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COMPARISON OF NDVI, EVI, AND SAVI METHODS TO KNOW VEGETATION DENSITY WITH LANDSAT 8 OIL IMAGES, 2019 (Case Study: Koto Tangah District, Padang City)

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ABSTRACT: This study aims to determine: (1) The level of vegetation density in Koto Tangah District, Padang City in 2019 using the NDVI, EVI, and SAVI methods, (2) The vegetation index method has the highest accuracy in predicting vegetation density in Koto Tangah District, Padang City. The type of research conducted is quantitative research, with research data in the form of Landsat 8 imagery data to identify the vegetation index NDVI, EVI, and SAVI. These indexes utilize a combination of bands on Landsat imagery. The value of the vegetation index can be calculated using the existing formula. carried out ArcGIS by using the raster calculator tool by entering the band values and calculations. In taking the accuracy test on the sample used a simple random sampling technique and using the Fitzpatricklens formula for each vegetation index method. Data collection techniques used are literature study, observation, and documentation. Meanwhile, the data analysis technique uses vegetation density analysis by looking at the accuracy of the NDVI, EVI, and SAVI methods. The results in this study indicate that each vegetation index is vulnerable, namely NDVI -1 -0.3 Very rare, -0.03- 0.15 Rare, 0.15 – 0.25 Medium, 0.25 – 0.35 Meeting, 0.35 – 1 Very Meeting, SAVI -1- -0.26 Very Rare, -0.26 – 0.29 Rare, 0.29-0.66 Moderate, 0.66-0.99 Meeting, 0.99-1 Very Meeting; EVI -0.99-0.1 Very Rare, 0.1-0.17 Rarely, 0.24-037 Moderate, 0.37-0.47 Meeting, 0.47-1 Very Meeting. the value results obtained that the area of the sub-district of Koto Tangah, the city of Padang, is dominated by high. Based on the research results of the three indices, the most dominating class is very dense vegetation density. The accuracy test results for the NDVI method were 86.95%, for the EVI method it was 86.95%, and for the SAVI method, it was 91.30%.

Keywords: Vegetation Density, Vegetation Index, Landsat Imagery, Remote Sensing

1. INTRIDUCTION

Vegetation can be interpreted as a combination of several plants with different types living together in a place that forms a unit that interacts with each other, both among individuals from the plants themselves and the interaction of environmental factors (Marsono, 1977). Vegetation has a big role in maintaining the ecosystem. The denser the vegetation in an area, the more comfortable it will be to live in. Vegetation is one form of spatial arrangement. Vegetation as part of the spatial arrangement has important benefits. One of them is changing the atmospheric conditions of the air environment both directly and indirectly (Ajun Purwanto, 2013).

The vegetation index is an algorithm that is applied to satellite imagery, to highlight aspects of vegetation density or other aspects related to density. The vegetation index is a mathematical transformation that involves three channels at once, namely the red (red) and green channels (greens),and near-infrared (near infrared). The use of the transformation of the vegetation index is carried out on a medium scale which is more for monitoring protection forests and production forests (Ajun Purwanto 2013).

The city of Padang is the capital city of West Sumatra Province. Land use with a variety of vegetation densities can be found in the city of Padang. Land use with very dense vegetation density in Padang City is still commonly found in Koto Tangah District, Kuranji District, Bungus District, and Pauh District. In this district, there are still many lands uses in the form of forests, plantations, and shrubs.

Koto Tangah District is one of the sub-districts in Padang City, West Sumatra Province. This district is located at 00°58 South Latitude and 99°36'40"- 100°21'11" East Longitude. Based on its geographical position, this sub-district has territorial boundaries, namely, to the north, it is bordered by Padang Pariaman Regency, to the south by Padang Utara District and Nanggalo District, to the west of the Ocean. Indies, east of Solok Regency. The condition is the a in this sub-district has roads, rivers, meadows, and, forests. The rest is utilized by the local community such as rice fields, buildings so on.

IRSAJ
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Vol 2 No 2 | Dec 2021

Landsat 8 is an observation satellite earth America which was launched on 11 February 2013. It is the eighth satellite in the Landsat program, the seventh to successfully enter orbit. The Landsat 8 satellite has Onboard Operational Land Imager (OLI) and Thermal sensors Infand rared sensors (TIRS) with a total of 11 channels. Among these channels, 9 channels (bands 1-9) are on OLI, and the other 2 (bands 10 and 11) are TIRS. Part big own specifications are similar to Landsat. Research This is with using remote sensing and imagery Landsat 8 aims To determine the level of vegetation density (NDVI), (EVI), and (SAVI) and the extent of vegetation density (NDVI), (EVI), and (SAVI) in the research area. Various kinds of transformation Vegetation index is made by remote sensing experts to find the value Index vegetation. Several experiences far world algorithm For extract the channel value in the image and claim that the algorithm it created a sharpen information about suggestion. Results processing of each vegetation index value can produce a class which different, matter This caused by an algorithm as well as the channel used in it. The difference resulted in not all vegetation indices can be applied in a region Forgetting the most information. Based on the background behind the problem the writer interested conducted research entitled “Comparison of NDVI, EVI, and Methods Savi For Knowing Vegetation Density Using Landsat 8 Oil Imagery 2019 (Case Study: Koto Tangah District, Padang City)", with the reasons for the need and the absence of information about this and knowing the best vegetation index that can be used in prediction of vegetation in Koto Tangah District Padang city.

2. THE METHOD

2.1 Time and Location of Research

The research was carried out in the odd semester of the 2020 school year. This research was conducted in the District Koto Tangah, Padang City. Geographically it is located between 0° 44' 00” and 1° 08' 35” South latitude and between 100° 05' 05” and 100° 34' 09” Longitude East. Koto Tangah is one of the sub-districts in Padang City, West Sumatra Province.

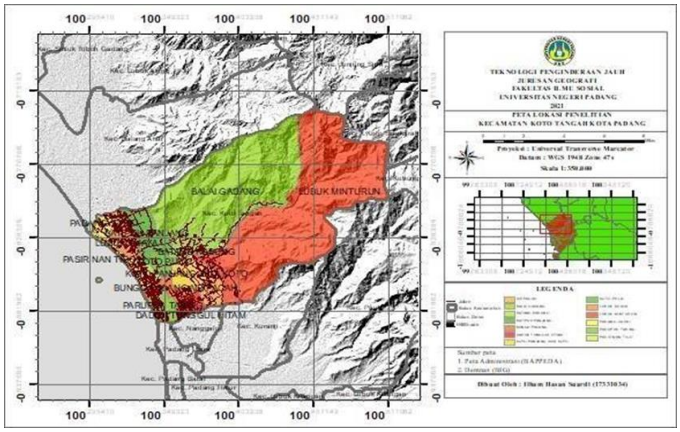

Fig 1.Research Location Map

2.2 Data collection

Type study This uses a quantitative case study approach by incorporating the vegetation index formula on Landsat 8 Oli imagery. The method used is the NDVI (Normalized Difference Vegetation Index), EVI (Enhanced Vegetation Index), and SAVI (Soil Adjusted Vegetation Index).

Vegetation Index). In this study, secondary data used Landsat 8 imagery sourced from the USGS website, shapefile data for research administrative areas from Bappeda, and vegetation density index data based on expert opinion on the website. The data collection technique carried out was adjusted to the type of data taken, namely by literature study, observation, and documentation techniques.

2.3 Data analysis

1. Vegetation Index

a. NDVI(Normalized Difference Vegetation Index)

The vegetation index value used in this study is the result of image processing using the NDVI (Normalized Difference Vegetation Index) transformation. This vegetation index value is calculated as the ratio between the

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Vol 2 No 2 | Dec 2021

reflectance measured from the red (R) band and the infra-red band (closer to the NIR band). The use of these two bands is widely chosen as a parameter of the vegetation index because the results of the size of this band are influenced by chlorophyll absorption, are sensitive to vegetation biomass, and make it easier to distinguish between vegetated land, open land, and water. The result of the rationing between infrared and infrared bands produces the maximum difference between vegetation and soil. The original values generated by NDVI always range from -1 to +1 (Danoedoro, 2012). Original values between -1 to +1 the results of this NDVI transformation have a different presentation on land use.

The formula for NDVI is:

NDVI = NIR+RED/NIR-RED

Information :

NIR: near-infrared band (band 5 on Landsat 8)
RED: band red (red light, namely band 4 on Landsat 8)
The result is that cover in the form of vegetation will appear brighter and non-vegetation will be dark (Putra, 2011).

b. EVI(Enhanced Vegetation Index)

EVI (Enhanced Vegetation Index) is the development of a method of determining the vegetation index to observe the limitations of NDVI by optimizing the sensitivity of better vegetation signals in areas with high biomass (a serious weakness of NDVI), increasing the level of greenery of plants through the influence of the background soil and canopy signals, as well as reducing the influence of atmospheric conditions on the vegetation index value from adding information to the blue channel. more EVIs responsive for determining variations in canopy structure, including LAI (Leaf Area Index), canopy type, plant physiognomy, and canopy architecture than NDVI which generally only responds to chlorophyll count.

The EVI algorithm is formulated by the following equation (Liu and Huete, 1995).

EVI = G * ((NIR - RED) /
(NIR + C1 * RED – C2 *B+ L))

Information :

NIR near infrared band value RED: red band value
G: the scale factor of EVI, worth 2.5
L: soil calibration factor, worth 1 C1: factor for overcoming aerosols, worth 6
C2: factor to overcome aerosols, worth 7.5

On Landsat 8, EVI formulated as follows.

EVI = 2.5 * ((Band 5 – Band 4) / (Band 5 + 6 * Band 4 – 7.5 * Band 2 +1))(Liu and Huete, 1995).

c. Savi(Soil Adjusted Vegetation Index)

SAVI (Soil Adjusted Vegetation Index) put forward by Huete (1988), with a value range of -1 to 1. Soil Adjusted Vegetation Index (SAVI) is an algorithm developed from NDVI by suppressing the influence of vegetation (vegetation with the same density and different soil background) derived by reflectance approximation canopy with a first-order photon interaction model between canopy And layer and mixed spectra drop, arena dark sing a significant increase in NDVI.

The SAVI formulation is as follows:SAVI = (1+L) x −
+

Information :

NIR: Near-infraredflectance (Band 5)
RED : Red channel reflectance value (Band 4)
L : Ground background brightening (0.5)

2. Accuracy Test

In this study, the researcher conducted an accuracy test using taking samples And plunging directlintoto the field, due to access to the area study very easyreached and the data obtained is also felt to be more accurate34 compared to other accuracy test methods. The sampling technique in this study was simple random sampling, which is a random sampling technique in which the researcher gives equal opportunities to all objects to be applied as samples.

For this sample to be taken

N =2

Information:

N : Number of Samples
z :standard deviation normalwhich value is 2

IRSAJ
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Vol 2 No 2 | Dec 2021

p : Accuracy expected (85%) q : 100 – p
E : Error received
In this study, the accuracy was set at 85% and the error rate was 15%, so the following results were obtained:
N =22×85×15 15

=4×1275
225

Represent the population so can calculated using the Fitzpatrick lins formula (in Aris Kurniadi, 2014). The results of each vegetation index method can be seen in the following table:

a. NDVI

Table 1. .Number of samples of the NDVI vegetation index

1.	Very rarely	27×100= 0.1% 22533 0.1× 23 = 0.02 samples 100
2.	Seldom	2009×100= 8% 22533 8× 23 = 2 samples 100
3.	Currently	481×100= 2% 22533 2× 23 = 0.4 samples 100
4.	Meeting	11454×100 = 50% 22533 50× 23 = 12 samples 100
5.	Very Meeting	8562 × 100= 37% 22533 37× 23 = 9 samples 100

b. EVI

Table 2. Number of EVI vegetation index samples

1.	Very rarely	284×100= 1% 22534 1× 23 = 0.23 samples 100
2.	Seldom	2032 × 100= 9% 22534 9× 23 = 2 samples 100
3.	Currently	4088×100= 18% 22534

IRSAJ
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p_ISSN =_____-_____
Vol 2 No 2 | Dec 2021

		18× 23 = 4 samples 100
4.	Meeting	7335×100= 32% 22534 32× 23 = 7 samples 100
5.	Very Meeting	8795 × 100= 39% 22534 39× 23 = 8 samples 100

c. Savi

Table 3. .Number of SAVI vegetation index samples

1.	Very rarely	27×100= 0.1% 22535 0.1× 23 = 0.2 samples 100
2.	Seldom	2008×100= 9% 22535 9× 23 = 2 samples 100
3.	Currently	484×100= 2% 22535 2× 23 = 0.46 samples 100
4.	Meeting	11454×100= 51% 22535 51× 23 = 12 samples 100
5.	Very Meeting	8562 × 100= 38% 22535 38× 23 = 9 samples 100

3. RESULTS AND DISCUSSION

1. Vegetation Density Map With NDVI, EVI and SAVI Indices

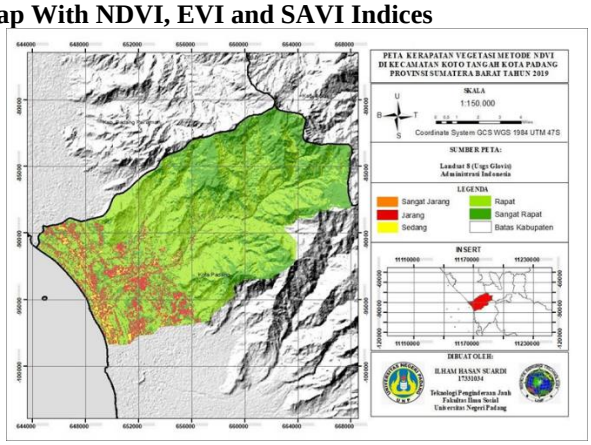

Figure 2.Vegetation Density Map of the NDVI Method of Koto Tangah District in 2019

IRSAJ
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Vol 2 No 2 | Dec 2021

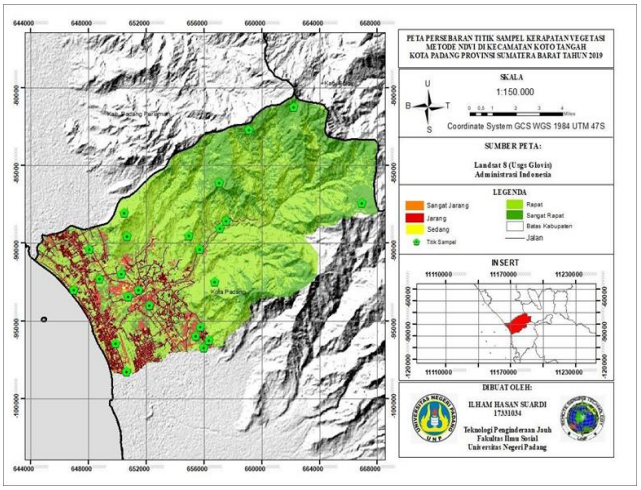

Figure 3.Map of Distribution of Vegetation Density Sample Points NDVI Method in Koto Tangah District in 2019

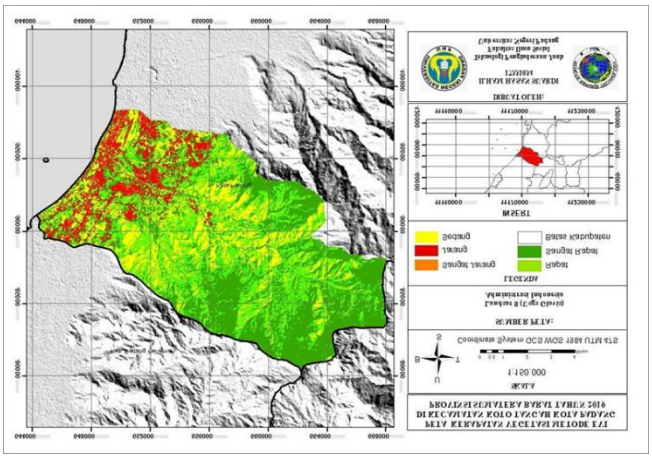

Figure 4.Vegetation Density Map of the EVI Method of Koto Tangah District in 2019

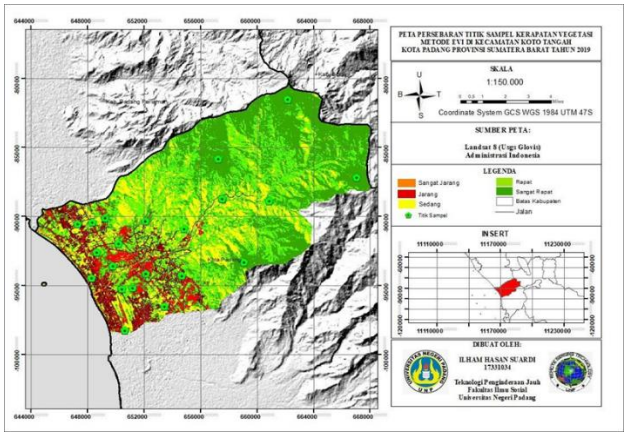

Figure 5.Map of Distribution of Vegetation Density Sample Points EVI Method of Koto Tangah District in 2019

IRSAJ
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e_ISSN =2775-3409
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Vol 2 No 2 | Dec 2021

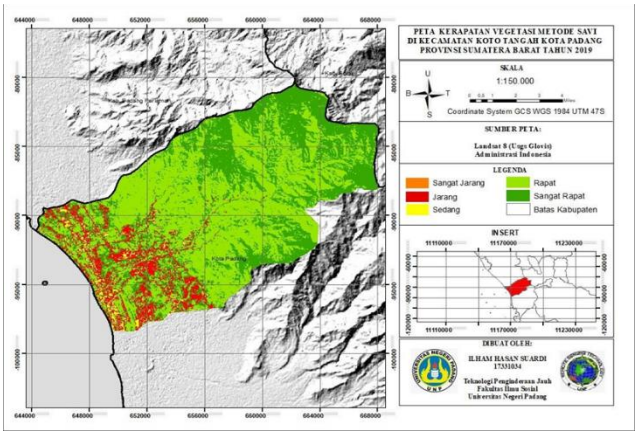

Figure 6.Vegetation Density Map of the SAVI Method in Koto Tangah District in 2019

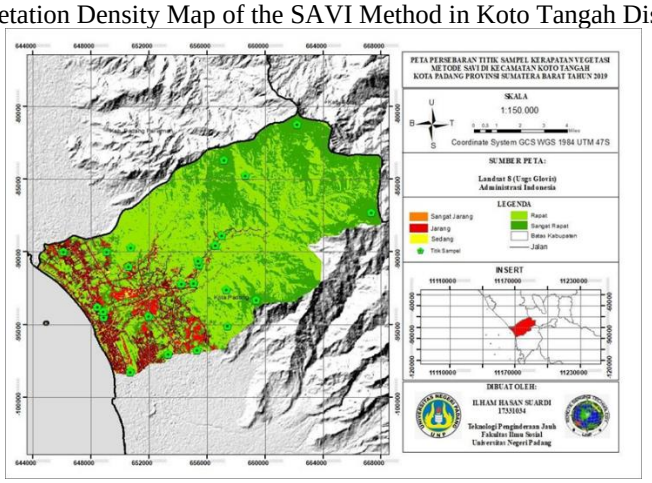

Figure 7.Map of the Distribution of Vegetation Density Sample Points of the SAVI Method in Koto Tangah District in 2019

Table 4.Classification of Vegetation Density

Class	NDVI value	Green Level
1	-1<NDVI<-0.03	Non-Vegetable Land
2	-0.03<NDVI<0.15	Very Low Greenery
3	0.15<NDVI<0.25	Low Green
4	0.25<NDVI<0.35	Medium Green
5	0.35<NDVI<1	High Greenery

Table 5.Density Classification

No	Density	RTH type
1	Land Not Vegetarian	Body of water like river etc
2	Rare Green	Settlements of open land lined with asphalt or paving or asphalt roads, buildings House
3	Medium Green	Land cover vegetation, such as on dirt roads, and empty fields, without being coated with asphalt or paving
4	Green Meeting	Vegetation cover land in the form of coconut plantations, mixed gardens, grass vegetation, golf courses, reeds
5	Greenish Very Meeting	Forested Vegetation

IRSAJ
International Remote Sensing Applied Journal
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p_ISSN =_____-_____
Vol 2 No 2 | Dec 2021

Table 6.NDVI Vegetation Density Area

No	Vegetation Density Class	Area (ha)
1	Unvegetated Land	27.29986
2	Rare Green	2009,954
3	Medium Green	481.8578
4	Green Meeting	11454.65
5	Very dense greenery	8562,547

Table 7. EVI Vegetation Density Area

No	Vegetation Density Class	Area (ha)
1	Unvegetated Land	284,2281
2	Rare Green	2032,338
3	Medium Green	8795,869
4	Green Meeting	7335,121
5	Very dense greenery	4088,283

Table 8. Area of Vegetation Density SAVI

No	Vegetation Density Class	Area (ha)
1	Unvegetated Land	27.29986
2	Rare Green	2008,218
3	Medium Green	484,0104
4	Green Meeting	11454.59
5	Very dense greenery	8562,188

2. NDVI, EVI, and SAVI Index Accuracy Levels

Table 9. NDVI Accuracy Test

Classification	Data in the Field					Amount
	SJ	J	S	R	SR	
Very rarely	0	0	0	0	0	0
Seldom	0	2	0	0	0	2
Currently	0	0	0	0	0	0
Meeting	0	0	1	10	1	12
Very Meeting	0	0	0	1	8	9
Total	0	2	1	11	9	23

Accuracy rate = Correct sample (yellow color) / Total sample × 100%
= 20 / 23 × 100% = 86.95%

Table 10. EVI Accuracy Test Table

Classification	Data in the Field					Amount
	SJ	J	S	R	SR	
Very rarely	0	0	0	0	0	0
Seldom	0	2	0	0	0	2
Currently	0	0	4	0	0	4
Meeting	0	0	2	6	0	8
Very Meeting	0	0	0	1	8	9
Total	0	2	6	7	8	23

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Vol 2 No 2 | Dec 2021

Source: Processing Results, 2021

Accuracy rate = Correct sample (yellow color) / Total sample × 100%
= 20 / 23 × 100% = 86.9Table 11.SAVI Accuracy Test Table

Classification	Data in the Field					Amount
	SJ	J	S	R	SR	
Very rarely	0	0	0	0	0	0
Seldom	0	2	0	0	0	2
Currently	0	0	0	0	0	0
Meeting	0	0	11	1	0	12
Very Meeting	0	0	0	1	8	9
Total	0	2	0	12	9	23

Source: Processing Results, 2021

Accuracy rate = Correct sample (yellow color) / Total sample × 100%
= 21 / 23 × 100% = 91.30%

Discussion

In the NDVI vegetation index accuracy test table, the results of a comparison of the processed data with the original data in the field are: 0.02 samples of very rare classification are the same as those in the field, 2 samples of classification are rarely the same as those in the field, 0.4 samples are very rare rarely the same as those in the field, the 12 samples of the dense classification 2 classes turned into medium and very dense classifications, and the 9 samples of the very dense classification there was 1 class that turned into a tight classification. In the EVI vegetation index accuracy test table, the results obtained from the comparison of processing data with original data in the field are: 0.23 samples of classification are very rarely the same as those in the field, 2 samples of classification are rarely the same as those in the field, 4 samples of moderate classification have 1 class that changes to a dense classification, 9 samples of dense classification have 1 class that changes to a medium classification, and 8 samples of very dense classification have 1 class change to a tight classification. In the SAVI vegetation index accuracy test table

the results of a comparison of the processing data with the original data in the field are: 0.2 samples of classification are very rarely the same as those in the field, 2 samples of classification are rarely the same as those in the field, 0.46 samples of medium classification are the same as those in the field, 12 samples of dense classification, 1 class changed to very dense classification, and 9 samples of very dense classification, 1 class changed to tight classification. In the calculation of the confusion matrix table, the results of the accuracy test on Landsat 8 imagery in 2019 using the NDVI index method obtained an accuracy level of 86.95%, EVI obtained an accuracy level of 86.95% and using the SAVI index method obtained an accuracy level of 91.30%.

4. CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

The results of this study resulted in conclusions based on the formulation of the problems that have been described previously, while the conclusions that can be drawn are as follows:

1. Based on the analysis of Landsat 8 imagery in 2019, the vegetation indices selected in this study are NDVI, EVI, and SAVI. Where each vegetation index has 5 classifications, namely very rare, rare, moderate, dense, and very dense. Based on the research results of the three indices, the most dominating class is very dense vegetation density.
2. From the results of the classification of vegetation density, the accuracy test was carried out in the field, and a confusion matrix table was obtained which showed that the accuracy test results for the NDVI index had an accuracy of 86.95%, EVI had an accuracy of 86.95% and the SAVI index had an accuracy of 91.30%.

4.2. Suggestion

As for some suggestions for similar related research, they are as follows:

1. Accuracy is needed when entering the value of the vegetation index variable in Landsat 8 imagery because if you enter it just a little wrong value, the research statistical process will not work.
2. It is necessary to test the accuracy of the three vegetation index methods, by first determining the sample and then conducting an accuracy test by checking in the field because the data in the software is not necessarily all correct.

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