

Land Suitability of Settlements in West Palu District, Palu City

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Abstract. A settlement is an important requirement for humans. Increasing the number of residents has encouraged additional needs for residential land while the amount of land has not increased. It is necessary to analyze the suitability of residential land to create decent and safe settlements from disasters. This study analyzes the suitability of residential land in the West Palu District based on the criteria of terrain slope, distance to the road network, the distance of educational facilities, the distance of health facilities, distance of trade facilities, and disaster vulnerability. The results of this study obtained a percentage of the area for unsuitability class 28.84%, marginally suitable 18.44%, suitable 34.93%, and more suitable 17.79%.

Keywords: **settlement; spatial analysis; land suitability.**

1 Introduction

Economic growth and an increase in population will increase the need for land for residential areas. The increase in land requirements is not followed by the availability of land that has not been added. The limitations of this land have led to encouraging the construction of settlements on land that is not following its designation [1] such as in water catchment areas, disaster vulnerability areas, or other areas that do not meet the carrying capacity of the environment. Land use that is not following its use can cause land damage [2], it can even lead to natural disasters and environmental degradation [3].

Research in the fields of geography, architecture, sociology, and urban planning has started to focus on residential environments. Several studies have evaluated the suitability of nature for human settlements based on grid data in various regions [4, 5]. Other researchers have analyzed the livability of cities and the factors that affect various countries [6], [7]. Besides, some researchers assess the level of satisfaction associated with the settlement environment [8, 9]. The results of various studies provide a better understanding of the settlement environment in several ways. First, they provide an understanding of the connotations of settlements and their focus on different scales. Second, they provide an analytical framework and method for the suitability of residential land. Finally, provide evidence and guidance on various factors that influence settlement [10].

Palu Barat District is the second most populous sub-district in the city of Palu. The population in 2017 is 62,293 with a growth rate of 1.41 [11]. This population growth was followed by an increase in the need for settlements. Land suitability for settlements needs to be taken into account to create decent and safe settlements from disasters. This study aims to analyze land suitability of settlements in West Palu District, Palu City.

2 Method

The West Palu sub-district which is the object of this study consisted of 6 villages, namely the villages of Lere, Baru, Kamonji, Siranindi, Ujuna, and Balaroa with a total area of 8.28 km². Maps of this region can be seen in Fig. 1.

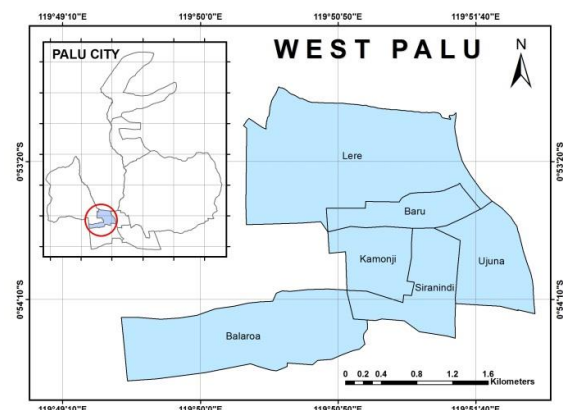


Fig. 1. Study area

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This research is quantitative with a spatial analysis method using a Global Information System (GIS) with the help of ArcGis 10.3 software. Analysis techniques are done by scoring and map overlay based on criteria. The settlement land suitability criteria used are terrain slope, distance to road network, distance of educational facilities, distance of health facilities, distance of trade facilities, and disaster vulnerability.

The data needed in this study are arranged based on predetermined criteria. The data used is secondary data obtained from relevant agencies and the Google Earth Pro application. Terrain Slope maps and Disaster Vulnerability Zone (DVZ) maps were obtained from the Central Sulawesi Provincial Office of Highways and Spatial Planning, a road network map of the Palu City Spatial Planning and Land Agency, the location of education, health and trade facilities obtained through the application of Google Earth Pro based on data from relevant agencies namely the Education and Culture Office of Palu City, Palu City Health Office, and the Trade and Industry Office of Palu City.

The criteria that have been compiled are then classified based on Disaster Vulnerability Zone (DVZ) Maps, Baja (2012), and SNI 03-1733-2004 concerning the procedures for planning residential environments in urban areas. Each criterion classified is scored as in Table 1.

Table 1. Criteria of settlement suitability

Criteria	Classification	Scoring
Terrain slope	> 15 %	1
	8 – 15 %	2
	< 8 %	3
Distance to road network	> 2000 m	1
	1000 – 2000 m	2
	< 1000 m	3
Distance of educational facilities	> 1000 m	1
	500 – 1000 m	2
	< 500 m	3
Distance of health facilities	> 3000 m	1
	1500 – 3000 m	2
	< 1500 m	3
Distance of trade facilities	> 2000 m	1
	1000 – 2000 m	2
	< 1000 m	3
Disaster vulnerability	DVZ IV	0
	DVZ III	1
	DVZ II	3
	DVZ I	5

The data obtained are then mapped and scaled according to Table 1. Scoring results map of all criteria is then overlaid and analyzed for the suitability of the land of the settlement.

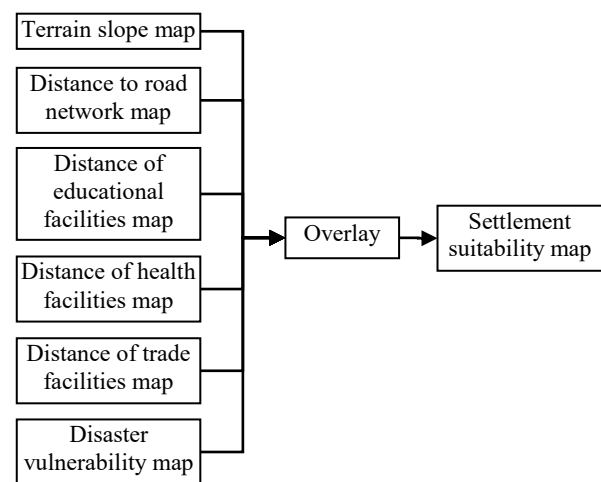


Fig. 2. Research flow diagram

3 Result and Discussion

The results of criterion analysis show that most of West Palu Subdistrict is 80.26% flat area (<8%), so if based on terrain slope this area is suitable for residential areas [12]. The whole area of West Palu has a distance with a road network of no more than 2000 m so that the level of accessibility is still good [13]. The availability of education, health, and trade facilities is still quite good where around 80% is still under the required achievement radius [12], even available health facilities still meet the entire West Palu region. Educational facilities that are still somewhat lacking due to the loss of several facilities in Balaroa Village due to the liquefaction disaster. The criteria for disaster vulnerability provide a limited area in the development of residential areas in West Palu, where the development zone (DVZ I) is only 29.53%, conditional zone (DVZ II) 37.28%, limited zone (DVZ III) 20.16%, and prohibited zone (DVZ IV) 13.03%.

Table 2. Result base on the criteria

Criteria	Classification	Area (m ²)	%
Terrain slope	> 15 %	420,395.39	5.08
	8 – 15 %	1,213,745.72	14.66
	< 8 %	6,645,857.60	80.26
Distance to road network	> 2000 m	-	-
	1000 – 2000 m	509,448.91	6.15
	< 1000 m	7,770,549.82	93.85
Distance of educational facilities	> 1000 m	1,662,315.21	20.08
	500 – 1000 m	1,111,490.08	13.42
	< 500 m	5,506,193.44	66.50
Distance of health facilities	> 3000 m	-	-
	1500 – 3000 m	995,437.25	12.02
	< 1500 m	7,284,561.36	87.98
Distance of trade facilities	> 2000 m	646,292.66	7.81
	1000 – 2000 m	2,110,481.07	25.49
	< 1000 m	5,523,225.13	66.71

Criteria	Classification	Area (m ²)	%
Disaster vulnerability	DVZ IV	1,078,883.47	13.03
	DVZ III	1,669,038.04	20.16
	DVZ II	3,086,829.22	37.28
	DVZ I	2,445,249.08	29.53

Based on the criteria maps that have been prepared, the process of determining the suitability of residential land in the West Palu District is done by overlaying or overlapping the arrangement of maps based on the criteria that have been made. The overlay process is done by calculating the scores on each criteria class map. The results of the calculations obtained show the highest to lowest value, the value obtained is classified into 4 classes, namely the class of settlement land suitability with criteria more suitable, suitable, marginally suitable, and unsuitable. Location classes with more suitable criteria show values with a high level of suitability for settlements while the location class unsuitable indicating a low level of suitability for settlements. The results of the analysis of land suitability of settlements in the West Palu District are shown in Fig. 2.

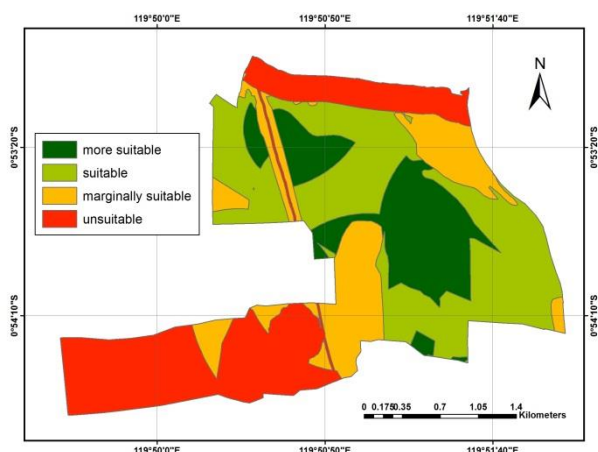


Fig. 2. Settlement suitability map

Fig. 2 illustrates that the area of West Palu which is suitable for settlements is mostly located in the center, while areas that are not suitable area in the north and west. The northern region is a coastal area prone to tsunamis and the western region is a hill where there is a liquefaction disaster and has been designated as a liquefaction prone area, besides that there are also western regions that have not been reached by education and trade facilities.

Table 3. Evaluation settlement suitability

Classification	Area (m ²)	%
More Suitable	1,473,338.06	17.79
Suitable	2,892,309.10	34.93
Marginally Suitable	1,526,741.72	18.44
Unsuitable	2,387,610.96	28.84

Table 3. shows that the total area suitable for settlements is 4,365,647.16 m² (52.72%), while the area of settlements in the area of West Palu in 2017 is 5.871,600

m² (70.91%) [14]. This shows that the West Palu area can no longer be developed as a residential area so further research is needed to find settlement area development outside the West Palu area.

4 Conclusion

The suitability of residential land in West Palu Subdistrict was analyzed spatially based on the slope criteria, distance with road networks, distance of educational facilities, distance of health facilities, distance of trade facilities, and disaster vulnerability. The results showed that the area of land suitability was divided into 4 classes, there are the unsuitability class had an area 2,387,610.96 m², the marginally suitable area is 1,526,741.72 m², the suitable area is 2,892,309.10 m², and the more suitable area is 1,473,338.06 m².

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