Land Cover Decreasing To Water Sources From Bua-Bua And Parappa Rivers In Selayar Island Regency, South Sulawesi

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Abstract: Water playing important roles in human activities. The change of land use or land cover and weather can caused the change at human water source condition. This fact has strong related in the availability of water. The main problem availability of water in number, quality and its distribution influenced by dynamics of land cover and people activities in Bua-bua and Parappa rivers basin. Bua-bua and Parappa is the important rivers in Selayar Island Regency, South Sulawesi. All of the people activities depend their life in water from the rivers. The average of monthly water change very influenced by rainfall period. Based on Maracov analysis, projection of Bua-bua land cover in 2023, the mangrove secondary forest decreasing about 10,52 hectare and increasing grasslands about 122,46 hectare, respectively. Increasing significantly for urban about 1570,51 hectare.

Keywords: land cover, water, Selayar, river, rainfall

INTRODUCTION

Land cover and water stock in nature has a strong related one to another. The vegetation were covered the land kept much of water inside. Water playing important role in human life. This article were investigated whether the land cover affect the water source and their impact to human life. It will be adapted gradually in time depending on the future trends of the land use scenarios. Water need is the one important factor in everywhere including Selayar island because its vital for agriculture, industry, human and cattle consumption. The Selayar island or *Tanadoang* is a regency of Indonesia in South Sulawesi province that covers the Selayar island, which lie to the south of Sulawesi. Selayar is the one beautiful island in the end of Sulawesi island. The Selayar strait separate the regency from another. Actually, Benteng, a capital of Selayar in 6,54°South and 121,25°East. Total area of the island is 10.505,69 km^2. Bua-bua and Parappa is two important rivers in Selayar. They both has a responsibility as the source of water supply for people in the island. Population increasing day by day in Selayar caused lost of land cover and water crisis especially for drinking water. Land cover and weather can cause change of water quality. Main problem in Selayar island is availiability of drinking water limited in number, quality and its distribution, Actually, drinking water for people in Benteng was managed by National Company of Drinking Water Area (PDAM). Total amount service by PDAM as much 1.954 unit of house extension, office and industry (Anonim, 1988) [1].

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Commonly climate change has responsibility for change the quality of water. The rainfall period and land cover influence the width of Bua-bua and Parappa rivers basin. The annual mean temperature increase 0.72 - 3.92°C accompanied with the degradation of precipitation until 2 - 3%. The significant factor for planning and development of Bua-bua and Parappa river basin depend on drainage, soil, land use/land cover and available water resources.

OBJECTIVES

The objectives of this research is to study impact land cover decreasing and predict potential water source based on land cover in Bua-bua and Parappa river basin. We were used meteorology variable including rainfall data from three local weather station. The study area mainly located in Bua-bua and Parappa rivers in Selayar island.

METHODOLOGY

1. Data Collecting Methods

The research was conducted in November 2012 until December 2013. We were used primary and secondary data. Secondary data used the amount of rainfall from year 2004 - 2013; evapotranspiration data from year 2004 - 2013; map of land cover start from year 2000, 2003, 2006, 2009, 2011, 2013; local resident data from year 2009 - 2013; geology data, water use data by people in Benteng City from 2009 - 2013. Data was processed using Maracov Chain Cellular Automata methods for the projection of land cover 2023. We was analysed the data of rainfall year projection 2023 obtained from Global Climate Method (GCM CSIRO-MK 3.5) with the elementary resolution horizontal in 200 km and 14 km in horizontal projection.

2. Data Analysis

2.1. Hydrology Analysis

To calculate the rainfall, we was used Thiessen methods (Deutsch and Busby, 2000) [4]. The rainfall measurement data comes from three weather station i.e: Benteng, Matalatang and Bontomanai.

2.2.The Change of Land Cover Analysis

We used the map from Citra Satellite analysis LANDSAT 7 ETM+ year 2009 – 2013. The projection of land cover with Maracov Chain Cellular Automata methods. The result of analysis as the input of total C value (*run-off* coefficient) (Fowler, Blenkinsop and Tebaldi, 2007) [7].

RESULT AND DISCUSSION

1. Availability of Potential Water Based On the Condition of Land Cover

1.1. Rainfall Analysis

Every area one to another different especially on soil type and rainfall. Selayar island contain soil texture sandy and loamy. The soil type affect the water absorbsion on the soil. Rainfall measurement analysis in Bua-bua and Parappa rivers basin based data in one decade from three station (Table 1).

Table 1. *The Rainfall Measurement Analysis in Three Weather Station*

Rainfall Measurement	Width of rivers basin Bua-Bua	Width of rivers basin Parappa	Thiessen coefficient Bua-bua	Thiessen coefficient Parappa
Benteng	947,08	1770,00	0,48046	0,97660
Matalatang	-	2,90	-	0,00160
Bontomanai	1024,10	39,50	0,51954	0,02180
Total area	**1971,18**	**1812,40**	**1.00000**	**1.00000**

Based on Tabel 1, Thiessen coefficient of total area three weather station show that number of Bua-bua and Parappa rivers basin was similar, but they are differ in width. Parappa rivers basin more widely than Bua-bua. Its assumed that more sedimentation in this rivers. Shampa and Pramanik (2012) [13] state commonly the rivers especially rivers of southwestern region in Bangladesh are characterized by active deposition of sediment causing significant reduction in their drainage capacity. The run-off on hydrology cycle affect form and composition of rivers basin.

1.2. Monthly Rainfall Prediction

The rainfall prediction result for year 2016, 2019, 2021 and 2023 from correlate between actually data 2004 to 2013 and model data CSIRO MK3.5 (Fig 1). We were assumed that two rivers has a good physical condition. Pawitan (2002) [11] found that the coefficient number of surface stream meaning is the one important indicator for physical condition a rivers basin and land cover situation. As show in Fig. 1, we predict that water need for people in island will enough for few years ahead.

	Jan	Feb	Mar	Apr	Mei	Jun	Jul	Ags	Sep	Okt	Nov	Des
Tahun 2013	21.68	11.33	10.75	20.87	13.19	43.64	22.29	15.00	-	5.50	15.55	21.00
Tahun 2016	14.13	18.24	13.90	16.61	21.50	24.33	11.00	15.74	4.02	16.43	24.46	21.69
Tahun 2019	30.43	18.79	17.78	18.70	16.49	22.35	14.09	13.03	6.44	22.93	14.68	22.28
Tahun 2021	17.09	17.25	12.95	17.19	18.80	20.14	10.04	12.95	3.78	21.12	19.60	23.27
Tahun 2023	18.39	17.26	14.03	16.14	18.18	16.38	9.08	10.84	4.43	16.98	18.74	24.27

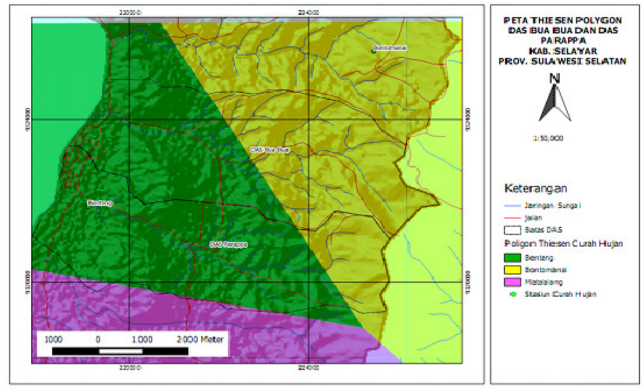

Fig 1. *Rainfall Montly Prediction From Benteng Weather Station year 2016,2019,2021 and 2023.*

2.The Change of Land Cover

2.1. Land Cover Analysis

The land cover (closing farm) from secondary forest mangrove in 2000 and 2013 was similar in two rivers basin. The explain of two place: in 2003 secondary forest about 728,52 hectare in Bua-bua and 591.10 hectare. In 2000 to 2013, the local residence (urban) increasing faster with presence of weeds (grassland) is 58,21 to be 108,70 and 751,23 to be 986,26, respectively . The local residence was spread and placed in the mountain. Commonly this area easy to find. No significant changes in water bodies (Table 2).

Table 2. *Change of Land Cover in Bua-bua and Parappa River Basin in 2000 and 2013*

Closing Farm	Year 2000 Bua-bua	Year 2000 Parappa	Year 2013 Bua-bua	Year 2013 Parappa	Closing Farm Reduce Bua-bua	Closing Farm Reduce Parappa
Secondary Forest Mangrove		42,13		42,13	0,00	0,00
Secondary Forest	728,52	591,10			-782,52	-591,10
Local Residence	56,21	73,04	100,45	108,70	44,24	35,67
Plantation		189,73		189,73	0,00	0,00
Dry Land Farming Mixed Weeds	435,22	497,18	422,96	480,65	-12,26	-16,54
Weeds	751,23	414,30	1447,77	986,26	696,54	571,97
Water bodies		4,93		4,93	0,00	0,00
Total (hectare)	**1971,18**	**1812,40**	**1971,18**	**1812,40**		

Based on result on Table 2, we assumed the number of local residence (urban) increasing in two area rivers basin. The increasing demand of living place caused development of remotes area.

Table 3. *Projection of Land Cover in Bua-bua and Parappa River Basin in 2023 based on Regression and Maracov Analysis.*

Land cover	Projection of land cover in 2023	
	Regression analysis	Maracov analysis
Bua-bua		
Mangrove secondary forest	42,13	10,52
Secondary forest	0,00	0,00
Urban	165,77	1570,61
Plantation	169,73	47,70
Dry land farming mixed grass	454,19	59,90
Grassland	955,66	122,46
Water bodies	4,93	1,21
Total area (hectare)	**1.812,40**	**1.812,40**
Parappa		
Secondary forest	0,00	0,00
Urban	171,23	624,49
Plantation	0,00	0,00
Dry land farming mixed grass	403,34	418,91
Grassland	1.396,61	927,78
Total area (hectare)	**1.971,18**	**1.971,18**

Based on Maracov analysis in 2023, the urban will increasing higher in Bua-bua than Parappa. In contrast, urban in Parappa more low. It assumed that natural source more rich in Bua-bua than Parappa. Kerr (2007) [9] state that urban will develop faster based on people living need. Rivers basin promises good living especially fishing catchment. Its the suitable place for higher biodiversity of fish. Mangrove habitat will keep the natural source for urban.

CONCLUSION

Based on Maracov analysis, projection of Bua-bua land cover in 2023, the mangrove secondary forest decreasing about 10,52 hectare and increasing grasslands about 122,46 hectare, respectively. Increasing significantly for urban about 1570,51 hectare.

REFERENCES

[1] Anonymous, (1998). Modul Perhitungan Kebutuhan Air Bersih, Departemen Pekerjaan Umum, Dirjen Cipta Karya, Jakarta (in Indonesian).

[2] Anonymous (2011). Selayar Island Regency. http://wikipedia.org./ (access date March 12, 2014).

[3] Anonim (2014). http://www.soilscience.org.au/events/indonesia/ (access date March 12, 2014).

[4] Deutsch, G. W. and L. A. Busby (2000). Community-Basic Water Quality Monitoring: from Data Collection to Sustainable Management of Water Resources. Land and Water Development Division FAO Rome, Rome.

[5] Droogers, P., W.G.M. Bastiaanssen, M.Beyazgul, Y.Kayam, G.W. Kite, H. And Murray-Rust (2000). Distributed Agro-hydrological Modelling of an Irrigation System in Western Turkey, Agricultural Water Management Vol.43(2) : 183-202.

[6] Flerchinger, G.N., R.M. Aiken, K.W. Rojas, and L.R. Ahuja (2000). Development of the Root Zone Water Quality Model (RZWQM) for Over-Winter Conditions, Transaction of the ASAE Vol. 43(1) : 59-68.

[7] Fowler H.J., S. Blenkinsop, dan C. Tebaldi (2007). Review Linking Climate Change Modelling to Impact Studies :Recent Advances in Downscaling Techniques for Hydrological Modelling. International Journal of Climatology (27), 1547-1578.

[8] IPCC (2007). The Physical Sciences Basic. Contribution of Working Group II to the Fouth Assessment Report on the Intergovernmental Panel on Climate Change. Cambrigde University Press, Cambrigde.

[9] Kerr, J . (2007). Watershed Management: Lessons from Common Property Theory. International Journal of the Commons. Vol 1 No. 1 October 2007, pp. 89-109 Publisher: Igitur, Utrecht Publishing & Archiving Services for IASC URL: http://www.thecommonsjournal.org/index.php/ijc/article/view/8

[10] Kiersch B. (2000). Land Use Impact on Water Resources: A Literature Review. Land and Water Development Division FAO Rome, Rome.

[11] Pawitan, H. (2002). Flood Hydrology and an Integrated Approach to Remedy the Jakarta Floods. Paper presented at International conference on Urban Hydrology for the 21st Century, the Southeast Asia and Pasific (HTC Kuala Lumpur) of the Department of Irrigation and Drainage Malaysia in Collaboration with UNESCO and IAHSO, 14-18 October 2002. Kuala Lumpur, Malaysia.

[12] Purwanto E. (1999). Erosion, Sediment Delivery and Soil Conservation in an Upland Agricultural Catchment in West Java, Indonesia. A hydrological approach in a socio-economic context. PhD thesis, Vrije Universiteit, Amsterdam.

[13] Shampa, Md and Pramanik, I.M (2012). Tidal River Management (TRM) for Selected Coastal Area of Bangladesh to Mitigate Drainage Congestion. International Journal of Science and Technology Research Vol.1(5):1-6 (access date 9 December 2014).

[14] Tolika K., P. Maheras, M. Vafiadis, H.A. Flocas, dan A.A. Papadimitriou, (2007). Simulation of seasonal precipitation and raindays over Greece : a statistical downscaling technique based on artificial neural networks (ANNs)". Int. J. Climatol. (27), 861–881.

[15] Tripathi V., Srinivas, dan R. S. Nanjundiah, (2006). Downscaling of precipitation for climate change scenarios : a support vector machine approach. Journal of Hydrology (330), 621-640.