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SUITABILITY EVALUATION OF SPACE UTILIZATION BASED ON ENVIROMENTAL SUSTAINABILITY AT THE COASTAL AREA OF BUNGUS BAY IN PADANG CITY, INDONESIA

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ABSTRACT: This study aimed to evaluate the suitability of space utilization conducted in the coastal area of Bungus bay. The research was conducted through field survey with a spatial approach using *Geographic Information System* (GIS) in order to know the suitability of area allocations which were served as a protected zone, utilization zone, and special zone. The results showed that zone II covers an area of 232,9 ha with a score of 48,4 and zone II covers an area of 136,2 ha with a score of 23 was *not-suitable* served as utilization zone, and zone III covers an area of 539,9 ha with a score of 61 was *suitable* served as utilization zone. Management alternative for *not-suitable* category in the protected zone at location 8 can be managed by the establishing of coast protection, establishing of stilt house, and the improvement of roads connected to the main road; On the utilization zone of location 11, location 12, location 18, and location 23 can be managed by relocating the settlement as far as >100 m from the coast, establishing of coast protection, establishing of stilt house, and improving roads connected to the main road; On the special zone of location 1 can be managed by relocating the distance limit of ship track and activity, making of settling ponds for waste discharging, and establishing stilt house; and on the special zone of location 25 can be managed by relocating the distance limit of ship track and activity, making of settling ponds for waste discharging, and dust suppression (wetting) during coal loading, and unloading.

Keywords: *Space Utilization, Suitability, Geographic Information System (GIS), Coastal Area, Bungus bay*

1. INTRODUCTION

Construction progress that makes use of protected zone as a new area significantly results in overlapping, and irregular space utilization [1]. [2] explain that obliterable space utilization can decrease both economically and ecologically the value of existing ecosystem utilization if it is not properly managed. [3] explain that have similar and synergistic utilization nature are used to be located in the same space while an obliterable space utilization is used to be separately categorized as *black zone* (potentially deadly for other areas). However, if the *black zone* area has been built, *buffer zone* should be applied as an operational requirement of the area.

Based on Regulation of the Ministry of Marine and Fisheries of the Republic of Indonesia No. 23/PERMEN-KP/2016 concerning "Management of Coastal Areas and Small Islands", then a coastal region in required to have a protected zone which is the protection zone in which there is a preservation zone and a buffer zone [4]. [5] added that utilization zone is a zone that is managed intensively and consider its enviromental carrying capacity such as coastal boundary, river boundary, and special zone for fast growing area.

The factors that be an obstacle in realizing the coastal area in *suitable* with the Regulation of the Ministry of Marine and Fisheries of the Republic of Indonesia No. 23/PERMEN-KP/2016 because of policy at the Regional of Regulation No. 4/PERDA/2012 who does not actionable with Regulation No. 27/UU RI/2007 concerning "Management of Coastal Area and Small Islands" [6], and an action plan to secure the coastal ecosystem environment that seemed to let the growth of industry sector in the area that is allocated as a zone of fisheries and tourism. Factor of space irregularities and factor of planning that is *economy-oriented* has changed the environmental setting in the coastal area of Bungus bay as the area of fisheries and tourism become the region of the industry. In accordance with the policy of areas set out in "*Development Master Plan of Regional Tourism Padang City Year 2008-2017*" [7], that the concept of the development strategy of development in the coastal area of Bungus bay prioritized for tourism development.

The purpose of this study is to determine the suitability of space utilization in the coastal area of Bungus bay so that happens the balance between the environmental carrying capacity with the ability of space that can be utilized in a sustainable.

2. RESEARCH METHOD

2.1 Research Locations

The research was conducted in the coastal area of Bungus bay residing on the sub-district of "Bungus Teluk Kabung" of Padang City and geographically located at coordinates of 100°22'23" - 100°29'13"E and 0°59'1" - 1°5'44"S.

Based on research [8], the coastal area of Bungus bay has the coastline with length ± 21.050 m, long of bay 5.418 m, and has a surface shape which tends to be rounded with a surface area 1.384 ha. Research location of covers the mainland area of bay and limited by the ridge of the hill where major rivers and tributaries entirety of empties into the bay.

Mapping of research location in the coastal area of bounded (*buffers*) with a distance 500 m from coastline towards of the mainland, and towards of the sea [9]. Width of research location in the coastal area of Bungus bay (*buffers* 500 m) is with the area of 980,19 ha of coastline to the waters (sea and river), and 911,13 ha of coastline to the mainland (Fig.1). The coastal area of Bungus bay is a functional area covers waters, foreshore, and mainland.

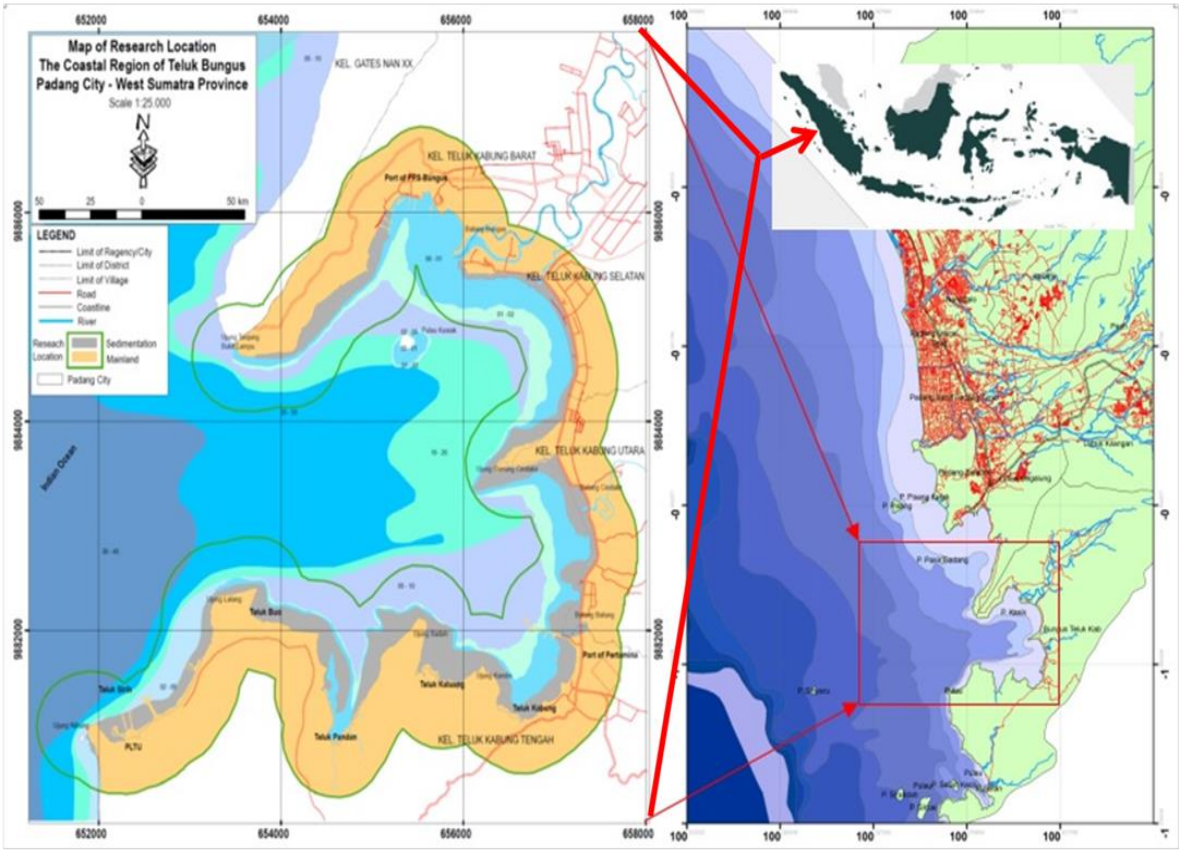

Fig. 1 Map of Research Location

2.2 Determinations Location of Field Survey

The determination of survey location was based on the location's high accessibility, and its representability of allocation classes of existing area, so that the information could be quickly and easily collected. The determination was done at the validated locations in the field. The locations represented a proportion of 10 % protected zone, 60 % utilization zone, and 30 % special zone [10].

Based on the three zones division, the zone is bordered by 2 main river flows located in Bungus bay coast whose names are Batang Bungus rivers and Batang Cindakir rivers. Further information regarding survey location spots are presented in the Table 1.

Table 1 Field survey location at the coastal area of Bungus bay

Zone	No	UTM - 47 S WGS84		Area Allocation
		X	Y	
	1	655332	9886039	special port
	2	655954	9886530	agriculture (rice field)
	3	656053	9886137	settlement
	4	655991	9885898	artificial conservation
I	5	655380	9885528	contamination of waters
	6	656038	9885436	artificial conservation
	7	656783	9885512	settlement
	8	656394	9885814	natural conservation
	9	656792	9885252	artificial conservation
	10	657225	9885338	agriculture (rice field)
	11	657208	9884851	settlement
II	12	657364	9883704	agriculture (rice field)
	13	657301	9883127	settlement
	14	656375	9883513	natural conservation
	15	657550	9882416	agriculture (rice field)
	16	657372	9881754	special port
	17	657001	9881228	settlement
	18	656337	9880995	agriculture (rice field)
	19	656458	9882445	contamination of waters
III	20	656444	9881233	natural conservation
	21	655699	9881541	natural conservation
	22	654587	9880813	natural conservation
	23	653745	9882196	contamination of waters
	24	652690	9880914	special port
	25	652151	9882279	contamination of waters

2.3 Data Analysis

2.3.1. Suitability of Biophiysical Parameters

Biophysical parameter based suitability analysis of space utilization is the information value of an ecosystem from an ecology in an area including the state and condition found while conducting the survey.

This biophysical feasibility assessment was conducted by identifying the biophysical requirements on the parameters of protected zone, utilization zone, and special zone and the field survey was based on Table 2 Furthermore, spatial approach based scoring was done by using *Geographic Information System* (GIS).

Table 2 Biophysical parameters of space utilization based on environmental sustainability

Zone		Allocation	Parameters	Number	Weight	Score
Protected Zone	Protected Area	natural	there is endemic	2	2	4
			there is no endemic	0	0	0
		coastal boundary	100 - 200 m from highest tidal point to the land	2	2	4
			0 - <100 m from highest tidal point to the land	0	0	0
		river boundary	100 - 200 m at the left and the right side of main river, and 50 m at the left and right side of the creek located outside of settlements.	2	2	4
			0 - <100 m at the left and the right side of main river and 50 m at the left and right side of the creek located outside of settlements.	0	0	0
		artificial	there is coast protection	2	1	2
			there is no coast protection	0	0	0
		coastal disaster-prone	ther is no seawater intrusion	2	1	1
			there is seawater intrusion	0	0	0
			there are no abrasion and accretion	2	1	1
			there is abrasion and accretion	0	0	0
			there is no *land subsidence*	2	1	1
			there is *land subsidence*	0	0	0

*Table 2 continued to next page

Zone	Allocation	Parameters		Number	Weight	Score
Utilization Zone	Mariculture	salinity ($^0/_{00}$)*	15 – 25	2	3	6
			10 - 15 and 25 - 35	1	3	3
			<10 or >35	0	0	0
		termperature (^{0}C)*	28,5 - 31,5	2	3	6
			26 - 28,5 and 31,6 - 33	1	3	3
			<26 or >33	0	0	0
		DO (mg/l)*	4,0 - 7,0	2	5	10
			3,0 - 4,0 and 7,0 - 12,0	1	5	5
			<3 or >2	0	0	0
		pH*	7.6 - 9,0	2	5	10
			4.0 - 7,5	1	5	5
			<6,0 or >9,0	0	0	0
		clarity (m)*	>6,0	2	3	6
			>4 - 5,9	1	3	3
			<20 and >60	0	0	0
		sulfide H_2S (mg/l)*	<0,01	2	3	6
			0,01 - 0,02	1	3	3
			>0,02	0	0	0
		nitrate (NO_3N) (mg/l)*	<0,005	2	5	10
			0,004 - 0,002	1	1	5
			>0,001	0	0	0
		rainfall	>2000 - 3000	2	2	4
			1000 - 2000	1	2	2
			<1000 or >3000	0	0	0
	Agriculture	there are a buffer for agricultural lands and river >50 m		2	1	2
		there are no a buffer for agricultural lands and river >50 m		0	0	0
		topsoil's pH (0 - 30)	5,5 - 7,4	2	3	6
			4,0 - 5,4 and 7,5 - 8	1	3	3
			<40,0 and >8,5	0	-	0
		landform units	beach ridge	2	2	4
			alluvial plain	1	2	2
			backswamp	0	0	0
		located on non flood-prone areas		2	2	4
		located on flood-prone areas		0	0	0
		do not settle on the beach border, wetland crops, and irrigation		2	3	6
		settle on the beach border, wetland crops, and irrigation		0	0	0
	Settlement	distance from main road (m)	<200	2	3	6
			200 - 500	1	3	3
			>500	0	0	0
		distance from beach (m)	>100	2	3	6
			50 - 100	1	3	3
			<50	0	0	0
		population density	<50 people/ha	2	2	4
			50 - 100 people/ha	1	2	2
			>100 people/ha	0	0	0
		do not settle on the locations of flood disaster, abrasion/accretion		2	1	2
		settle on the locations of flood disaster, abrasion/accretion		0	0	0
	Fishery Industry	flow (cm/Sec)	>2	2	2	4
			2 - 1	1	-	3
			<1	0	-	0
				indicators of organic contamination		
		BOD (mg/l)*	<20	2	2	4
			20 - 30	1	2	2
			>30	0	0	0
		DO (mg/l)*	4,0 - 7,0	2	2	4
			3,0 - 4,0 and 7,0 - 12,0	1	2	2
			<3 or >2	0	0	0
		located on non flood-and-inundation-prone zone		2	1	2
		located on flood-and-inundation-prone zone		0	0	0
		wave height (m)	<1	2	2	4
			1 - 2	1	2	2
			>2	0	0	0

*Table 2 continued to next page

Zone		Allocation	Parameters	Number	Weight	Score
		50 m *Open Green Space* (RTH) is available to border industrial area and other zones		2	1	2
		50 m *Open Green Space* (RTH) is unavailable to border industrial area and other zones		0	0	0
Special Zone	Special Area	wave height (m)	<1	2	5	10
			1 - 2	1	5	5
			>2	0	0	0
		ebb and flow (cm)	<100	2	2	4
			>100	0	0	0
		dynamics of abrasion coast	located on no-abrasion zone	2	4	8
			located on abrasion zone	0	0	0
		dynamics of accretion coast	located on non accretion zone	2	4	8
			located on accretion zone	0	0	0
						water pollution
		oil and fat (mg/l)*	<1	2	3	6
			>1	0	0	0
		cadmium Cd (mg/l)*	<0,001	2	3	6
			>0,001	0	0	0
		hexavalent chromium Cr^{+6} (mg/l)*	<0,005	2	3	6
			>0,005	0	0	0
		lead (Pb)*	<0,008	2	2	4
			>0,008	0	0	0
		copper (Cu)*	<0,008	3	2	4
			>0,008	0	0	0

Source: Adapted from PERMEN KP Number 23 of 2016.
Number: 2 = very suitable; 1 = suitable, and 0 = not-suitable.
*Note: *) Sea water's physical and chemical quality and contamination are based on water quality standard stated in KEPMEN LH No. 1 of 1988 and No. 51 of 2004.*

2.3.2. Evaluation of Suitable Space Utilization

Determination of allotment the area zone is based on criteria that refer to "Development of Prototype the coastal area and Marine" [11]. Where the assessment of biophysical parameter of each allotment area is further used as the evaluation of suitable space utilization in the coastal area of Bungus bay.

Results of score analysis the evaluation of space utilization that corresponding is used as a representation of the value of a space which is then used in the calculation the algorithm scoring in a spatial of the coastal area.

The algorithm scoring used to determine the 3 class values of suitable of space utilization i.e *highly suitable*, *suitable*, and *not-suitable* [10]. Results of this analysis in the form of data information, and the map of zone alternative of space utilization that a suitable in the coastal area of Bungus bay based the algorithm scoring refer to on the criteria of value suitability of space utilization shown in Table 3.

Table 3 Evaluation of space utilization value of suitable

Suitability Criteria	Score	Information
highly suitable	>80-100	space this of supportive and very decent as utilization zone and does not rule out the possibility to be developed.
suitable	60-80	space this of supportive and decent as utilization zone, but need to be considered certain requirements if want to be developed as the same area.
not-suitable	0-<60	space this not be supportive and not be decent as utilization zone and can be allocated as protected zone, special zone, and others.

Source: Modified [11].

3. DISCUSSION

3.1 Suitability of Space Utilization

The results of scoring algorithm in a the spatial in the coastal area of Bungus bay (Table 4) at a zone I with an area of 232,9 ha showed category of *not-suitable* for utilization zone with a score of 48,4 and zone II with an area of 136,2 ha showed category of *not-suitable* for utilization zone with a score of 23. This means of value mentioned be on a 0 - <60 showed that this space is not worth as utilization zone, and can be allocated for a protected zone or special zone; zone III with an area of 539,9 ha showed *suitable* for space utilization with a score of 61. This means of value mentioned be on a >60 - 80 showed that space this of supportive, and decent as utilization zone, However, need to be considered

certain requirements if want to be developed as the same zone. Zone of area that be used for protected zone, utilization zone, and special zone as the zone of space utilization be on a minimum limit. Area which is the center of industrial activity, and economy are in a zone of space utilization with a radius 3.5 and 7 km from the center of sub-district showed the category is *not-suitable*, this is because space location residing in the coast border and river has no vegetation as buffer zone of the good one [12].

Table 4. Results of scoring algorithm of space utilization suitability

Zone		Location	Allotment	Score		Category
	1	Port of Fisheries Bungus	special	35	10,5	
	2	Labuhan Tarok	utilization	5	3	
	3	Labuhan Tarok	utilization	20	12	
	4	Sako Beach	protected	4	0,4	
I	5	Waters of Fisheries Bungus	special	35	10,5	*not-suitable*
	6	Sako Estuary	protected	4	0,4	
	7	Primary School/SD No. 01	utilization	18	10,8	
	8	Primary School/SD No.18	protected	4	0,4	
	9	Carolina Estuary	protected	4	0,4	
Total				**129**	**48,4**	
	10	Talawi	utilization	11	6,6	
	11	Pasa Laban Beach	utilization	6	3,6	
II	12	Cindakir Beach	utilization	14	8,4	*not-suitable*
	13	Cindakir Estuary	utilization	6	3,6	
	14	Cindakir	protected	8	0,8	
Total				**45**	**23**	
	15	Batung Beach	utilization	12	7,2	
	16	Port of Pertamina	special	27	8,1	
	17	Labuhan Cino	utilization	12	7,2	
	18	Labuhan Cino	utilization	5	3	
	19	Batung Waters	special	27	8,1	
III	20	Kabung Cove	protected	12	1,2	*suitable*
	21	Kaluang Cove	protected	14	1,4	
	22	Pandan Cove	protected	14	1,4	
	23	Waters of Buo Cove	utilization	20	12	
	24	Port of *Steam-electric power station* in Sirih Cove	special	19	5,7	
	25	Waters of *Steam-electric power station* in Sirih Cove	special	19	5,7	
Total				**181**	**61**	

Source: Data analysis, 2016.

Development activity of industry, settlement, and other activity with no regard to quality of the environment through of mangrove conversion activity on the coastal boundary, and river boundary at the location 2, location 3, location 6, and location 8 in Labuhan Tarok cause a decrease in the function of the space on the coastal environment. Conditions this makes the coastal area in Bungus bay disaster-prone of coastal that can harm society in aspects of agriculture and settlement, such as sedimentation which can hamper sea transportation and abrasion that threaten land and access roads the coastal area in Bungus bay. [13] add, limited of mangroves as a buffer zone between zone that are not synergistic (harming each other) brings the influence against a decline in waters quality and coastal environment. As for the map of utilization space suitability in the coastal area in Bungus bay can be seen in Fig. 2.

3.2 Evaluation of Space Utilization

The based on scoring algorithm results for the space utilization zone and the focus activity in the coastal area of Bungus bay with a *suitable*, and *not-suitable* category is shown in Table 5. Where, conditions are space utilization on the zone I, and zone II be on a minimum limit so that is not optimal and could damage other areas through various activity.

According to [14] zone of space utilization in the coastal area can be grouped according to the similarity of the characteristics physical, biology, ecology, and economy of that are determined based the activity grouping that is synergistic, and separate from activity that contradicts with criteria certain so that this zone can defend the sustainable value.

Tabel 5. Width of space utilization zone category

Zone	Allotment	Width (ha)		
		suitable	*not-suitable*	*natural*
I	protected	-	55,84	297,15
	special	26,15	-	-
	utilization	27,11	1,98	-
II	protected	15,1	55,83	37,31
	special	-	-	-
	utilization	34,2	11,85	-
II	protected	87,0	-	307,62
	special	19,2	46,32	-
	utilization	78,4	9,21	-
	total value	287,16	181,03	641,08

Source: Data analysis, 2016.

The based on the results of research which refer to the Regulation of the Ministry of Marine and Fisheries of the Republic of Indonesia No. 23/PERMEN-KP/2016, the coastal area of Bungus bay can be grouped in 3 zone representing the characteristic of a space utilization area for utilization zone, protection zone, and buffer zone.

3.2.1. Utilization Zone

Zones this serves as the main zone for the activity of fishing, agriculture, settlement, tourism and other activity are still in touch or mutual support inter the space utilization in the coastal area of Bungus bay in the allocation this zone consists of 2 sub-zone i.e 1) utilization zone constitute a area or a zone in its activity constitute a zone or a similar activity could support another zone, and does not cause problems on the other zone. zone this consists of a group of mariculture, fishing industry, settlement, and agricultural area of 230,65 ha; and 2) special zone constitute a zone that in its activity could adversely affect the other space, so that need is done effort protection against the other space with adjusting the placement of zone this on a certain space a that utilized as big as possible for these activity. In addition, the placement of vegetation as a buffer zone between regions should be applied in the zone.

3.2.2. Protected Zone

Zones this serves as a zone of protection because it has a great diversity of ecosystems therein. For protection zone is allocated amounted 201,46 ha, effect land clearing on a large scale at the location 8, and 6 in Sako Estuary - Labuhan Tarok for the construction of *Crude Palm Oil* (CPO) amounted 79 ha causing damage to coastal ecosystems conditions, and vulnerable to coastal disasters. Protected zone at location 8, and location 6 covers an area of 35,45 ha become damaged by mentioned land clearing. Width of protected zone other such as coastal boundary, and river boundary continue to experience the decrease in extents, so it needs to be optimized.

3.2.3. Buffer Zone

Allocation and distribution of this zone are needed, especially in the area whose activity could potentially have an impact on another area, so the value of other zone become a declined. Buffer zone in the coastal area of Bungus bay of allocation a space determination distributed on a special port activity that potentially contaminates other area. Almost all of space utilization is prone to cause problems inter of the zone a that not yet has a buffer zone, only agricultural land that has a buffer zone.

According to [15] minimum width of the buffer zone 7.6 m plus 0.6 m for each of slope 1 % between the water surface with the mainland. Besides a role in the ecology of protective function as a buffer zone to protect the quality of water masses, water pollution and slow down the *run-off*, so that sedimentation can be reduced. As for the width a alternative zone can be seen in Table 6 and map of space utilization alternative in the coastal area of Bungus bay can be seen in Fig. 2.

The activity of special port in location 24, and location 16 has a big impact toward the mariculture at location 19, and location 23. [16] add turbidity of the waters during the rainy season led to lower the *Dissolved Oxygen* (DO) content in the waters so that process of *photosynthesis* is inhibited, and causing of death on aquatic biota, especially fish.

Development activity in the coastal area of Bungus bay that *not-suitable* with one another can lead to adverse impacts on the surrounding environment. To overcome of the impact that a occurs need management of the environment, both ecologically and through the policy of revision "The Spatial Planning and Regional of Padang City and West Sumatra Province" so that this area can be utilized in a sustainable manner.

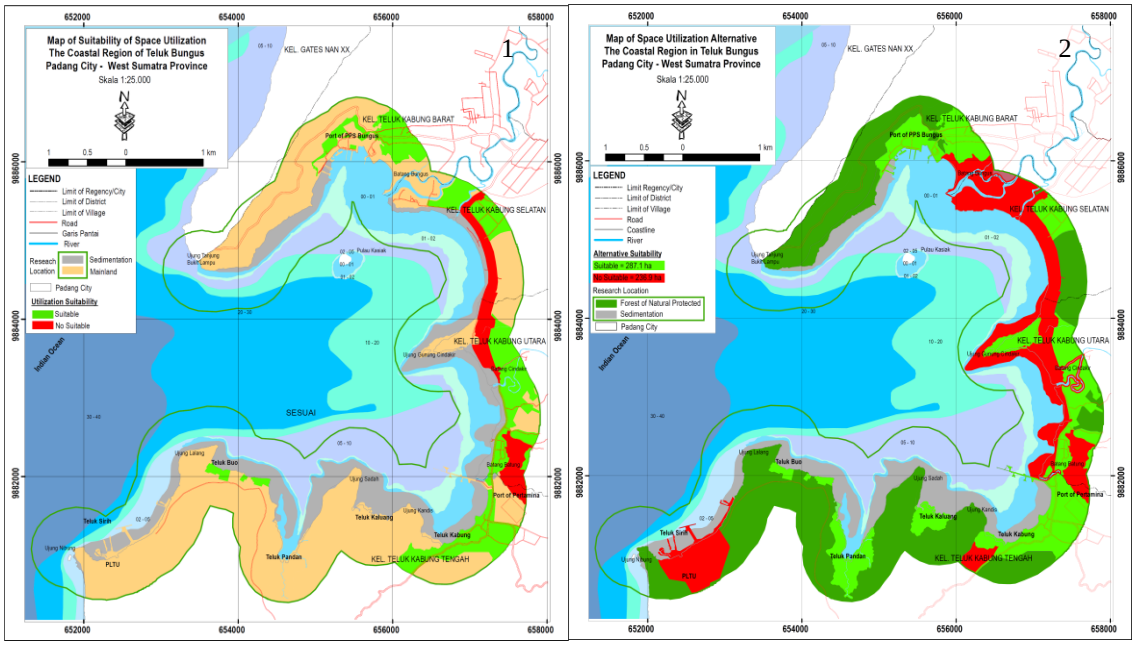

Fig 2. Map of 1) utilization space suitability, and 2) space utilization alternative in Bungus bay.

Tabel 6. Width of altenative zone in the coastal area of Bungus bay.

Location		Width (ha)	Function	Location are Protected
Utilizatin Zone				
8	33,78	industy, protected/mangrove, agricultural, and area not yet utilized		Carolina beach, Sako beach, Sako estuary, and Kasiak island.
15	19,54	agricultural, protected/mangrove, and settlement		settlement in Batung, Labuhan Cino, and mariculture
18	9,21	agricultural, protected/mangrove, and settlement		settlement in Labuhan Cino, and mariculture
Special Zone				
25	46,30	material of coal unloading		protected forest, mariculture, and inside and outside the bay waters
Protected Zone				
6; 9; 11; 13	33; 78; 67; 97; 25; 55	coastal boundary, and river boundary		settlement, agricultural, and mariculture
Buffer Zone				
8; 20; 21; 22	83; 90	protecting water masses, withstand water contaminant materials, and slow down the run-off		settlement, agricultural, and mariculture

Source: Data analysis, 2016.

Environmental management on an allotment zone in the coastal area of Bungus bay based on the value that is in the category *not-suitable* as the utilization zone for agriculture such as in location 8, and location 18. As for the actual environmental management to be a condition of potential environment in the coastal area of Bungus bay i.e management for *not-suitable* category on the special zone in location 1 caused due to the high of sedimentation which resulted in disruption of the transport ship in port and prone to flooding. Environment management is carried out by the drainage system repair, establishing of coast protection, and establishing of stilt house on a limit coastal settlement. The denseness of port activity on a location mentioned affect towards water pollution Cd, Cr+6, and Pb for overcoming of the problem with relocation the limit distance of ship track and activity and making of settling ponds for waste discharging.

Environment management for *not-suitable* category on the protected zone in location 8 a result of land clearing for the development of palm oil mill in which there are settlement, and adjacent to agricultural and location 18 which a prone to flood. For overcoming of the problem with establishing of

coast protection, establishing of stilt house, and improving roads connected to the main road.

Environment management for *not-suitable* category on the utilization zone in location 11, location 13, and location 12 a result of abrasion and flood disaster that resulted in destruction the physical building of settlement and agricultural land. For overcoming of the problem with relocating the settlement as far as >100 m from the coast, establishing of coast protection, establishing of stilt house, and improving roads connected to the main road, relocate the settlement from the river as far as >50 m and, establishing of coast protection.

Environment management for *not-suitable* category on the special zone in location 16 has the natural habitat of mangrove and agricultural of wetlands from water pollution Cd, Cr+6, and Pb are with relocating the distance limit of ship track and activity, making of settling ponds for waste discharging. Need to socialize with the community regarding the determination of law regarding the protection of coastal ecosystems, especially of taking of mangrove wood.

Environment management for *not-suitable* category on the special zone in location 23 that constitute the location of the fish hatchery, and mariculture. On location of coastal boundary, there is settlement either owned by government or settlement and communities, where the location such settlement are vulnerable to flood disaster. Management to be undertaken i.e with establishing of coast protection.

Environment management for the *not-suitable* category on the special zone in location 25 that dealing directly with the high seas/mouth of the bay and the location of ship crossings. Environment management to be undertaken, namely with relocating the distance limit of ship track and activity, making of settling ponds for waste discharging, and dust suppression (wetting) during coal loading, and unloading.

4. CONCLUSION

The analysis of suitability the space utilization based a biophysical parameters in the coastal area of Bungus bay shows the category is *not-suitable* for space utilization in the zone I with a score 48.4, and only on a zone III which shows the category is *suitable* with a score 61, this indicates the existence of *Steam-electric power station* in Sirih cove on the zone III does not lower the quality environment in the zone. The condition of each zone which is used for protected zone, utilization zone, and special zone as the zone of space utilization is at a minimum. This is because the location of space that utilized residing on a coastal boundary, and river boundary without owning vegetation as a good buffer zone, so it needs to be developed mangrove revegetation efforts with good as the utilization zone, protection zone, and buffer zone amounted 83.90 ha. And socialization with the public and stakeholders towards a logging activity of mangroves in the coastal area of Bungus bay.

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6. REFERENCES

[1] Cengiz T. 2009. Tourism, an ecological approach in protected areas: Karagöl-Sahara National Park, Turkey. J. Sustainable Development & World Ecology, Vol. 14, Issue 3, pp. 260-267.

[2] Hermon D. 2016. The changes of carbon stocks and CO_2 emission as the result of land cover changes for tin mining and settlement in belitung island, indonesia. 2016. J. Geography and Earth Science, Vol. 4, Issue 1, pp. 17-30.

[3] Feng L., X. Zhu and X. Sun. 2014. Assessing coastal reclamation suitability based on a fuzzy-AHP comprehensive evaluation framework: A case study of Lianyungang, China. J. Marine Pollution, Vol . 89, pp. 102-111.

[4] Regulation of the Minister of Marine and Fisheries of the Republic of Indonesia No. 23/PERMEN-KP/2016 concerning "Management of Coastal Areas and Small Islands". Jakarta. Director General of Legislation Regulation of the Ministry of Justice and Human Rights of the Republic of Indonesia. (In Indonesian).

[5] Omar M M and A M A Moussa. 2016. Water management in Egypt for facing the future challenges, J. Advanced Research, Vol. 7, Issue 3, pp. 403-412.

[6] Regulation No. 27/UU RI/2007 concerning "Management of Coastal Area and Small Islands". State Gazette of the Republic of Indonesia Number 4739. (In Indonesian).

[7] Development Planning Agency at Sub-National Level. 2007. Development Master Plan of Regional Tourism Padang City Year 2008-2017. Padang. Government of Padang City. 135 pp. (In Indonesian).

[8] Kusumah G and H Salim. 2008. Condition of Morphometric and morphological of Bungus Bay, Padang City. J. Segara, Vol. 4, Issue 2, pp. 101 - 110.

[9] Li Y., X Zhang., X Zhao., S Ma., H Cao and J Cao. 2016. Assessing Spatial Vulnerability From Rapid Urbanization To Inform Coastal Urban Regional Planning. J. Ocean & Coastal Management, Vol. 123, pp. 53 - 65.

[10] Hartoko A and M Helmi. 2004. Development of Digital Multilayer Ecological Model For Padang Coastal Water (West Sumatra). J. Coastal Development, Vol. 7, Issue 3, pp. 129 - 136.

[11] National Coordinating Agency for Surveys and Mapping [NCASM]. 1996. Development of Prototype the Coastal Area and Marine Kupang. Cibinong. The Center for Cultivate and SIG Application Development. 107 pp. (In Indonesian).

[12] Julzarika A. 2016. Utilization of LAPAN Satellite (TUBSAT, A2, and A3) in supporting Indonesia's potential as maritime center of the world. IOP Conference Series: Earth and Environmental Science., 54. 012097.

[13] Ahmad C B., J Abdullah and J Jaafar. 2016. Buffer Zone Delineation at Conservation Reserve. Procedia - Social and Behavioral Sciences, Vol. 222, pp. 685 - 692.

[14] Hermon D. 2014. Impact of land cover change on climate change trend in padang, indonesia. Indonesia Journal of Geography, Vol. 46, Issue 2, pp. 138-142.

[15] Putra A and H Mutmainah. 2016. The Mapping of Temporary Evacuation Site (TES) and Tsunami Evacuation Route in North Pagai Island, Mentawai Islands Regency – Indonesia. IOP Conference Series: Earth and Environmental Science., 47. 012020.

[16] Ezeanya N C., G O Chukwuma., K N Nwaigwe and C C Egwuonwu. 2015. Standard Water Quality Requirements and Management Strategies for Fish Farming (A Case Study of Otamiri River). J. International Journal of Research in Engineering and Technology. Vol. 4 Issue 3, pp. 1-5.