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Dynamics urban development to the carrying capacity of agricultural land Maros Region Province South Sulawesi

Dynamics urban development to the carrying capacity of agricultural land Maros Region Province South Sulawesi

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Abstract. The development of Maros tends to influence the development of the surrounding areas. The presidential Regulation no. 55 in 2011 the establishment of Mamminasata metropolitan areas (Makassar - Maros - Sungguminasa - Takalar) became one of the National Strategic Areas (KSN) in Indonesia, where Maros' one of the main functions in agriculture. The purpose is to study the dynamism of urban development based on the demographic, economic and physical aspects of the developed areas as well as seeing the relevance of urban development towards the agricultural lands supporting the capacity in Maros Regency, and to become the considerable basis for spatial planning in Maros Regency. The approach uses the analysis of the dynamism of urban area development, and the analysis is done by looking at the demographic aspects, such as population, economy, and the physical built area especially in the built area itself. Analyzing the carrying capacity of agricultural lands, this analysis is intended to see the availability of existing agricultural lands based on land use, and the relevance of urban development towards the carrying capacity of agricultural lands in Maros Regency.

1. Introduction

As the cities or regencies in South Sulawesi grow and become economic magnets in the eastern part of Indonesia, it shows that there is a change in the conversion of productive agricultural land into a built area. The development of the Maros Regency also popularizes the surrounding area development. Presidential Regulation No. 55/2011 establishes the Mamminasata metropolitan areas (Makassar - Maros - Sungguminasa - Takalar) becoming one of the National Strategic Areas (KSN) in Indonesia, where Maros Regency's one of the main functions in agriculture.

The determination in most of Maros Regency becoming a metropolitan influence the changes in land function in the area where the land is specially designated as RTH / agriculture. The area in Maros Regency has the largest agricultural lands in Mamminasata which is the potential to experience the land conversion into a built-up area due to the development.

The construction and repair of new roads to integrate the cities/districts in Maros Regency followed by the rapid growth of the built area raises several problems, such as the reduction of agricultural lands and the increasing need for space for community activities due to the increasing visits. Based on the current phenomena, the urban development study affecting the agricultural land areas is considered in terms of availability and ability of the land. This study will look at the relationship between the demographic and physical aspects of the built area on the carrying capacity status of agricultural land in Maros Regency. The link between dynamism and urban development and its impact on land indicates the sustainability of agricultural land in the future.

2. Dynamism of urban development & land carrying capacity

2.1 The dynamism of urban development

The pattern of urban development is influenced by certain topographic conditions or due to certain socioeconomic developments [1]. Some patterns of development that occur can be spread, parallel or clustered. The ongoing process of population urbanization, accumulating and compacting informal settlements in the remaining (marginal) spaces in the city causes the city to receive the impact of slum settlements is that the city with the most marginal/residual space and its utilization is carried out unplannable. The space addition on open land towards the suburban areas results in increased land areas (with urban functions) built (urban built-up land). This is a symptom of urban expansion to suburban areas. Urban development is a process of changing urban conditions from one state to another under different times. The spotlight changes are usually based on different times and need to analyze the same space.

2.2 *Land carrying capacity*

The research suggests that land ability implies the carrying capacity of land [2]. The land capability is the land quality assessed as a whole with an understanding that it is a plural identifier of the land and the value of different land capabilities for different uses. In relation to meeting human needs, the ability of land is translated into an understanding of land carrying capacity.

According to studies, the carrying capacity of the land is a measure of the number of individuals from a species that can be supported by a particular environment [3]. The carrying capacity of an area is largely determined by the potential of resources (natural, artificial, and human). Technology for managing resources (natural, artificial, human), as well as the type of work and income of the population. The availability of natural resources that can be managed and utilized for humans will increase the carrying capacity of the environment. The use of technology as a production factor that can increase the productivity of land, industry, and services will increase the carrying capacity of land in a region.

2.3 Environmental carrying capacity

Environmental carrying capacity according to Law No. 32 of 2009 concerning Environmental Management is the ability of the environment to support human life, other living things, and the balance between them [4]. In addition, the study also tried to explain that carrying capacity or the carrying capacity of the environment implies the ability to optimally support the life of living things in a long period of time [5].

3. Method

3.1 Growth rate analysis

In this analysis, a calculation is done to see the growth or development of all the population, the economy and the built land [6]. The identification of development dynamism in every aspect will use this analysis.

3.2 Analysis of land requirements

The analysis of land requirements is used to calculate the need for agricultural lands in an area in order to find out the carrying capacity status of agricultural lands in Mamminasata areas. The formula to calculate the land requirements (Demand) [7]:

$$D_L = N \times KHL_L \quad (1)$$

Information:

D_L = The total need for land equivalent to rice (ha)
N = Population (people)
KHL_L = The land area needed for decent living needs per population:

- The land area needed for a decent living need per population is a decent living necessity per population divided by local rice productivity.
- A decent living requirement per population is assumed to be 1 ton equivalent to rice/capita/year. Regions that do not have national rice productivity data are 2400 kg/ha year.

3.3. Regression analysis

Regression analysis is used to find out how much the relationship/correlation is between the independent variables, namely the dynamism of urban development (economy, population, and built area) to the dependent variable, namely the carrying capacity of agricultural land (availability of agricultural lands).

4. Results

4.1 The development dynamism of Maros Regency urban area in terms of demographics, economic and physical aspects of the built area

On demographic aspects, population growth is one of the land development factors in the region. The population growth rates need to be known to analyze the development dynamism of a region or regions. The developments knowledge in the level of population growth can be seen by looking at a trend or trends in population growth rates which are the basis for determining the projections or population estimates in the future and can determine the level of space or land needed in the area/region. Maros Regency is a part of the plan in the Mamminasata metropolitan area which of course experiences the growth in terms of its demographic population. The population growth rates in Maros Regency can be seen in the following table 1.

Table 1. The population growth rates in Maros Regency.

No	Districts	Large Km^2	Population / Year Amount					Growth rate Percent (%)
			2013	2014	2015	2016	2017	
1	Moncongloe	46.87	17593	17887	18183	18476	18671	1.50
2	MarosBaru	53.76	24697	25000	25303	25599	25303	0.61
3	Marusu	53.73	25907	26192	26476	26752	27035	1.07
4	Turikale	29.93	42419	42877	43335	43778	44242	1.06
5	Lau	73.83	24917	25223	25529	25827	26101	1.17
6	Bontoa	93.52	27176	27416	27655	27884	28179	0.91
7	Bantimurung	173.70	28478	29019	29288	29548	29861	1.19
8	Simbang	105.31	22757	22981	23204	23419	23667	0.99
9	Tanralili	89.45	25075	25329	25582	25828	26101	1.01
10	Cenrana	180.97	13965	14121	14276	14428	14580	1.08
11	Mandai	49.11	36397	37004	37617	38224	38628	1.50
12	Tompobulu	287.66	14512	14685	14858	15027	15186	1.14

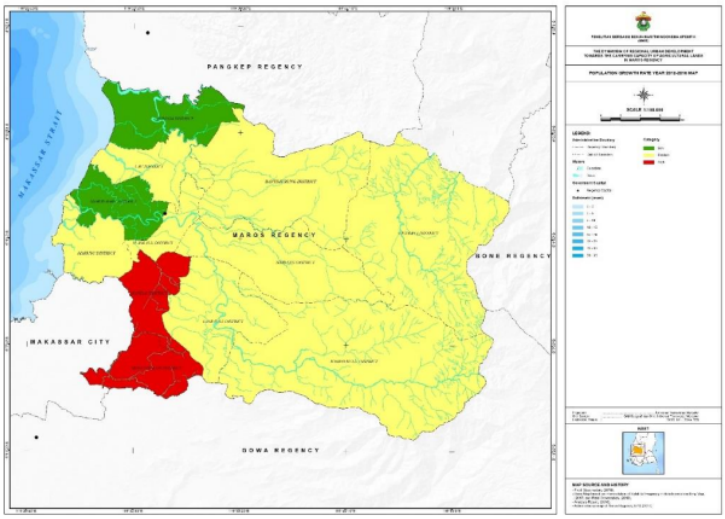

Figure 1. Map of Maros Regency population growth rate 2012-2016.

In calculating the level of economic growth of a country or region, GDP is measured in units of Rupiah using constant prices, and its own economic growth is measured by percentage. If positive values are obtained and tend to experience an increase in economic growth in a region, it can be said that the economic growth in the region is growing and developing. Whereas if it produces negatively, it indicates that the region's economy has decreased. Figure 1 illustrates Maros Regency's GRDP value per the year 2017 shows three business fields or industries that have the largest production, namely agriculture, forestry & fisheries, transportation, and warehousing and industry. The overall GRDP of Maros Regency in figure 2 has increased every year and produced positive values for its economic growth. The average value of economic growth in Maros Regency during 2013-2017 was at a percentage of 7.15% which can be indicated that the Maros Regency experienced growth in its economy.

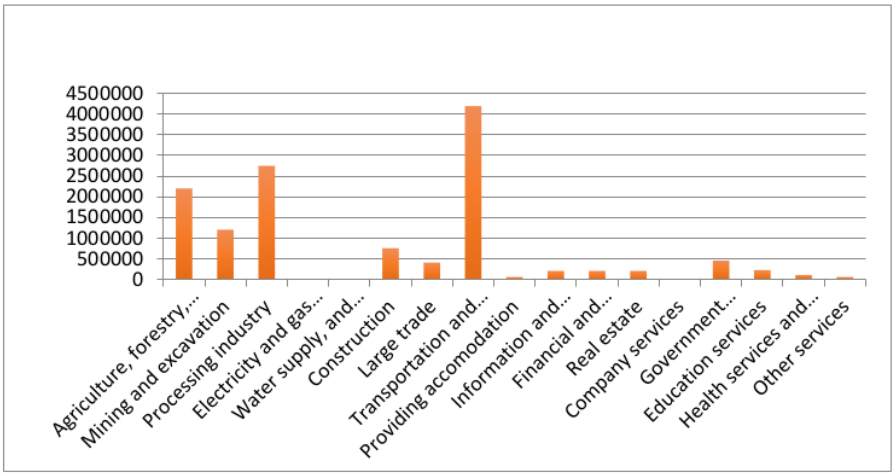

Figure 2. Graph of GRDP value in Maros Regency in 2017.

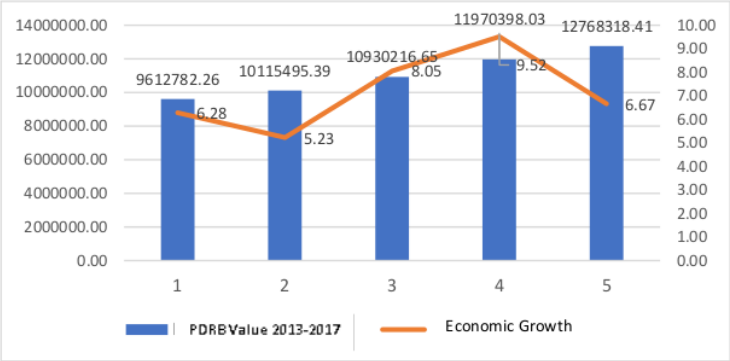

Figure 3. Graph of economic growth based on GRDP in Maros Regency.

In the next aspect, concerning the built area, the spatial analysis is carried out and the growth rate calculation of the area is the 12 sub-districts in Maros Regency by looking at the level of growth o the built area using map data in 2012,2013, 2014, 2015,2016,2017. The results of the growth rate analysis are then divided into 3 classes, namely, high, medium and low. To determine the class, the Equal Interval method is used. The calculation formula is used to determine the value interval, as follows:

Interval = (Max Value-Min Value) / (Number of Intervals) (2)

The results of the analysis of the growth rate of the built area showed that almost all districts experienced a rapid/high growth rate with an average value of the growth rate of 18.03%. Based on interval calculations, 11 of the 12 sub-districts were in the high category with intervals of> 6.29% and the region with the highest growth rate in the built area was Moncongloe district. While the rest of the Turikale sub-district is in the medium category with a value of 6.29% and is in the interval> -18.83% - 6.29%.

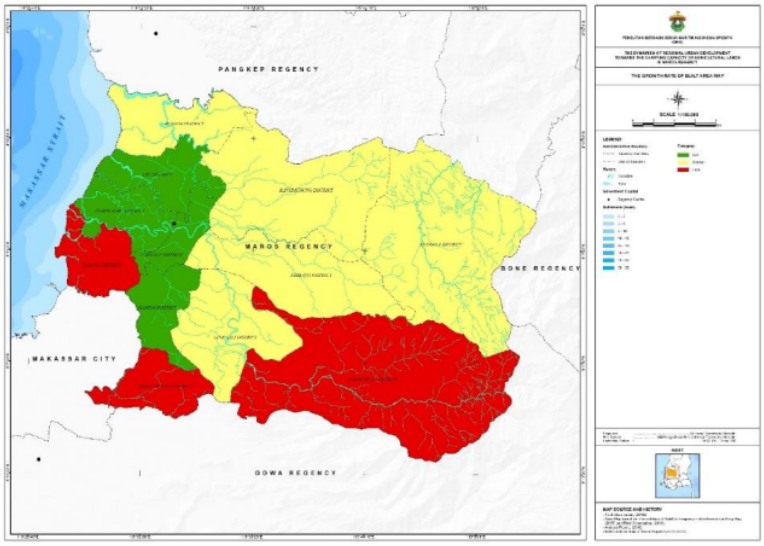

Figure 4. Map of the rate of growth of the area built by Maros Regency.

4.2 The carrying capacity status of agricultural land Maros Region

In the analysis of land carrying capacity status, it is carried out in the analysis and land requirements. Based on the analysis of land availability, the agricultural land availability in Maros Regency in accordance with the study location has an area of 22,365 ha. The area that has the largest area of agricultural land is Bantimurung District covering 3964 ha, while the smallest is Turikale District with a land area of 975 ha from all districts in Maros Regency.

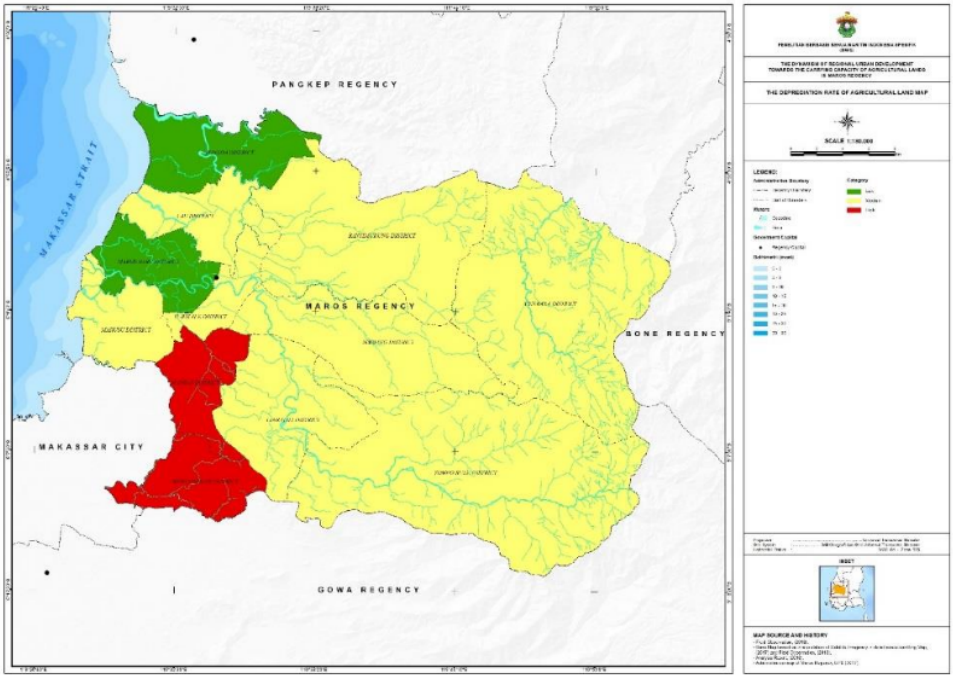

Figure 5. Map of Maros Regency agricultural land depreciation.

The projection of land availability is known that most of the eight out of 12 sub-districts which are research locations have not experienced the growth at all. However, there are four sub-districts that have experienced an increase and decrease in the amount of land available. Maros Baru and Tompobulu districts experienced an increase in land growth with a growth rate of 5.71 and 1.14%, while Marusu and Lau Subdistricts were sub-districts that experienced a decrease in the agricultural land availability with the growth rates of -3.97 and 0.45%.

Furthermore, the analysis of land needs is carried out to calculate the needs of agricultural land in the area in order to find out the status of the carrying capacity of agricultural land in Maros Regency. Based on the calculation of agricultural land requirements for every sub-district, the need for agricultural land in Maros Regency has an average area of 3635 ha. The region with the highest score is Turikale District with an area of 6242 ha, while the smallest is the Cenrana District with an area of 2,051 ha.

In analyzing the carrying capacity of agricultural land, one analysis that is also needed is an analysis of land depreciation. This analysis is used to determine land depreciation that occurs in the Maros Regency Area by calculating the rate of depreciation of agricultural land in 2012-2016. Based on the results of the analysis, the area that has the highest rate of land change is the Tompobulu Sub-district with a value of 1.5% per year, while the lowest or depreciated land is Marusu District with a value of -

4.6% per year. The results of this analysis are divided into 3 classes, namely, high, medium and low illustrated in the following land depreciation maps.

After knowing the amount of available land and the area of land needed, every sub-district in Maros regency is known for the power status of the farmland, which can be seen in Annex E. It is assumed that if an area has a fairly rapid development or has been designated as a metropolitan area, the carrying capacity status of the land will decrease, this is due to the increase in the population accompanied by the space requirements that can help the activities of the community in it. Conversely, an urban area that is less developed than the status of its land carrying capacity remains in a surplus condition. The status of land carrying capacity is obtained from calculating the ratio between land availability (SL) and land requirements (DL).

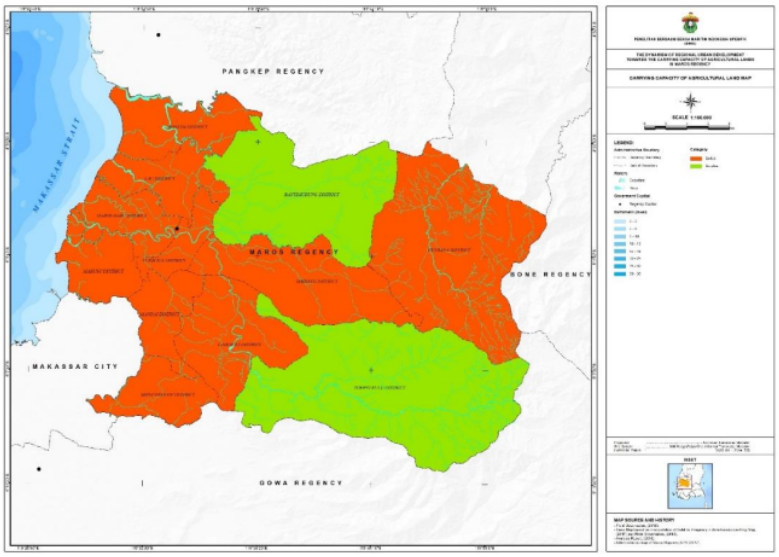

Figure 6. Carrying capacity of agricultural lands map.

Based on the analysis of the carrying capacity status of agricultural land in Maros Regency, it is known that most of the sub-districts are in deficit status with an average value of comparison between the availability of land needs is 0.59. The total area that has surplus status is 2 Districts or 16.7%, while the deficit status area is 10 Districts or 83.3% of all sub-districts in Maros Regency. The region that has the maximum coefficient value with the status of carrying capacity of surplus land (DDL> 1) is Bantimurung Subdistrict which is 1.19, while the area that has a minimum coefficient value with the status of land deficit carrying capacity (DDL <1) is Turikale sub-district which is 0.16. An overview of the level of environmental carrying capacity is further illustrated in the following map.

4.3 Linkage of urban development dynamics to the carrying capacity of an agricultural land metropolitan area in Maros Regency

The analysis of the development dynamism of urban areas on the carrying capacity of agricultural land aims to determine the extent to which the development of urban areas is related to the carrying capacity of the land, especially agriculture in Mamminasata regions, especially Maros Regency. There are several variables related to the development of urban areas, including the rate of population growth, the economy and the built area as independent variables, while changes in agricultural land areas the dependent variable. The results of the analysis were carried out to find out which variables had the most influence on the carrying capacity of the land in the Mamminasata Area, especially Maros Regency

which was the location of the study. For more details, it can be seen in the table below the results of multiple linear regression analysis processed through the SPSS program.

4.3.1 Determination coefficient (r^2)

After obtaining the independent variables that affect the dependent variable, an analysis is performed to see the coefficient of determination that shows the relationship between the dependent and independent variables.

Table 2. Determination value.

Model Summary[b]

R	R Square	Adjusted R Square	Std. An error of the Estimate	Change Statistics					Durbin-Watson
				R Square Change	F Change	df1	df2	Sig. F Change	
.610[a]	0.373	0.137	2.08103	0.373	1.584	3	8	0.268	1.393

a. Predictors: (Constant), The rate of economic growth, the growth rate of built areas, population growth rate
b. Dependent Variable: Land Depreciation

Based on the table above, it explains that the number of predictor variables formed has a low influence on the dependent variable. The value of Adjusted R Squared is 0.137, meaning that the predictor variable population growth rate, economic growth rate, and growth rate of the built area only explain the dependent variable, the rate of depreciation of agricultural land by 13.7% and the rest by other variables.

Based on the R^2 value between 0-1, the value of 0.137 means that the variable X in the model is not good at explaining the Y response together. The greater R^2, the better the variable X explains the Y response together.

4.3.2 Multiple regression models

After knowing the variables that affect the dependent variable, an analysis is performed to see the level of influence of the independent variables that most influence the dependent variable.
Regression Equation Model:

$$Y = -71.4838 - 18.3081LPP - 0,369PKT + 13.5793LPE \quad (3)$$

Where:

Y = Dependent Variable (predicted value/depreciation of agricultural land)
LPP = Population Growth Rate
LPKT = Built-in Area Growth Rate
LPE = The Rate of Economic Growth

Based on the above regression model explained, the variable population growth rate and the growth rate of the built area have a negative relationship with the rate of depreciation of agricultural land, while the rate of economic growth has a positive correlation with the rate of depreciation of agricultural land. The rate of economic growth is the variable that most influences the rate of depreciation of agricultural land (carrying capacity of agricultural land) with a value of 13.57%. To see the overall results of the SPSS multiple interest regression analysis.

Table 3. Coefficients[a].

Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.	95.0% Confidence Interval for B	
	B	Std. Error	Beta			Lower Bound	Upper Bound
(Constant)	-71.4838	785.354		-0.91	0.389	-2525.87	1096.191
LPP	-18.3081	193.837	-15.62	-0.945	0.373	-630.07	263.908
LPKT	-0.369	0.431	-0.255	-0.857	0.417	-1.363	0.624
LPE	13.5793	147.942	15.19	0.918	0.386	-205.363	476.949

a. Dependent Variable: LPL

5. Conclusions

Based on the findings described in the previous section, the research objectives related can be concluded as follows:

- Maros Regency, as part of the Mamminasata metropolitan area, has experienced rapid growth in various aspects, particularly the economic aspects that experience an average growth rate of over 10% per year until 2017.
- The aspects that most influence land carrying capacity are three economic aspects, where the increasing number of GRDP in urban areas affects the agricultural land which results in reduced agricultural land.
- The development of agricultural land in the Mamminasata Area is already at an alarming stage because most of the sub-districts have a deficit status with a total of 10 sub-districts or 83.3% of all existing districts.

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