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Study Of Land Use Changes With Spatial Approach Sukoharjo District, Pringsewu Regency

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Abstract – Changes in land use in each region have different cases, one of which occurred in Sukoharjo District. Sukoharjo District is one of the areas that has quite extensive agricultural land. Based on data from the Central Statistics Agency in 2018, the area of Sukoharjo District is 72.95 km^2 with an area of 1,068 ha of paddy fields. However, in line with the increasing standard of living and opening up opportunities to create job opportunities and build public facilities, the need for land will increase. This research was conducted in Sukoharjo District, Pringsewu Regency. This research was conducted in the Sukoharjo District at Pringsewu Regency. The research conducted in order to (1) the changes in the use of paddy fields to settlements in 2014-2019,(2) the causative factors of changes in the use of paddy fields to the settlements, and (3) the changes pattern of the paddy fields. This research use survey research method that conducted in the Pringsewu Regency. The data collection technique was in the formed of observation, documentation, and interview. The data analysis that was conducted in this research was spatial approach analysis techniques. The results of this research show that: (1) in 2014-2019 in the Sukoharjo District, there was a change in the use of paddy fields became settlements in the range of 11,48 ha. (2) The causative factors of changes in the use of paddy fields to the settlements consist of physical factors and non physical factors. (3) The settlement pattern elongated that follow the road.

Keywords – Settlements, Changes Of Land Use, Paddy Fields.

I. INTRODUCTION

Land use change is a process of changing from the previous land use to another land use that is permanent or temporary [1, 2, 3, 4]. Changes in land use occur due to the increasing needs of the population [5, 6]. It is undeniable that basically changes in land use itself cannot be avoided in the implementation of development [7, 8, 9]. The rapid development carried out has resulted in limitations and increased land requirements supported by an increasing population, social activities, and economic activities [10, 11, 12. 13].

Changes in land use can be triggered by various interrelated factors, so that any form of land use change will have the potential to affect other land uses in the vicinity disekitarnya [14, 15, 16]. Therefore, it is necessary to study the changes in land use and its designation to determine the extent of the level of development (physical) which will be very useful for future development plans. If the implementation of development ignores the environment and the balance of nature, then without realizing it, environmental degradation will occur which in the end will also harm humans themselves [17. 18, 19]. Development carried out in order to remain environmentally sound must be regulated and planned properly in accordance with the conditions and potentials of the region, for that we need a development plan in the form of government policy to regulate all forms of development carried out [20, 21, 22].

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The rapid population growth, as well as the growing intensity of development in various fields will of course lead to an increase in demand for food [23, 24]. This is done to meet the needs of people's lives. In terms of land use, areas that experience changes in land use are from agricultural land to non-agricultural land [25, 26, 27]. If this condition occurs continuously without paying attention to the balance between the use of paddy fields for agriculture and non-agriculture, the paddy fields will decrease, so that it will reduce agricultural production, especially rice. Therefore, if this agricultural land is converted to function continuously, it will cause problems [28, 29].

Sukoharjo District is one of the areas that has a fairly large agricultural land. Based on data from the Central Statistics Agency in 2018, the area of Sukoharjo District is 72.95 km2 with an area of 1,068 ha of paddy fields. However, in line with the increasing standard of living and the opening of opportunities to create job opportunities and build public facilities, the need for land is increasing [30, 31, 32].

The increase in land demand is driven by an increase in population, while the availability of land area is fixed [33, 34]. This has resulted in a large number of agricultural land being converted to meet these needs. In addition, changes in land use may also be due to the lack of government's role in managing the agricultural sector [35]. So it is proven that there are still many paddy fields that have been turned into other sectors, one of which is settlements [36, 37].

The total of residents in Sukoharjo District every year always increases this is due to the driving factors consisting of births (natality), death (mortality), and population movement (migration) [38, 39]. The total population in Sukoharjo District in 2014 was 46,651 people divided into 16 villages. Compared to 2020, which amounted to 49,703 people, so there was a population increase of 3,052 people in a span of 7 years. This description causes changes in land use because population growth means that it requires additional places to live and supporting facilities. The population that continues to increase from 2014-2020 can be seen in Table 1.

Table 1. Population of Sukoharjo District Kecamatan Pringsewu Regency 2014-2020.

No.	Year	Total Population
1.	2014	47.217
2.	2015	47.771
3.	2016	48.302
4.	2017	48.814
5.	2018	49.315
6.	2019	49.518
7.	2020	49.704
Growth rate		**1%**

Source: Central Bureau of Statistics of Pringsewu Regency, year 2021.

Based on Table 1, the population in Sukoharjo District continues to increase every year with a population growth rate of 1% per year. With the increase in population each year, the activities of the population also increase, which requires land for settlements while the available land is limited. In addition to population growth, land use changes occur due to government policies [40, 41]. This is thought to have caused a lot of changes in the use of paddy fields into settlements. Therefore, residential development occurred in almost all areas which resulted in changes in the use of paddy fields from year to year [42, 43].

Paddy fields in Sukoharjo District in 2014 were recorded at 1,182 ha but in 2018 the area of paddy fields in Sukoharjo District was recorded at 1,1068 ha. This condition proves that there is a shift in the function of paddy fields in Sukoharjo District. It is suspected that paddy fields are used by the community to build houses [44, 45]. With the continued reduction of agricultural land in Sukoharjo District caused by changes in agricultural land use to non-agricultural, it is feared that the needs of the community in the area will not be met [46, 47]. Sukoharjo District, and in the next few years we will lose a very valuable ancestral heritage,

namely agricultural land. Another impact caused by the reduction in the area of agricultural land is a decrease in income in the agricultural sector [48, 49]. The decrease in paddy fields and employment opportunities in agriculture causes a shift or shift in the livelihoods of the population from agriculture to non-agriculture [50, 51].

Changes in land use in each region have different cases, one of which occurred in Sukoharjo District. Sukoharjo District is one of the areas that has a fairly large agricultural land. Based on data from the Central Statistics Agency in 2018, the area of Sukoharjo District is 72.95 km2 with an area of paddy fields which is 1,068 ha. However, in line with the increasing standard of living and the opening of opportunities to create job opportunities and build public facilities, the need for land is increasing.

It is very important to conduct a study on land use change so that it becomes a reference for the government for development activities in an area [52, 53, 54]. Land conservation from one function to another must be carefully considered. The factors driving land change that are interrelated with each other also need to be analyzed in depth to describe how land use occurs in an area [55, 56].

Based on the description of the background of the problem above regarding changes in land use that occurred in Sukoharjo District, the purpose of this study was to see the area, pattern, and factors that caused changes in the use of paddy fields.

II. Research Method

The method used in this study is a survey research method. According to [57, 58] the survey method is research conducted using questionnaires as a research tool carried out on large and small populations, but the data studied are data from samples taken from the population, so that relative incidence is found, distribution, and the relationship between variables, sociological and psychological. The purpose of survey research is to provide a detailed description of the background, characteristics, and characteristics of typical cases or events of a general nature.

The population in this research is the area of Sukoharjo District. This study did not use a sample because the researcher wanted to examine all elements in the area, so this research is a population study or population study. The population is the whole object of research. If someone wants to examine all the elements that exist in the research area, then the research is a population study or population study or census study. The variables in this study consisted of: changes in the use of paddy fields, the factors causing changes in the use of paddy fields, and the pattern of direction of changes in paddy fields that became settlements.

Data was collected using observation and documentation studies. The observation technique was carried out to check the truth of the data that had been obtained from the field to find out the location and obtain data on the area of paddy fields that were turned into settlements in Sukoharjo District. This observation technique is carried out in several ways, namely: recording, measuring with GPS, and taking photos. While the documentation study is used to complete secondary data such as administrative location, area, population, and total area of paddy fields that have been converted into settlements. The data sources were obtained from the Sukoharjo District office and the Regional Development Planning Agency (BAPPEDA). For example, monograph data from Sukoharjo District and other data that is document or written to support this research.

The spatial approach analysis technique was used to determine changes in the use of paddy fields into settlements in Sukoharjo District, Pringsewu Regency in 2014-2019. This technique uses Arcgis software to manage data obtained from observations and interviews. The data obtained is in the form of a map of paddy fields in Sukoharjo District in 2014 and 2019. Then a map of paddy fields in 2014 and a map of paddy fields in 2019 will be overlaid which will produce a map of changes in paddy fields into settlements in Sukoharjo District, Pringsewu Regency in 2014-2019. .

Data analysis techniques to determine the factors causing land use change using descriptive data analysis using a spatial approach [59, 60]. The unit of analysis is a certain unit that is calculated as the subject of research. In this study, researchers used a District analysis unit, where researchers analyzed land use changes based on all Sukoharjo Districts.

The data analysis technique to find out the pattern of changing paddy fields into settlements uses the results of the overlay in the form of land units used to analyze using several forms of settlement patterns [61, 62]. It will be known that the settlement pattern in the District is included in one of the settlement pattern groups according to the shape seen in the overlay.

III. Result And Discuccion

Sukoharjo District is one of the Districts in Pringsewu Regency. Astronomically, Sukoharjo District is located between 5º16'S and 5º20'05"S and between 104º55'-105º2'15"E with an area of 7,925 ha. Based on its geographical position, Sukoharjo District has regional boundaries with other regions, which are as follows:

a) North side: Adiluwih District

b) South side: Pringsewu and Pagelaran Districts

c) West: Banyumas District

d) East: Gading Rejo District

Administratively, Sukoharjo District consists of 16 village areas, namely, Sinarbaru Village, Sukoharjo I Village, Sukoharjo Village II, Sukoharjo III Village, Sukoharjo IV Village, Panggungrejo Village, Pandansari Village, Pandansurat Village, Keputran Village, Sukoyoso Village, Siliwangi Village, Waringginsari Village West, South Pandasari village, East Sinarbaru village, North Panggungrejo village, West Sukoharjo III village.

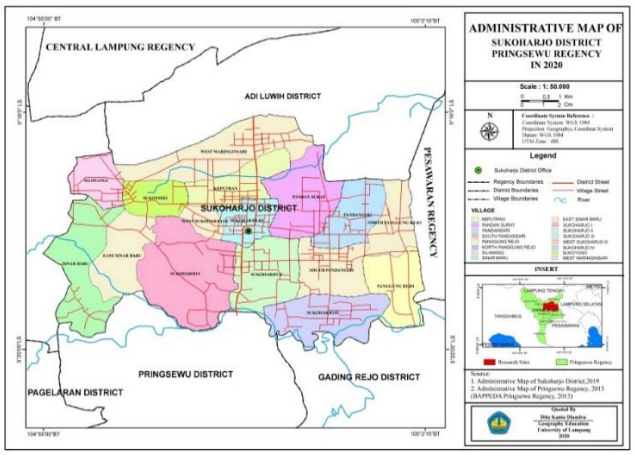


Figure 1. Administrative Map of Sukoharjo District, Pringsewu Regency in 2020

Sukoharjo District there are 5 types of land cover, namely settlements, paddy fields, plantations, dry fields and fields. Land cover in an area is strongly influenced by physical factors such as slope, altitude, rainfall and soil type. The following is the area of land cover in Sukoharjo District in 2014 and 2019, which can be seen in Table 2.

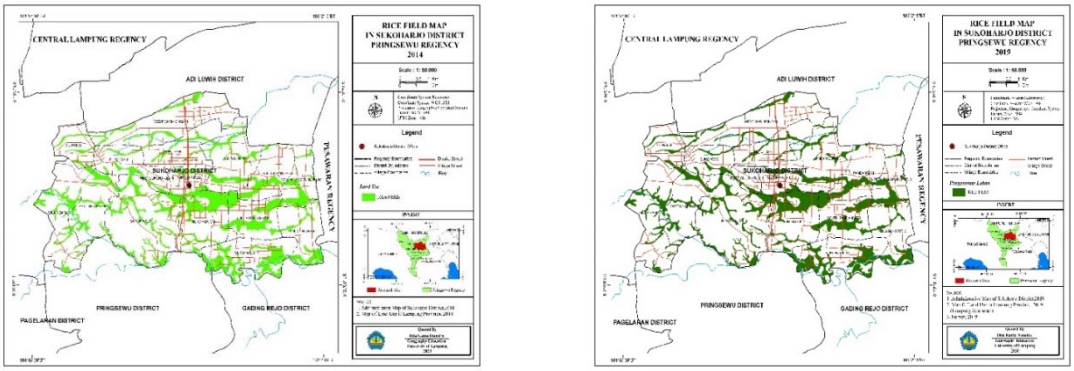
Table 2. Land Use in Sukoharjo District in 2014-2019.

No.	Land Use Type	2014		2019		Change Different 2014-2019 (ha)
		ha	%	ha	%	
1	Plantation, Moor, and Field	5.180,52	71,01	5172,10	70,90	-8,42
2	Settlement and activity place	642,47	8,81	663,11	9,09	20,64
3	paddy fields	1.439,54	19,73	1.427,32	19,56	-12,22
4	River and swamp	32,47	0,45	32,47	0,45	-
Total		7.295	100	7.295	100	-

Source: Data Processing of Land Use Map in Sukoharjo District, year 2014-2019.

Based on Table 2, the most extensive land use in Sukoharjo District in 2014 and 2019 is Plantation, Upland and Field, which covers more than the entire area of this District, namely 5,180.52 ha or 71.01% in 2014 and 5,172.10 ha or 70.90% in 2019.

Meanwhile, the smallest land use area is rivers and swamps which cover 0.45% of the total area of Sukoharjo District. Map of land use in 2014 and 2019 in Sukoharjo District can be seen in Figure 2 (a and b).



a) b)

Figure 2. Paddy Field Map of Sukoharjo District, Pringsewu Regency in 2014 and 2019

The area of paddy fields in Sukoharjo District in 2014 had an area of 1439.54 ha of the total area of Sukoharjo District, which was spread over 16 villages. Meanwhile, in 2019, paddy fields in Sukoharjo District were recorded to have an area of 1,427.32 ha, which means there was a decrease of 12.22 ha in a period of 5 years. In the last 5 years there has been a change in the use of paddy fields into settlements spread over 4 villages, namely Siliwangi Village, Sinarbaru Village, Sukoharjo III Village, and East Sinarbaru. This is because paddy fields in Sukoharjo District continue to decrease every year. The area of paddy fields in Sukoharjo District in 2014-2019 can be presented in Table 3.

Table 3. Area of Paddy Fields in Sukoharjo District in 2014-2019.

No.	Pekon/Village	Paddy Fields Area (ha)		Change of Paddy Fields (ha)
		2014	2019	
1	Pandansari Selatan	136,96	136,96	
2	Sukoyoso	33,25	33,25	
3	Keputran	37,38	37,38	
4	Pandansari	71,91	71,91	
5	Pandan Surat	91,21	91,21	
6	Sukoharjo II	176,08	176,08	
7	Siliwangi	30,22	29,19	1,03
8	Sinar Baru	96,22	95,75	0,47
9	Sukoharjo III	54,97	54,21	0,76
10	Sukoharjo I	181,94	181,94	
11	Sukoharjo IV	197,21	197,21	
12	Waringinsari Barat	75,12	75,12	
13	Panggung Rejo	79,95	79,21	
14	Sinar Baru Timur	87,79	78,57	9,22
15	Sukoharjo III Barat	15,55	15,55	

16	Panggung Rejo Utara	73,78	73,78	
	Total	**1439,54**	**1427,32**	**11,48**

Source: Research Data Processing Results in 2020

During the last 5 years the paddy fields in Sukoharjo District which have undergone changes are spread over 4 villages due to the transfer of land functions. Based on Table 3, the largest area of change in paddy fields is in Pekon Sinarbaru Timur, which is 9.22 ha. The East Sinarbaru village has changed the most because the paddy fields in the area are less productive in producing agricultural products because the paddy fields are rainfed. So that people prefer to use the paddy fields as a place to live because it is in accordance with the needs to live. While the area of the smallest change in paddy fields is in Pekon Siliwangi with an area of 0.47 ha. In Figure 2 (a, b) above, it can be seen that the results of the analysis of land use maps in 2014 and 2019 which have been overlaid with paddy fields have changed into settlements covering an area of 11.48 ha. More details can be seen in table 4.

Table 4. Area of Change in Paddy Land Use.

No.	Pekon/Village	Change of Paddy Fields Area	
		ha	%
1	Pandansari Selatan		
2	Sukoyoso		
3	Keputran		
4	Pandansari		
5	Pandan Surat		
6	Sukoharjo II		
7	Siliwangi	1,03	8,97
8	Sinar Baru	0,47	4,10
9	Sukoharjo III	0,76	6,62
10	Sukoharjo I		
11	Sukoharjo IV		
12	Waringinsari Barat		
13	Panggung Rejo		
14	Sinar Baru Timur	9,22	80,31
15	Sukoharjo III Barat		
16	Panggung Rejo Utara		
Total		11,48	100

Source: Research Data Processing Results in 2020

Based on Table 4, the largest area of change in paddy fields is in Pekon Sinarbaru Timur, which is 9.22 ha or 80.31%. The East Sinarbaru village has changed the most because the paddy fields in the area are less productive in producing agricultural products because the paddy fields are rainfed. So that people prefer to use the paddy fields as a place to live because it is in accordance with the needs to live. While the area of the smallest change in paddy fields is in Pekon Siliwangi with an area of 0.47 ha or 4.10%. Changes in land use into settlements in Sukoharjo District in 2014-2019 can be seen in Table 5.

Table 5. Area of Land Conversion Into Settlements in Sukoharjo District in 2014-2019.

No.	Pekon/Village	Change of Paddy Fields Area **(ha)**
1	Plantation, fields, fields to settlement	8,42
2	Paddy to settlement	11,48
	Total	19,90

Source: Map of Land Change in Sukoharjo District 2014-2019

Based on Table 5, there has been a change in the use of paddy fields to settlements on garden and paddy fields. The paddy fields have changed to become the largest settlement, which is 11.48 ha. While the change of garden land into settlements has an area of 8.42 ha. To see the area of conversion of paddy fields into settlements in Sukoharjo District in 2014-2019 can be seen in Table 6.

Table 6. Area of Conversion of Paddy Fields Into Settlements in Sukoharjo District in 2014-2019.

No.	Pekon/Village	Change of Paddy Fields Area **(ha)**
1	Siliwangi	1,03
2	Sinarbaru	0,47
3	Sukoharjo III	0,76
4	Sinarbaru Timur	9,22
	Total	11,48

Source: Research Data Processing Results in 2020

Based on Table 6, the largest area of change in paddy fields is in Pekon Sinarbaru Timur, which is 9.22 ha. The East Sinarbaru village has changed the most because the paddy fields in the area are less productive in producing agricultural products because the paddy fields are rainfed. So that people prefer to use the paddy fields as a place to live because it is in accordance with the needs to live. Pekon Siliwangi experienced a change in land use covering an area of 1.03 ha. Pekon Sukoharjo III experienced a land use change of 0.76 ha. While the area of the smallest change in paddy fields is in Pekon Siliwangi with an area of 0.47 ha. So the total area of change in the use of paddy fields is 11.48 ha. The distribution of the total area of land change can be seen in Figure 3.

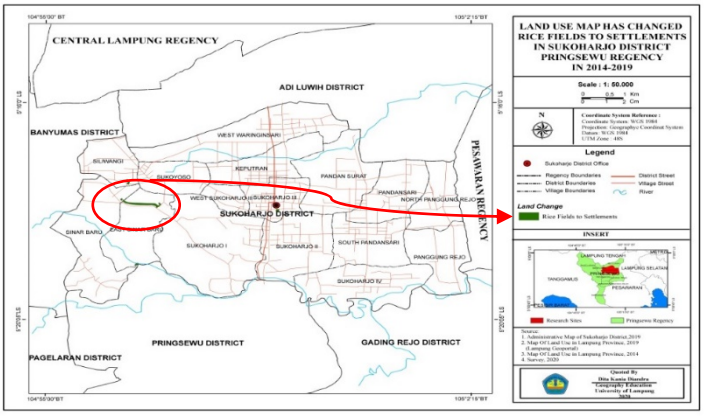


Figure 3. Land Use Map Has Changed Paddy Fields to Settlements of Sukoharjo District, Pringsewu Regency in year 2014-2019

Based on Figure 3 above, it can be seen that the paddy fields in Sukoharjo District in the past 5 years have changed the use of paddy fields into settlements covering an area of 11.48 ha, this is due to the existence of supporting and pulling factors that cause people to build settlements above. the paddy field. Land change is influenced by several factors, namely physical and non-physical factors. Non-physical factors include population, educational facilities, health facilities, government facilities, economic facilities, land prices and government policies [63, 64, 65]. Physical factors include topography, slope, soil type, land accessibility, location to the city, traffic lanes and the presence or absence of activity centers. Changes in land use are caused by human needs and desires [66, 67].

Physical conditions in an area are often expressed by land potential which greatly determines the land capability of an area, which includes topography, water sources, soil type fertility, and slope [68, 69]. These physical factors are also a driving factor for land change. Physical factors causing land use change can be seen in Table 7.

Table 7. Physical Factors Causing Land Use Change.

No.	Causative Factor	Amount (House)
1.	Rainfed paddy fileds	12
2.	Infertile soil type	7
3.	Flat slope	5
	Total	**24**

Source: Research Data Processing Results in 2020

Based on Table 7, there are various physical factors that cause land use change in Sukoharjo District. The majority of paddy fields in Sukoharjo District are rainfed paddy fileds, namely paddy fileds whose irrigation system relies heavily on rainfall. This type of paddy fileds only produces in the rainy season [70]. In the dry season these fields are left untreated because water is hard to come by or not available at all. Rainfed paddy fileds are generally only harvested once a year. The intensity of the use of labor in rainfed paddy fields is higher because farmers have to replant (replant) more often than irrigated fields, due to unstable water supply [71].

The slope factor and soil type are also included in the physical factor of land use change in Sukoharjo District. The state of the slope in Sukoharjo District is in the 0-8% slope class which is included in the flat category. Areas that have areas that tend to be flat generally experience more land change, compared to areas that are not flat (slopes) [72].

The types of soil found in Sukoharjo District based on the soil type map are alluvial, gleisol, cambisol and pedsolic. Kambisol soil type is a type of soil that is not very fertile which is spread in almost all areas of Sukoharjo District from the central part to the southern part. Then in the southern part of Sukoharjo District there are pedsolic, alluvial and gleisol soil types which are fertile enough to be used by the community for farming and farming. While in the northern part of the soil type is dominated by pedsolic soil type haplik. This type of soil is quite fertile and is widely used by the community for gardening and farming.

Changes in the use of paddy fields into settlements in Sukoharjo District cannot be separated from human activities, the increasing number of residents in an area, the need for land used for housing is also increasing [73, 74]. According to data from the Pringsewu Regency Central Statistics Agency, the population in 2019 was 49,315 people, with a total population density of 13,017 people/km^2. Meanwhile, the rate of population growth in Sukoharjo District has increased by 1% every year. The population density that occurs in Sukoharjo District is not evenly distributed throughout each village. This is due to the large number of plantation lands, fields and fields that are used more for agricultural products than for settlements. The highest population density is in Pekon Sukoharjo III with a total of 2,201 people/km^2.

These factors are in accordance with the facts on the ground that as the population increases, the need for housing also increases, while the residential land decreases [75, 76, 77]. So this is a very strong driving factor for residents to choose to establish new settlements on existing paddy fields near the previous settlements.

Table 8. Non-Physical Factors Causing Land Transfer.

No.	Causative Factor	Amount
1.	The Land price	6
2.	Edocationla/school facility	4
3.	Market/economic facility	6
4.	Puskesmas/pusdes/healt facility	5
5.	Goverment facility	5
	Total	**26**

Source: Research Data Processing Results in 2020

Based on Table 8, there are various non-physical factors that cause land use change in Sukoharjo District, land prices are also one of the factors that affect land use changes in an area. Each area has a different land price depending on the location and function of the land itself. The more strategic the location of the land, the higher the price of the land. The price of land in Sukoharjo District has a price range of ± 50,000; up to ± 300,000/m^2. In general, the relatively cheaper price of land usually attracts residents to build a place to live. So many people choose to convert paddy fields into settlements.

The location and public facilities also attract people to build a place to live. Proximity and access to public facilities are also factors that influence residents to choose a place to live. The closer you are to public facilities, the higher the land price [78, 79, 80]. This is one of the factors driving people to make changes. land use in Sukoharjo District.

Strategic area is an area whose spatial planning is prioritized because it has an important influence and is a supporting factor that affects the change of paddy fields into settlements [81, 82]. in Sukoharjo District. This strategic area includes the availability of very complete public facilities such as economic growth, state security, state sovereignty, educational facilities, health facilities, and the environment. The closer to public facilities, the more residents are interested in making new settlements in the area. Because with complete public facilities, it can facilitate and support the daily activities of residents.

The pattern of distribution of settlements in Sukoharjo District is elongated following the road. In this area the settlements are on the right and left of the road. This is supported by research conducted by [83]. about the analysis of changes in the use of paddy fields into settlements in North Pagelaran District, Pringsewu Regency in 2014-2018 which states that residential settlements are built along the highway in an elongated pattern. This condition occurs because the location is close to public facilities such as educational facilities, health facilities, economic facilities and government facilities.

Generally, settlement patterns like this are mostly found in the lowlands with sloping morphology, making it easier to build roads in settlements [84]. But this pattern actually formed naturally to approach transportation advice. The settlement pattern is the pattern of settlement distribution which is strongly influenced by soil conditions, topographical water systems, and the state of natural resources. The pattern of elongated settlements has the characteristics of settlements in the form of elongated rows because they follow roads, rivers, railroads or beaches [85]. The pattern of elongated settlements following the road is a settlement on the right and left of the road. Generally, this type of settlement pattern is found in the lowlands with a gentle morphology, making it easier to build roads in settlements. However, this pattern is actually formed naturally to approach transportation facilities. Residential settlements in Sukoharjo District were built along the road so that they formed an elongated pattern. This condition occurs because the location is close to public facilities such as health facilities, government facilities, economic facilities, educational facilities and the KUA office.

IV. CONCLUSION

Based on the results and analysis of the research that has been done, it can be concluded as follows:

1. The area of change in the use of paddy fields to settlements in Sukoharjo District, Pringsewu Regency during 2014-2019 is 11.48ha.

2. The factors that cause changes in paddy fields into settlements in Sukoharjo District consist of physical factors and non-physical factors. Physical factors consist of topography, slope and soil type. While non-physical factors consist of population growth, land prices and the availability of public facilities such as educational facilities, health facilities, government facilities and economic facilities.
3. The pattern of changing paddy fields to settlements in Sukoharjo District is included in the elongated pattern following the road. The elongated pattern following the road is the pattern of the village arrangement following the paths.

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