# THESIS

# ESTIMATION PRODUCTION PALM OIL BASED ON NDVI VALUE ( *NORMAL DIFFERENCE VEGETATION INDEX* ) IN PT. ANDIRA AGRO DISTRICTS LOTS PROVINCE SUMATERA SOUTH

## *THE ESTIMATION OF PALM OIL PRODUCTION BASED ON THE VALUE OF NDVI (NORMAL DIFFERENCE VEGETATION INDEX) AT PT. ANDIRA AGRO BANYUASIN SOUTH SUMATERA*

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# SUMMARY

**Yudistra Mahatma Jaya.** The Estimation of Palm Oil Production Based on The Value of NDVI (Normal Difference Vegetation Index) at PT. Andira Agro Banyuasin South Sumatera (supervised by **Dr. Ir. Dwi Setyawan, M.Sc.** and **Dr. Ir. Warsito, M.P.**)

Observation of vegetation using satellite imagery that utilizes reflectance from landscape features, one of the methods is to use the Normal Difference Vegetation Index (NDVI) method.The estimation of oil palm production using Landsat 8 with NDVI method has an accuracy level of 80 %. Based on that situation, this research was conducted. The problem in this study were the accuracy level, the estimation of palm oil production and also the level of vegetation density at PT. Andira Agro. This study aims to determine the accuracy level and the estimation results of palm oil production and also to examine the level of vegetation density using the NDVI method. This study used the NDVI method which is calculated based on the ratio between the red (R) and near infrared (NIR) values based on USGS.gov and regression analysis was carried out to assess the estimation of palm oil production. The results of this study found that the highest vegetation density value was at 0,54 with the estimated value of palm oil production was 97,138,728.25 kg and 88 % of maximum accuracy value and 83 % of a minimum accuracy value with 158,115 kg/pixel of error estimation.

Keywords : Production Estimation, Palm Oil, NDVI

# SUMMARY

**Yudhistra Mahatma Jaya.** Estimated Oil Palm Production By Value NDVI ( *Normal Difference Vegetation index* ) in PT. Andira Agro Regency Banyuasin, South Sumatra Province. (supervised by **Dr. Ir. Dwi Setyawan, M.Sc.** and **Dr. Ir. Warsito, MP** )

Observation vegetation use image satellite which utilise reflectance of a landscape feature one of the methods is to use *Normal Difference Vegetation Index* (NDVI) method . Production estimation oil palm using Landsat 8 using the NDVI approach have level accuracy reach 80 %. Based on Thing the, so conducted study this. Formulas problem on study this that is level accuracy and estimation of oil palm production as well as, the level of vegetation density in PT. Andira Agro. This study aims to determine the level of accuracy and estimation results oil palm production, as well as assessing the level of vegetation density using method NDVI. Study this use method NDVI which calculated based on the ratio between red (R) and near infrared (NIR) values based on USGS.gov, then performed a regression analysis to assess the estimated production coconut palm. Results study this obtained that score density vegetation highest on score 0.54 with score estimation coconut production palm as big as 97,138,728.25 kg and score accuracy maximum as big as 88 %, whereas score minimum accuracy as big as 83 % with estimation error as big as 158,115 kg/pixel.

Say Key : Estimate Production , Palm oil, NDVI.

# THESIS

# ESTIMATION OF PALM OIL PRODUCTION BASED ON SCORE NDVI (NORMAL VEGETATION DIFFERENCE INDEX) IN PT. ANDIRA AGRO DISTRICTS LOTS PROVINCE OF SUMATRA SOUTH

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## LEMBAR PENGESAHAN

# ESTIMASI PRODUKSI KELAPA SAWIT BERDASARKAN NILAI NDVI (NORMAL DIFFERENCE VEGETATION INDEX) DI PT. ANDIRA AGRO KABUPATEN BANYUASIN PROVINSISUMATERA SELATAN

**SKRIPSI**

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# FOREWORD

Praise be to Allah SWT who always bestows grace and guidance to all his people as well as give enjoyment health and opportunity, so that writer can finish Thesis with title "Estimate Palm Oil Production Based on NDVI Value ( *Normal Difference Vegetation index* ) in PT. Andira Agro Regency Banyuasin Province South Sumatra".

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# BAB 1
# PRELIMINARY

## 1.1. Background Behind

The palm oil industry is experiencing very rapid development, you can see from increasing the area and production of oil palm. Based on GAPKI data (Indonesian Palm Oil Association) production of palm oil in 2020 reached 4.53 million tons, an increase of 7.2% from 2019. Sumatra the island with the largest oil palm plantation area in Indonesia. According to the Directorate General of Plantation in 2020, the area of oil palm plantations on this island is in 2018 reached 8,047,920. In 2020 it is estimated that Sumatra South produce coconut palm reach 4,365,004 tons.

In this case, then it is necessary estimation of oil palm production to estimate oil palm production in plantations and optimize potency from land company that alone. along with running time Technological advances have developed very rapidly so that it affects the development knowledge knowledge, specifically sensing distance far. Sensing distance far or senses is wrong one knowledge which very biginfluenced by technological advances, characterized by remote recording by using satellites. This is in line with the statement of Purwanto (2015) that the technology is Remote Sensing technology (Ideraja) and System Information Geographic (GIS).

Utilization image satellite which used could in the form of image with resolutionhigh, medium or low. One of them is by using image Landsat8 which is image satellite latest which issued by NASA cooperatewith USGS/Earth explorer. Landsat 8 fly with height 705 km fromsurface earth and have area *scan* wide 170 km x 183 km (Purwanto, 2015).The image could showing surface information earth wrong the only one is vegetation. Vegetation as composer land havetype which very various variety, gathering from various vegetation which various

variety this will produce level density vegetation which different on

each land use in an area. According to Lufilah *et al* . (2017) Wave which unique could analyzed for get index condition from vegetation. Method measurement to get the vegetation index by utilizing reflectance from feature landscape wrong one the method with use method NDVI. Research previously show that estimation production coconut palm use Landsat 8 with use approach NDVI have level accuracy reach 80 %.

This study aims to estimate oil palm production by method analyze level density vegetation with method *Normalized Difference Vegetation Index* (NDVI). Besides that NDVI this also could used for see greenish something vegetation, biomass and determine health something plant. On this research focuses on analyzing the level of vegetation density in PT. Andira Agro and estimate the productivity of oil palm in PT. Andira Agro with Regression Analysis.

### 1.2. Formulas Problem

Formulas problem on study this is as following.

1. How results level density vegetation using method NDVI?
2. How level accuracy and results estimation production coconut palm in PT.Andira Agro ?

### 1.3. Destination Study

Destination from study this is as following.

1. Knowing score level density vegetation using method NDVI.
2. Knowing level accuracy and results estimation production coconut palm in PT.Andira Agro.

### 1.4. Benefit Study

This research is expected to be used as useful information for knowing potency land and quantity production plant palm in plantation PT. Andira Agro. This research is also expected to provide information about utilization method NDVI in PT. Andira Agro specifically in estimate productivity coconut palm in plantation.

# CHAPTER 2
# OVERVIEW
# REFERENCES

## 2.1. Coconut Palm oil

Palm oil (Elaeis guineensis Jacq.) Source oil vegetable from family Palmae. Potency coconut palm in Indonesia very big, and deployment plantation Palm oil in Indonesia is currently increasing in 22 states. Large Oil palm plantations in Indonesia continue to increase from year to year. Large plantation coconut palm increase from 8,248,328 hectares on year 2009 Becomes
8,430,026 hectares in 2010. Growing plantation area palm oil, the more the production will increase. Palm oil production increase from 19,324,293 ton on year 2007 Becomes 19,760.011 ton on year2009 (Director General Plantation, 2010).

Plant coconut palm is plant plantation which many cultivated by both plantation owners and business actors. Main harvest The oil palm plant is the fruit of the oil palm known as Fruit Bunches Fresh (FFB). Oil palm plants flower at the age of 2-3 years and start shape grain. Fruit ripe around 5-6 month after pollination (Sukadi and Widyaiswara, 2014).

Several parameters that affect oil palm production are soil suitable for oil palm plantations, namely Latosol, Podosolic, Alluvial and Hambut (Saputra, 2011). Besides that, drainage which good, advance water soil which relatively low soil pH, 4 to 6, and rock-free soil are requirements for oil palm cultivation (Pusri, 2014). The rapid growth of plant height and the formation of chlorophyll is influenced by the coefficient of nitrogen content (N) of the soil (Pitojo, 1995; Gunawan, 2014). bulk rain also related with fluctuation production coconut palm. bulk rain which ideal for plant coconut palm is around
2,000 to 2,500 mm per year, and circulates evenly throughout the year. Oil palm plantations are more resistant to strong winds than plant other, so the condition wind not enough take effect (Saputra, 2011).

One aspect of oil palm cultivation that directly affects the impact of oil palm production is the harvest. Successful harvesting helps achieve productivity Palm oil. Palm oil start producing mangosteen on age 3-4 year and produce more from 20 ton fruit fresh (FFB)/ha/year at the age of 8-11 years. Harvesting is done when the grapes 56 months old. Oil palm can be harvested economically until the age of 25 year (Pahan, 2008).

**2.2. Sensing Far**

Remote sensing is a science and technology that extracts information about an object, domain, or reality by analyzing the sensory data not directly related to the object or phenomenon being studied (Lilesand *et al* .,2004)

System sensing far distinguished on system photographic and non photographic. System photography has superiority simple, no expensive as well as quality good. Electronic systems have the advantage of having greater capabilities and more absolute in distinguishing objects and the analysis process is faster because using a personal computer. The latest technology Geographic information system (GIS) and remote sensing can used for receive digital spatial data use quickly and carefully, as a result can answer questions information needs of policy makers. Multi-concept in the senses can provide a variety of spatial and multi-information other (multi spectral, multi sensor, multi spatial, multi moment, multi polarization and multi stage. The multi-concept sense technology software can be used to predict area harvest area and productivity (Sofiyanti, 2011).

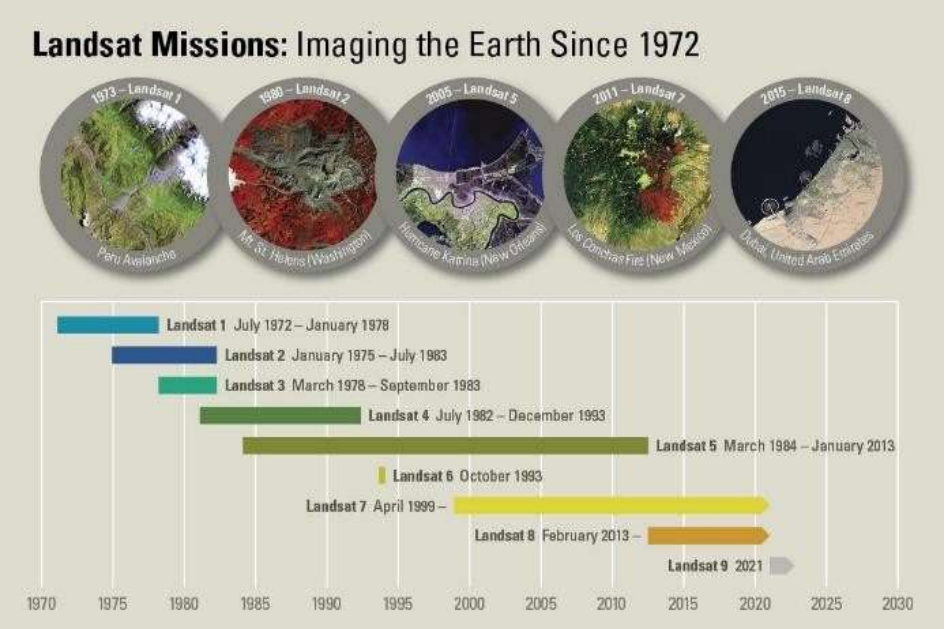
Currently remote sensing technology is developing very rapidly, and with expansion application technology this, type vehicle, sensors, and system sensing far which there is Becomes the more diverse. Wrong one Duty development of remote sensing is collecting data on the earth's surface and use it for inventory and evaluation of resource use natural which stored in earth. Technology sensing far create various

the type of image recorded by the sensor different (multi-sensor) which can generate images with different resolutions (multi-resolution). In addition, the image sensing far processed and interpreted for shape data and information which useful for device soft like agriculture, forestry, archeology, geography, geology, regional planning, and disaster risk mitigation. Data extracted from remotely sensed imagery has advantages in terms ofobservation real-time and human error which small compared with use observation data direct in field (Murti, 2012).

### 2.2.1. Citra Landsat 8

Landsat is satellite oldest in program observation Earth. Landsat startoperated in 1972 using the Landsat1 satellite with the MSS . sensor multispectral. Since 1982, Thematic Mapper TM has been installed on sensors MSS. MS and TM. Satellite Landsat (Satellite Earth) owned by America Union. A number of generation of Landsat satellites designed by Americans, but no longer working. Landsat 5, launched on 1 March 1984, have sensors Thematic Mapper (TM)with a spatial resolution of 30 mx 30 m in the ranges 1, 2, 3, 4, 5, and 7. Thematic Mapper monitors objects on the earth's surface. Seven spectral ranges, 1, 2 . range and 3 is range looks, range 4, 5 and 7 is near-infrared, middle-infrared, and tape 6 is infrared thermal with resolution spatial 120x 120 m. 185 x 185 km from surface. Landsat 5 could covers area which same above Earth every 16 days at an orbital altitude of 705 km. Landsat7 . satellite image ETM refers to Earth satellites carrying the Enchced Thamatic . instrument Mapper (ETM) with eight marine multispectral scanning radiometers that launched in April 1999 using the ETM+ carrier scanner. Currently only Landsat 5 and 7 are not recommended and this Landsat TM7 data have many utility for mapping sword, mapping use sword, geological mapping, sea surface temperature mapping, etc. Middle infrared range allows Landsat TM data to be selected for occlusion and use mapping gingiva. Landsat TM is the only non-weather satellite operating in thermal infrared range. Thermal data is needed to study the process surface energy, such as crop temperature variability in irrigated areas (Suwargana, 2013).

On date 23 July 1972, with launching Satellite Technology source Power Earth (ERTS-1), later renamed Landsat 1. Launch Landsat 2, Landsat 3, and Landsat 4 followed in 1975, 1978, and 1982. when Landsat 5 launched in year 1984, not there is which could predict that satellitewill continue to transmit global ground level data earth high quality During 28 year and 10 month, by official set Record world Guinness new for "satellite observation Earth which operate most long. Landsat 6 fail reachorbit in 1993. Landsat 7 successfully launched in 1999, Landsat 8 in 2013, and the two satellites continued to acquire data. Landsat 9 . satellite currently developed going to date readiness launching September 2021 (USGS, 2021).




Picture 2.1. Landsat Mission
Source : USGS.gov

Landsat 8 is an American Earth observation satellite launched at 11 February 2013. Reached orbit as the eighth satellite of the Landsat 7 program. Originally conceived as the Landsat Data Continuity Mission (LDCM), it is results collaboration Among NASA and United States Geological Survey (USGS). Center NASA's Goddard Space Flight provides development, design system mission, and acquisition launcher, while USGS provide

land system development and mission operations. This satellite was built by Orbital Sciences Corporation as prime contractor the mission. Aircraft room hardware spaceship built by Ball Aerospace and Aviation Center NASA's Goddard Space, and launch contracted by United Launch Alliance. During the first 108 days in orbit, LDCM was examined and validated by NASA, and profession moved from NASA to USGS on 30 May 2013, when LDCM formally change name Becomes Landsat 8 (USGS, 2021).

Image of Landsat 8 orbiting the earth in a solar synchronous orbit near the poles, on height 705 km (438 miles), crooked on 98.2, as well as complete one orbit earth every 99 minute. Satellite have cycle repeated 16 ahri with time crossequator: 10:00 +/- 15 minute. Landsat 8 accept around 740 appearance per day from allworld2 (WRS2) lane or lane system with overlapping blades or sides from 7% at the equator to about 85% at extreme latitudes. Scope Landsat 8 sized 185 km x 180 km (114 noodles x 112 noodles) with 9 range spectral, measured with the Landsat 8 Operational Land Imager (OLI) (USGS, 2021) which produced by Ball Aerospace and Technologies Corporation which can be seen on the table 2.1. Instrument Landsat 8.

Table 2.1. Instrument Landsat 8

| band | Information |
|---|---|
| band 1 | Visible (0.43 – 0.45 m) 30 m |
| band 2 | Visible (0.450 – 0.51 µm) 30 m |
| Band 3 | Visible (0.53 – 0.59 µm) 30 m |
| Band 4 | Red (0.64 – 0.67 µm) 30 m |
| Band 5 | Near-Infrared (0.85 – 0.88 µm) 30 m |
| Band 6 | SWIR 1 (1.57 – 1.65 µm) 30 m |
| Band 7 | SWIR 2 (2.11 – 2.29 µm) 30 m |
| Band 8 | Panchromatic (PAN) (0.50 – 0.68 µm) 15 m |
| Band 9 | Cirrus (1.36 – 1.38 µm) 30 m |

Source data : USGS.gov " *Landsat 8 Instruments* "

OLI acquires data using improved radiometric accuracy through the 12-bit dynamic range, resulting in a higher frequency-to-noise ratio good by whole. This equivalent with 4096 level gray potential compared with 256 level gray on Landsat engine 17 8-bit.

Enhancement performance signal-to-noise allow characterization condition and requirements cover land which more good.

The 12-bit data is scaled to a 16-bit integer and sent as a product Level 1 data. This product is scaled to 55,000 levels gray and can reduced return to reflectance and/or reflectance atmosphere on (TOA) using radiation coefficient scaling. It is provided in the metadata file product (MTL file). Thermal Infrared Sensor (TIRS) - built by the center NASA Goddard Space Flight 2 spectral bands listed in Table2.2.

Table 2.2. Pita Spektral

| **Band** | **Keterangan** |
|---|---|
| Band 10 | TIRS 1 (10.6 - 11.19 )m) 100 m |
| Band 11 | TIRS 2 (11.5) - 12.51 )m) 100 m |

Source data : USGS.gov *"Landsat 8 Instruments"*

### 2.3.System Information Geographical (GIS)

A geographic information system (GIS) is a computer system used for gather, learn, integrate, and analyze information which related with surface earth. On basically, term system news geographical refers to a combination of three basic elements: systems, news, and geography (Prahasta, 2002). So understanding the three basic elements will help you a lot in understand GIS. Looking at the key factors, it becomes clear that GIS is a bugs in news system. GIS is a system that highlights the elements geographic information. Say "geographical" is part from the origin of space (spaces). These two words are often used interchangeably until third word, geospatial, emerges. These three terms have the same meaning in the context of GIS. The use of the term "geography" refers to matters relating to the Earth, that is surface two dimensions or three dimensions. Which meant with "information geographic" is news about an area located on the earth's surface, information about a position object on the earth's surface and information about news (attribute) about surface earth.

GIS makes it easy to see soil phenomena from a more comprehensive perspective good. GIS could keep, processing, and showing data spatial digital and can also combine multiple data including satellite imagery, aerial photography, maps, and statistical data. Thanks to today's speeds and the availability of personal computers with large amounts of memory, GIS can process and display data with fast and thorough. GIS also consider dynamics data, so that make it easy update data (Wibowo et al., 2015).

**2.4. Correct Geometric and radiometric**

Raiometric Correction designed to correct the pixel values in order sync with this value, which is usually considered the atmospheric disturbance factor as main source of error. The influence of the atmosphere leads to the fact that the value of The reflection of an object on the earth's surface recorded by the sensor is not a value initial, but larger due to scattering or less reflected by the process absorption. (Lukiawan et al., 2019). Radiation correction aims to correct pixel value to match which is usually required to take into account disturbance atmosphere which is reason main error. Moment caught atmosphere, the reflected value of terrestrial objects recorded by the sensor is not a value initially, but increase with scatter or decrease with process absorption. Method like method correct histogram, method regression, and method correct shadow many used for remove influence atmosphere (Danoedoro, 1996). Correct radiometric is correct base image which done to eliminate the noise contained in the picture into an impact from the deviation of the position of the sun's light, as well as one example Satellite images that require this process are Landsat Satellite images (Rahayu and Chandra, 2014).

Geometric Correction is a change of remotely sensed image so that the picture has projection, scale and also this geometric correction to fix the solar distance value and also the maximum and minimum values of the image. Geometry is a geographical location related to scatter spatial. Geometry containing data which relate with earth (data georeference), location (latitude and longitude coordinate system), and information about information which it contains. According to Mather (1987), correction geometric is

transformation of an image so that due to remote sensing the image hastraits inner map form, scale, and projection.

The simplest geometric transformation is repositioning pixels so that the converted digital image can be seen as the image of an objecton the earth's surface recorded by sensors. The result of this transformation is change the shape of the coverage frame from a square to a parallelogram. this step applies to raw digital images (live satellite recording) and is correct error geometric systematic.

**2.5. Classification Multispectral**

Classification Multispectral it means algorithm statistics parametric use estimation in accordance data sensing far which distributed normal on form curve density method is considered to be a structured division method regarding procedure solving statistics parametric. Distribution structured this also imply that procedure taking decision which declared by statistics is the most established (Danoedoro, 1996), Therefore, often used when map information cover land from image sensing far. Although this classification is the most established, there are still problems. In other words, classification this assume that data input sensing far which usedmust distribute normal. Wrong one approach for predict data sensing far which not yet general disseminated is with use classification based on understanding statistics non-parametric.

This classification is done with ENVI *software* . This multispectral classification can easily classify land cover in the study area. This multispectral classification process can quickly distinguish land cover by taking samples/objects (in the form of spectral values) by the operator forrecognize object based on trend spectral so that could used to differentiate between vegetated and non vegetated. Multispectral ClassificationThis study uses a 567 composite to make it easier to distinguish vegetation, non vegetation (Murti, 2012).

## 2.6. Normal Difference Vegetation Index (NDVI)

Index vegetation, or Normalized Vegetation Difference Index (NDVI), is a scientific geographical study that is constantly evolving and can be used to other scientific studies. Vegetation Index, or Normalized Vegetation Difference Index (NDVI), is index which represent color green plant. Index Vegetation is combination mathematical from stem red and zero, which has long used as an indicator of the presence and condition of vegetation. Plants (Lillesand et al., 1997).

Vegetation Index (NDVI) can be obtained using intrinsic properties plant (vegetation), that is emission and absorption wave, so that differentiate it from individual other without nature plant. Method this Becomes base to distinguish vegetation objects by using objects other than vegetation. Algorithm NDVI lowered with compare tape red and tape near-infrared from the remote sensing image, and can determine the green index vegetation. (NDVI) is index rate vegetation which most general used (Amalia, 2017).

Index vegetation is one of characteristics which connect reflectivity leaf with characteristics header and header. Index vegetation developed 40 years ago, including the development of the vegetation index and its application to the header (Hatifield et al., 2008). Vegetation Index defined as a mathematical combination of lines or lines representing the state of vegetation green (Lillesand et al, 1999; bullock, 2009). According to Campbell and Wynn(2011), the vegetation index was analyzed based on the luminance value of the vegetation index, which consists of special equations for the various spectral bands representing amount or intensity vegetation in pixels. Score the vegetation more tall show vegetation which more congested or more healthy.

The process of transforming the vegetation index indirectly produces the . value brightness that highlights aspects such as vegetation density, area index leaf, biomass and concentration chlorophyll. Density plant coconut palm in field related with Step growth vegetative plant. Normal Vegetation Difference Index (NDVI) is calculation image used

to determine the level of vegetation of parcels, waterways, or swaths in Landsat 8 . imageryas following:

Table 2.3. Combination Use band for Image Landsat 8

| Application Study | Combination band |
|---|---|
| Natural Color | 4 3 2 |
| false Color (urban) | 7 6 4 |
| Color Infrared (Vegetation) | 5 4 3 |
| Agriculture | 6 5 2 |
| Atmospheric Penetration | 7 6 5 |
| Healthy Vegetation | 5 6 2 |
| Land/Water | 5 6 4 |
| Natural With Atmospheric Removal | 7 5 3 |
| Shortwave Infrared | 7 5 4 |
| Vegetation Analysis | 6 5 4 |

Sumber data : United States Geological Survey (USGS)

Score NDVI obtained with count area near-infrared as color red which reflected by plant. Score NDVI obtained with compare data infrared close and data red (Green et al., 2000; Purwanto, 2015) with formula as following.

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

NDVI is Normalized value Vegetation Difference Index, NIR is band 5 of the Landasat image 8, and red is band 4 of the Landsat image 8. Density Seldom, Currently, and Congested.

According to Lillesand *et al.*, (1990); Lufilah *et al* ., (2017) The NDVI value ranges from between -1 to 1. Clouds, water, and non-vegetable objects with less NDVI values from zero. Score which represent vegetation range from 0.1 until 0.7. If score indexexceed range, cover vegetation more healthy.

**2.7. Analysis Regression**

Regression linear is tool statistics which used for knowing influence one or more variables against one variable. The origin of linear regression has advantages of more accurate in correlation analysis because hard to determine the degree of change from one variable to another (slope) as a result analysis. This also determine direction correlation Among variable dependent

positive or negative and predict the original value of the dependent variable as well as the variable independent when the value of the independent variable increases or decreases. Data that used is data interval or scale connection (Sena, 2016).

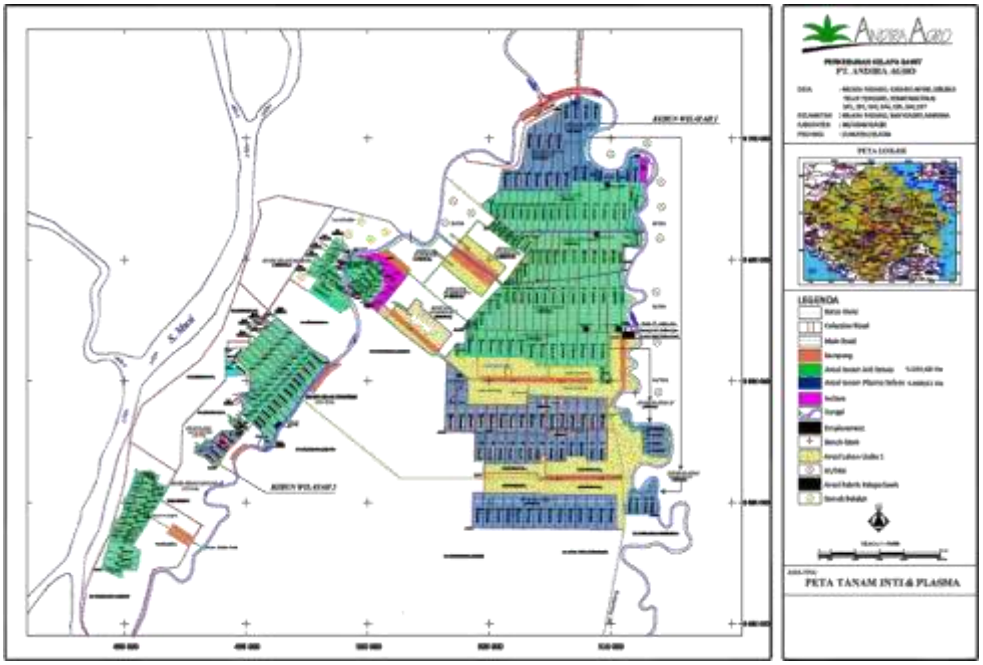
Linear regression is an approach to the relationship between the dependent variable x and one or more independent variables called y. Uses of linear regression is for To do prediction based on data which has owned previously. Analysis regression conducted for knowing big influence whichcaused by change on every unit variable y. Score coefficient determination ranges from 0 to 1. If the value is close to 1, then it can be it is said that the influence of the independent variable on the dependent variable is large, where model which used for explain influence variable the good (Ndruru*et al.*, 2014).

# CHAPTER 3
# IMPLEMENTATION STUDY

## 3.1. The place and Time

This research was conducted at PT. Andira Agro which is at Bay Village Coconut, Ward Coral new Subdistrict estuary field Regency Banyuasin South Sumatera Province. The company is located about 70 km from Palembang. This company can be accessed via a major road and can also be via the River Music use *speedboats* . Dock closest distance around 500 m from factory CPO PT. Andira Agro.

This research was conducted from April 2021 to June 2021.




Picture 3.1. Map Garden PT. Andira Agro

## 3.2. Ingredient and Method

### 3.2.1. Tool and Ingredient

As for ingredient and tool which used for study this is asfollowing.

1. Laptop

Laptop Becomes device for manage photo image and make map as well as write a report. The laptop used in this study is a *Toshiba Satellite C-50B Intel(R) core (TM) i3-32172 CPU @ 1.80GHz , 8GB RAM , OS Microsoft Windows 7 Ultimate 64-bit.*

*2. Software*

In this study, 2 (two) kinds of *software were used* , namely *ArcGIS 10.5* . and *ENVI 5. 3.* as well as needed also *Microsoft Word 2007.*

3. Garmin GPS 64s

In this study using secondary and primary materials/data, where the data is taken directly from the field and supported by data that has been there is. Required data to complete the research this time are as follows: following :

a. Image Landsat 8
b. Map RBI scale 1:50,000 region districts Banyuasin
c. Map Administration Regency Banyuasin
d. Data Subdistrict estuary Inner field number
e. Data results production palm in PT. Andira Agro year 2020
f. Map plantation coconut palm PT. Andira Agro

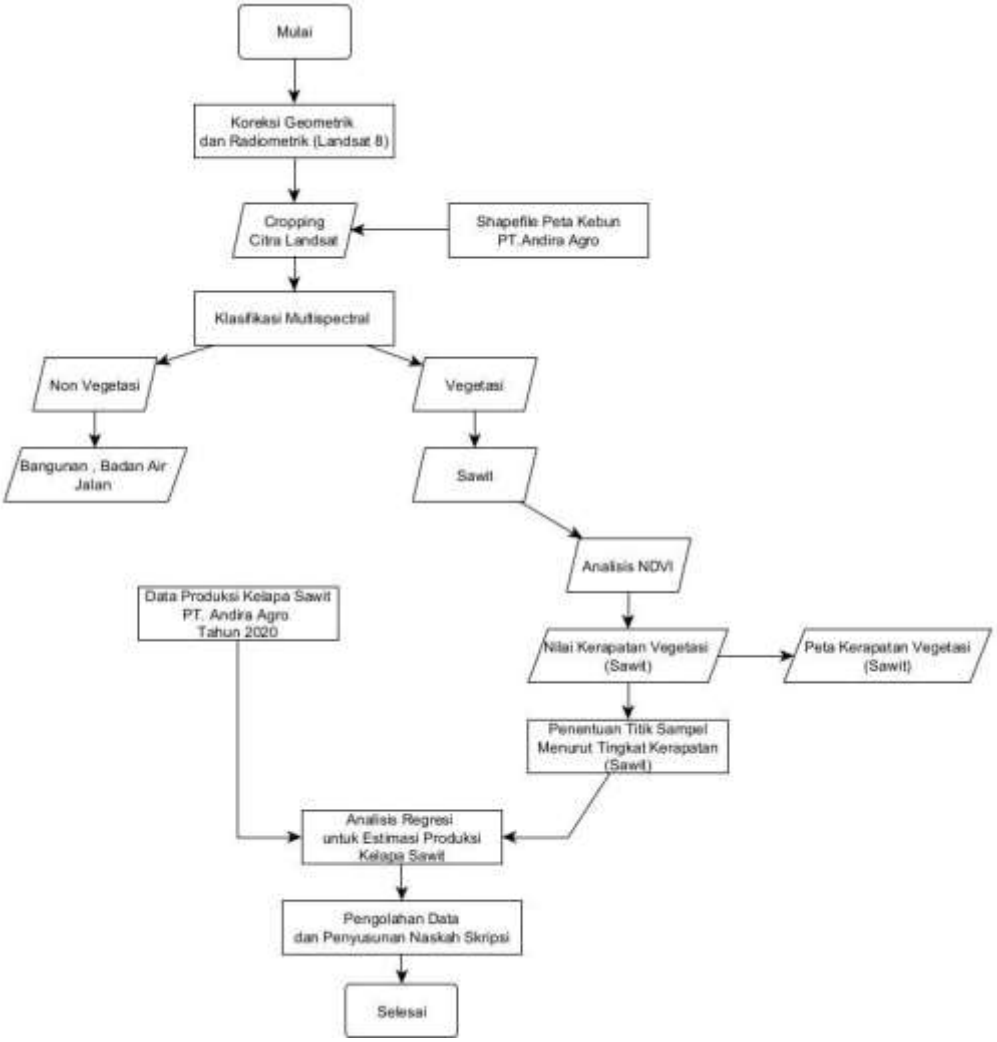
### 3.2.2. Method Study

Method study this use method NDVI which calculated based on ratio Among score red (R) and infrared close (NON) with formulaas following :

$$\text{NDVI} = \frac{(\text{Band } 5/\text{Nir} - \text{Band } 4/\text{Red})}{(\text{Band } 5/\text{Nir} + \text{Band } 4/\text{Red})}$$

## 3.3. Diagram Alur Penelitian

Flowchart used in implementation research as a reference in implementation so that could reach destination which expected on study which could seen on picture 3.2.




Picture 3.2. Diagram Plot Activity

## 3.4. Procedure Study

### 3.4.1. Study References

Studies literature conducted with gather data from books, articles in journals and other library *websites* which support in analysis NDVI in estimation production coconut palm, so that could help as reference study which will conducted. After that, donepreparation of research proposals, selection of research sites, preparation of tools and equipment ingredient, and equipment which required for research in field.

### 3.4.2. Preparation Study

On stages preparation study conducted after studies literature. Stages this covers preparation administration, collection data from study References, and preparation of tools and materials. This stage is carried out before the implementation of the research held.

### 3.4.3. Implementation Study

**a. Image Landsat 8 and Map Garden**

Ingredient which used in image landsat 8 downloaded on page *earthexplorer.usgs.gov.* For image landsat 8 this taken with notes *Land cloud the cover* Less *than* 10% to get accurate results with data on year 2020. Whereas for Map plant and Core Plasma plantation coconut palm PT. Andira Agro got from party PT. Andira That agro alone.

**b. Correct Geometric and radiometric**

Geometric and Radiometric Corrections are performed using *software* ENVI and ArcGIS. The purpose of this correction is that the absolute position of the image in accordance with the conditions that there is in field and for repair quality from image which already downloaded due to influence from atmosphere.

**c. Cropping Image landsat and Map Garden**

Process this conducted with use *Software* ArcGIS with method cut image landsat previously which already corrected Geometric and radiometric. Customized image with garden map PT. Andira Agro.

**d. Classification Multispectral**

Classification this conducted with use *software* ENVI withusing the Terselia or Supervised method where the level of accuracy is high generated more accurate compared to methods other. Process classification multispectral this could with fast distinguish close land with method sampling/object (in the form of spectral values) by the operator to identify objects based on their spectral tendencies so that they can be used to differentiate vegetation and non vegetation.

**e. Analysis NDVI**

NDVI calculated as ratio Among score red (R) and infrared close (NON)based on USGS.gov with equality as following.

$$\text{NDVI} = \frac{(\text{Band 5/Nir} - \text{Band 4/Red})}{(\text{Band 5/Nir} + \text{Band 4/Red})}$$

Score NDVI have range score from -1, 0 until 1.0 with descriptionrange score as following.

Table 3.1. Information range score NDVI

| Score | Information |
|---|---|
| 0.1< | Area Rocky/Rock and Land empty |
| 0.2 - 0.4 | Bush, field grass, Plant Old |
| 0.5 - 1 | Vegetation heavy |

Source : USGS.gov

### 3.5. Analysis Data

Analysis which conducted on study time this there is analysis Regression which will used in this study is linear regression because it only uses 1 variable free Score Productivity as factor Dependent whereas score pixels as Factor Independent with formula as following.

$$Y = a + bX$$

Information :

Y = Score Prediction estimation

a and b = Coefficient score which

generatedX = Vegetation Index

### 3.6. Test Accuracy Model

Model Accuracy Test using the *Standard Error Of Estimate* (SEE) method. Function test accuracy model for measure big error estimation which generatedby each model by comparing the estimation results and field data on sample test accuracy with formula as following.

$$SE = \frac{\overline{(y - y)^2}}{2}$$

Where:

SE : *Standard Error of Estimate* (tons/pixel)

$(yy')^2$ : Total difference Among score production field in sample test accuracy andsample model

n : Amount sample test accuracy

Score *standard error of estimate* converted in form score accuracy mapping in percent (%) with use *margin of error* in the form of *minimumerror* generated by the model. *Minimum* and *maximum error* values are obtained through several stages calculation, of them as following.

*CL* 95% = *Confidence (α, St.dev,n)*

*Lower range* = *Mean* - *CL* 95%

*Upper range* = *Mean* + *CL* 95%

*Min. Error* (%) = $(\frac{SE}{\text{Upper range}})$ x 100%

*Max. Error* (%) = $(\frac{SE}{Lower\ range})$ x 100%

*Min. Accuracy* = 100% - *Max. Error*

*Max. Accuracy* = 100% - *Min. Error*

Dimana :

Error Rate (5%) St.Dev :

Standard deviation of production dataN

: Number of production test

data *mean* : Average production

data

*CL* 95% : *Confidence 95% level*

**3.7. Presentation Data**

The final results of this study were compiled descriptively and visually, table or chart which in accordance with draft which applied on design study.

# CHAPTER 4
# RESULTS AND DISCUSSION

## 4.1. Pre Processing Data Digital Landsat 8

### 4.1.1. Correct Geometric

Geometric correction aims to adjust pixel coordinates contained in the downloaded image. uncorrected image generallywill have error geometric, where there is 2 type error geometric, i.e. systematic errors caused by sensors and errors random which caused by orbit as well as effect rotation earth.

On Landsat files 8 have metadata which have information like under this :

```
GROUND_CONTROL_POINTS_MODEL = 66
GEOMETRIC_RMSE_MODEL = 7.878
GEOMETRIC_RMSE_MODEL_Y = 5.821
GEOMETRIC_RMSE_MODEL_X = 5.308
```

Based on Landsat metadata 8 already downloaded, information about *Ground Control Point* (GCP) can be used for Geometric and *Root correction Mean Square Error* (RMSE). In the metadata it was found that the GCP usedis 66 point with total RMSE 7.8 meters and RMSE to direction X worth 5.8 metersand in the Y direction is 5.3 meters. It can be concluded that the Landsat 8 image released to the public in the form of a *Level-one terrain-corrected* (L1 T) product that has been free from errors due to sensors, satellites and the earth so Landsat 8 does not need corrected geometric again (Landsat handbooks, 2020).

### 4.1.2. Correct radiometric

Radiometric correction is fundamental in the management image data, this radiometric correction aims to eliminate the value of bias in image caused by atmospheric disturbance. The more atmosphere that recorded on the image, the higher the bias value, the correction is made radiometric. On study time this, researcher use application ENVI *Classic*for correction radiometric.

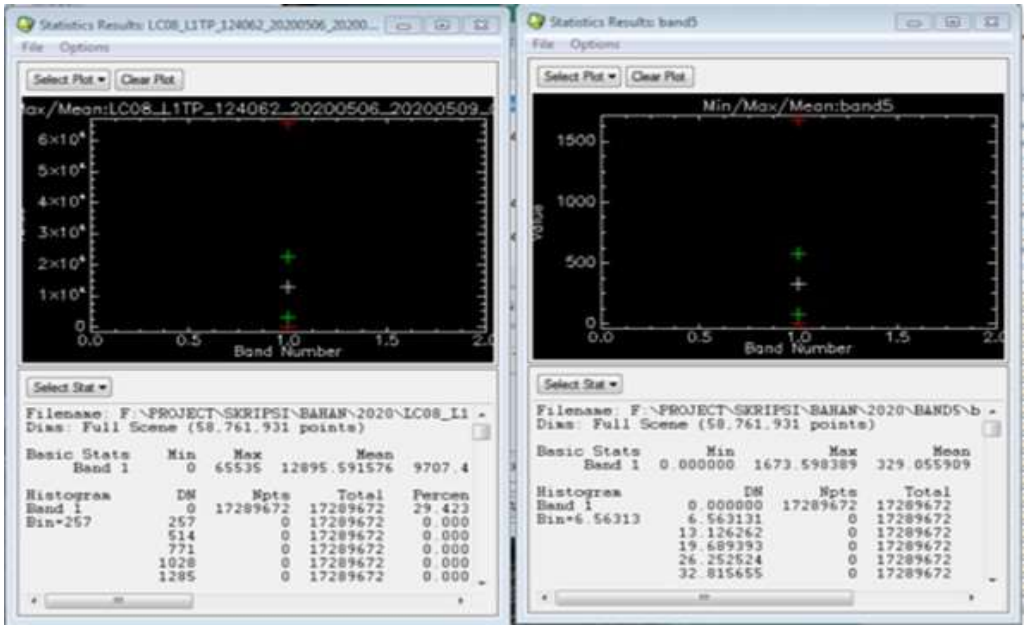



Figure 4.1. Landsat 8 Image Histogram, Band 5 After correction (right) and Before corrected (left)

On Picture 4.1. could seen with clear difference score digital (DN) image which already corrected nor which not yet in correct. Score maximum and minimum from image landsat 8 based on metadata seen like under this.

```
RADIANCE_MAXIMUM_BAND_5 = 363.64301
RADIANCE_MINIMUM_BAND_5 = -30.02976
```

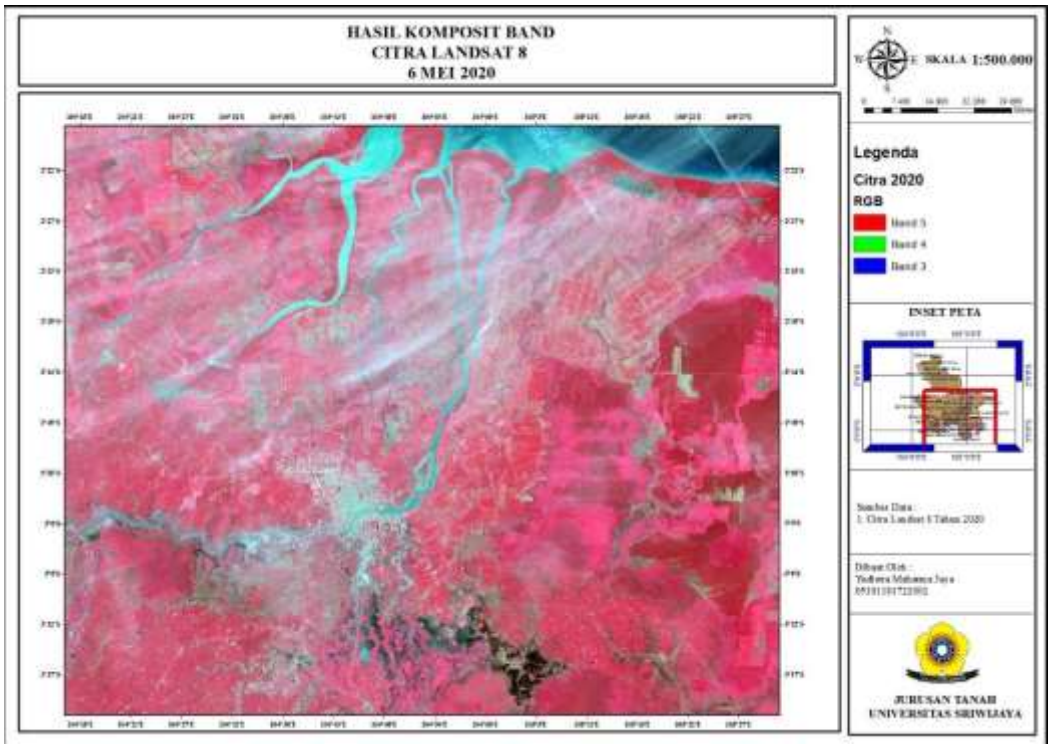
On radiometric correction results, visible that the result of the radian correction on Figure 4.1. (right side) is in the correct range, i.e. does not cross the minimum and maximum limits of the values contained in the metadata with the value a minimum of 0 and a maximum value of 1673. While those that have not been corrected are Picture 4.1. (part left) show score minimum 0 and score maximum whichexceed limit metadata, i.e. as big as 65535.

## 4.2. Processing Data Digital Landsat 8

### 4.2.1. Cutting Image Landsat 8 and Map garden Andira Agro

Geometrically and radiometrically corrected Landsat 8 imagery entered into the ArcGis (ArcMap) for process management data. On stages time this, Thing which conducted is To do composite band

(merging) Bands. In this study, the composited bands are Band 543, where Band 5 is *Near-Infrared* , Band 4 is *Red* , while Band 3 is *Visible* . The function of the merging of Band 543 is to see *Color Infrared (Vegetation)* . The results of the composite Band 543 that have been corrected will seen like Picture 4.2.




Picture 4.2. Results composite band 543 image Landsat 8

After the Landsat 8 Image has been composited, then the next step is to include a map of PT. Andira Agro which is already in the form of SHP ( *shapefile* ), then the *Masking process is carried out* to get the results as shown in Picture 4.3.

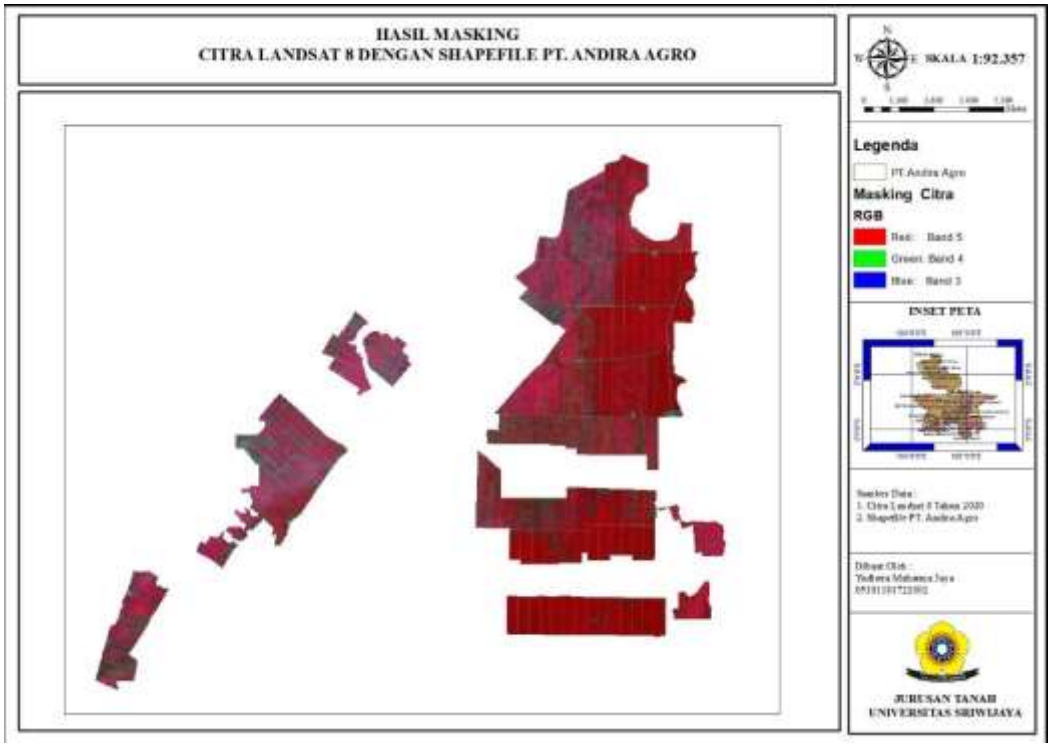
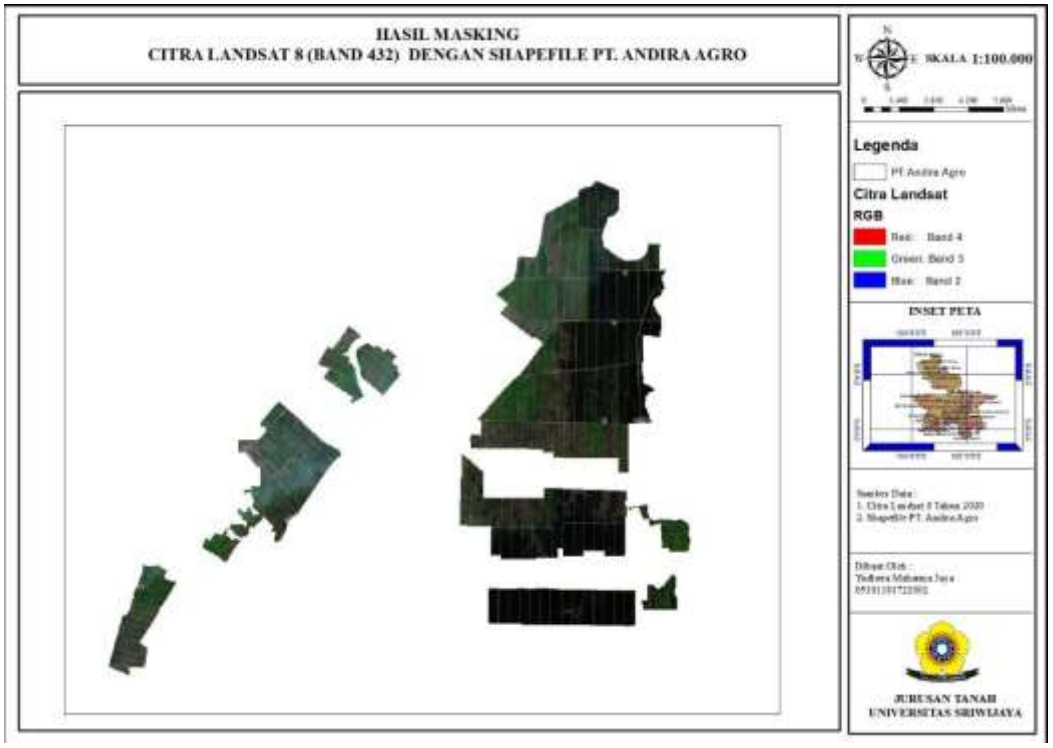



Figure 4.3. Results Map mask garden and image Landsat 8

*PT.Andira* Agro's shapefile in the form of a polygon is masked *with* an image Landsat 8 that has been composited, it looks like in Figure 4.2. *Mask* function to separate or delete part outside *Area of interest* (AOI) for make it easy in process management image. Results from process *masking* between PT. Andira Agro and Landsat 8 Image can be seen in Figure 4.3.

### 4.2.2. Classification Multispectral

Multispectral classification was carried out using the *Maximum Likelihood method* . The advantage of using this method is that it is easy to classify cover land on area research with method taking sample/object (spectral value) by the researcher to identify the observed object based on trend spectral. Trends spectral here which could used for differentiate vegetation and non vegetation on process classification.




Picture 4.4. Image Composite band 432 on Image Landsat 8

In this study the operator was assisted by a composite of Band 432 ( *Natural Color* ) where Band 4 is *Red* while 3 and 2 are *Visible* channel . In this composite process, the original appearance of the image will be seen like vegetation coconut palm until with river. Appearance band 432could seen on Picture 4.4.

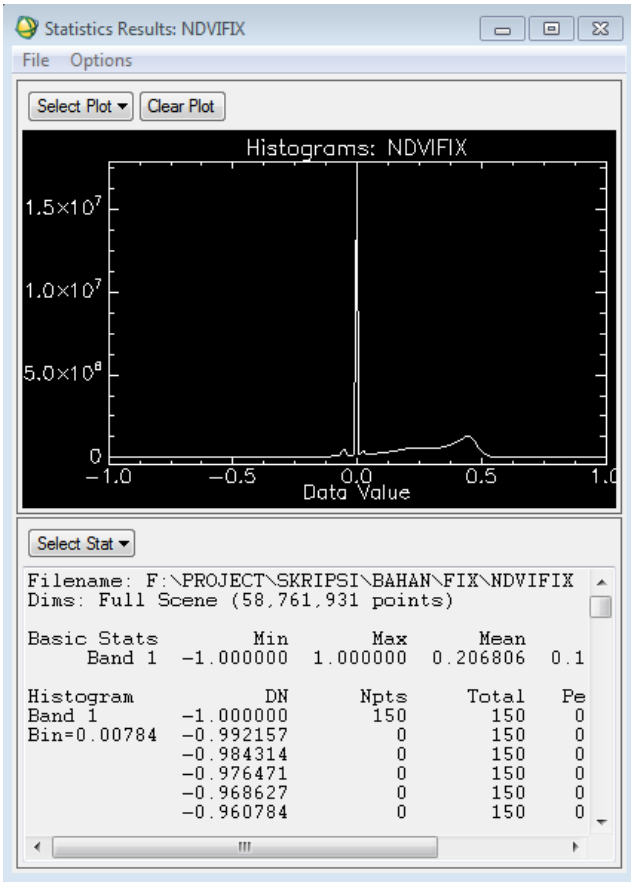
### 4.3. Compilation Image Index Vegetation

#### 4.3.1. Analysis NDVI

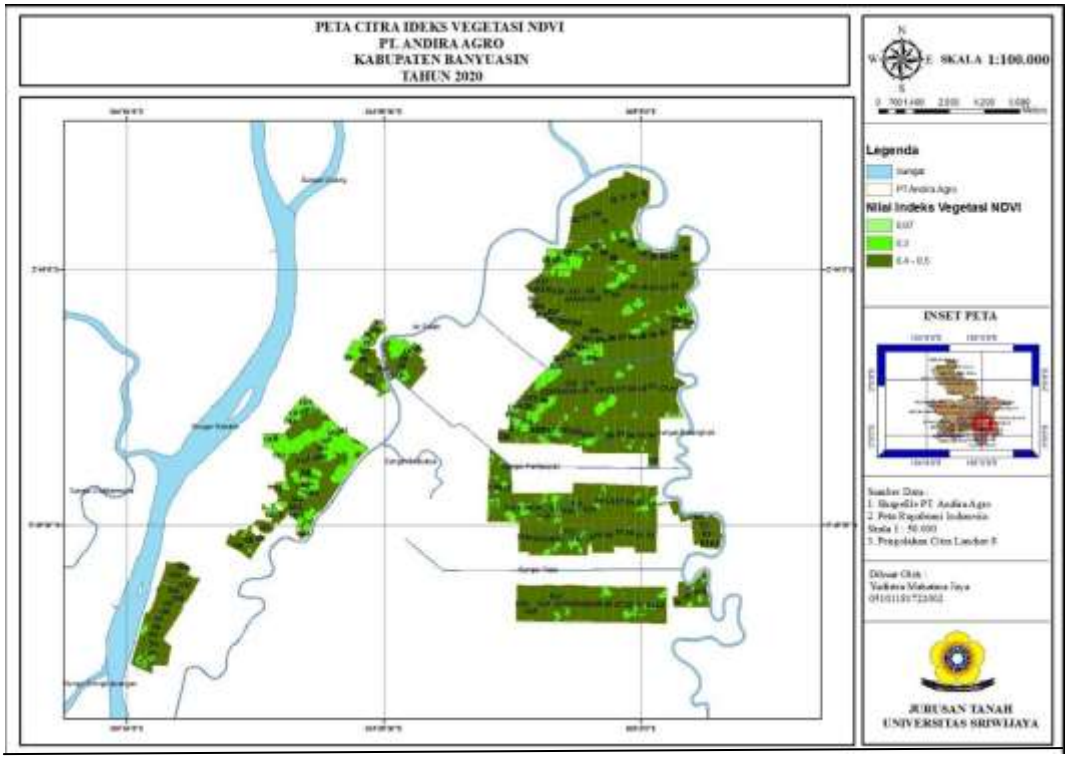
Analysis *Natural Difference Vegetation Index* conducted with using ArcGIS software. NDVI calculated through reflected radiation sunlight at the red wavelength ( *RED* ) which in the Landsat image is 8 long wave RED there is in band 4, while *Near-Infrared* ( *NIR* ) there is in band 5 with formula as following.

$$\text{NDVI} = \frac{(\text{Band } 5/\text{Nir} - \text{Band } 4/\text{Red})}{(\text{Band } 5/\text{Nir} + \text{Band } 4/\text{Red})}$$

This NDVI value has a range of values from -1 to 1. Values less than 0 indicates clouds, water and other non-vegetated objects, while 0.1 to 0.7is range score which represent vegetation.




Picture 4.5. histogram Results NDVI With Score Pixels -1 until with 1




Picture 4.6. Map Image Index Vegetation NDVI PT. Andira Agro

Based on the vegetation index image map Figure 4.6 the value of the vegetation index at PT. Andira Agro ranges from -1 to 0.7. Reflection value -1 to 0.07 which showing that density the low. Object on reflection this in the form of vacant land which is either a body of water or a building. At values with reflection 0.4 until 0.5 is score highest and object which there is on score thisis a plantation. When the index value of oil palm is known, so step next is test regression. Test regression this aim for knowing connection and influence from score density header with score productionPalm oil which there is in PT. Andira Agro.

### 4.4. Type Coconut Palm oil PT. Andira Agro

Types of palm oil in PT. Andira Agroin the planting year 1999, 2002, 2003, 2004, 2008, 2009, 2010 to the youngest planting year, i.e 2011. This *ground check* is carried out for the verification process of image data whether each planting year has a significant amount of production between planting years one and year plant other like on table under this.

Table 4.1. Varieties Coconut Palm oil PT. Andira Agro

| No. | Year plant | Varieties Seeds Coconut Palm oil |
|---|---|---|
| 1 | 1999 | Seeds dumpy |
| 2 | 2002 | Marehat |
| 3 | 2003 | Marehat |
| 4 | 2004 | Marehat |
| 5 | 2006 | Srivijaya (SJ) |
| 6 | 2007 | Srivijaya (SJ) |
| 7 | 2008 | Srivijaya (SJ) |
| 8 | 2009 | Srivijaya (SJ) |
| 9 | 2010 | Srivijaya (SJ) |
| 10 | 2011 | Srivijaya (SJ) |

dumpy is seeds certified output Center Study Coconut Palm oil (PPKS) (Nasution and Putri, 2021). Dumpy variety is the result of marriage Among Dura Dumpy and Pisifera SP540 derivative. Mutant from Dura Deli that introduced from Elmina which is owned by the Palm Oil Research Center (PPKS) is Dura dumpy. Varieties DY x P SP1 issued on year 1984 based on the Decree of the Minister of Agriculture No. 384/Kpts/TP.204/4/1984 (Edy*et al* ., 2019).

Varieties dumpy is varieties coconut palm with superiority specific, namely the slow growth rate with an average bunch weight of which tall. Character growth slow, make varieties dumpy could reach a production life of up to 30 years. Dumpy also has stems that are relatively large so as to reduce the potential for falling. Dumpy has adaptability on the marginal area is good especially in tidal land and area peat (Gunawan, 2018).

In *website* official PPKS explained that on year 1985 PPKS produce Marihat Clone (MK) from results technique culture network so that produce Marihat Klon seeds. Marihat Clone Seeds have more yield tall compared to seeds other. Profit Marihat Clone Among other :

1. The growth that uniform in field,
2. Potency productivity more tall 20 – 30 %
3. Stand to attack pest and disease,

4. Production more fast
5. Easy care and maintenance, no different of care and maintenance plant Palm oil in general (PPKS)

According to the Directorate of Seeds, 2004 the advantages of these marihat seedsproduce pasair fruit at the age of 2.8 to 3 years. Fruit bunch production fresh or TBS produce 20 until 30% with production the oil average 7.53 ton per hectares per year.

D x P Sriwijaya is a variety belonging to PT. The Prosperous Palm Oil Development located in South Sumatra. Based on indicators of crop yields on land class 3, D x P Sriwijaya has an average productivity of 24.6 tons/ha/year with oil productivity 7.5 tons/ha. The Sriwijaya variety bears fruit at the age of 18 months and this variety can be harvested at the age of 26 months. The Sriwijaya variety has resistance to diseases such as *Crown disease* and *Fusarium wit.* The Sriwijaya variety is also drought tolerant. Parent of the Sriwijaya variety comes from ASD Costarica, which makes this variety have similar characteristics with seed parent (Seed Plantation, 2016).

To get big bunches , PT. perishing recommend for use varieties DxP Srivijaya 4 and DxP Srivijaya 6. In addition, both varieties have advantages, namely the extraction of CPO oil more from 27 %. From sixth varieties DxP Srivijaya, only varieties DxP Srivijaya 1 which can produce virescens type fruit (when unripe it is green then colored orange when ripe). Though thereby, no all Crosses on DxP Sriwijaya 1 can produce virescens type fruit, however part of the cross will produce fruit type nigrescens (when raw black then blackish red when ripe) (PT.perishing Prosperous, 2021).

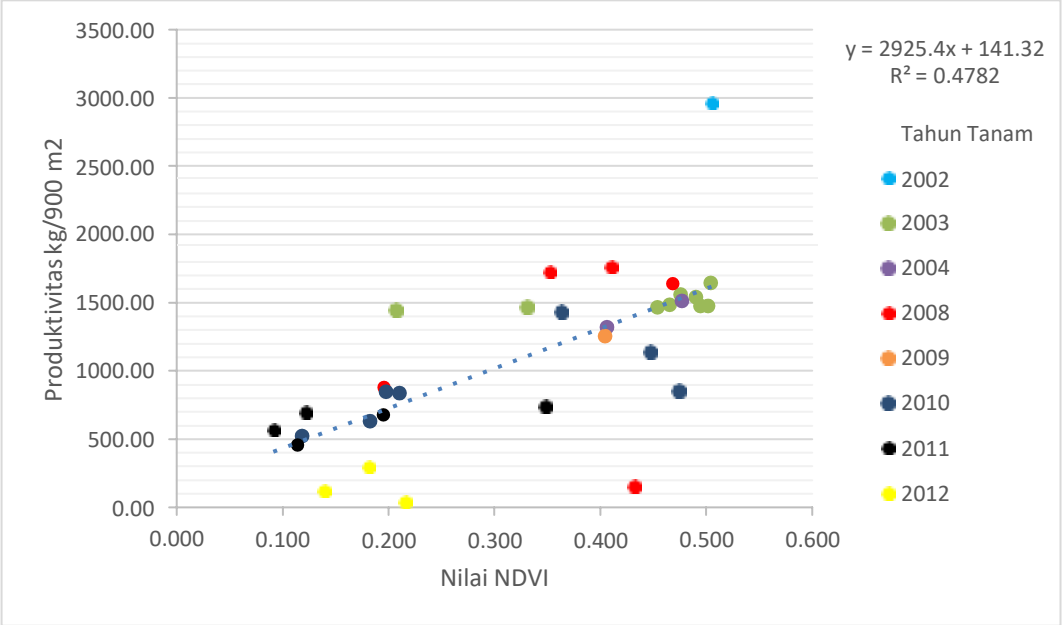
DxP Sriwijaya 1 can be planted up to a density of 145 trees/ha at a distance ofplanting 8.9 mx 8.9 mx 8.9 m. While DxP Sriwijaya 2 and 5, can be planted up to a density of 160 trees ha with a spacing of 8.5 mx 8.5 mx 8.5 m. For land hilly, recommended for plant varieties DxP Srivijaya 1 with advantages of slow high growth, so that it can facilitate the process harvesting, where every fruit ripe could harvested by effective. Then,

DxP Srivijaya 2 with superiority range midrib which relatively short, so that capable give room more so that ray sun could received every plant, though there is difference height surface soil. Next is DxP Sriwijaya 3 with a slow rising ability and can produce the number of bunches is above average and the size of the bunches is relatively not too large, so that make it easy harvesting. Then which final is DxP Srivijaya 5 because this variety has two characters that can be taken into consideration to be planted on hilly land, i.e. slow rising growth and range midrib relatively more short (PT. perishing Prosperous, 2021).

In this study, the production of palm oil at PT. The biggest Andira Agro in the planting year 2002, namely the Marehat variety while the smallest production on year plant 2012 that is on varieties Srivijaya. On Varieties dumpy have average weight bunch which tall and could reach age production until 30 year.

**4.5. Analysis Regression**

Analysis Regression used for knowing big influence Among variable (X) and Variable (Y), that is estimated predictive value. Analysis which conducted on study time this is Analysis Regression linear. Study time this data which used for analysis regression that is data Score Index Vegetation (X) and Production Value (Y). This analysis serves to determine the magnitude of the effect of because of a change in each unit of the Y variable. The relationship between the values of palm oil canopy density (vegetation index value) with crop production value Palm oil is as following.




Picture 4.7. Chart Connection Production Coconut Palm oil With Score Density Vegetation Coconut Palm oil

Based on the graph above, it can be seen that the value of R2 is $^{0.4782}$ with the regression equation (Y) is 2925x – 141.32. Based on the graph the also could is known that direction correlation positive, where the more big the NDVI value obtained will affect the increase in the estimated value production value. This is because the age of the plant affects the reflection value which received based on chlorophyll in processing NDVI, so that age plant old have score the NDVI low compared with age plantyoung.

Score R2 ‾ is coefficient determination which show how much biginfluence NDVI in modeling estimation production. Coefficient determination NDVIget score 0.4782 or 47.82 % interpreted that NDVI could explainedby production value in modeling estimation production, however by weak,the rest influenced by factor other outside NDVI. According to Listiono and Sugiarto(2015), explain that score coefficient determination based on score whichobtained R2 above 0.75 (substantial), $^{0.50}$ – 0.75 ( *moderate* ), 0.25–0.50 (weak). Coefficient value correlation (r) which obtained is 0.691, where score this show that existence connection which strong Among score index vegetation

oil palm density with oil palm production value. This correlation coefficient has a value between -1 to +1, then if the value is close to +1 then the relationship is perfectly positive, and vice versa, if the value is close to -1 then the relationship is perfectly negative. Then it can be concluded that the index value vegetation and score production have connection which positive.

Resolution spatial image landsat 8 which as big as 30 x 30 meters with largethe pixels as big as 900 $m^2$ ,for get unit production 900 m2 – so column production (tons/ha/year) from 10,000 m2 – (1 Ha) shared 900 m2 , – so result become11.11 $m^2$ . Then, obtained score production like which seen on Table 4.4. Results from processing data image landsat 8 year 2020, so obtained results estimation production coconut palm in PT. Andira Agro as big as 97,138,728.25 kg.Whereas amount production coconut palm could seen on Table 4.5. PT. AndiraAgro has a total area of 10,183.03 ha. The estimation results obtained havescore which far more tall if compared with data from garden PT. AndiraAgro. Thing this caused by variable which used only score NDVI, whereas for get score which in accordance variable x his could added like fertilization, nutrient content on land and another so on.

In research, the independent variable is only as wide as the Landsat pixel size, so it is necessary conversion is carried out, where the conversion has properties that can generalize data or make data the more random. Then, NDVI only capable as big as

47 % for model production estimate based on the coefficient of determination, while the maximum model accuracy reaches 88%. In short, accuracy to estimate production with medium resolution images such as Landsat 8 is sufficient. Then, processing noise on raster data where there is often a pixel value in the form of noise whose frequency is quite a lot, so the estimated value can be biased. The value of NDVI in the image is not only record the palm object, but also other objects, so the NDVI value usedmay have a mixture of the spectral responses of other objects, such as ground, plant attendant and other etc.

Analysis regression conducted for knowing influence which caused by changes to each variable unit. Relationship between vegetation index values with estimation production coconut palm here which will analyzed for

knowing how big the influence between vegetation density and production coconut palm. Test regression which conducted in the form of test regression linear simple, where The sample used was 50 sample points with 35 samples and 15 samplesfor accuracy model.

### 4.6. Test Accuracy Model

Test Accuracy Model use point sample 35 until 50 with using the *Standard Error of Estimate method.* It was found that *Standard Error of Estimate* on study time this as big as 158,114 kg/pixel with accuracymaximum as big as 88.003 % and accuracy minimum as big as 83.105 %. Following table point sample for test accuracy model on study time this.

Table 4.2.Point Sample Test Accuracy Model

| Point Sample | Block | Large (Ha) | Productivity (kg/Ha/Th) | NDVI |
|---|---|---|---|---|
| 35 | C16 | 49.98 | 1151,488595 | 0.302765 |
| 36 | C2 | 53.35 | 1476.506092 | 0.496081 |
| 37 | C14 | 59.77 | 1241,418772 | 0,363577 |
| 38 | A9 | 51,01 | 1308,696334 | 0,38283 |
| 39 | A13 | 52,14 | 1032,721519 | 0,268927 |
| 40 | B17 | 18,8 | 1029,398936 | 0,192729 |
| 41 | Q1 | 9,69 | 953,498452 | 0,152148 |
| 42 | I10 | 68,79 | 290,8940253 | 0.114245 |
| 43 | C17 | 42,52 | 1136,64158 | 0,351702 |
| 44 | C18 | 29,59 | 1117,867523 | 0,311267 |
| 45 | A4 | 77,21 | 1553,627768 | 0,510211 |
| 46 | B6 | 73,23 | 1615,600164 | 0,543035 |
| 47 | Q2 | 34,72 | 698,718318 | 0.143525 |
| 48 | I9 | 51,07 | 661,9326415 | 0.145429 |
| 50 | C9 | 78,11 | 1635,508898 | 0,533824 |

Table 4.3. Results Test Accuracy Model

| | | |
|---|---|---|
| SUM | 375002,2294 | |
| SE | 158.114353 | Estimate Error (kg/pixel(900m $^2$)) |
| MEAN | 1126,967975 | |

| | | |
|---|---|---|
| STDEV | 377.5543165 | |
| CL95% | 191.0653355 | |
| UPPER RANGE | 1318,03331 | |
| LOWER RANGE | 935,902639 | |
| MAX ERROR | 16,8943164 | |
| MIN ERROR | 11.99623346 | |
| MAX ACCURACY | 88.00376654 | Accuracy Maximum which can achieved (%) |
| MIN ACCURACY | 83.1056836 | Accuracy Minimum which can achieved (%) |

Table 4.4. Table Point Sample

| Point Sample | Block | Year plant | Large (Ha) | Productivity (kg/900m2) | NDVI | Estimate Production (kg) |
|---|---|---|---|---|---|---|
| 1 | B2b | 2004 | 39,94 | 1322,78 | 0,406 | 1329,03 |
| 2 | H9 | 2011 | 59,83 | 742,05 | 0,347 | 1156,43 |
| 3 | H8 | 2010 | 65,2 | 846,37 | 0,197 | 717,62 |
| 4 | H11 | 2012 | 56,55 | 301,16 | 0,181 | 670,81 |
| 5 | I11 | 2008 | 60,95 | 158,68 | 0,431 | 1402,16 |
| 6 | A2 | 2003 | 77,05 | 1486,72 | 0,465 | 1501,63 |
| 7 | B2a | 2002 | 10,53 | 2966,84 | 0,505 | 1618,64 |
| 8 | B9b | 2008 | 46,56 | 1727,59 | 0,352 | 1171,06 |
| 9 | H12 | 2012 | 54,54 | 125,59 | 0,139 | 547,95 |
| 10 | Q6 | 2011 | 20,31 | 682,02 | 0.195 th most common | 711,77 |
| 11 | A15 | 2010 | 52.77 | 526,39 | 0.118 | 486,51 |
| 12 | Q4 | 2011 | 56.29 | 460,44 | 0.114 | 474,81 |
| 13 | B4 | 2003 | 68.2 | 1559,69 | 0.475 | 1530,88 |
| 14 | A11 | 2010 | 59.57 | 840,90 | 0.210 | 755.65 |
| 15 | A16 | 2010 | 47,11 | 635,23 | 0.182 | 673,74 |
| 16 | A7 | 2003 | 77,61 | 1467,97 | 0,330 | 1106,7 |
| 17 | B11 | 2008 | 45,67 | 1641,85 | 0,468 | 1501,4 |
| 18 | A10 | 2010 | 52,73 | 1140,80 | 0,447 | 1448,97 |
| 19 | B2c | 2008 | 21,85 | 884,68 | 0.195 th | 711,77 |

| | | | | | | |
|---|---|---|---|---|---|---|
| | | | | | most common | |
| 20 | B10 | 2008 | 52.86 | 1764,33 | 0.410 | 1340,73 |
| 21 | A6 | 2003 | 82.49 | 1449,04 | 0.207 | 746,87 |
| 22 | B19 | 2010 | 13.53 | 1436,54 | 0.363 | 1203,24 |
| | | | | | th most common | |
| 23 | B8 | 2003 | 77.82 | 1479,14 | 0.502 | 1609,87 |

| | | | | | | |
|---|---|---|---|---|---|---|
| 24 | B3 | 2003 | 66,66 | 1543,49 | 0,490 | 1574,76 |
| 25 | A3 | 2003 | 83,85 | 1466,06 | 0,454 | 1469,45 |
| 26 | A14 | 2010 | 51,86 | 859,74 | 0,474 | 1527,95 |
| 28 | B7 | 2003 | 75,97 | 1477,57 | 0,494 | 1586,46 |
| 29 | B9a | 2003 | 70,26 | 1645,36 | 0,503 | 1612,79 |
| 30 | A1 | 2004 | 89.58 | 1513,26 | 0.477 | 1536,73 |
| 31 | C20 | 2009 | 6.4 | 1256,06 | 0.404 | 1323,18 |
| 32 | Q5 | 2011 | 51.45 | 571,14 | 0.091 | 407,53 |
| 33 | H10 | 2011 | 55.13 | 701.62 | 0.121 | 492,36 |
| 34 | I12 | 2012 | 38.3 | 43.59 | 0.215 | 770.28 |

Table 4.5. Results production PT. Andira Agro 2020

| Planting Year | Population | POP. Effective | Total Production (Kg) | BJR |
|---|---|---|---|---|
| 1999 | 6,599 | 6,599 | 881,220 | 133.54 |
| 2002 | 2,620 | 2,533 | 349.020 | 137,79 |
| 2003 | 146.899 | 145.594 | 19.494.940 | 133,90 |
| 2004 | 70.607 | 68.355 | 8.508.550 | 124,48 |
| 2005 | 1.283 | 1.179 | 214.780 | 182,17 |
| 2008 | 51.857 | 47.566 | 7.272.540 | 152,89 |
| 2009 | 77.134 | 64.509 | 6.803.840 | 105,47 |
| 2010 | 193.114 | 169.592 | 15,595,280 | 91.96 |
| 2011 | 83.042 | 67.033 | 3,908,750 | 58.31 |
| 2012 | 58,424 | 38,931 | 1,173,420 | 30,14 |
| **GRAND TOTAL** | **691,579** | **611,891** | **64,202,340** | **104.92** |

# CHAPTER 5
# CONCLUSION AND SUGGESTION

## 5.1. Conclusion

Based on the objectives and results obtained in this study, it can be concluded:

1. Score density vegetation on study time this Lowest with score 0.07 andhighest with score 0.54
2. In Landsat 8 image processing, the estimation results in this study were obtained score coconut production palm as big as 97,138,728.25 kg with large garden as big as 10,183.03 Ha. Based on processing image Landsat 8 obtained score maximum accuracy of 88% and minimum accuracy of 83% with estimation error as big as 158,114 kg/pixel.

## 5.2. Suggestion

The suggestions that can be given are to get the estimation results which more can accurately use image resolution tall , like image sentinel,Iconos, QuickBird and other etc.

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# ATTACHMENT

## Attachment 1. Taking pictures Activity

(Photo 1. Activities Harvesting) palm)

(Photo 2. Results Harvest Fruit Coconut

(Photo 3. Activity Taking Data)

(Photo 4. Memories Together Employee)

## Attachment 2. Photo Appearance Coconut Palm oil

Appearance Coconut Palm oil Year 1999 in PT. Andira Agro

Appearance Coconut Palm oil Year 2003 in PT. Andira Agro

Appearance Coconut Palm oil Year 2004 in PT. Andira Agro

Appearance Coconut Palm oil Year 2008 in PT. Andira Agro

Appearance Coconut Palm oil Year 2009 in PT. Andira Agro

Appearance Coconut Palm oil Year 2010 in PT. Andira Agro

Appearance Coconut Palm oil Year 2011 in PT. Andira Agro