

Coastal Vulnerability Index Of Segeri, Pangkajene And Islands Regency

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Abstract

The coastal area of Segeri sub-district, Pangkajene and Kepulauan Regency is a zone that is prone to natural phenomena of sea level rise. The impact received due to this phenomenon is something that needs to be studied to identify the level of coastal vulnerability and project changes in coastal vulnerability in the future. This study aims to calculate the coastal vulnerability index and project changes in vulnerability in the future due to changes in factors that affect coastal vulnerability. This research was conducted in August – December 2022 in Segeri District, namely in, Bone, Bawasalo and Bonto Matene Villages. The methods or approaches used in analyzing the data are: 1) analysis of coastal ecosystems and resources, 2) analysis of the physical and social characteristics of the community, 3) analysis of the vulnerability of the coastal environment. The Vulnerability Scoping Diagram (VSD) models places exposure, sensitivity and adaptive capacity as dimensions of vulnerability. The components of the exposure dimension consist of coastal dynamics, natural disturbances and population. The components of the sensitivity dimension are the characteristics of the coast, land use, and population settlements. The dimensions of adaptability include coastal habitats and marine conservation areas. Based on the scores of each parameter on the three dimensions, the coastal vulnerability index (IKP) in the three locations is in the range of IKP values of 7.96 - 9.59 which is included in the category of moderate vulnerability. Factors that are very influential on the IKP are the dimensions of sensitivity including: erosion, waves and tides caused by oceanographic factors so that if adaptation and mitigation efforts are not carried out, it is likely that in the next 5-10 years, the level of vulnerability can become high and even very high. Adaptation efforts that



can be done are strengthening the coastal border area, planting and expanding mangrove trees in the coastal area of Segeri.

Keywords: Coastal Vulnerability index, Segeri

INTRODUCTION

Coastal area is a weak area or characteristic prone to by factors environment like variability climate, change climate and rise surface sea , risk earthquake earth , tsunamis and events volcanoes, and ecosystems fragile (Pratt et al. 2004). Beach is a dynamic zone Because is the zone of contact and interaction between three very complicated phase namely: sea, land, and air. Beach zone always have a continuous adjustment process continuously going to balance experience to impact from influence both external and internal in nature experience nor natural. Factor experience among them is waves, currents, action wind, input from river, conditions plant beach as well as activity tectonic nor volcanic. Non- natural factors like activity mix hand human / artificial in matter this , is utilization area beach as something area such as : fisheries, industry, ports, tourism, agriculture / forestry, mining and settlements (Kasmi et al., 2017).

Mainland Fresh stretched from North to South along 5 km. Height from surface sea between 0 – 2 meters (Hafiidh et al., 2018). Problems in coastal areas are very sensitive and vulnerable to phenomenon natural change climate and global warming . Impact received in coastal areas consequence phenomenon This is necessary thing studied for identify in a manner spatial level vulnerability beach and project change vulnerability beach in the future come caused change influencing factors beach (Alham et al., 2022)vulnerability

Study aim for count index vulnerability beach and project change vulnerability in the future come caused change influencing factors vulnerability beach. Based on matter the expected the information obtained can used as input for government in planning policy For developing adaptation and mitigation strategies disaster coast in the district Pangkep



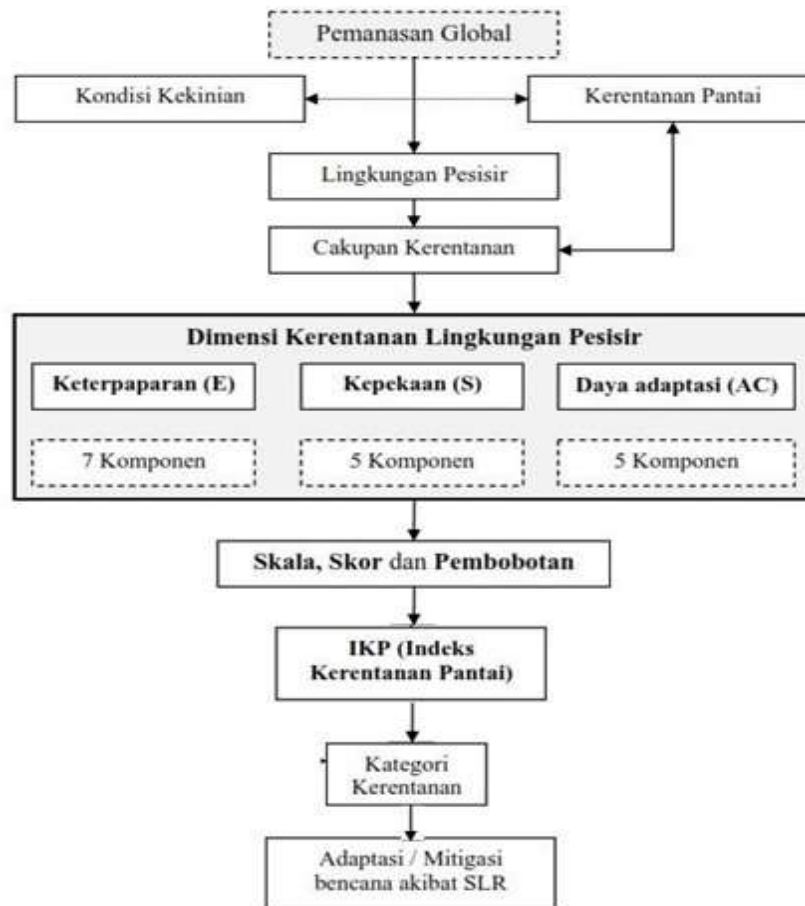


Figure 1. Framework Conceptual Study Index Beach Vulnerability

METHOD

Study This will be held in May – July 2022 in three village within the district area Fresh Regency Pangkep , namely : Bone, Bawasalo and Bonto villages matene . Research Locations presented in the figure 2.

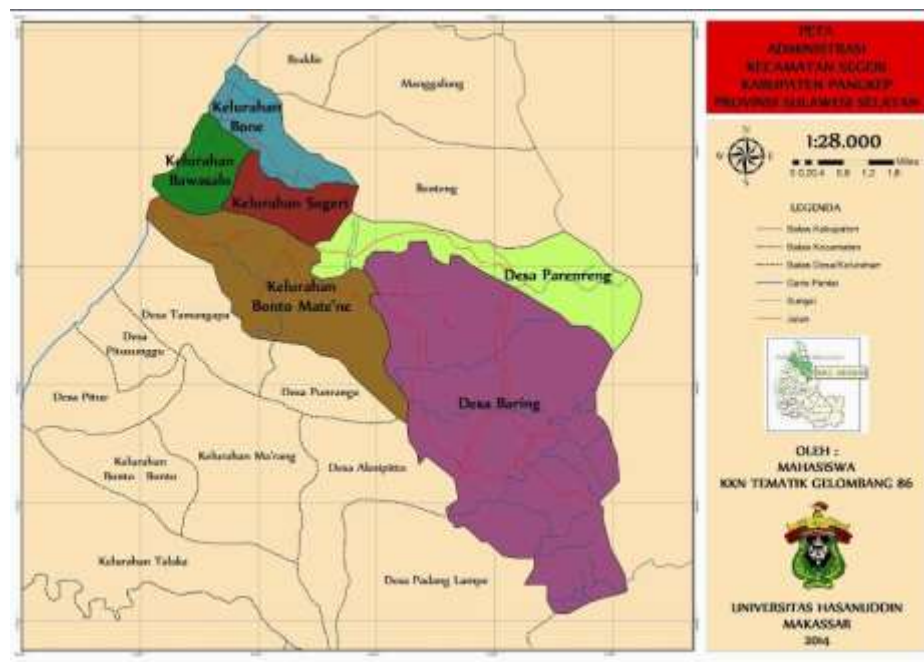


Figure 2. Research Locations (Source: RBI Map Scale 1: 50,000 Sheets 2011 - 33 Segeri Bakosurtanal)

Materials and equipment

On research This is the material used are :

- Satellite Image Data *google earth* Segeri Beach 2022.
- RBI map sheet year 2021 from Bakosurtanal with scale 1:50,000.
- Related data with component dimensions' vulnerability beach include: characteristics beach and dynamics coast (typology, increase advance sea relative, tidal range, high wave, elevation, slope, type rocks, and shoreline changes).
- Equipment used is *Global Positioning System* (GPS), 1 set of computer, *MS-office* and *google office software*, *water pass* 1 set, and a digital camera .

Stages Study

Stages study vulnerability environment coast started with data collection . Method or approach used in analyzing data are: 1) analysis ecosystem and resources coast, 2) analysis characteristics physical and social society, 3) analysis vulnerability environment beach. Results obtained from analysis This is information related with dynamics vulnerability environment coast .

something mark score. Doukakis (2005) and Rao *et al.* (2008) uses 5 levels (1-5). For interpret every mark score above, Doukakis (2005) and Rao *et al.* (2008) provides definition from every score. Where is the value middle as mark medium, value lowest and highest as limit bottom and limit top. Given weighting use method matrix comparison Because considered most suitable in describe role or significance from each vulnerability parameter beach (Villa and McLeod 2002).

Exposure (*exposure*)

Dimensions exposure consists of __ from three component with parameters including : 1) dynamics coast (Triharto, 2019), that is *sea level rise* (SR), erosion (ER), tides (PS), waves (GL), 2) disturbances nature ; tsunami events (TS) for 100 years last , and 3) residents ; growth (PD) and density resident (PD). System scaling and scoring parameter ratings are presented in Table 1.

Table 1. System scaling and scoring of vulnerability parameters dimensions' exposure

Score E	1	2	3	4	5	Source
SR mm/ yr	≤ 4.99	5 – 9.99	10 – 14.99	15 – 25	>25	DKP (2008)
ER m/ yr	>2.0	1.0 – 2.0	-1.0 – 1.0	1.0 – (-2.0)	<-2.0	Gornitz <i>et al.</i> (1992)
PS m	<0.50	0.51 – 1.0	1.1 – 2.0	2.1 – 4.0	>4	DKP (2008)
GL m	<0.50	0.51 - 1	1.1 - 1.5	1.51 – 2	>2	DKP (2008)
TS	0	1	2 – 3	4 – 10	>10	SOPAC (2005)
PD % / yr	≤ 0.5	0.51 – 1.0	1.1 – 1.5	1.51 – 2.0	$\geq 2,1$	SOPAC (2005)
KP jw / ha	<75	76 – 150	151–200	201–400	>400	BSN (2004)

Sensitivity (*Sensitivity*)

Dimensions sensitivity consists of from three components namely: 1) characteristics beach, that is elevation (EL), slope (SL), typology (TP); 2) usage land (PL); and 3) settlements population (PP). System scaling and scoring parameter ratings are presented in Table 2.

Table 2. System scaling and scoring of vulnerability parameters dimensions' sensitivity

S	1	2	3	4	5	Source
EL m	>5	3.1 – 5	2,1 – 3	1,1 – 2	0 – 1	Tahir (2010)
SL %	>40	25.1 – 40	15.1 – 25	9 – 15	0 – 8	Tahir (2010)
TP	Vegetative _	rocky	Pebbled	Beach sandy	Beach Precipitate Results	DKP (2009)

PL	Land open / not utilized	Cultivation n sea	Cultivation agriculture	Farm	settlement	DKP (2009)
pp	On site height > 5 m	At a height of 2-5 m	Behind border beach	Around beach	above _ waters	Tahir (2010)

Power Adaptation (*Adaptive Capacity*)

Dimensions Power adaptation (*adaptive capacity*) consists from two component namely : 1) coastal habitat (HP), which includes ecosystem reef coral (TK), meadow seagrass (LM) and mangrove (MR), and 2) areas conservation (KL). System scaling and scoring parameter ratings are presented in Table 3.

Table 3. System scaling and scoring of vulnerability parameters dimensions Power adaptive (*adaptive capacity*)

air conditioning	1	2	3	4	5	Source
HP (times)	$\leq$ mainland beach	2 x > mainland beach	3 x > mainland beach	4 x > mainland beach	> 5 times mainland beach	Tahir (2010)
MR (phn /Ha)	0 – 500	501–1,000	1001-1250	1251-1500	>1,500	KLH (2004)
Kindergarten (%)	0 – 20	21–40	41-60	61–80	81–100	KLH (2004)
LM (%)	<10	10 – 29.9	30 – 59.9	60 – 79.9	>80	KLH (2004)
KL (%)	0	1 – 10	11 – 25	26–40	>50	KLH (2004)

Data Collection

Collected data among others a) geophysical data , such as elevation and slope mainland coast , typology and morphology coast , coastline length and oceanographic data (rise advance sea , tides , waves sea), b) bioecological data , eg ecosystem reef coral , mangrove ecosystem , ecosystem seagrass , vegetation beaches and resources other . c) conditions social economy such as ; population , utilization resource coast , utilization land , protection and conservation programs ecosystem coast (Hafiidh et al., 2018).

Data Analysis

Analysis done is ; 1) analysis ecosystem coast , 2) analysis characteristics geophysics , 3) analysis characteristics social, and 4) analysis index vulnerability beach . Analysis ecosystem coast covers ecosystem reef coral covers area (habitat distribution) and percentage cover coral live . The mangrove ecosystem includes habitat distribution and density tree . Ecosystem paddock however covers distribution and quality cover . Geophysical Parameters analyzed coast _ is marbles coast (*coastal slope*), altitude or elevation beach from surface sea (asl), and typology / type beach , fast erosion coast , and oceanographic parameters like waves and tides . The social parameters analyzed is ; rate growth and density population and distribution settlement resident .

Index Beach Vulnerability

Draft referred vulnerability is results formulation index vulnerability from Tahir (2010) where vulnerability is function *overlays* from exposure, sensitivity, and capacity adaptive (adaptive *capacity*), the next expressed equality mathematics as following :

$$V = (ExS) / AC \quad \text{..... (1)}$$

With describes the parameters of the vulnerability as adopted _ from Polsky *et al* . (2007), then dimensions E, S and AC can be formulated as following :

$$IE = 0.41 (SR \times ER) + 0.21 GL + 0.14 PS + 0.14 TS + 0.10 (PD \times KD) \quad \text{..... (2)}$$

With the same approach, then dimension Scan written down to be:

$$IS = 0.43 EL + 0.21 TP + 0.14 SL + 0.11 EL + 0.11 PP \quad \text{..... (3)}$$

As for the dimensions of the AC , you can written down as following :

$$IAC = 0.40HP + 0.20 TK + 0.20 MR + 0.11 LM + 0.11 KL \quad \text{..... (4)}$$

With substitute equations (2), (3), and (4) to in equation (1) is obtained equality index vulnerability beach (IKP) as following :

$$IKP = IE \times IS / IAC \quad \text{..... (5)}$$

Based on mark scoring from every parameter has identified through approach *Vulnerability Scoping Diagrams* before , that is scale mark scoring each parameter is between 1 to 5, with substitute values maximum and minimum in equation (5), is obtained the minimum value of IKP is 0.20 and value maximum by 76. With use mark the maximum and minimum are, scale evaluation level vulnerability beach shared into 4 categories (Doukakis 2005) as following:

0.20 - 6.04: vulnerability low (low)

6.05 - 18, 18: vulnerability medium (*moderate*)

18,19 - 40, 48: vulnerability high (*high*)

40.49 - 76.00: Very high vulnerability (*very high*)

RESULTS AND DISCUSSION

Index Beach Vulnerability of value substituted parameter scores to in equality index per dimension in equations (2), (3) and (4) for get mark index vulnerability beach (IKP). From transformation value parameters value parameters scores and results the calculation on equation (5) shows that range mark index vulnerability in Segeri Beach is in the range of 6.55 - 8.85 entered in category vulnerability medium (moderate).

Based on dimensions exposure (exposure), the exposure index is 2.38 where dynamics influential coast is erosion, tides wave is at an incoming value of 3 category medium, meanwhile disturbance nature; tsunami events over 100 years final the score is 1 (low), Growth and density population at score 1 (Category low). Dimensions sensitivity (*sensitivity*), the sensitivity index ranges from 4.49 - 4.89 entered category currently Where characteristics the beach covers elevation , slope, typology beach is on a score of 4 - 5. who entered category level sensitivity high . Whereas use land score 5 ie settlements and activities cultivation waters, settlements resident is behind border beach and some large at a height of 1 - 3 meters. Power score adaptive show mark index low due to coastal habitat covers reef corals, seagrasses and mangroves are on the score low in matter cover coral, density however, amount and type mangrove trees. Whereas area conservation the score low (no There is area conservation). Index value adaptive capacity 1.20 - 1.70 incoming category low (Hasibuan, 2019; Utina & others, 2015).

Index vulnerability beach (IKP) in the third location is in the range IKP value of 6.55 - 8.55 which is included in the category vulnerability moderate (*moderate*). Factors that greatly influence the IKP are dimensions' sensitivity includes: erosion, waves and tides are caused by factors oceanography so that If No do effort adaptation and mitigation so probably 5 - 10 years in the future, the IKP category is moderate Can become a high IKP (High) even very high (Very high). Effort possible adaptation done is strengthen wall border coast, planting and expansion mangrove trees in the area coast beach fresh. As for value index vulnerability beach presented in table 4.

Table 4. Index Coastal Vulnerability (IKP) Vo according Villages in Research Locations

No	Index	Village		
		bones	Bawasalo	Bonto Matene
1	Exposure (IE)	2.38	2.38	2.38

2	Sensitivity (IS)	4.89	4.68	4.46
3	Power adaptation (IAC)	1.70	1.70	1.20
4	IKP Vo	6.85	6.55	8.85
5	Vulnerability level	Currently	Currently	Currently

CONCLUSIONS AND RECOMMENDATIONS

1. Index vulnerability beach (IKP) in the third location is in the range IKP value of 6.55 - 8.85 which is included in the category Medium Vulnerability (*Moderate*) .
2. Factors that greatly influence the IKP are dimensions sensitivity includes : erosion , waves and tides are caused by factors oceanography so that If No do effort adaptation and mitigation so probably 5 - 10 years forward , category index vulnerability Can become vulnerability high (*High*) even very high (*Very high*) .
3. Effort possible adaptation done is strengthen the border area coast, planting and expansion mangrove trees in the area coast beach fresh .

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