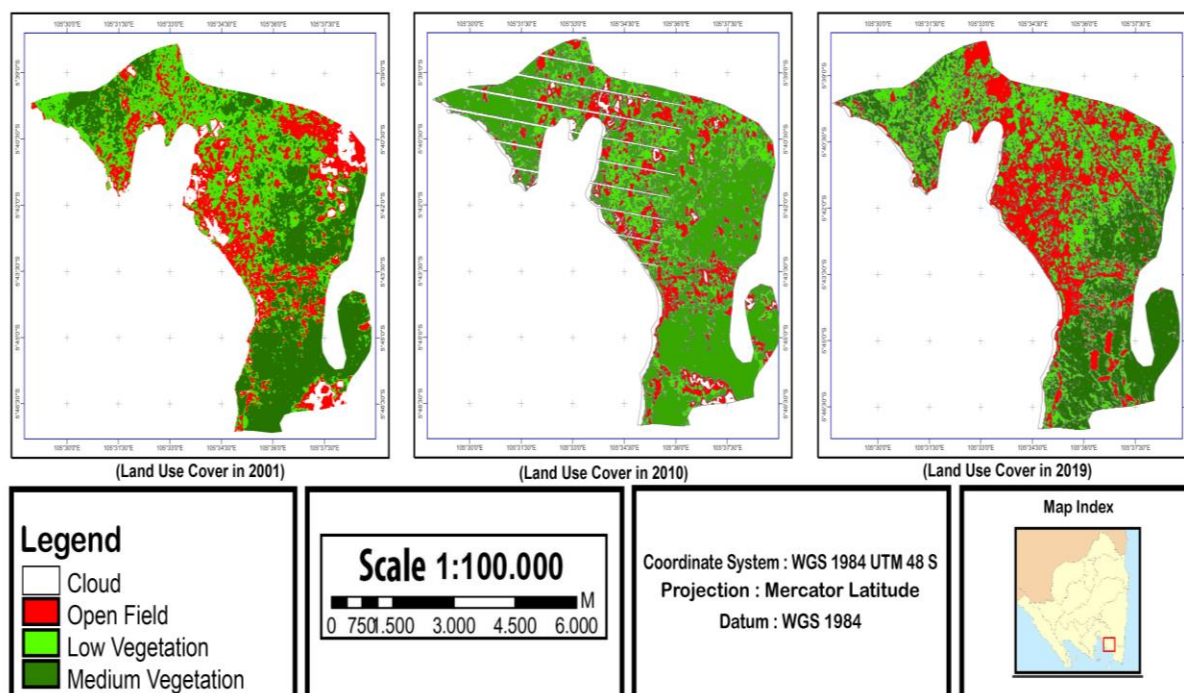
**Figure 3.** Research’s Flowchart  
*Source:* Primary Data Analysis, 2020

vegetation area to non-vegetation area, as well as the conversion of land functions from medium-density plants to seasonal crops. A map of the land cover of the Kalianda sub-district in 2019 is shown in Figure 5 and Table 2.

Masrukhin, 2019 stated that an increase in population can increase the occurrence of land clearing by the surrounding populations. The satellite imaging results show that there are changes in land cover every year. This is per the statement of Umar, Sela, & Tarore (2016) which explains that changes in land use are correlated with the increasing need for living space. Driptufany et al. (2019) also added that any changes in the land will not only affect green open space but also water absorption. According to Sitorus, Patria, & Panuju (2012), the high population growth in urban areas is due to urbanization which resulted in the high rate of conversion of land-use function. The increase in the open area is due to the increase in population reaching around

1,011,286 people between 2010 and 2019 (Badan Pusat Statistik, 2019). In addition, from 2018 to 2019 there was a development of highway roads which resulted in the clearing of community plantation area and there was also the development of tourist destinations around the Kalianda sea coast. This shows that the land use shown on the map corresponds to the actual situation in the field. Land cover with low density has a very significant decrease in the area from 2010 to 2019 (2053 Ha). In addition, from 2010 to 2019 there was an increase in the area of open land/non-vegetation cover (1600 Ha) and low-density vegetation cover (1169 Ha) (Table 3). Based on observation at 30 points, this shows that the 2019 land cover map is following actual conditions on the ground (Table 4). The data show that in the Kalianda sub-district, land management is necessary to suppress land cover changes so that it won’t lead to environmental disasters.

### CHANGES OF LAND COVER IN KALIANDA DISTRICT 2001 UNTIL 2019



**Figure 4.** Land Cover Map of Kalianda sub-district 2001 until 2019  
 Source: Primary Data Analysis, 2020

**Table 2.** Changes in Area and Percentage of Land Cover in Kalianda sub-district 2001- 2019

Classification	2001		2019		Change Between 2001-2019	
	Area (Ha)	(%)	Area (Ha)	%	Area (Ha)	(%)
Clouds	919	7,8	240	2	-679	-5,8
Open land/ non vegetations	2783	23,6	3597	30,5	814	6,9
Low Vegetation	3655	30,9	4630	39,3	-975	8,4
Medium Vegetation	4457	37,7	3334	28,2	-1123	-9,5
Total	11814	100	11801	100		

Source: (Primary Data Analysis, 2020)

**Table 3.** Field observation results were collected from 30 sample location points.

Num.	Coordinate Point	Location Description	Accuracy with description
1	5°44'55.7''S. 105°35'13.1''E	Settlement	Accurate, the data match with the condition on the field
2	5°44'19.0''S. 105°35'37.5''E	Settlement	Accurate, the data match with the condition on the field
3	5°43'41.6''S. 105°35'51.2''E	Open land/ non vegetation/ho	Accurate, the data match with the condition on the field
4	5°42'39.3''S. 105°34'37.5''E	Open land/ non vegetation	Accurate, the data match with the condition on the field
5	5°41'49.1''S. 105°34'53.2''E	Settlement	Accurate, the data match with the condition on the field
6	5°40'25.6''S. 105°36'55.4''E	Settlement	Accurate, the data match with the condition on the field
7	5°39'49.6''S. 105°33'39.5''E	Settlement	Accurate, the data match with the condition on the field
8	5°40'15.8''S.	Settlement	Accurate, the data match with the

	105°31'42.8''E		condition on the field
9	5°40'43.6''S. 105°31'51.2''E	Open land/ non vegetation	Accurate, the data match with the condition on the field
10	5°43'38.3''S. 105°35'37.4''E	Settlement	Accurate, the data match with the condition on the field
11	5°39'55.9''S. 105°31'40.1''E	Bush	Accurate, the data match with the condition on the field
12	5°39'51.0''S. 105°34'03.4''E	Bush	Accurate, the data match with the condition on the field
13	5°41'20.9''S. 105°34'47.0''E	Corn Field	Accurate, the data match with the condition on the field
14	5°40'49.0''S. 105°36'49.4''E	Corn Field	Accurate, the data match with the condition on the field
15	5°40'55.9''S. 105°36'80.3''E	Bush	Accurate, the data match with the condition on the field
16	5°41'33.0''S. 105°36'03.7''E	Paddy Field	Accurate, the data match with the condition on the field
17	5°40'39.2''S. 105°33'42.2''E	Bush	Accurate, the data match with the condition on the field
18	5°43'51.3''S. 105°35'22.8''E	Bush	Accurate, the data match with the condition on the field
19	5°38'33.9''S. 105°36'42.9''E	Bush	Accurate, the data match with the condition on the field
20	5°39'44.0''S. 105°33'27.1''E	Bush	Accurate, the data match with the condition on the field
21	5°46'33.8''S. 105°33'39.2''E	Teak Field	Accurate, the data match with the condition on the field
22	5°45'51.0''S. 105°28'03.4''E	Shrubs	Accurate, the data match with the condition on the field
23	5°45'55.9''S. 105°35'40.1''E	Shrubs	Accurate, the data match with the condition on the field
24	5°39'51.0''S. 105°30'03.4''E	Shrubs	Accurate, the data match with the condition on the field
25	5°40'55.9''S. 105°36'80.3''E	Teak Trees	Accurate, the data match with the condition on the field
26	5°37'37.9''S. 105°42'23.9''E	Coconut Trees	Accurate, the data match with the condition on the field
27	5°40'33.0''S. 105°33'42.2''E	Teak Trees	Accurate, the data match with the condition on the field
28	5°37'37.9''S. 105°40'23.7''E	Cacao Trees	Accurate, the data match with the condition on the field
29	5°38'32.0''S. 105°39'45.2''E	Shrubs	Accurate, the data match with the condition on the field
30	5°39'33.3''S. 105°42'22.8''E	Cacao Trees	Accurate, the data match with the condition on the field

Source: Primary Data Analysis, 2020

**Open land/non vegetations**



Coordinate: 5°44'55.7''S. 105°35'13.1''E  
Fields condition: Settlement



Coordinate: 5°43'41.6''S. 105° 35'51.2''E  
Fields condition: Settlement

**Low Vegetation**



Coordinate: 5°41'33.0''S. 105° 36'03.7''E  
Fields condition: Paddy fields



Coordinate: 5°41'20.9''S. 105° 34'47.0''E  
Fields condition: Cornfields

**Medium Vegetation**



Coordinate: 5°37'37.9''S. 105° 40'23.7''E  
Fields condition: Cacao trees



Coordinate : 5°40'33.0''S. 105°33'42.2''E  
Fields condition: Sengon tree and Shrubs

**Medium Vegetation**



Coordinate: 5°37'37.9''S. 105° 40'23.7''E  
Fields condition: Cacao trees



Coordinate : 5°40'33.0''S. 105°33'42.2''E  
Fields condition: Sengon tree and Shrubs

Source: Primary Data Analysis, 2020

**CONCLUSIONS**

The conclusion of this research is the open land/no vegetation and low vegetation land cover areas had an increase. While the medium density vegetation cover such as trees is decreasing. The open land/no

vegetation is 2783 in 2001, an increase is 3597 ha in 2019. This results in changes in land cover in the Kalianda sub-district especially a decreased green area every year. This is supported by the accuracy between NDVI data and a real condition



by field observations is high. The data show that in the Kalianda sub-district, land management is necessary to suppress land cover changes so that it won't lead to environmental disaster

#### AUTHORSHIP

All authors in this paper are the main author.

#### REFERENCES

- Aburas, M. M., Abdullah, S. H., Ramli, M. F., & Ash'aari, Z. H. (2015). Measuring Land Cover Change in Seremban, Malaysia Using NDVI Index. *Procedia Environmental Sciences*, 30, 238–243. <https://doi.org/10.1016/j.proenv.2015.10.043>
- Adhiatma, R., Widiatmaka, & Iskandar Lubis. (2020). Perubahan penggunaan/ tutupan lahan dan prediksi perubahan penggunaan/ tutupan lahan di Kabupaten Lampung Selatan. *Jurnal Pengelolaan Sumberdaya Alam Dan Lingkungan (Journal of Natural Resources and Environmental Management)*, 10(2), 234–246. <https://doi.org/10.29244/jpsl.10.2.234-246>
- Adiyaksa, F., & Djojomartono, Ph.D., P. N. (2020). Evaluasi Alih Fungsi Lahan Pertanian Menjadi Lahan Industri di Kabupaten Kendal Tahun 2014 - 2018. *JGISE: Journal of Geospatial Information Science and Engineering*, 3(1), 71. <https://doi.org/10.22146/jgise.55519>
- Badan Pusat Statistik. (2019). *Badan Pusat Statistik*. Lampung. Retrieved from <https://lampungselatankab.bps.go.id/publication/2019/09/26/d504deafd0c0767a4295e470/kecamatan-kalianda-dalam-angka-2019.html>
- Driptufany, D. M., Guvil, Q., & S, M. (2019). Ekstraksi Normalized Difference Vegetation Indeks (NDVI) pada Citra Landsat 8 Untuk Identifikasi Ruang Terbuka Hijau di kawasan Resapan Air Kota Padang. *Seminar Nasional Penginderaan Jauh*, 6(1), 48–53. Retrieved from [http://sinasinderaja.lapan.go.id/files/sinasja2019/prosiding/6\\_Ekstraksi NDVI pada Citra Landsat 8 OLI Untuk Identifikasi Ruang Terbuka Hijau di Kawasan Resapan Air Kota Padang.pdf](http://sinasinderaja.lapan.go.id/files/sinasja2019/prosiding/6_Ekstraksi%20NDVI%20pada%20Citra%20Landsat%208%20OLI%20Untuk%20Identifikasi%20Ruang%20Terbuka%20Hijau%20di%20Kawasan%20Resapan%20Air%20Kota%20Padang.pdf)
- Lenney, M. P., Woodcock, C. E., Collins, J. B., & Hamdi, H. (1996). The status of agricultural lands in Egypt: the use of multitemporal NDVI features derived from Landsat TM. In M. J. Chen, M. Wang, & M. Weiss (Eds.), *Remote Sensing of Environment (1st ed., Vol. 56)*. Canada: Elsevier
- Lufilah, S. N., Makalew, A. D., & Sulistyantara, B. (2017). Pemanfaatan Citra Landsat 8 Untuk Analisis Indeks Vegetasi di DKI Jakarta. *Jurnal Lanskap Indonesia*, 9(1), 73–80. <https://doi.org/10.29244/jli.2017.9.1.73-80>
- Masrukhin, M. (2019). Perlindungan Lahan Pertanian Pangan Berkelanjutan Dalam Perspektif Alih Fungsi Lahan di Kabupaten Cirebon. *Hermeneutika : Jurnal Ilmu Hukum*, 3(2), 370–373. <https://doi.org/10.33603/hermeneutika.v3i2.2598>
- Mukhlisin, A., & Soemarno, S. (2020). Estimasi Kandungan Klorofil Tanaman Kopi Robusta (*Coffea canephora* var. Robusta) Menggunakan Normalized Difference Vegetation Index (NDVI) Di Bangelan, Wonosari, Malang. *Jurnal Tanah Dan Sumberdaya Lahan*, 7(2), 329–339. <https://doi.org/10.21776/ub.jtsl.2020.007.2.18>
- 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), 46–57. <https://doi.org/doi.org/10.33292/ares.te.v1i1.7>
- Parwati, P., Zubaidah, A., Vetrira, Y., Yulianto, F., DS, K. A., & Khomarudin, M. R. (2012). Kapasitas indeks lahan terbakar Normalized Burn Ratio (NBR) dan Normalized Difference vegetation Index (NDVI) dalam mengidentifikasi bekas lahan terbakar berdasarkan data SPOT-4. *Geomatika*, 18(1). Retrieved from <https://core.ac.uk/download/pdf/296285815.pdf>
- Peng, J., Xu, Y. Q., Cai, Y. L., & Xiao, H. L. (2011). The role of policies in land use/cover change since the 1970s in ecologically fragile karst areas of Southwest China: A case study on the Maotiaohe watershed. *Environmental Science & Policy*, 14(4), 408–418. <https://doi.org/10.1016/j.envsci.2011.03.009>
- Purwanto, A. (2016). Pemanfaatan citra Landsat 8 untuk identifikasi Normalized Difference Vegetation Index (NDVI) di kecamatan silat hilir kabupaten Kapuas Hulu. *Edukasi: Jurnal Pendidikan*, 13(1), 27–36.
- Setya, R. S., Wiryani, E., & Jumari, J. (2019). Dinamika Tutupan Lahan di Kawasan Karst Kecamatan Gunem Kabupaten Rembang. *Jurnal Ilmu Lingkungan*, 17(2), 264. <https://doi.org/10.14710/jil.17.2.264-271>
- Sitorus, S. R. P., Patria, S. I. D., & Panuju, D. R. (2012). Analisis Perubahan Penggunaan Lahan Ruang Terbuka Hijau di Jakarta Timur. *Jurnal Lanskap Indonesia*, 4(2). <https://doi.org/doi.org/10.29244/jli.2012.4.2.%25p>
- Umar, F. P., Sela, R. L. E., & Tarore, R. C. (2016). Perubahan Fungsi Pemanfaatan Ruang di Kelurahan Mogolaing Kota Kotamobagu. *Spasial*, 3(3), 156–163. Retrieved from <https://ejournal.unsrat.ac.id/index.php/spasial/article/view/13743/13324>
- United States Geological Survey (USGS). (2021). EarthExplorer. Retrieved October 15, 2021, from EarthExplorer website: <https://earthexplorer.usgs.gov/>
- Winarti, W., & Rahmad, R. (2019). Analisis Sebaran Dan Kerapatan Vegetasi Menggunakan Citra Landsat 8 Di Kabupaten Dairi, Sumatera Utara. *Jurnal Swarnabhumi : Jurnal Geografi Dan Pembelajaran Geografi*, 4(1). <https://doi.org/10.31851/swarnabhumi.v4i1.2459>