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# The Study of Land Use Change from Agricultural to Residential Infrastructure Development in Takalar

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**Abstract.** Agricultural land has a strategic role and function for Indonesian people who are agrarian. It is due to a large number of Indonesians who are depending on the agricultural sector. Thus, land does not only have economic value, but also social value. In the sustainable agricultural development, land is a limited natural resource because the number does not increase but the needs are always increasing. Currently there is a lot of unclear and irregular land management. Land use change is also arising in South Sulawesi, particularly Takalar district. The increasing need for space in urban areas causes high demand for land. The provision of land in the city center is increasingly limited and of course very expensive, so that urban development tends to "take" areas in the suburbs. One of the potential affected areas is the Takalar regency area as part of the MAMMINASATA area development plan (Makassar, Maros, Sungguminasa, Gowa and Takalar) which is currently being promoted. Recently, the changes in land use and function, which originally being served as a food land and turning out become the land for residential infrastructure, are issues that need serious attention against macro food threats. This research will provide an overview of the conversion mapping results of agricultural land that occurred in the Takalar district from 2012 to 2018.

## 1. Introduction

Uncontrolled development of areas will encourage a land use change from agriculture to non-agriculture, the consequences of which are contrary to the efforts maintaining food self-sufficiency and sustainable development [1, 11]. Subsequently, uncontrolled conversion of agricultural land will become a threat to food security at the regional, provincial, or even national. Moreover, an irregular land acquisition for the purpose of building community infrastructure violating the road map territorial space plan will certainly be a serious problem for the urban system that is being built [4].

In line with the increase of population number and the economic development, the land needs for non-agricultural activities tends to develop [2,3]. This trend makes the conversion of agricultural land difficult to avoid. Several cases show that if a land use change occurs, in a short time the surrounding land will also change its function progressively. This is caused by three factors. First, the construction



of a residential or industrial area in a conversion land location, accessibility in that location becomes increasingly conducive to industrial and residential development, which ultimately encourages a huge demand for land by other investors or land speculators so that the price of the surrounding land also increases [5,9]. Secondly, the increase in land prices can further stimulate other farmers in the vicinity to sell land. Third, the stakeholders who are purchasing land are usually not local residents, resulting in the formation of Guntai lands which are generally vulnerable to the process of the land conversion.

The conversion of agricultural land functions is a threat to the achievement of food security and sovereignty [7]. However, on the other hand, the pressure from urban population migration is also a major factor in infrastructure development, especially in the capital buffer areas. The conversion of land functions has serious implications for food production, the physical environment, and the welfare of agricultural and rural communities whose livelihoods depend on the land [10,12]. Protection of food agriculture land is an integral part of spatial planning and construction of infrastructure and facilities. For this reason, the protection of agricultural food land needs to be synchronized with the management of land supply for infrastructure development needs.

Takalar Regency is included in the KSN MAMMINASATA development area which will later be very clear that the impact of the management of the national strategic area will greatly affect land use patterns and forms of change in several sub-districts that look like the Galesong District, North and South Polongbangkeng Districts and Patalassang Districts. In general, the research objective of the Study of the Study of the Transfer of Function of Agricultural Land to Infrastructure Development in Takalar Regency is to analyze and classify the change in the distribution of the actual conversion of paddy fields to the construction of residential infrastructure that has occurred due to land conversion in the takalar district in the period 2012-2018.

## 2. Research Methodology

### 2.1 Research Location and Time

This research was conducted in Takalar district, South Sulawesi. It is located between 5°30' - 5°38' South Latitude and 119°22' - 119°39' East Longitude, astronomically. This research started in April 2020.

### 2.2 Research Variable

According to Hartono (2011), a variable is an object of research or the point of attention from a study [6]. While, Sugiono (2002), explains that a research variable is an attribute, nature or value of people, objects, or activities that have certain variables determined by the researcher to study and draw the conclusions [8]. The variables used in this study consisted of two variables, namely the independent variable and the dependent variable. The independent variable is a symptom or phenomenon which has a known effect on the dependent variable. While the dependent variable are the effect occurs caused by the independent variable. The variables used in this study are:

**Table 1.** The variables of research

Independent Variable ( x )	Dependent Variable ( y )
The population density level, The distribution pattern of residential infrastructure, Infrastructure classification and Land use	The rate of conversion of productive lowland agricultural land to infrastructure development

### 2.3 Type and Data Source

Primary data were obtained through direct field observation by taking coordinate point sampling and the documentation of field visualization. Secondary data is comes from related agencies. The data has

been collected and processed by each agency, with the method and amount according to their respective interests and abilities. The data source agencies include:

- a. CSRT Spot data 6-7 / pleides from LAPAN
- b. MOA 2012 wetland audit data
- c. RTRW document from Provincial / Regency Bappeda
- d. SK ATR / BPN 2018 South Sulawesi Province
- e. District Administration Map. Takalar SP2010
- f. Map of District / Province HGU Areas
- g. Land Use Map 2016
- h. Map of the PSDA Irrigation Area Takalar Regency
- i. Population data

#### 2.4 Data Collection

The data were taken and collected from related agencies. Data collection methods in this study include:

##### i) Documentation

The documentation method is carried out primarily to obtain an inventory of input and output variable data available at various related agencies and agencies including the Ministry of Agriculture of the Republic of Indonesia, LAPAN (Aviation and Space Agency), the Information and Geospatial Agency (BIG), Public Works Agency, Bappeda / Spatial Planning Service, BPN / ATR, Takalar Regency Agriculture Service, population agency and BPS. This method is also applied to various publications, reports, literature books, magazines, journals and papers that support this research.

##### ii) Observation

Observation is a way of collecting data by direct observation of the object to be studied. Observations were made by researchers by taking coordinate data sampling and field visualization (documentation)

#### 2.5 Methodology and Procedures

The distribution pattern analysis of the land change is carried out by using the method of overlapping or overlaying spatial data in the form of digitized maps with various sources of primary and secondary data / previous attribute data. Overlay is an important procedure in geographic information system analysis of a region. Overlay is the ability to place one map graphic on top of another map graphic and display the results on a computer screen or on a plot. Briefly, the overlay was a digital map along with its attributes and a combined map produces. The combining procedures proposed information from the two maps which is resulted on the process of unifying data by different layers. In simple terms overlay is referred to as a visual operation which requires more than one layer to be physically joined.

##### 2.5.1 The function change analysis of the actual paddy field

Validity testing is carried out to determine valid instrument items and / or data inventory and raw rice field series maps. The data and maps obtained from the Ministry of Agriculture's paddy field audit in 2012, maps and data of paddy fields digitized by CSRT spot 6/7 and updates. BIG rice fields, as well as rice field maps according to the Decree of the Minister of ATR / Head of BPN-RI No.399 / Kep-23.3 / X / 2018 dated 8 October 2018, the latest land cover map, or other related maps. Data processing, maps, and overlay maps of inventory results are carried out to get the results:

- (i) The number and distribution of the conversion of paddy fields.
- (ii) Volume Area of land distribution converted.
- (iii) Descriptive analysis is carried out by interpreting images that include elements of location, size, shape, shadow, tone / color, texture, pattern, height / depth / situation / association as well as assessment of spatial and textual aspects.

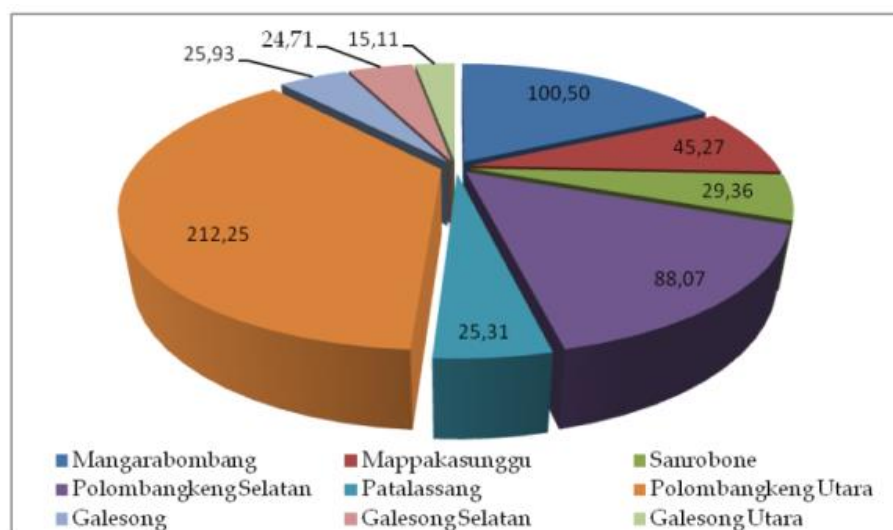
### 2.5.2 The classification of land use change

The method used is tabular data analysis. Tabulation is a process of making tables according to the required analysis. Tabular data analysis was performed after the results of remote sensing analysis and image interpretation were obtained. The data from the results of image interpretation obtained are classified into categories of answers based on the type of built infrastructure variables which are then entered into the data tab.

Result and Discussion

## 3. Overview of the Study Area

In the national spatial planning policy (PP. 26/2008 concerning RTRWN) the entire Takalar Regency is included in the KSN Mamminasata Urban along with the Maros urban area, Makassar City, Sungguminasata urban area and Takalar city (the capital of Pattalasang district). The administrative area of Takalar Regency until 2006 consisted of 7 sub-districts, and in 2007 it experienced a division into 9 sub-districts. The two sub-districts resulting from the division are the Sanrobone District which was expanded from the Mappakkasunggu District, and the Galesong District which was expanded from the North Galesong and South Galesong Districts. The data source from BPS Takalar Regency shows that the largest sub-district area is North Polombangkeng District with an area of approximately 212.25 Km<sup>2</sup>, or about 37.47% of the total area of Takalar Regency, while the sub-district with the smallest area is Galesong Utara District with less area with more than 15.11 km<sup>2</sup> or about 2.67% of the area of Takalar Regency. In detail, the area of each sub-district in Takalar Regency is described in **Fig. 1**.



**Figure 1.** The Area of Takalar Regency based on the Number of District

### 3.1 The Overview of Urban Development System based on the RUTR Kab. Takalar

Broadly speaking, the urban system plan for the Takalar Regency area is formulated based on several considerations, namely:

The basic objective of spatial planning is to create a space system that is safe, comfortable, productive and sustainable. When further elaborated, the meaning of productive and sustainable in the context of spatial structure is interpreted as a system and functional relations between urban centers that are effective, efficient, encouraging the improvement of the potential of each center (area) in a sustainable manner while maintaining the balance of nature.

The objective conditions of the hierarchy of the existing settlement centers and the 2006 RUTR of Takalar Regency, the national and provincial spatial planning policies that place the Pattalasang Takalar urban area (PKN and PKL).

One of the roles of the spatial planning plan is to create a balance of development between regions (sub-districts) and at the same time to anticipate development growth which is concentrated in the city center (district capital) or in certain areas only. This also relates to the creation of a tiered system of urban centers so that an effective and efficient urban system is built. Therefore, there are settlement centers whose growth needs to be encouraged and some are only sufficiently controlled according to their potential, maybe even limited.

Observing regional developments and national spatial planning policies and the Province of South Sulawesi, the growth of urban areas in Takalar Regency, the Pattalasang urban area and the Galesong City urban area will have the characteristics of an urban settlement area. The Pattalasang urban area is one of the urban areas in the Mamminasata Metropolitan area and Galesong Kota as a maritime urban area along with the North Galesong area which borders Makassar City. Rural Settlements; Generally, the characteristics of rural settlements are in the form of traditional house buildings, generally with semi-permanent conditions, low KDB, toilets outside the house and most of them use wells (groundwater) as a source of drinking water and have not received electricity. The characteristics of settlements are clustered and sporadically scattered. Taking into account the factual conditions in the field, the settlement development patterns in Takalar Regency generally form an elongated ribbon pattern following the development pattern of road construction. This is easily seen in the West from the direction of Makassar along the secondary collector roads of Bontokassi (North Galesong), Galesong Kota (Galesong), Bulukunyi (South Galesong), Sanrobone to Pattalasang. The same thing can be seen from the direction of Palleko (North Polombangkeng) to Pattalasang which is the main concentration of population settlements in Takalar Regency. The existing spatial pattern of the district planning area. Takalar can be grouped into 4 specific characteristics, namely:

- a. The eastern part of Takalar Regency (covering the areas of North Palombangkeng and South Palombangkeng) is part of the lowlands which is quite fertile and part of it is a hilly area (Mount Bawakaraeng). This area is an area suitable for agriculture and plantations.
- b. The central part of Takalar District (Pattalasang area as the district capital) is a lowland area with relatively fertile soil so that this area is an area suitable for agriculture, plantations and aquaculture.
- c. The western part of Takalar Regency (covering Mangarabombang, North Galesong, South Galesong, Galesong Kota, Mappakasunggu and Sanrobone) is part of the lowlands that are fertile enough for agriculture and plantations, some are coastal areas suitable for aquaculture and marine fisheries. The potential for flying fish, flying fish eggs, and seaweed in this area is thought to be quite potential to be developed.

### 3.2 The Change of The Rice Field Area in Takalar

**Tabel 2.** The Change of the rice field Area in Takalar

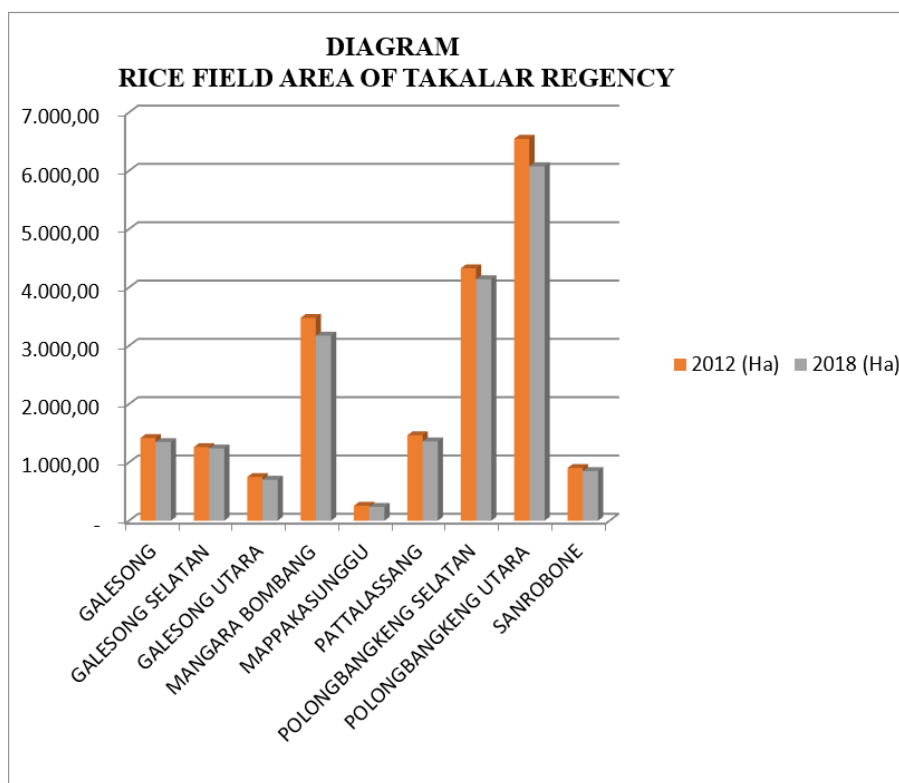
No	District	Rice Field Area In 2012 (Ha)	Rice Field Area In 2018 (Ha)
1	Galesong	1,417.67	1,348.07
2	Galesong Selatan	1,262.68	1,239.51
3	Galesong Utara	749.79	702.84
4	Mangara Bombang	3,478.32	3,172.96

**Tabel 2.** The Change of the rice field Area in Takalar (continued)

No	District	Rice Field Area In 2012 (Ha)	Rice Field Area In 2018 (Ha)
5	Mappakasunggu	257.31	237.22
6	Pattalassang	1,465.61	1,360.73
7	Polongbangkeng Selatan	4,327.51	4,140.72
8	Polongbangkeng Utara	6,548.62	6,077.69
9	Sanrobone	905.09	852.74
<b>Recapitulation</b>		<b>20,412.60</b>	<b>19,132.49</b>

Source: Analysis Data

Based on the Table 2 there has been a decrease in the area of raw paddy fields of 1,280.11 Ha which occurred in the last 6 years where the comparison of the degraded rice field area in each district can be seen in the Fig. 2.



**Figure 2.** The Change of Rice Field Area in Takalar

As can be seen from Fig. 2., in the diagram, it shows that all sub-district areas have experienced a decrease in the quantity of functional paddy fields in all sub-districts in Takalar Regency, where the most dominant areas experiencing decline are in Patalassang and North Polongbangkeng districts.

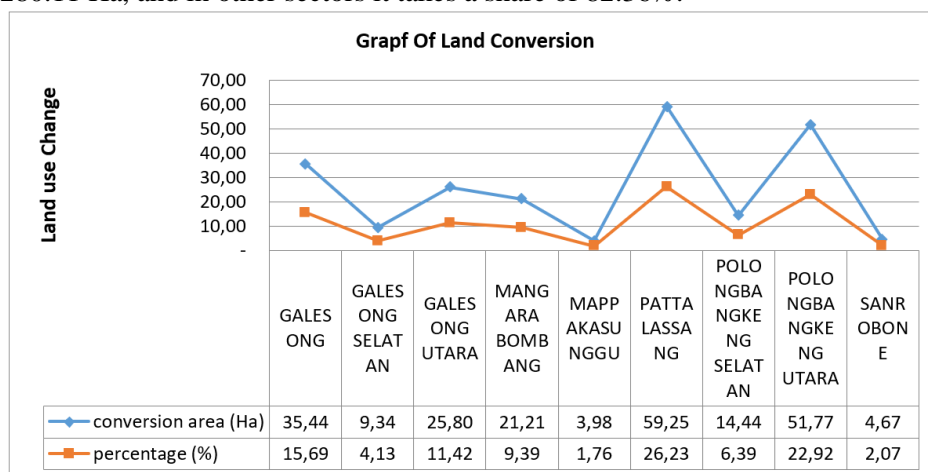
## The Change of Land use in Takalar

**Table 3.** The analysis tabulation of Land use change in Takalar

NO	DISTRICT	RICE FIELD AREA in 2012 (Ha)	RICE FIELD AREA in 2018 (Ha)	Land use change progress (%)	Land Use change area (Ha)		The total area of land use change (Ha)
					Residential	others	
1	GALESONG	1,417.67	1,348.07	4.91	35.441	34.160	69.60
2	GALESONG SELATAN	1,262.68	1,239.51	1.83	9.335	13.831	23.17
3	GALESONG UTARA	749.79	702.84	6.26	25.805	21.142	46.95
4	MANGARA BOMBANG	3,478.32	3,172.96	8.78	21.208	284.149	305.36
5	MAPPAKASUNGGU	257.31	237.22	7.80	3.977	16.105	20.08
6	PATTALASSANG	1,465.61	1,360.73	7.16	59.250	45.633	104.88
7	POLONGBANGKENG SELATAN	4,327.51	4,140.72	4.32	14.436	172.356	186.79
8	POLONGBANGKENG UTARA	6,548.62	6,077.69	7.19	51.770	419.156	470.93
9	SANROBONE	905.09	852.74	5.78	4.666	47.690	52.36
<b>TOTAL</b>		<b>20,412.60</b>	<b>19,132.49</b>	<b>6.27</b>	<b>225.888</b>	<b>1,054.221</b>	<b>1280.11</b>

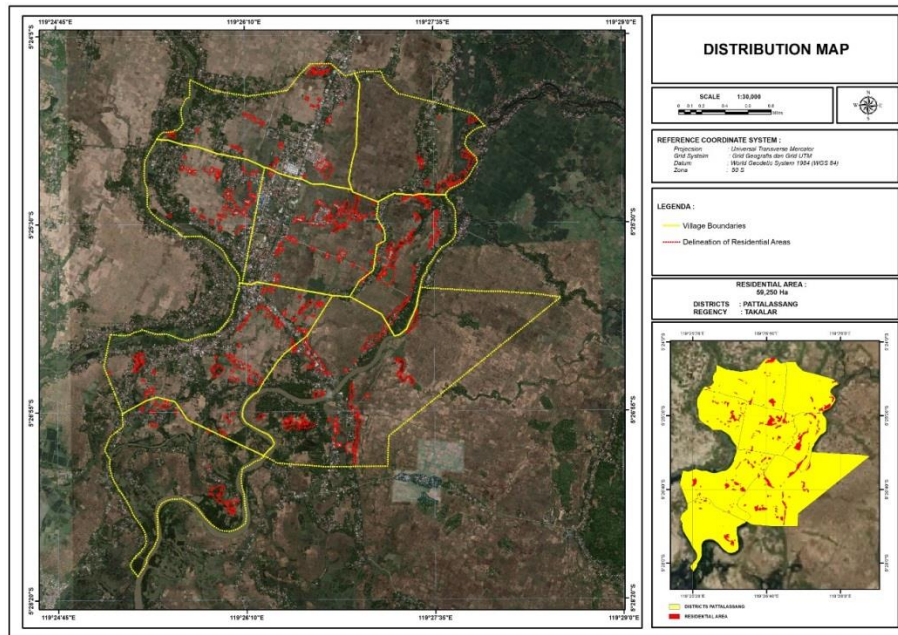
Source: Analysis Data

Based on the analysis data from **Table. 2**, it shows that a very large area that has undergone changes in land use change to infrastructure development is in the Patalassang District area, where the development of the capital city of Takalar Regency has indeed developed by shifting the function of agricultural land to the residential sector. Referring to the above analysis data, the change in the function of agricultural land to the residential sector is around 17.64% of the total land conversion that occurred of 1,280.11 Ha, and in other sectors it takes a share of 82.36%.

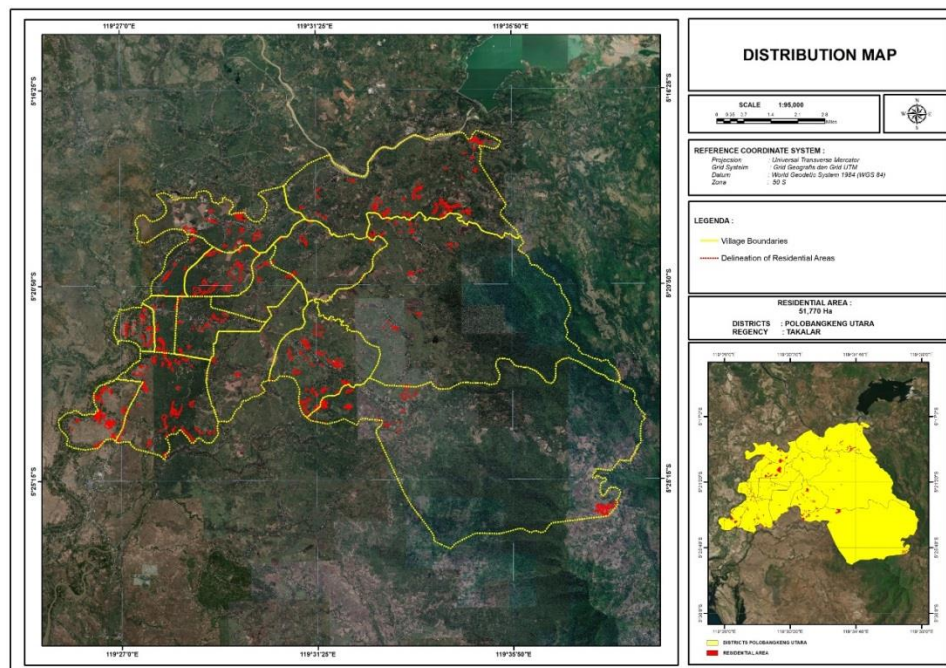
**Figure 3.** The Analysis tabulation of the Land use change area in Takalar

Furthermore, the analysis of the percentage rate of land conversion in the housing / settlement sector is illustrated in the **Figure 3**.

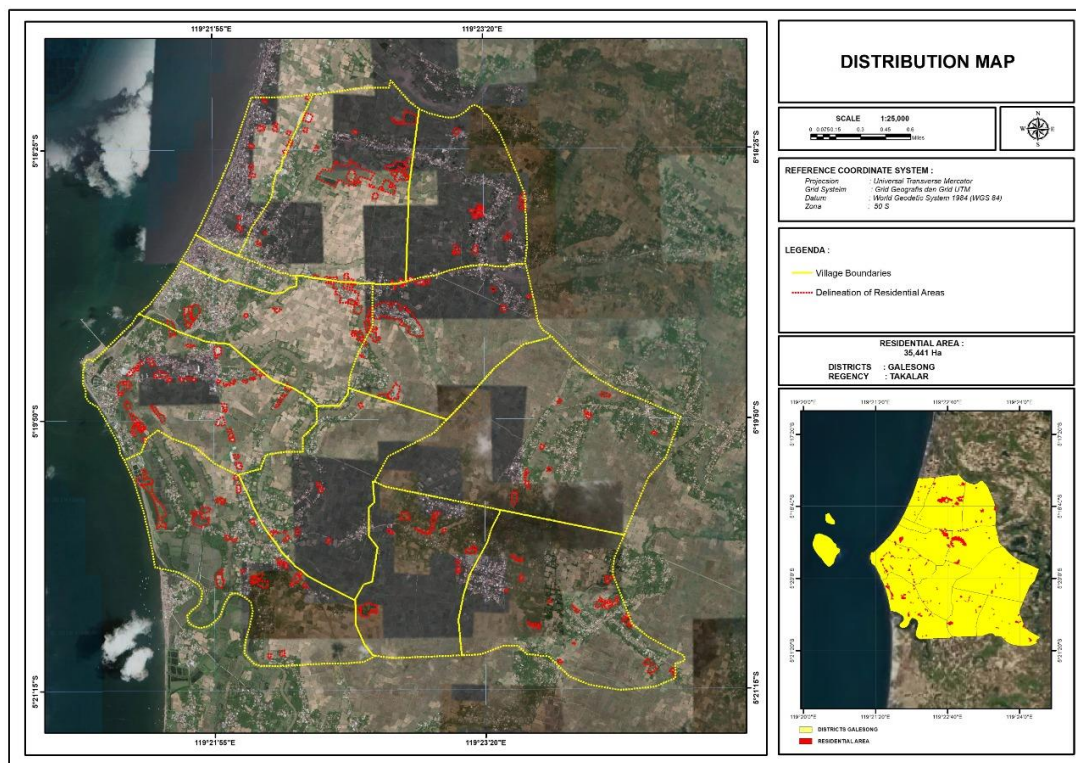
Referring to **Fig. 3**, it is found that the three largest sub-districts which are the distribution areas of land conversion for settlement development in Takalar district, namely, the Patalassang sub-district with a land conversion rate reaching 26.23%, then North Polongbangkeng sub-district with a percentage level by 22.92% and Galesong District with a rate of 15.69%.



**Figure 4.** The Maps of Land use Change distribution patterns in Patalassang District



**Figure 5.** The Maps of Land use Change distribution patterns in North Polongbangkeng District



**Figure 6.** The Maps of Land use Change distribution patterns in Galesong District

#### 4. Conclusion

Pattalassang, Galesong, and Polongbangkeng Utara Districts have a fairly large percentage ratio level of land conversion that occurred in the residential sector in the last 6 years (2012-2018). Pattalassang Subdistrict is the center of the capital city of Takalar Regency, so it is possible that land conversion changes will occur very quickly in that area where the business and industrial sectors are also moving in the area, while Galesong sub-district is a coastal area that is directly adjacent to the provincial capital, namely Makassar City. Galesong sub-district, especially those bordering the city of Makassar in the western region, is very vulnerable to being used as residential and residential land, while for the northern podbangkeng area it is the largest sub-district area with an area coverage of approximately 212.25 Km<sup>2</sup>, or around 37.47% of the Regency area. Takalar is coupled with a fairly large population demographic level. the area of raw rice fields in Polongbangkeng Utara sub-district in 2012 was 6,548.62 and in 2018 it experienced a decrease due to a change of function by 7.19% so that the raw area of functional rice fields became 6,077.69.

The total number of land conversion that occurred in all sub-districts in the takalar area reached 1,280.11 ha in the housing and housing sectors, this is a serious threat in the future where the shrinkage that occurs based on data analysis can reach 213.35 ha per year. Even this figure will increase if there is no control process over function change or proper urban planning by relying on the implementation of the existing city spatial plan in Takalar Regency. The application of Law No. 41 of 2009 concerning Protection of Sustainable Food Agricultural Land which was passed on October 14, 2009 concerning the Protection of Sustainable Food Agricultural Land is very clear which has serious implications for the fate of food agriculture land in Indonesia. Therefore, the implementation of laws and activities for the conversion of agricultural land functions in various sectors, especially the residential sector, must work together so that the good impact on urban spatial planning and the impact on the value of regional food security can be mutually maintained.

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