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COASTAL VULNERABILITY ANALYSIS IN DUMAI BARAT DISTRICT

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ABSTRACT

The Coastal area is an area that is very vulnerable to the phenomenon of natural change. The coastal area's vulnerability level is influenced by geological variables, namely coastal geomorphology, sea level rise, shoreline changes, tides, and coastal elevations. This research was conducted in October 2021. This study aims to determine the level of coastal vulnerability in the Dumai Barat Sub-District, Riau Province with a quantitative descriptive method. Based on the result of the study, the coastal vulnerability index can be classified into five categories: very not vulnerable, not vulnerable, medium, high, and very high. The coastal area of Dumai Barat District is categorized as low vulnerability.

Keywords: Dumai, Coastal Vulnerability, Geological Variables Quantitative Descriptive.

I. INTRODUCTION

The coastal area is a transitional area between land and sea which has two kinds of boundaries in terms of its coastline (coastline), namely boundaries parallel to the coast (longshore) and boundaries perpendicular to the coastline (cross-shore)[1]. One of the most important uses of coastal areas is as residential areas, where more than 70% of the world's major cities are located in coastal areas. This is closely related to the extraordinary potential of the coast which has visual appeal, and other potentials of the area as residential areas, aquaculture, ponds, agriculture, ports, and tourism[2].

Problems in coastal areas are very sensitive and vulnerable to natural phenomena. According to Kaly et al.[3], coastal areas are areas that are weak or vulnerable to environmental factors such as climate variability and climate change. The impact received by coastal areas due to this phenomenon is something that needs to be studied to spatially identify the level of coastal vulnerability and to project changes in the vulnerability of coastal areas in the future. Other processes that can affect the level of vulnerability of coastal areas include coastal geomorphology, sea level rise, and rate of change of coastline, coastal slope, wave height, and tides[4].

The Dumai coast is the main buffer for the economic activities of the city of Dumai and even for the Province of Riau. Apart from being a densely populated area, the coastal area of Dumai is also used for harvesting forest products, industrial locations, and opening roads, especially in mangrove areas. These activities have provided physical changes to the condition of coastal features, which have affected the mass of rising seawater through the phenomenon of tides (tide). In addition to these activities, the coastal area of Dumai is also affected by climate change which also provides physical changes to the Dumai coast such as the rate of change of the coastline, waves, and the slope of the beach.

The Dumai area is very strategic to be used as an international trade development area because Dumai is in the international trade cross area of the Malacca Strait. Dumai waters are also waters that are directly related to Rupat Beach, which always experiences several climate changes every year. This condition made the writer

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interested in researching coastal vulnerability in Dumai City.

2. RESEARCH METHOD

This research was conducted using a quantitative descriptive method through a multi-temporal approach. The data that has been collected is then processed to obtain the form of spatial data. The data is compiled into a spatial database for coastal vulnerability assessment. Processing data on each parameter through different stages.

Time and Place

This research was carried out in October 2021 which is located in Dumai Barat District, Dumai City, Riau Province (Figure 1)

Figure 1. Map of research locations

The physical vulnerability assessment begins with the Multi-Criteria Analysis (MCA) to standardize variable rankings based on the CVI method. Figures for MCA calculations use secondary data from each physical parameter website that has been downloaded. Standardization of the scores for each variable so that they become scores with a standard range of 0-1 using the MCA matrix based on the following equation[5]:

$$Xin \frac{(xin - min\ xin)}{(max\ xi - min\ xi)}$$

xin : The standard value of the i-variable in the nth unit of analysis

xin : The original value of the i-variable in the nth unit of analysis

max xi : Highest variable value

min xi : Lowest variable value

After getting the standardized value of each physical parameter, it is continued with the CVI method approach. Calculation of the level of vulnerability of coastal areas is calculated using the coastal vulnerability index formula as used in Gornitz[6]:

$$CVI = \frac{\sqrt{axbxcxdxdxexf}}{6}$$

a = Vulnerability ranking classification for geomorphology

b = Vulnerability ranking classification for sea level rise

c = Vulnerability ranking classification for shoreline change

d = Vulnerability ranking classification for tidal

e = Classification ranking of susceptibility to wave height

f = Vulnerability ranking classification for elevation

The CVI calculation results at each point are then classified into 5 vulnerability classes, namely very not vulnerable, not vulnerable, moderate, vulnerable, and very vulnerable. Classification is done by finding the highest vulnerability value and multiplying it with the percentage for each vulnerability class. These results are then used as intervals in determining the level of coastal vulnerability.

3. RESULT AND DISCUSSION

The coastal vulnerability index shows the level of vulnerability of a coastal area to the threat of coastal disasters. The vulnerability index starts from very not vulnerable, not vulnerable, moderate, vulnerable, and very vulnerable. The steps for obtaining a coastal vulnerability index are to combine all the values for each of the physical parameters that have been standardized using the MCA method, and then rank them from 1 to 5.

After all the values for each of the physical parameters have been standardized using the MCA method and the CVI values for the variables have been ranked from 1 to 5, then the coastal vulnerability index value of Dumai Barat District has been calculated using the CVI method, the CVI value for Dumai Barat District has been calculated ranged from 1 – 10 for 9 observation points. Using the highest CVI value, we look for coastal vulnerability intervals using percentages for each level of vulnerability.

Based on the interval value obtained, then the variable CVI value is converted into a CVI rank value, and the CVI rank value is obtained, namely, the very not vulnerable category is in segments 1 and 2, the non-vulnerable category is in segments 4, 7 and 9, the moderate category is in segments 3, 5 and 8 and the very vulnerable category is in segment 6.

The CVI value is then interpreted, resulting in a map containing information on the vulnerability status of the coast of Dumai Barat District. The following is a map of the coastal vulnerability of the Dumai Barat District.

Figure 2. Coastal vulnerability map of Dumai Barat District

In the figure above it can be seen that the highest vulnerability value is in segment 6 while the lowest vulnerability value is in segments 1 and 2. According to PERMEN KP No 21 of 2018, a physical vulnerability in Dumai Barat District is influenced by geological variables consisting of coastal geomorphology, sea level rise, shoreline changes, tides, wave height, and beach elevation that already meet the criteria for coastal vulnerability.

The average variable values that have been standardized are sea level rise of 0.699, shoreline changes of 0.440, tides of 0.420, wave height of 0.469, and beach elevation of 0.333. Based on the results of this analysis it is known that sea level rise conditions have the highest contribution to increasing physical vulnerability. The average value of each variable that has been standardized means that it can also be known which variable has the highest contribution which causes a high level of vulnerability in the study area[7].

It can also be seen that the east coast of Dumai Barat District tends to have a higher physical vulnerability value than the west coast of Dumai Barat District. This is similar to sea level rise and waves which have the highest values on the east coast of the Dumai Barat District. So the physical vulnerability to water conditions is influenced by waves, currents, tides, wind, temperature, and salinity[8].

4. CONCLUSION

Physical vulnerability in Dumai Barat District is influenced by geological variables consisting of coastal geomorphology, sea level rise, shoreline changes, tides, wave height, and beach elevation. Coastal of Dumai Barat District is divided into 5 vulnerability classes, namely very not vulnerable, not vulnerable, moderate, vulnerable, and very vulnerable. In the physical parameters of the coastal area of Dumai Barat District, the highest level of vulnerability is in segment 6 with a very vulnerable value, in segments 3, 5, and 8 it is a moderate vulnerability value, in segments 4, 7 and 9 it is in the vulnerability value not vulnerable and in segment 1 and 2 is in a very non-vulnerable vulnerability value. So it can be concluded that the coast of Dumai Barat District is in the low vulnerability level category.

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