

Makassar Coastal Land Suitability Analysis for Aquaculture Purposes

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ABSTRACT

The coastal area is a place where land and sea meet therefore the region is an area of unique geological, ecological, and biological domains that are very important to many of life on land and in water, including humans. The coastal area is also unique in terms of the economy because this region provides a space for human activities that generate substantial economic benefits. One of the important coastal areas that are economically and ecological coastal areas is Makassar. This area is a coastal area that is characterized by the use of diverse and related to one another. In this region there are economic activities based on natural resources such as fisheries, housing, ports and marine tourism. The primary objective of this study is to analyze the suitability of the coastal area of Makassar in sustainability basis. Analysis of coastal land suitability using Geographic Information System (GIS) indicated that the coastal area of Makassar city can be utilized for various activities and purposes (residential, industrial estate, aquaculture, general harbor, coastal port area, coastal tourism area, floating net cages, seaweed cultivation, and conservation area). The aquaculture area included 1,759.3 ha of very suitable area, 5,853.2 ha suitable area, 8,55.2 ha conditional suitable area, and 3,792.7 ha not suitable area. Further studies are necessary to analyze specific aspects such as supporting capacity and other studies considered relevant for planning and management of coastal area of Makassar.

Keywords: Makassar, Coastal Land, Aquaculture, Suitability.

1. INTRODUCTION

The coastal area is a place where land and sea meet therefore the region is an area of unique geological, ecological, and biological domains that are very important to many of life on land and in water, including humans (Beatley et al, 1994). The coastal area is also unique in terms of the economy because this region provides a space for human activities that generate substantial economic benefits (Ring-Sain and Knecht, 1998). In addition, the coastal region is a mosaic of ecosystems and resources are very diverse, so the coast is a strategic area for economic conditions and social welfare and development of the country (Cincin-Sain and Knecht, 1998).

One of the important coastal areas that are economically and ecological coastal areas is Makassar. This area is a coastal area that is characterized by the use of diverse and related to one another. In this region there are economic activities based on natural resources such as fisheries, housing, ports and marine tourism. The primary objective of this study is to analyze the suitability of the coastal area of Makassar in sustainability basis.

Analysis of land suitability in coastal areas of Makassar directed to nine development of allotment ie (i) settlement (ii) industrial (iii) aquaculture (iv) public port, (v) harbor beach, (vi) coastal tourism (vii) net cage aquaculture floating, (viii) the cultivation of seaweed and (ix) conservation.

The analysis is based on the limiting factors for each allotment in terms of biophysical aspects. This analysis is intended to assess the feasibility or suitability of land for development of the above nine allotments. Land suitability analysis results are grouped into four categories / classes, namely (i) is suitable (S1), (ii) appropriate (S2), (iii) the corresponding conditional (S3), and (iv) does not match (N). Based on spatial analysis using geographic information system (GIS) by means of overlay land suitability results obtained for each of the following zoning.

This study aims to (1) analyze the suitability of land for the coastal areas of Makassar, residential areas, public ports, aquaculture, tourism beaches, conservation areas, seaweed farming, aquaculture net cages, coastal fishing ports and industrial areas, (2) give consideration in the planning and direction of the development of coastal zone management Makassar based on the analysis of land suitability

2. METHODS

A. Place and Time of Research

Ecologically, this research area included the river bank area of Jeneberang and Tallo which are located in upstream and related to coastal area of Makassar, South Sulawesi, Indonesia. Research location lies at 119°24'17'38" East and 5°8'6'9" South, bordering with Pangkep Regency in North, Maros in East, Gowa in South and Makassar Strait in West. This research was conducted during June to December 2007.

B. Data Collection and Analysis

The required data in this study were primary and secondary data. Primary data were obtained by direct observation in the field/research location, discussion, direct interview with experts and stakeholders and questionnaire by stakeholder in research location. Secondary data were obtained by exploring various sources such research publications and scientific documents in related institutions.

In order to know the existing conditions of space utilization for various purposes, spatial analysis with overlay technique using geographic information system was used. Coastal land use model referred to spatial policies that divide land use into two main area: cultivation area and protection area. The cultivation area consists of agricultural area, production forest and people forest, fishery area, residence area, mining area, tourism area, and industrial area.

Criteria of land suitability for residence, industrial, aquaculture, general port, coastal fishery port and coastal tourism, seaweed cultivation, and floating pond cultivation areas are determined according to existing matrices: land suitability matrix for residential area (Sjafi'I, 2000 and Sugiarti 2000), land suitability matrix for general port region (Kramadibrata, 1985), land suitability matrix for coastal tourism region (Bakosurtanal, 1996 and Dahyar, 1999), land suitability matrix for conservation area (Soedharma et al., 1992), land suitability matrix for seaweed cultivation area (Wahyuningrum, 2001), land suitability matrix for floating pond (Tionsongrasmee, 1986), land suitability land for coastal fishery port area (Masrul, 2002), land suitability matrix for industrial area.

3. RESULTS AND DISCUSSION

A. Land Suitability for Cultivation Pond Area

The parameters used in analyzing the suitability of land for aquaculture region includes 7 parameters, namely (i) salinity waters, (ii) soil type, (iii) the distance from the river (iv) the distance from the road, (v) the distance from the coast, (vi) landuse, and (vii) the slope of the land.

Table 1: The extent and location of land suitability for cultivation pond area

Sub-District	Not suitable (Ha)	Conditional suitable (Ha)	Suitable (Ha)	Very suitable (Ha)	TOTAL (Ha)
Biringkanaya	1.995,9	17,5	1.836,7	99,2	3.949,3
Mariso	0,2	198,2	-	87,7	286,1
Tallo	82,8	207,4	270,3	271,9	832,4
Tamalanrea	618,8	132,5	2.230,8	761,5	3.743,5
Tamalate	761,8	19,6	1.455,7	478,3	2.715,3
Ujungpandang	31,2	225,6	16,1	15,4	288,3
Ujungtanah	114,6	54,5	37,6	45,2	252,0
Waio	187,4		6,1		193,5
Total	3.792,7	855,2	5.853,2	1.759,3	12.260,4

Based on the results of the spatial analysis conducted on eight coastal districts in the city of Makassar turned out very appropriate category area of 1759.3 ha, covering an area of 5853.2 ha corresponding category and the category is not appropriate area of 3792.7 ha. For more details, extent and location of land suitability for aquaculture areas can be seen in Table 1.

In the course of development of environmentally sustainable farms and nuanced travel remains a priority Makassar local government and its efforts to meet the development needs of Makassar oriented development of safe and sustainable with a target on 2 aspects: production and tourist aspects of farm production target aspect is to keep maintain and develop production ponds that have been achieved so far, while the target aspect pond tour is to provide added value to the existing farm land to be double, ie in addition to the means of production as well as a tourist attraction which is a means of expression that reflects at once perpetuate pride, potential and uniqueness of the mangrove forests of Makassar which is a green belt encircling the city of Makassar which has functions of physical, ecological, social and economic sustainability assurance is a mainstay of the city.

B. Land Suitability for Floating Net Cages

The parameters used in analyzing specific land for breeding fish in floating net cages, includes 9 parameters: the depth of the water from the bottom of the net, water temperature, salinity, current velocity, high tides, water pH, dissolved oxygen, nitrate and phosphate. Based on the results of the spatial analysis conducted on these parameters is known that the land is very suitable to be around the coastal waters of Makassar.

Total area waters termasuk very appropriate category is 699.9 ha (Table 2). Waters with this class is characterized by the following characteristics: has a water depth of the base mesh > 10 meters, water temperature 30 - 32°C, salinity waters > 30 per mil, flow velocity 10-13 cm / sec, high tides > 1 m, pH waters 8, dissolved oxygen > 6 ppt, nitrate levels < 0.1 mg / liter, and phosphate levels < 0.1 mg / liter.

Table 2: The extent of land suitability for floating net cages in study location

Land Category	Area
Very suitable	699,9
Suitable	1.261,4
Conditional suitable	-
Not suitable	108.158,2
TOTAL	110.119,6

Land included in the appropriate category, the total area is 1261.4 km² waters. waters in accordance with the class characterized by the following characteristics: has a water depth of basic nets 4-10 meters, water temperature 28 - 30°C, salinity waters of 20-30 per mil, flow velocity from 3.8 to 10 cm / sec, high tidal 0, 5-1 m, water PH 6-9, dissolved oxygen 3-5 ppt, nitrate levels of 0.1 to 0.9 mg / liter, and phosphate levels 0.1 to 0.9 mg / liter.

Land included in categories according to the conditional, the total area of the waters is 0 km². waters in accordance with the conditional class characterized by the following characteristics: has a water depth of 4 feet from the bottom of the net, the water temperature of 28°C, 20 per mil salinity waters, flow velocity 3.8 cm / sec, 0.5 m high tides, water pH < 6 and > 9, dissolved oxygen < 3 ppt, nitrate levels > 0.9 mg / liter, and phosphate levels > 0.9 mg / liter..

C. Land Suitability for Seaweed Cultivation

The parameters used to analyze the suitability of seaweed farming land includes 7 parameters, namely: the depth of the waters, the waters of the base material, water temperature, salinity, pH waters, current speed, wave height. Based on the results of spatial analysis (Table 3.) Were performed on these parameters, it is known that the land is suitable is 324.3 km², is very appropriate class premises waters are characterized by the following characteristics: has a water depth of 1.0 to 2.5 m, seabed material is sand, coral and sea grass, water temperature 24 - 29°C, salinity waters of 32-34 per mil, water pH 7.5 to 8, the flow velocity 20-30 cm / sec, and the wave height 0-15 cm.

Land in accordance with the category of the total water area is 1639.3 km², with the waters of this class are characterized by the following characteristics: has a water depth of 2,5 - 2,7 m, water base material is sand, coral and seaweed, water temperature 29 - 30°C, salinity waters of 30-32 per mil, water pH 7 to 7.5 and 8 to 8.5, the flow velocity 30-40 cm / sec, and the wave height 15-25 cm.

For the category corresponding conditional total water area is 108 049 km², with the waters of this class are characterized by the following characteristics: has a water depth of 2.7 to 10 m, the base material is rocky waters, water temperature 30 - 31°C, salinity waters of 28-30 per mil, and wave height 25-35 cm.

Table 3: The extent of land suitability for seaweed cultivation in study location.

Land Category	Area (Ha)
Very suitable	324,3
Suitable	1.639,3
Conditional suitable	108.049,0
Not suitable	106,9
Total	110.119,6

Based on a compilation of maps between floating net cage aquaculture and seaweed farming in coastal waters of Makassar, it can be seen that the area of cultivation of floating net of 108,623.6 ha and extensive farming seaweed for 1,496 ha (Table 4).

Table 4. The area of floating net cages and seaweed cultivation in Makassar coastal area

No	Type of Culture	Land Area (Ha)
1.	Floating Cage	108.623,6
2.	Sea weed	1.496,0
	Total	110.119,6

CONCLUSION

Analysis of coastal land suitability using Geographic Information System (GIS) indicated that the coastal area of Makassar city can be utilized for various activities and purposes (residential, industrial estate, aquaculture, general harbor, coastal port area, coastal tourism area, floating net cages, seaweed cultivation, and conservation area). The aquaculture area included 1,759.3 ha of very suitable area, 5,853.2 ha suitable area, 8,55.2 ha conditional suitable area, and 3,792.7 ha not suitable area. Further studies are necessary to analyze specific aspects such as supporting capacity and other studies considered relevant for planning and management of coastal area of Makassar.

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