Developments carrying capacity land of settlement in the Suburban of Mamminasata, Maros Regency, Indonesia

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Abstract. The growth of Makassar city as a national activity center of Mamminasata Metropolitan produces a high current of urbanization so that development leads to a suburban area which is one of which is in Maros Regency, which functions as the satellite city of Mamminasata. Population growth will certainly require shelter as one of the mandatory needs of the community. The purpose of this study is to determine the carrying capacity land of settlement in the suburban area of Mamminasata, especially the Maros Regency. The method in calculating the carrying capacity of the land is by comparing the supply and demand of settlement land. Land suitable for settlement development is 109,052 hectares, while the need for settlement of land in the next 20 years (2038) is 5,572 hectares. The conclusion of the study is the carrying capacity land of settlement in the suburban area of Mamminasata, which is still in a state of surplus, meaning that there is still a lot of lands that can be developed as settlements in line with the development of new cities in the periphery as anticipation of settlement land needs that cannot be met in Makassar City.

1. Introduction

The development of the metropolitan area is a phenomenon that is happening in the world. This also happened in developing countries that followed the trends in world urban development. The population living in cities in 2015 reached more than 50% of the threshold, and it is predicted that 3 out of 5 world population will live in cities [1]. Besides, the phenomenon of urbanization is also classified as developing rapidly in developing countries such as Indonesia, which of course, will have more significant potential in dealing with environmental problems that will occur [2]. Urban growth is characterized by an increase in urban population or the phenomenon of urbanization that causes a high demand for space resulting in increasingly narrow space available in urban areas, and uncontrolled urbanization causes land use on the outskirts of urban areas or suburban areas commonly called invasions that will potentially become urban sprawl [3].

Presidential Regulation Number 55 the Year 2011, establishes the Mamminasata metropolitan area (Makassar-Maros-Sungguminasa-Takalar) as one of the National Strategic Areas (KSN) in Indonesia, where Makassar as the central city acts as the National Activity Center (PKN) and the Balancing City, namely the Maros Urban Area, Sungguminasa and Takalar. Makassar City, as the core city, makes a high current of urbanization, resulting in high demand for space. The high population growth will also affect the need for settlement land in rural areas. The development of suburban areas in Mamminasata
is one of the developments of new cities to overcome problems in Makassar City, which has a core city role.

In general, this area will be developed as a settlement area supporting for Makassar City residents which are affected by urbanization and become a magnet counter for the development of big cities and a center for rural services, so it is necessary to pay attention to the carrying capacity of the environment in suburban areas as a consideration in developing regions according to proportion and suitability [5]. [6] Generally limits the functions of satellite cities as a place of residence or residence for commuters who mostly have jobs in the core city and are still very dependent on activities in the core city or, in other words, do not yet have independence in the economy. Dynamic urban development will result in the development of various aspects that will require space so that it will potentially face complex environmental problems, especially in the availability of land for settlement development.

1.1. Carrying Capacity Land Of Settlement
The land carrying capacity is systematic land use and population data. Where all human activities in meeting the needs of life require space so that the availability of land greatly influences human activities [7]. Land carrying capacity uses the concept of supply and demand in the guidelines for determining the carrying capacity and carrying capacity of environmental ministries in 2014. However, the guidelines only specify the carrying capacity of agricultural land and other natural resources. However, the concept of carrying capacity, in general, is back again in the comparison of supply (availability) and demand (needs) so that the carrying capacity of the land for settlement development, and can compare availability and needs, to produce the status of the region whether classified as a deficit or a surplus to accommodate humans in the development of settlements.

1.2. Land Availability of Settlement
Land availability is a supply-side in regional and city planning, and the available land is a place to accommodate residents' activities both in social and economic activities in carrying out their daily lives so that the population's need for land is strongly influenced by the population and its development as well as ongoing activities such as social and economical especially the provision of facilities and infrastructure and land for business activities [8]. Land adjustment is a step in knowing the ability of a region's land, whether the area can be developed activities that support human life, especially in the development of settlements. In Indonesia, land suitability is set in the guidelines for the use of cultivated areas [9].

1.3. Land requirements of Settlement
According to the 2014 Ministry of Environment's carrying and carrying capacity guidelines, the land need is a minimum standard of decent human needs that can be calculated based on the needs of decent living, so the need for land for settlements is strongly influenced by the number and development of the population as subjects and objects in the living ecosystem. Furthermore, land requirements for development or cultivation are influenced by two capital, human capital and social capital. Human capital as described above is a human factor, in this case, the growth in population and the need for space for housing per capita, while social capital is a development policy from the government regarding the direction and function of development in urban planning that reflects the economic function of the city which includes the need for space for socio-economic activities such as trade, industry, offices, and functions according to government directives [8].
2. Methodology
To determine the carrying capacity of land using the concepts of supply (availability) and demand (requirements), the results of the calculation of supply and demand will be compared if the results are >1 then the status is surplus and if <1 the carrying capacity of the land for deficit settlements. The analysis technique used to calculate availability and needs is as follows:

2.1. Land Availability
In this analysis, the area of Land Availability (supply):

$$KL = LKP - RTH - SPP$$  \hspace{1cm} (1)

Where:
- KL : Land Availability
- LKP : Area of Conformity of settlement land
- RTH : Private green open space needs 10%
- SPP : Facilities and infrastructure supporting urban 20% of the total land area

2.2. Land Requirements
In this analysis, to calculate the area of land needs (demand) using:

$$\text{Land Requirements} = PK (LK+KSP)$$  \hspace{1cm} (2)

Where:
- PK : Family projections (soul)
- LKP : Spacious house according to the composition of the balanced occupancy (m2)
- KSP : Percentage of area requirements (non-occupancy) social-economic activities

3. Result and Discussion
3.1. Land Requirements
To calculate the land requirements, it is necessary to consider the needs of green space that must be provided by the private sector by 10%, which is divided into residential and non-residential. The assumptions used are Green Open Space of 8% occupancy and 2% non-occupancy due to consideration of the basic coefficient of buildings in the suburban area of Maros Regency and the need for land for supporting infrastructure and urban facilities by 20% of the total land area.

Table 1. Projected Number of Families in the Next 20 Years

| Sub-District | 2012  | 2018  | 2038  |
|--------------|-------|-------|-------|
| Bantimurung  | 6,479 | 6,953 | 8,042 |
| Bontoa       | 5,493 | 5,862 | 6,861 |
| Cenrana      | 3,430 | 3,616 | 5,026 |
| Lau          | 4,995 | 5,440 | 5,440 |
| Mandai       | 7,995 | 8,531 | 10,693|
| Maros baru   | 4,948 | 4,896 | 5,815 |
| Marusu       | 5,652 | 6,029 | 6,178 |
| Moncongloe   | 3,887 | 4,215 | 2,840 |
| Simbang      | 5,058 | 5,455 | 6,480 |
| Tanralili    | 5,725 | 6,145 | 7,708 |
| Tompu Bulu   | 3,599 | 3,360 | 3,877 |
| Turikale     | 8,763 | 9,380 | 12,908|
| Total        | 66,024| 69,882| 81,868|
From the table above the number of family projections in the suburban district of Maros Regency experienced a significant increase to 81,868 families. This amount will be one of the benchmarks for land requirements for settlements.

From the results of this calculation, the suburban area of Maros Regency needed land area is 114,923,187 ha for settlement development in the next 20 years. More details can be seen in Table 2 below.

| Sub-District   | Families Year 2038 | Requirements Land of Occupancy (m²) | Requirements Land of Non-Occupancy (m²) |
|----------------|-------------------|------------------------------------|----------------------------------------|
| Bantimurung    | 8,042             | 1,284,039                          | 56,294                                 |
| Bontoa         | 6,861             | 1,095,473                          | 48,027                                 |
| Cenrana        | 5,026             | 850,734                            | 35,182                                 |
| Lau            | 5,440             | 868,587                            | 38,080                                 |
| Mandai         | 10,693            | 1,760,781                          | 74,851                                 |
| Maros baru     | 5,815             | 957,537                            | 40,705                                 |
| Marusu         | 6,178             | 1,017,311                          | 43,246                                 |
| Moncongloe     | 2,840             | 467,653                            | 19,880                                 |
| Simbang        | 6,480             | 1,129,248                          | 45,360                                 |
| Tanralili      | 7,708             | 1,269,251                          | 53,956                                 |
| Tompu bulu     | 3,877             | 638,413                            | 27,139                                 |
| Turikale       | 12,908            | 2,125,517                          | 90,356                                 |
| Total          | 81,868            | 13,464,544                         | 573,076                                |

From the calculation table of settlement land needs above, it is known that all districts experienced an increase in the amount of land needed for settlements in line with the increase in the number of families. The sub-districts that have the highest settlement land requirements are Turikale Sub-district with land area 2,125,517 m². While the lowest is the Moncongloe sub-district with land requirements for settlements of 467,653 m². So the need for land for settlements in the suburban area of Maros Regency is 114,923,187 ha.

3.2. Land Availability

3.2.1. Analysis of Regional Functions. This analysis was conducted to study the ability of land for settlements with the method used, namely overlaying the base map under The Minister of Public Work Regulation No. 41/PRT/M/2007, namely, topographic conditions, needing air, the ability to access drainage land, disaster-prone areas, climate and hydrology, buffer border, and aviation operations safety zones.

Figure 1. Map of The Regional Function
Based on the analysis results, it is known that most of the regions in the Regency Maros are an area with a cultivation function.

3.2.2. Land Suitability Analysis. This analysis was conducted to study the ability of land for settlements with the method used, namely overlaying the base map under The Minister of Public Work Regulation No. 41/PRT/M/2007, namely, topographic conditions, needing air, the ability to access drainage land, disaster-prone areas, climate and hydrology, buffer border and aviation operations safety zones.

**Table 3. Distribution of Regional Functions in The Mamminasata Suburban Area**

| Regional Function | Extensive (Ha) |
|-------------------|----------------|
| Cultivation       | 149,370.90     |
| Protected         | 84,285.81      |
| **Total**         | **233,656.70** |

Figure 2. Map Distribution of Suitability of Settlement Land in the Maros Regency

**Table 4. Distribution of Suitability of Settlement Land in the Mamminasata Suburban Area**

| Sub-District      | Land Suitability |                  |
|-------------------|------------------|------------------|
|                   | Suitable (ha)    | Non-Suitable (ha)|
| Bantimurung       | 6,148            | 4,887.49         |
| Bontoa            | 4,425            | 1,876.62         |
| Cenrana           | 1,242            | 2,741.92         |
| Lau               | 4,212            | 3,185.07         |
| Mandai            | 5                | 3,821.42         |
| Maros baru        | 3,431            | 3,032.20         |
| Marusu            | 2,430            | 1,008.41         |
| Moncongloe        | 3,407            | 5,015.19         |
| Simbang           | 3,172            | 3,038.42         |
| Tanralili         | 4,824            | 4,929.85         |
Based on the results of the analysis, note that most of the Maros Regency are land that is not suitable for settlement, which is 41,094.09 ha while suitable land is only 37,272 ha.

3.2.3. Availability of Settlement Land. To calculate the availability of land, it is necessary to consider the needs of green open space that must be provided by the private sector by 10%, which is divided into occupancy and non-occupancy. The assumptions used are RTH of occupancy of 8% and non-occupancy of 2% on the consideration of the basic coefficient of buildings in the Maros Regency and land requirements for supporting facilities and infrastructure for urban areas by 20% of the total land area.

\[
\text{Land Availability} = \text{Area Land of Suitability} - 10\% \text{ Private Green Open Space} - 20\% \text{ needed area for facilities and infrastructure} \\
= 37,272 - 3,727.2 - 7,454.4 \text{ ha} \\
= 26,090.4 \text{ ha}
\]

3.3. Status The carrying capacity of settlement land

Based on the comparison between the availability of land (supply) and land requirements (demand). It is known that most of the settlement land area in Maros Regency or about 92 percent has a surplus status, namely at sub-district Bantimurung, Bontoa, Cenrana, Lau, Maros Baru, Marusu, Moncongloe, Simbang, Tanralili, Tompobulu, and Turikale. Whereas the area with deficit status or around 8 percent of the total land area is in the Mandai sub-district.

| Sub-District | Land Availability (ha) | Land Requirements (ha) | Ratio | Status |
|--------------|------------------------|------------------------|-------|--------|
| Bantimurung  | 6,148                  | 128                    | 47.9  | Surplus|
| Bontoa       | 4,425                  | 110                    | 40.4  | Surplus|
| Cenrana      | 1,242                  | 85                     | 14.6  | Surplus|
| Lau          | 4,212                  | 87                     | 48.5  | Surplus|
| Mandai       | 5                      | 176                    | 0.0   | Deficit|
| Maros baru   | 3,431                  | 96                     | 35.8  | Surplus|
| Marusu       | 2,430                  | 102                    | 23.9  | Surplus|
| Moncongloe   | 3,407                  | 47                     | 72.9  | Surplus|
| Simbang      | 3,172                  | 113                    | 28.1  | Surplus|
| Tanralili    | 4,824                  | 127                    | 38.0  | Surplus|
| Tompu Bulu   | 2,220                  | 64                     | 34.8  | Surplus|
| Turikale     | 1,756                  | 213                    | 8.3   | Surplus|

4. Conclusion

The carrying capacity of residential land in the Maros Regency is still in a surplus. This means that there are still cultivated lands for social, economic, and physical activities of suburban communities in the next 20 years, especially for settlement development. This supports the direction and function of the region as one of the satellite cities in the Mamminasata area for the development of settlements in addressing the need for settlement land for the Mamminasata Metropolitan community, especially Maros Regency.
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