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Landuse Changes in Pancor Village, Selong District, East Lombok Regency 2019-2023

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Abstract

Land use changes have positive and negative sides. Land use changes are influenced by population growth, thereby increasing the area of settlement area and other buildings as supporting facilities around settlements. Agricultural land is productive land that is used for staple food production and is subject to land conversion. The reduction in agricultural land results in reduced agricultural production which can threaten food security. In addition, land conversion is increasing, having a negative impact on the surrounding environment. The aim of this research was to determine land use changes in Pancor Village in the last 5 years. This research was carried out in Pancor Village by collecting field data obtained through the East Lombok ATR/BPN service and carrying out spatial analysis using ArcGIS 10.8. The results of the research show that in the last five years there has been a decrease in the area of rice fields by 33.8 hectares, fields/moors by 2.275 hectares, plantations by 0.035 hectares, while settlements and built-up land have increased by 36.11 hectares.

Keywords: landuse, agriculture, settlement

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1. Introduction

Land use change is a serious problem and needs special attention from the government. On the one hand, this is a positive thing, namely increasing regional development, on the other hand, this can have a negative impact on the environment. The main factors causing land change include an increase in population, social activities and the social economy of the community (Juniyanti et al., 2020). One of the most frequent changes in land use is land conversion for residential development (Ayun et al., 2020). Changes in land use are also caused by the increasing need for land for the construction of public and commercial facilities such as schools, shops, markets, offices and industrial facilities (Iemaaniah, Shakila, et al., 2023).

Currently, the most frequent land use change is the conversion of agricultural to non-agricultural land use (Prabowo et al., 2020). Agricultural land dominates land use in

Indonesia (Rosidah et al., 2019) and East Lombok is no exception. As time goes by, agricultural land dominates, the population increases and requires more food to meet people's basic needs. The amount of food supply in an area determines the food security of that area. On the other hand, the reduction in agricultural land can result in the loss of farmers' livelihoods and an increase in unemployment rates in the community so that farmers' income decreases in agricultural areas such as in peri-urban areas (Janah et al., 2017). This condition can trigger symptoms of environmental problems such as land degradation, loss of biodiversity, and other environmental damage (Li et al., 2024) and in particular conditions of rapid land use change that can affect the quality of agricultural land in the area (Huang & Tan, 2023). Apart from that, social problems also arise because people who work in the agricultural sector generally only have skills as farmers. So it is not easy for them to change professions outside their expertise as farmers.

Land use changes occur in all regions in Indonesia, including in the province of West Nusa Tenggara (NTB), especially the Pancor sub-district, Selong District, East Lombok Regency. East Lombok Regency is one of the districts in NTB province with the highest population among the 10 districts/cities. Based on population projection data according to BPS East Lombok Regency in 2022 figures, the population in East Lombok Regency is 1,343,901 people. There was an increase in population of 1.88 percent from 2021 with a population density of 837 people per km. This increase in population causes an increase in land demand which can trigger land conversion or changes in the use of agricultural land to residential land.

In 2019, the National Defense Agency stated that every year the area of productive agricultural land continues to decrease by five hundred hectares (Taufikhurrahman, 2019). The decline in agricultural land area has been diverted to infrastructure development. The depreciation rate is predicted to continue to increase in line with the widespread conversion of land to open new buildings such as infrastructure development, housing, shops, etc. The increasing development activity that occurs in various fields is what causes the demand for land conversion to continue to increase (Lee et al., 2020). Meanwhile, availability is increasingly limited. This phenomenon of changing the function of agricultural land to non-agricultural land can pose a serious threat to national food security.

2. Method

Pancor sub-district or village is administratively located in Selong District, East Lombok Regency, West Nusa Tenggara with an area of 4.72 km. The Pancor area borders Sekarteja Village to the north, to the south it borders Rakam Village and Majidi Village, to the east it borders Selong District and Sandubaya Village and to the west it borders Dasan Lekong Village. Pancor Village is one of the sub-districts in the city center of East Lombok Regency. Most of the land use in Pancor Village is built-up land such as offices, public facilities and residential areas (Ahsani et al., 2023).

The collection of research data was obtained through indirect sources or literature studies by conducting searches through journals or books related to research titles and official websites of agencies related to information about the general description of the Pancor sub-district area such as village administration, area and population density of Pancor sub-district in 2019-2023. Apart from that, spatial data was also obtained from BPN East Lombok Regency. The data that has been obtained is subjected to spatial analysis using Geographic Information System (GIS) using ArcGIS/ArcMap 10.8 software. as a tool for spatial analysis (Darem et al., 2023). The data collection carried

out is aimed at obtaining:

1. Data regarding the status of land use in Pancor Village over a period of 5 years (2019-2023)
2. Data on the extent of land use changes over a period of 5 years (2019-2023) in Pancor Village
3. Obtain a map of land use changes over a period of 5 years (2019-2023) in Pancor Village using the GIS system.

Data analysis for this research is raster data obtained through satellite imagery. From the satellite image data obtained, spatial analysis was then carried out using analysis tools to convert satellite image raster data into vector data through management tools in ArcGIS (Arrighi et al., 2023). Converting satellite image data into a polygon-shaped land use map. The steps for analyzing imagery for land use are as follows:

1. Satellite imagery is input via ArcGIS and composite band correction is carried out to obtain image data that matches the original appearance in the field. Composite bands are applied to clarify images whose function is to analyze land cover and land use, so RGB 4,3,2 band composites are carried out. This composite band with RGB 432 will show image results that match the original appearance of the land use.
2. Next, corrections are made to the image system coordinates so that they match the vector data from Pancor Village administrative data which will be analyzed by selecting the management tool button, select raster and change the transformation by selecting project raster and we select it according to the Pancor Village area, namely UTM 1984 50S.
3. The next step is to enter the shp data for Pancor Village and geoprocessing is carried out by selecting the clip so that the satellite image is cropped according to the administrative boundaries of Pancor Village.
4. Next, the satellite image that has formed the administration of Pancor Village is sharpened using raster processing-create pan sharpened raster dataset.
5. The next step to obtain land use classification can be done by right clicking on the ArcGIS screen and selecting Image Classification (Darem et al., 2023), then selecting Iso Cluster Unsupervised Classification and the number of classification is filled in with the number 4 according to the number of classes to be classified and the land use image results are then created. land use maps for 2019 and 2023.
6. For accuracy of land use classification data via satellite imagery, use the Arctoolbox, then select the Segmentation and classification menu and click create accuracy assessment points and select land use classification data on the working Arcmap layer. After that, the accuracy points are obtained and the image results are reviewed and compared with the classification results. After the activity of matching the accuracy test with the classification results, an accuracy matrix appears from the accuracy test steps.

Accuracy testing of satellite imagery can also be done manually, namely by comparing the map maker's interpretation with the person using the image compared with the results in the field. Image interpretation accuracy tests can be carried out with kappa accuracy. From the image data that has been formed according to the administrative boundaries of the Pancor sub-district, then analysis of the image results is carried out. The initial step was carried out by inputting land use data for 2019 in Pancor Village, then a map layout was carried out as a base map which became a reference for land use changes

that occurred in 2023. The data analysis process was carried out through the Geographic Information System (GIS) using the ArcGIS application to process spatial data (Ansar et al., 2020). Stages of data analysis on land use changes that occurred in Pancor Village, Selong District, East Lombok Regency. Over a period of 5 years, this was done by comparing land use in 2019 and land use in 2023. Based on the analysis of this data, the type of land use and area of land use in each year 2019 and 2023 were obtained. The steps in analyzing using ArcGIS are as follows :

1. Download shp data and satellite imagery for East Lombok Regency in 2019-2023 data.
2. Use and apply ArcGis to map the land use of the location you want to map in 2019-2023.
3. Carry out land use layouts in Pancor Village in 2019 and 2023.
4. Identify changes in land use by observing satellite imagery via ArcGis/ArcMap 10.8 by overlaying it to determine the extent of land use changes in Pancor Village, Selong District, East Lombok Regency in 2019-2023.

From the steps mentioned above, the land use maps for 2019 and 2023 have been analyzed and the research results can be described.

3. Result and Discussion

Land conversion is a very normal thing nowadays. This activity is influenced by increasingly high population growth, this influences human needs for housing and the construction of supporting facilities to make life easier for people in the new settlements that are being formed. Settlements are increasingly developing and are supported by the development of facilities such as health facilities, educational facilities, entertainment venues, trade complexes and industry. In fact, based on regional development theory, the development of settlements and the spread of land conversion are influenced by the development of economic centers (Ariana et al., 2023).

In East Lombok Regency in general, land conversion has experienced rapid changes. Pancor Village in Selong District is one of the administrative areas that has experienced many land conversions. The location of Pancor Village is at the center of activity in Selong District, especially as the economic center of the community, not only the Selong District community, but this area is also a transit route from Mataram City to the port to Sumbawa and Bima Islands. Therefore, this research discusses changes in land use in Pancor Village, Selong District, East Lombok.

Based on the data that has been collected, data analysis is then carried out using the ArcGis 10.8 application. Apart from obtaining land use data and the area of rice field use, the distribution of land use areas is obtained. Spatial data obtained through taking satellite imagery and analyzing it using ArcGIS. This data can then be presented in the form of a land use map. Interpretation of the map can make it easier to understand and find out more clearly the spatial data. The interpretation of this map can be seen in Figures 1 and 2 as a reference base map for land use in 2019-2023.

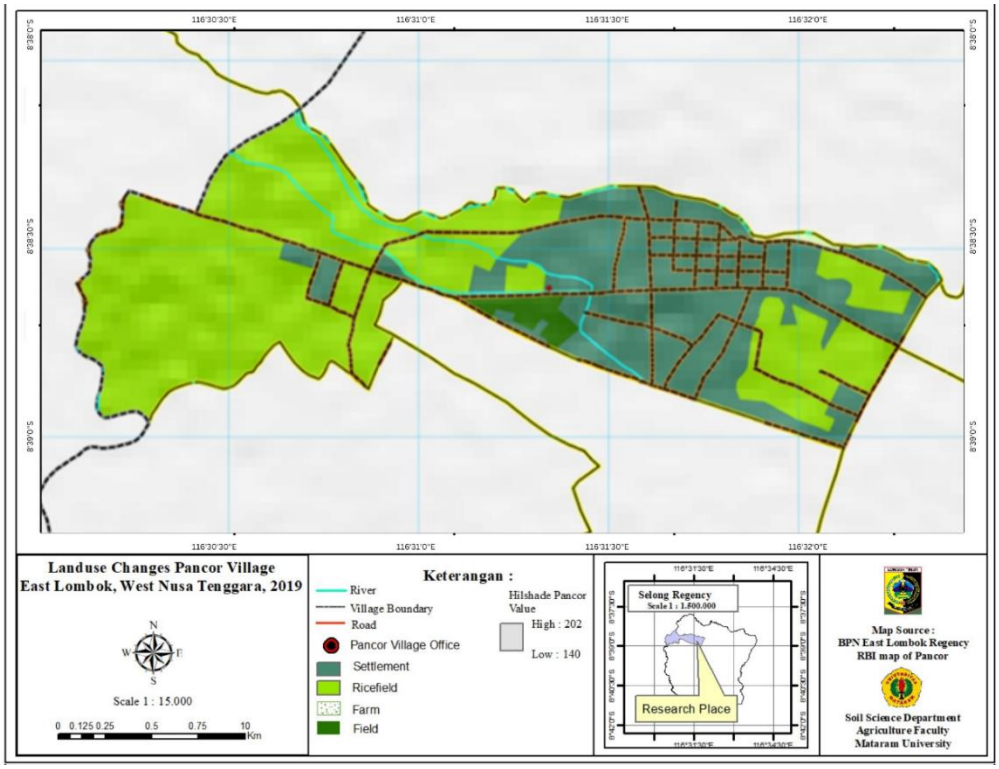

Figure 1. Landuse 2019

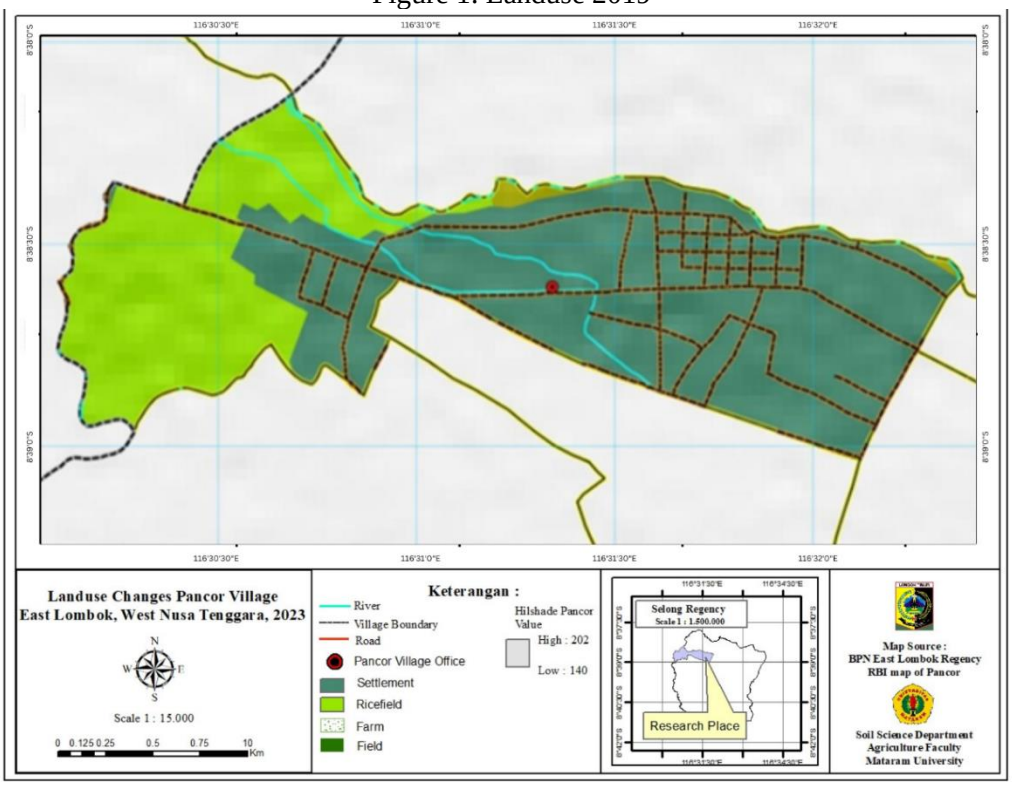

Figure 2. Landuse 2023

Based on the map above, you can see the types of land use which are marked with different colors for each type of land use. From this map, the location and distribution of land use areas can also be seen through information (legend). This map is a basic map and reference for analyzing and knowing land use changes that occurred in Pancor

Village, Selong District, East Lombok Regency over a period of 5 years. After analyzing the spatial data processed through the ArcGis 10.8 application, the area of each type of land use and the percentage of land use can also be determined. The area of land use is presented in Table 1. Interpretation of the value of the area of land use types through tables was carried out to make it easier to understand and calculate how much land use change occurred over a period of 5 years in Pancor Village, Selong District, East Lombok Regency.

Based on the data in the table and image above, you can see changes in the area of each land use in Pancor Village, Selong District, East Lombok Regency. Table 1 shows that the most extensive land use is still the use of similar plantation land with an area of 1948.194058 ha or 39.30% of the entire area of Pancor Subdistrict, although the area has decreased from 2023. The second position is irrigated rice fields with 2x rice and secondary crops/year with an area of 1537.638962 ha or 31.02% of the entire area of Pancor Subdistrict, the area of which also decreased from 2019. Next in third position is land use for dense villages with an area of 576.286007 ha or 11.62% of the entire area of Pancor Subdistrict which increases with increasing population. For more details on land use changes that occurred in each land use over a period of 5 years (2019-2023) can be seen in tables 1 below:

Table 1. Landuse Changes in Pancor Village 2019-2023

No	Landuse	Large of Landuse (Hectar)		Large of Landuse Changes	Inf
		2019	2023		
1	Settlement	59,37	95,48	36,11	Increase
2	Field	3,02	0,745	2,275	Decrease
3	Ricefield	83,13	49,33	33,8	Decrease
4	Farm	0,78	0,745	0,035	Decrease

Source: Data Analysis, 2023

To determine the level of accuracy of image interpretation, it is necessary to test the accuracy of satellite images (Iemaaniah, Dewi, et al., 2023). Test the accuracy of satellite imagery using accuracy kappa. The results of satellite image interpretation for land use in 2019 and 2023 were carried out by a kappa accuracy test with the following results:

Table 2. Classification of Landuse 2019

class/samples	Settlement	Field	Ricefield	Farm	**sum**
Settlement	17	0	0	0	17
Field	0	10	0	0	10
Ricefield	1	0	13	0	14
Farm	0	0	1	6	7
sum	18	10	14	6	48

With the interpretation error matrix above, systematic calculations are then carried out with user's accuracy, producer's accuracy, overall accuracy, and kappa accuracy as follows:

Table 3. Producer’s Accuracy year 2019

Settlement	17/18	94%
Field	10/10	100%
Ricefield	13/14	93%
Farm	6/6	100%

Table 4. User's Accuracy year 2023

Settlement	17/17	100%
Field	10/10	100%
Ricefield	13/14	93%
Farm	6/7	86%

Overall accuracy = (17+10+13+6)/48 = 46/48 = 95%

Sample Cross Multiplication = (18x17)+(10x10)+(14x14) + (6x7) =
= 306+100+196+42
= 644

$$Kappa\ Accuracy = \frac{(46x48) - 644}{(48)^2 - 644} x100\%$$
$$= \frac{(2.208) - 644}{2.304 - 644} x100\%$$
$$= \frac{1.564}{1.660} x100\%$$
$$= 92{,}4\%$$

Table 5. Classification of Landuse 2023

Class/samples	Settlement	Field	Ricefield	Farm	**sum**
Settlement	9	0	0	0	9
Field	0	11	0	0	11
Ricefield	1	0	15	0	16
Farm	0	0	0	8	8
sum	10	11	15	8	44

With the interpretation error matrix above, systematic calculations are then carried out with user's accuracy, producer's accuracy, overall accuracy, and kappa accuracy as follows:

Table 6. Producer's Accuracy

Settlement	9/10	90%
Field	11/11	100%
Ricefield	15/15	100%
Farm	8/8	100%

Table 7. User's Accuracy

Settlement	9/9	100%
Field	11/11	100%
Ricefield	15/16	93%
Farm	8/8	100%

Overall accuracy = (9+11+15+8)/44 = 43/44 = 97%

Sample Cross Multiplication = (10x9)+(11x11)+(15x16) + (8x8) =

= 90+121+240+64

= 515

$$Kappa\ Accuracy = \frac{(43x44) - 515}{(44)^2 - 515} x100\%$$

$$= \frac{(1.892) - 515}{1.936 - 515} x100\%$$

$$= \frac{1.377}{1.421} x100\%$$

$$= 92{,}6\%$$

Based on the accuracy tests that have been carried out, it can be seen that all interpretation results for 2019 and 2023 obtained results of 92.4% and 92.6%, land use analysis using satellite imagery obtained valid results and can be used to create land use maps.

The data from this table is the result of the difference from land use from 2019 to 2023 or in the last 5 years. The table above details the use of residential land, rice fields, fields and plantations. The settlement data itself does not only contain houses where people live, but settlements from the results of this analysis show residential buildings and other settlement supporting facilities such as office buildings, places of worship, educational facilities, health facilities, trade centers and also industrial buildings.

Based on the table above, it shows that there are changes in land use as indicated by changes in the area of each land use. From this data it is known that land use in Pancor Village is still dominated by residential areas, plantations, rice fields and fields. In 2023, the biggest change in land use will be the type of rice field use which will decrease from 83.13 hectares in 2019 to 49.33 hectares. Many changes in rice fields have resulted in land clearing/conversion from rice fields to residential areas. Most of the changes that occur are generally changes from undeveloped land to built-up land which is categorized as residential. Residential land has increased from 2019 of 59.37 hectares and 2023 of 95.48 hectares. Meanwhile, apart from residential land use, in the last five years all land use has decreased in area, and the decrease in land area has been dominated by changes in the use of rice fields. Plantation land and fields experienced a decrease in land area of 2,275 hectares and 0.035 hectares respectively. This is because development will always lead to land that has not yet been developed, such as ricefields, farms and fields.

Changes in land use on agricultural lands can threaten human survival. This is because the population continues to increase while the amount of productive agricultural land is decreasing. Judging from the developments taking place in Pancor Subdistrict, this is due to the increasing number of residents and the increasing number of new buildings used as residential support facilities. Compared with the spatial pattern plan that has been designed by the East Lombok Regency Government, this has greatly exceeded the limits of the very rapid increase in settlements.

Based on the land use pattern that occurred over a period of 5 years (2019-2023) in Pancor Village, Selong District, Lombok Regency, it does not match the pattern of the Regional Spatial Planning (RTRW) for the Pancor Village area published by the Ministry of Spatial Planning/Regency National Land Agency East Lombok (ATR/BPN). The increase in residential areas is a problem that is the cause of land conversion which has implications for increasing the need for space to accommodate and manifests in the form of land use that is not in accordance with the Regional Spatial Planning (RTRW). Based

on data from the RTRW pattern of Pancor subdistrict, the area of land use for residential areas is 59.37 hectares, while the land use for settlements that will occur in 2023 will reach 95.48 hectares (East Lombok Regency Government, 2012). The large number of land use changes in this settlement requires follow-up action to stop development. In the future, if changes in land use continue to occur for settlements, it could affect the carrying capacity and capacity of the environment in Pancor Village. Based on the spatial pattern plan, this shows that land use is not in accordance with the RTRW pattern of Pancor Village, Selong District, East Lombok Regency.

In general, changes in agricultural land use that have occurred in Pancor Village over the last 5 years have been influenced by 2 (two) factors as follows: 1). The significant increase in population, the phenomenon of changes in agricultural land use in Pancor Village cannot be separated from human activity, as the population increases, the need for land for residence will also increase. The change in land use caused by the increase in population is in line with the opinion of Sidharta et al., (2021) which states that the need for land for settlement is influenced by population growth that occurs in an area so that it requires a place to live. 2) Apart from that, the availability of public facilities is a further supporting factor that influences the conversion of agricultural land into residential areas in Pancor Village. The closer to public facilities, the higher the selling value of the land around it. The existence of complete public facilities can support the daily activities of residents, on the other hand, over a long period of time it can cause new problems on the surrounding land, such as land degradation, shrinking of agricultural land and environmental pollution (Siagian et al., 2015).

4. Conclusion

Based on research conducted in Pancor Village, Selong, East Lombok, within 5 years there has been changing in land use. It was identified that the change was from undeveloped land to developed land. This is based on the expansion of built-up land use such as settlements, construction of supporting facilities, on the other hand, there has been a decrease in the area of plantation land, rice fields and fields. The extensive changes in land use that occurred were as follows:

1. Settlements experienced an increase of 36.11 hectares
2. Non-residential land such as rice fields, farms and plantations experienced a decrease in land area, including rice fields decreased by 33.8 hectares, fields experienced a decrease of 2.275 hectares and plantations experienced a decrease of 0.035 hectares.

Changes in land use that occur due to the construction of offices, residential areas and other facilities supporting the area.

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