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DETERMINATION OF TH DYNAMICS OF THE FIELD AREAWITH FOOD SUPPORTUSING REMOTE SENSING IN SOLOK DISTRICT

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ABSTRACT: The availability of carrying capacity of food in an area is closely related to the availability of sufficient agricultural rice fields, from both sides they are very mutually supportive, so if the area of agricultural land is in an area, the availability of food inthe area will also help reduce this problem. will have an impact on the food-carrying capacity of the people in the region. This study uses a quantitative descriptive approach using a supervised classification method using the SNI 7645 Classification. The data required are Landsat images from 2000, 2010 and 2020 . The data obtained from the results of image data processing is the occurrence of changes in the area of rice fields in Solok Regency in 2000, 2010 and 2020, where in 2000 the area of rice fields was 90,344, in 2010 the area of rice fields again was 80,452Ha, and in 2020 the area of rice fields continues to decrease to 75,750 Ha.

Keywords: Remote Sensing, Rice Fields, Food Carrying Capacity

1. INTRODUCTION

The land is a natural resource that has a very broad function in meeting various human needs from an economic standpoint land and is the main permanent input for various production activities of agricultural and non-agricultural commodities. In general, food needs in Indonesia depend on paddy rice farming because rice is the main food commodity for the people of Indonesia. The availability of food carrying capacity in an area is closely related to the availability of sufficient paddy fields, from both sides this is very interdependent, so if the area of paddy fields in an area decreases, the availability of food in that area will also decrease, so This problem will have an impact on the community's food carrying capacity

existing in the region, In Law No. 32/2009 there is about the protection and management of the environment is the ability of the environment to support human life, and other creatures, and the balance between the two. The existence of population pressure that continues to increase will have an impact on land use and excessive food-carrying capacity it will threaten the sustainability of the environment in an area. Very fast population growth will encourage changes in land use, including various purposes such as housing and development facilities, this is because the surface area of the earth is relatively fixed while human needs on this earth will continue to increase along with the increase in population from year to year (Iswandi, 2017). Land conversion is a logical consequence of increasing population and other development processes. Land conversion is a natural thing to happen, but in reality land conversion is a problem because it occurs on productive land. The impact of the conversion of paddy fields to non-agricultural uses involves a broad dimension. This relates to aspects of changing the economic, social, technological and political orientation of society (Kafrinas et al, 2016)

Remote sensing is where we can obtain an object or area using remote sensing technology data, namely by using imagery, using imagery we can analyze and obtain information about objects in an area without going directly to the object or area to be studied (Lillesand and Kiefer, 1979). The development of remote sensing technology today or in the future provides the possibility to obtain data that is relatively new, fast and accurate. The launch of various kinds of satellites by developed countries has increasingly spurred the development of remote sensing as a tool for obtaining reliable natural resource inventory data. The existence of Landsat, SPOT, ERS-1, NOAA, and others satellites orbiting the earth with various types of sensors, spectral resolution, and spatial resolution greatly benefits satellite data users according to their needs.
According to Lindgren in Sutanto (1986) remote sensing is a technique developed for obtaining and analyzing information about the earth, this information is in the form of electromagnetic radiation reflected or emitted from the earth's surface. Meanwhile, Liles and, et.al (2004) said that remote sensing is the science and art of obtaining

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information about an object, area or phenomenon through the analysis of data obtained with a tool without direct contact with the object. Based on this understanding, it can be concluded that remote sensing is a technique used to obtain data about the earth's surface using satellite or airplane media.

Landsat is the oldest satellite in the mission to observe the appearance of the earth's surface. Landsat serves to map the potential of natural resources and monitor environmental conditions on the earth's surface. Therefore, Landsat can be called a natural resource satellite. LANDSAT (Land satellite), is the first satellite launched by NASA in the United States in 1972 under the name ERTS-1 (Earth Resources Technology Satellite-1).
The quality of an image is affected by cloud cover, fog and smoke. The first-generation Landsat has not been operating since 1983, so the object-recording mission was continued by the second generation. The second generation Landsat, namely Landsat 5, Landsat, Landsat 7, and Landsat 8. The weakness of Landsat is that Landsat 7 experienced damage to the SLC (Scan Line Correction) at the end of May 2003. The USGS (United States Geological Survey) as the operator of the Landsat 7 satellite stated that the damage is permanent. The impact of the damage every Landsat 7 SCL-Off data has a gap or part that is missed by the sensor recording by 22% or in each scene the resulting image data will lose information by 7,5295.5 $km2$ from the recording area of the object where the recording coverage made by the sensor before experiencing SLC damage is 34,225 $km2$. This situation resulted in the accuracy of object recording data being reduced. This error is called stripping, which is a line without data that is located vertically in the direction of the scanner line. So that in 2013 Landsat 8 was launched to continue the mission of Landsat 7.

2. RESEARCH METHOD

This study used a quantitative descriptive study with a spatial approach to explaining changes the in paddy field area with food support. The method used in this study is a supervised classification method using SNI 7645 Classification, and the ratio formula for the area of harvested food crops per capita to the area of land for food self-sufficiency and by using the CA (cellular automata) method to predict food carrying capacity for 2030 in the District. Solo. To determine predictions and accuracy tests were carried out using Google Earth to determine the accuracy of the image for land cover interpretation.

The sampling technique was obtained using the Arcgis supervised software method with the SNI-7645 Classification. The collected data were processed to obtain the final result in the form of spatial data. The data is arranged based on the steps- the steps. After obtaining Landsat 5 and 8 images for 2010, 2015 and 2020 which were obtained through the USGS website, the first step that can be done is to enter these images into the Envi application then do radiometric, geometric and atmospheric corrections, then input them to arcgis
, then cut the image using the Administrative boundaries of the area under study after that carry out the process of giving samples to carry out supervised classification with SNI classification. After carrying out supervised classification the next step is to calculate the area of rice fields which is then linked to the food carrying capacity, finally, is to overlay the area of rice fields with the results of the carrying capacity of food which is classified using the formula for the ratio of the area of harvested food crops per capita with an area of land for self-sufficiency in food.

DD = Paddy field area x Ip x production/ha Total population x KFM
DD = Food carrying capacity Lp = Harvested area
KFM = Minimum physical needs

Then test the accuracy using high-resolution imagery that is maniji with the Kappa index (accuracy) using 50 random sample points. The location and type of land cover tested are determined by the appearance of the type of cover on the high-resolution imagery and the results of the field survey.

3. RESULTS AND DISCUSSION

3.1. Research Results

Doing research on the Change of Paddy Field Area with the Food Carrying Capacity in Solok Regency and the prediction of rice fields in Solok Regency in 2030 by using some data including landsat imagery for 2000, 2010 and 2020, then data from the Central Statistics Agency for Solok Regency and the Solok Regency Shapefile, the following results are obtained:

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In the process of Mapping Changes in paddy field areas with food carrying capacity through three stages including:

A. Results of the Supervised Classification Map of the Distribution of Rice Fields in Solok Regency in 2000, scale 1: 500,000

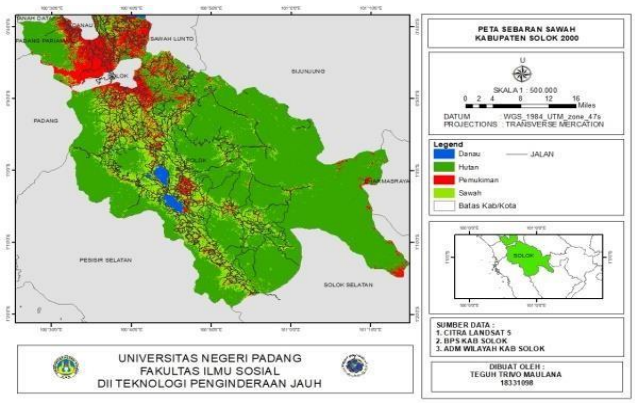

Figure 1 . Distribution Map of Supervised Citra Landsat 5 the Year 2000 Classification of Solok District

B. Results of Supervised Classification Map of the Distribution of Paddy Fields and Land Cover in Solok Regency in 2010, scale 1: 500,000

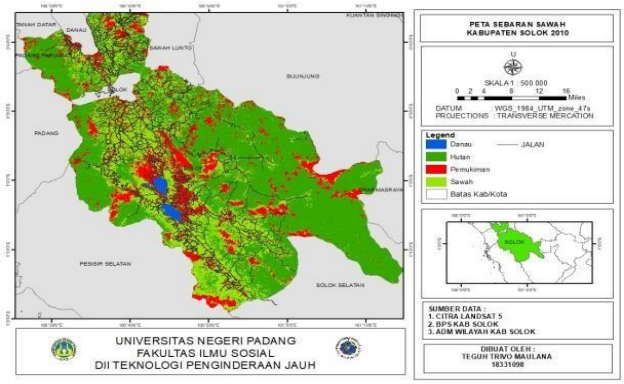

Figure 2. Distribution Map of Supervised Citra Landsat 5 Classification of 2010 Solok District

C. Results of Supervised Classification Map of the distribution of rice fields and land cover in Solok Regency in 2020, scale 1: 500,000

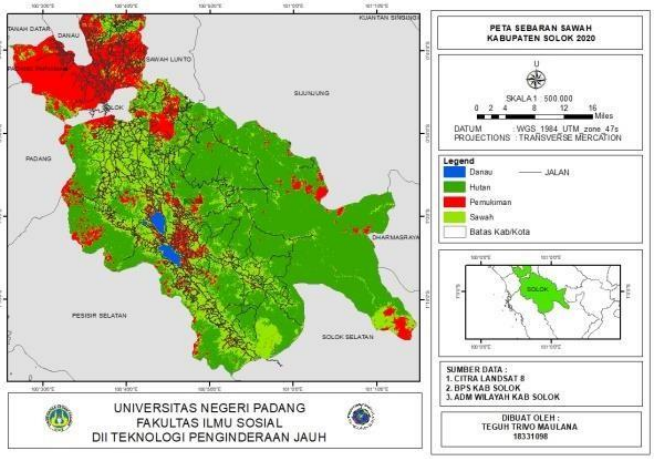

Figure 3. Distribution Map of Supervised Citra Landsat 8 2020 Classification of Solok Regency

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Table 1. Total population, paddy field area and rice production results in 2020 per district

District	Number of Population	Area of Rice	Field Production	Carrying Capacity	Class of Food Supporting Capacity
Pantai Cermin	22 255	11.152	24.243	5	I
Lembah Gumanti	59 449	11.487	5.819	2	II
Hiliran Gumanti	18 185	8.052	17.003	4	I
Payung Sekaki	9 021	3.049	20.532	3	I
Tigo Lurah	10 472	8.747	17.728	8	I
Lembang Jaya	29 490	3.583	36.391	1,6	II
Danau Kembar	21 563	4.730	2.367	0,2	III
Gunung Talang	52 947	12.425	60.538	5	I
Bukit Sundi	26 182	5.158	54.115	5	I
IX Koto Sungai Lasi	10 920	4.132	20.115	3	I
Kubung	60 992	7.391	51.869	2,5	I
X Koto Diatas	19 379	3.626	18.654	2	II
X Kt. Singkarak	34 275	1.850	30.902	1	III
Junjung Sirih	12 783	1.548	11.001	1	III
Jumlah	**387 868**	**75 750**	**369 153**	**43**	

Source: Processed landsat 8 imagery and carrying capacity formula food

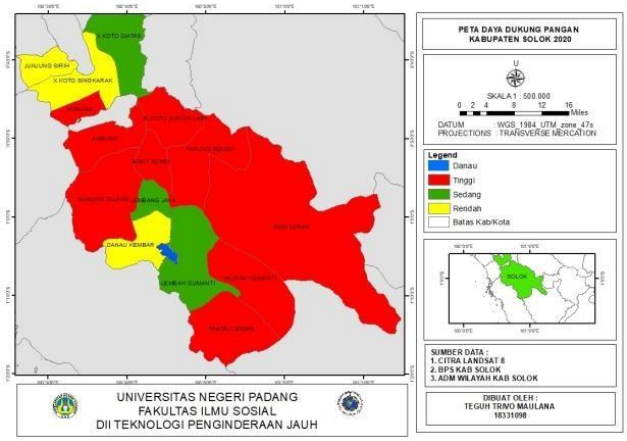

Figure 4. 2020 Solok Regency Food Supporting Capacity Map

In 2020 the food carrying capacity in Solok Regency is 8 sub-districts that are in class I, then 3 other sub-districts in class II and 3 other sub-districts in class III. For more clarity, it is in the table.

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Table 2. Food Carrying Capacity 2020

Class	**Carrying Capacity**	Total District	District
I	σ > 2,46	8	Pantai Cermin,Hiliran Gumanti,Payung Sekaki,Tigo Lurah,Gunung Talang,Bukit Sundi,IX Koto Sungai Lasi, Kubung
II	1 ≤ σ ≤ 2,46	3	Lembah Gumanti, Lembang Jaya,Lembang Jaya
III	σ < 1	3	Danau Kembar, X Kt. Singkarak,Junjung Sirih

b. Prediction of Paddy Field Area with Food Carrying Capacity in 2030 Using the Cellular Automata Method
Before predicting the carrying capacity of existing food, some supporting data is needed, including the prediction of the number of residents in the Agam district in 2030. The rate of population growth is one of the most frequently used indicators to describe a population condition in an area. Table of Predictions of Population, Paddy Field Area and Rice Production in 2030 per District.

District	**Number of Population**	**Area of Rice**	**Field Production**	**Carrying Capacity**	**Class of Food Supporting Capacity**
Pantai Cermin	23.456	1.594	3.465	2,1	I
Lembah Gumanti	63.789	3.009	1.524	4,5	I
Hiliran Gumanti	22.345	1.325	2.797	1,5	II
Payung Sekaki	10.679	1.346	8.992	1,8	II
Tigo Lurah	11.998	1.417	2.871	2	II
Lembang Jaya	31.128	1.588	16.128	2,1	I
Danau Kembar	24.768	833	1.416	0,4	III
Gunung Talang	55.890	1.829	8.911	1,7	II
Bukit Sundi	28.145	1.348	14.142	1,4	II
IX Koto Sungai Lasi	12.918	1.243	6.051	1	III
Kubung	64.567	2.158	17.670	2,6	I
X Koto Diatas	20.967	1.310	6.739	1,4	II
X Kt. Singkarak	36.876	3.281	54.805	5	I
Junjung Sirih	13.879	1.563	11.100	1,8	II
Jumlah	421.405	23.844	156.611	29,7	

Source: Landsat 8 image processing results using the CA (Cellular Automata) Method , Food carrying capacity formula and population growth rate formula

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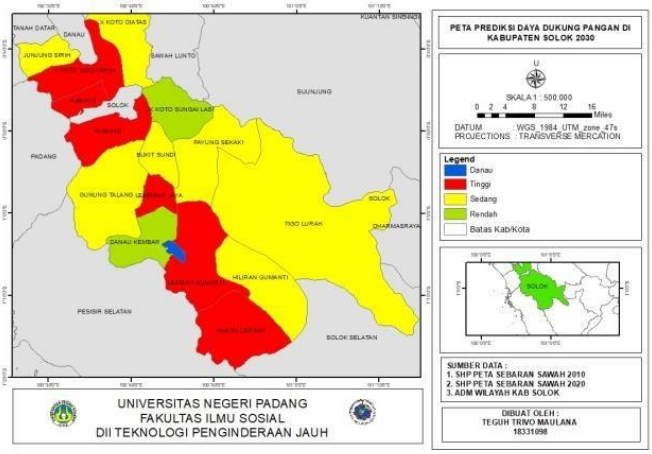

Figure 6 . Predicted Map of Food Carrying Capacity in 2030 in Solo district

In 2030 the food carrying capacity in Solok Regency is 5 sub-districts that are in class I, then 7 other sub-districts are in class II and 2 other sub-districts are in class III. For more clarity, it can be found in the table.

Table 4. Food Carrying Capacity 2030

Class	**Carrying Capacity**	Total District	District
I	σ > 2,46	5	Pantai Cermin,Lembah Gumanti, Lembang Jaya,Kubung, X Kt. Singkarak
II	1 ≤ σ ≤ 2,46	7	Hiliran Gumanti, Payung Sekaki,Tigo Lurah,Gunung Talang,Bukit Sundi,IX Koto Diatas
III	σ < 1	2	IX Koto Sungai Lasi, DanauKembar

Based on the research results obtained, produce a map of changes in the paddy field area, a map of food carrying capacity with 10-year time intervals from 2000, 2010 and 2020, then Predictions of Paddy Distribution Map along with In 2020 8 sub-districts are capable of self-sufficiency in food in the Solok district, namely PantaiCermin, Hiliran Gumanti, Payung Sekaki, Tigo Lurah, Gunung Talang, Bukit Sundi, IX Koto Sungai Lasi, Kubung is still a sub-district that is included in class I where Class I is a region that is capable of self-sufficiency in food and can provide a decent life for its inhabitants. Then in Class II there are 3 sub-districts including Lembah Gumanti, Lembang Jaya, and Lembang Jaya, namely Then in Class III there are 3 sub-districts including Danau. Kembar, X Kt. Singkarak, Junjung Sirih.

5. RESULT

The results of this study resulted in conclusions based on the formulation of the problems that have been described previously. The conclusions that can be drawn are changes in the area of paddy fields in Solok Regency using Landsat imagery from 2000, 2010 and 2020 there was a change in the area of paddy fields where in 2000 the area of paddy fields was 90,344, in 2010 the area of paddy fields was 80,452 Ha, and in 2020 the area paddy fields continued to decrease to 75,750Ha.

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