GIS-BASED ESTIMATION OF SHORELINE CHANGE IN THE OLIE PIER HARBOR HERITAGE SITE, MANGGAR, EAST BELITUNG, INDONESIA

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Introduction

Coastal areas, where land meets sea, are highly dynamic and vulnerable to changes driven by both natural processes and human activities. The coastline, constantly reshaped by the interaction of waves, tides, and currents, faces significant threats from extreme weather events and human interventions (Baig et al., 2020; Mentaschi et al., 2018). In East Belitung, Indonesia, these challenges are exacerbated by intensive tin mining activities, which have led to severe coastal erosion and environmental degradation. This research aims to analyze the extent of coastline changes in East Belitung using remote sensing technology, identify the contributing factors, and propose sustainable management strategies to mitigate the impacts of coastal erosion.

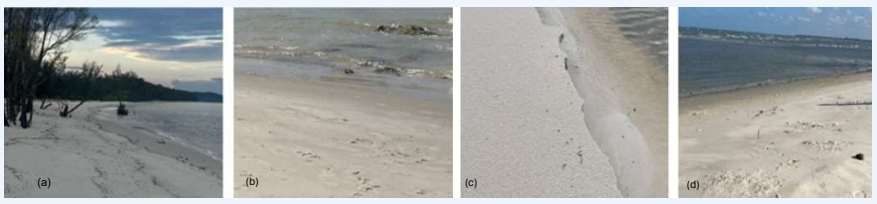

Figure 1. Beach conditions in (a) Tambak Beach, photo taken on June 19, 2023 (b) Nyiur Melambai Beach, photo taken on June 18, 2023 (c) Serdang Beach, photo taken on June 17, 2023 and (d) Mudong Beach, photo taken on June 18, 2023. (Source: private document-Authors, 2023)

Methodology

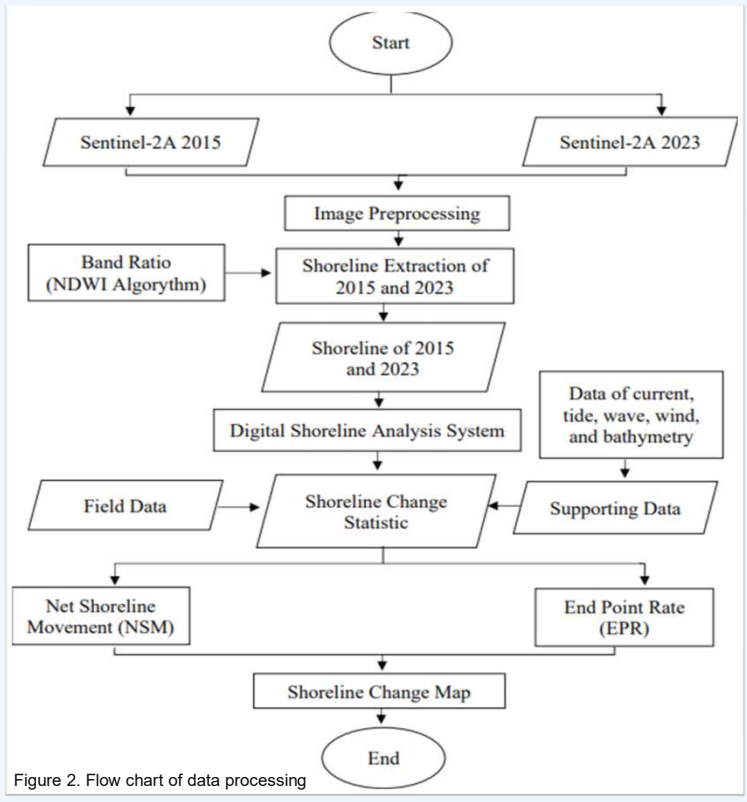

Figure 2. Flow chart of data processing

Data Type	Data Source	Resolution	Time	Provider
Data GPS Handheld	Field Survey	5 m	2023	BRIN
Sentinel-2A Imagery	National Research and Innovation Agency Indonesia	10 m	2015 and 2023	BRIN
RBI Map	tanahair.indonesia.go.id	1:10,000	2019	-
Tides	https://www.tpxo.net/	0.083°	2015-2023	Oregon State University (OSU).
Winds	https://cds.climate.copernicus.eu/	0.083°	2015-2023	European Centre for Medium-Range Weather Forecasts (ECMWF)
Waves	https://cds.climate.copernicus.eu/	0.083°	2015-2023	European Centre for Medium-Range Weather Forecasts (ECMWF)
Currents	https://data.marine.copernicus.eu/	0.083°	2015-2023	European Space Agency (ESA) and European Commission

Table 1. Research material

Results

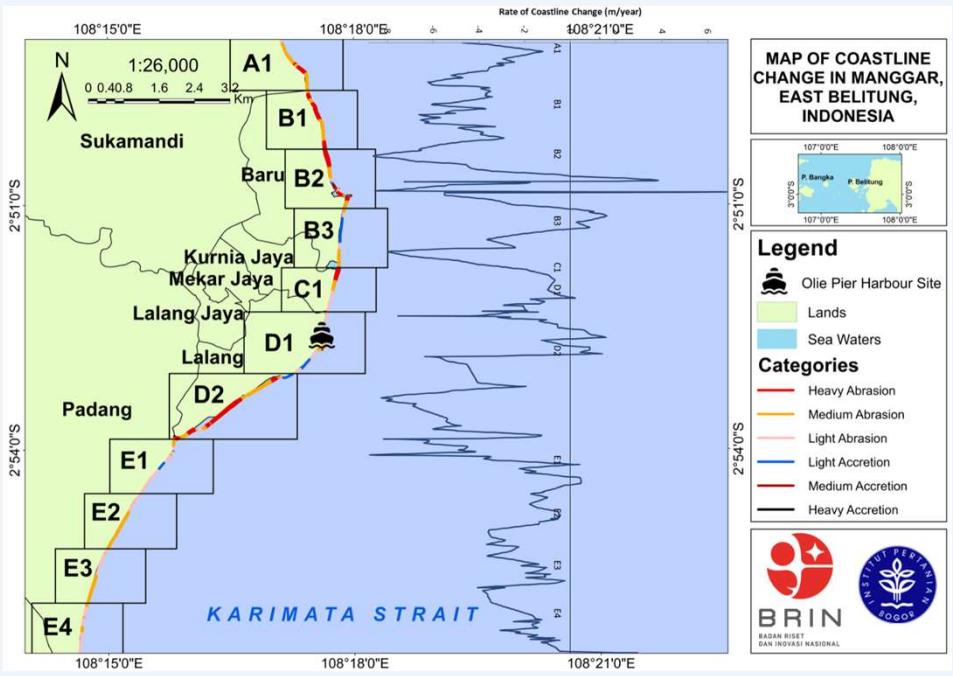

Figure 3 Map of coastline change in Manggar, East Belitung Timur from 2015 - 2023

Zone	Net Shoreline Movement (NSM)			End Point Rate (EPR)			Dominant
	Low	High	Average	Low	High	Average	
A1	-46.33	-8.91	-27.05	-6.22	-1.20	-3.63	Medium Abrasion
B1	-49.33	-21.66	-36.91	-6.62	-2.91	-4.96	Medium Abrasion
B2	-64.09	56.68	-25.93	-8.61	7.61	-3.48	Heavy Abrasion
B3	-59.26	12.01	-20.28	-7.96	1.61	-2.72	Medium Abrasion
C1	-33.55	-5.01	-13.55	-4.5	-0.67	-1.82	Light Abrasion
D1	-56.08	11.71	-7.64	-7.53	1.57	-1.03	Light Abrasion
D2	-65.38	10.41	-34.64	-8.78	1.40	-4.65	Heavy Abrasion
E1	-62.52	3.55	-9.62	-8.40	0.48	-1.29	Light Abrasion
E2	-27.16	-3.66	-17.27	-3.65	-0.49	-2.32	Medium Abrasion
E3	-30.18	-1.86	-17.40	-4.05	-0.25	-2.34	Medium Abrasion
E4	-22.89	21.96	-10.87	-3.07	2.95	-1.45	Light Abrasion

Table 2 Result of coastline change analysis

Conclusion

The coastal area of Manggar Subdistrict, East Belitung, from 2015 to 2023, experienced changes in its shoreline, both through erosion and accretion. The highest erosion occurred in Lalang Village (sub-zone D2), with a shoreline retreat of 65.38 meters and a retreat rate of 8.78 meters per year. In addition to erosion, the Manggar coast also experienced instances of accretion. The highest accretion occurred in Baru Village (sub-zone B2), with a shoreline advancement of 56.68 meters and an advancement rate of 7.61 meters per year.

The dominance of shoreline changes on the Manggar coast falls under the moderate erosion category. Oceanographic factors such as currents, waves, tides, wind, and bathymetry significantly influence the phenomenon of shoreline changes in Manggar, East Belitung. It is due to the conditions of the waters in East Belitung being in open waters directly adjacent to the Karimata Strait, causing the generated wave energy to impact the increasing wind speed.

Reference/Footnotes

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Acknowledgments

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