SMART SURVEYORS FOR LAND AND WATER MANAGEMENT
CHALLENGES IN A NEW REALITY

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Pangandaran Coastal Land Carrying Capacity Analysis for Tourism Activity

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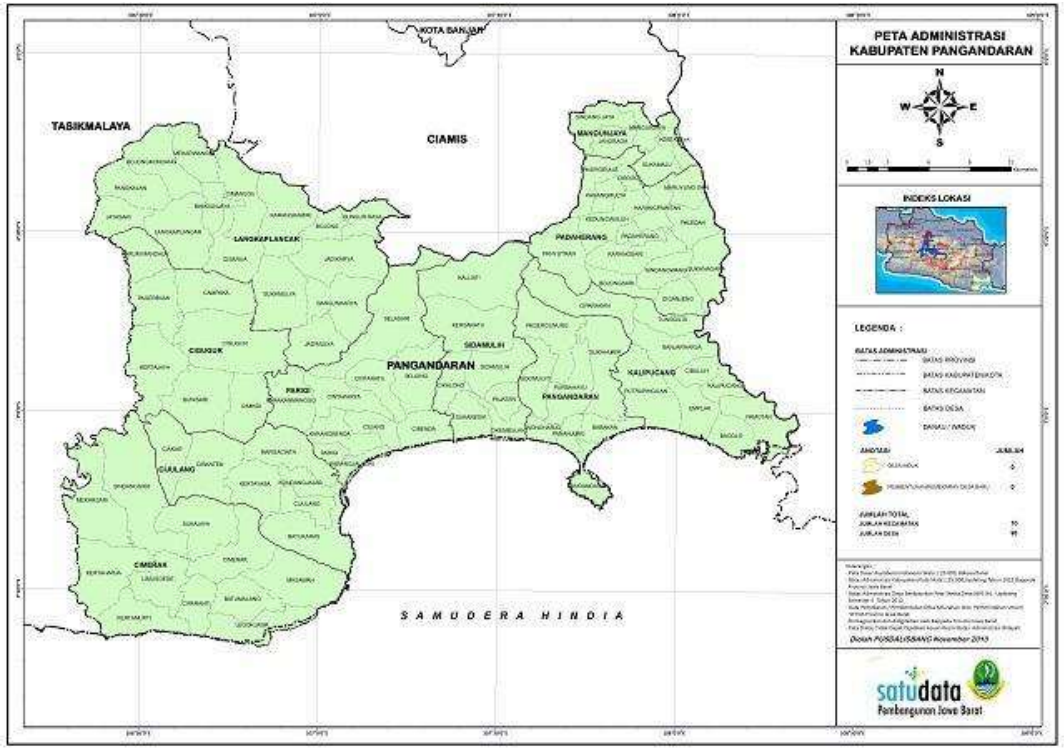
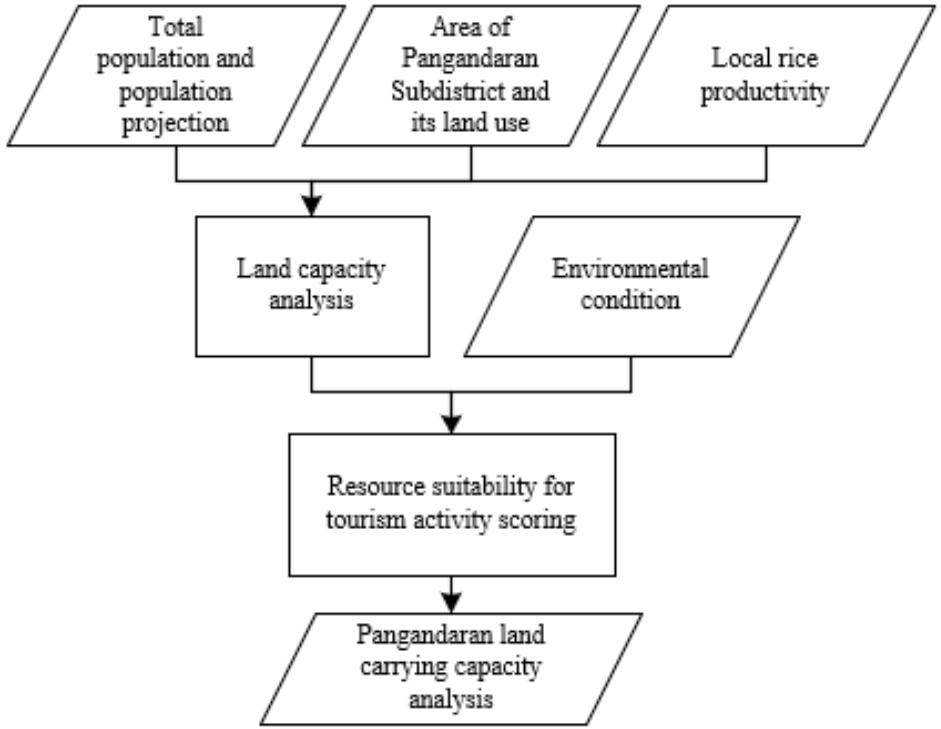
- INTRODUCTION
- Pangandaran beach has gone through a lot of environmental dynamics due to anthropological interference or natural disasters such as earthquake and tsunami.
- Coastal engineering and directed development are needed to prevent Pangandaran Area from undesirable condition such as overshot carrying capacity or get into the tourism stagnan phase.
- Study concerning the coastal environment management which is conducted by several parties has been shown to be optimal in restoring environmental degradation without reducing the benefits obtained from tourism activities.
- Marine tourism development itself is currently being a hot topic between tourism developers or academic researchers. Uncontrolled marine tourism development will always leads to the imbalance of monetary, social, and ecological aspects and disrupt the sustainability idea. Unfortunately, Pangandaran Beach's land carrying capacity as a largest marine tourism destination in West Java never been analysed; and there is no update of Pangandaran suitability environment to support its marine tourism activity.
- To that end, this research aims to analysing the suitability of Pangandaran Beach for tourism area and its land carrying capacity based on its environmental condition to support spatial planning or stakeholder take on policy in order to attain marine tourism sustainability.

Pangandaran Regency Administration Map



Research Flow Diagram



- **METHODOLOGY**
- The methodology used for calculating Pangandaran Carrying Capacity is referred to Regulation of the Indonesian Minister of Environment and Forestry No. 7 of 2009

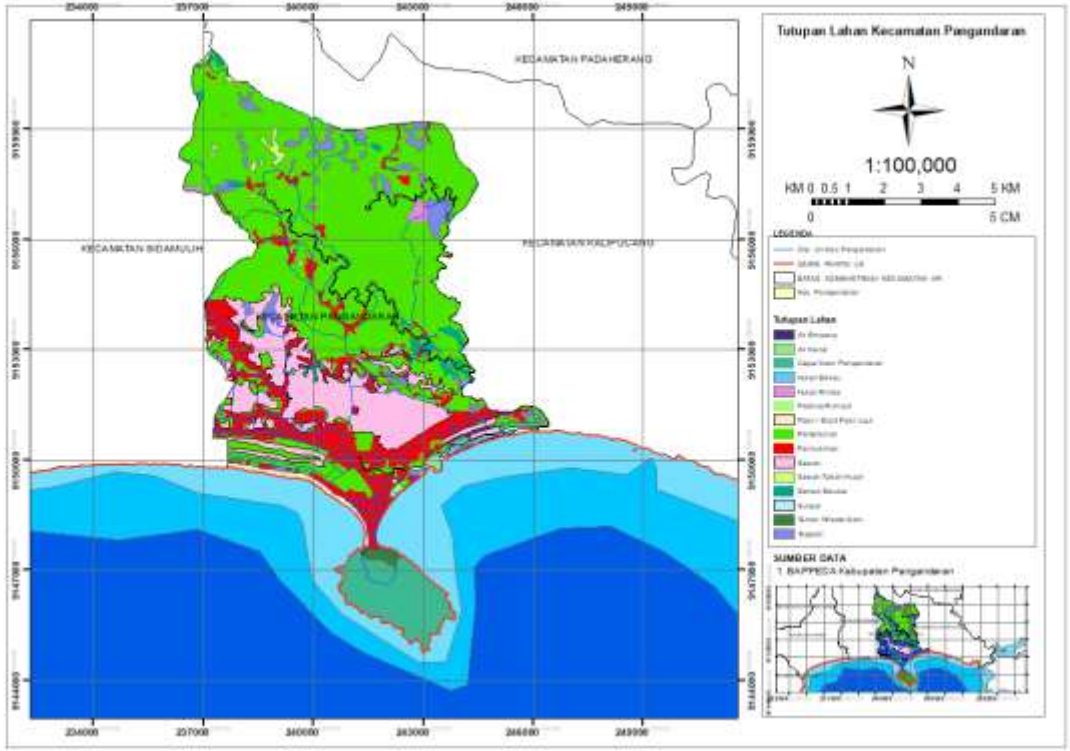
Population Projection

Population projection is counted by exponential methods. This methods is used because its advantages such as the data required easy to fulfill, easy to do, and a model used is close to dynamics that are not linear (Karpen & Fahmi, 2018)

Year	Population (People)	Population Growth Rate (%)
2015	61864	0,558
2016	62210	0,598
2017	62583	0,577
2018	62945	0,529
2019	63279	0,565
Prediction		
2020	63638	
2030	67339	
2040	71256	
2050	75401	

Land Use

Based on data obtained from government agencies such as the Regional Planning and Development Agency of Pangandaran Regency and the Public Works Office of Pangandaran Regency in the form of shapefiles, the authors carried out processing and analysis. The results of data processing can be seen that the land cover in Pangandaran District consists of pond water, canal water, mangrove forests, jungle forests, grasslands, sand or sand dunes, plantations, settlements, rice fields, rainfed rice fields, shrubs, rivers, tourist parks and moor. Furthermore, based on the author's analysis, it can be seen that the land cover in Pangandaran District is dominated by plantations by 88%. More details related to land cover in Pangandaran District will be visualized in the image



- *Local Rice Productivity*
- Environmental productivity to calculate land needs and capacity in terms of rice or local rice productivity in an area. According to the Agriculture Ministerial Regulation No. 07/2012, the criteria for land that can be called productive is when the land can produce 30 quintals of rice per hectare each year. in which there are criteria for each commodity to be called productive. Data related to the results of the 3 commodities above were obtained from the Pangandaran Central Statistics Agency in 2019.

- Data of Rice productivity in the year of 2013-2017 (kw)

Agri product	2013 (Kw)	2014 (Kw)	2015 (Kw)	2016 (Kw)	2017 (Kw)	All in average (Kw)
Rice	99.53	104.25	104.89	94.27	105.58	101.704

The Area of Land Required for proper living needs per resident

- The area of land required for proper living needs per population is the need for decent living per population divided by local rice productivity. According to Pemen LH No. 17 of 2009, for the needs of a decent living per population is assumed to be 1 tonne equivalent to rice / capita / year. According to data from BPS Pangandaran Regency, rice productivity in Pangandaran District is 10170 kg / ha / year. The KHLL calculation is made to project land needs in Pangandaran District until 2050 with the population as calculated using the previous exponential method.
- The value of the need for a decent life is a constant set by the Ministry of Environment in Permen LHK No. 17 of 2009 in the amount of I ton / capita / year. In this calculation, all weight is converted into kilograms for easier calculation. Data on local rice productivity is obtained from the BPS annual report entitled "Pangandaran in Numbers" 2020 edition. S_L is the value of land availability, and D_L is the value of land needs; both are expressed in hectares (ha).

Land Carrying Capacity Analysis

- It can be seen that S_L has a lower value than D_L ($S_L < D_L$). This means that the carrying capacity of the land is declared a deficit or overshot for the projection from 2020 to 2050.

Year	Population (people)	Decent life necessities (kg/capita /year)	Local rice productivity (kg/ha)	KHL_L	S_L (ha)	D_L (ha)
2020	63638	1000	10170	0,098328	6.077	6257,402
2030	67339	1000	10170	0,098328	6.077	6621,373
2040	71256	1000	10170	0,098328	6.077	7006,516
2050	75401	1000	10170	0,098328	6.077	7414,061

Environmental Condition Analysis

- After observating and data collecting, the environmental condition of Pangandaran Beach can be shown. After that, the processed data is then entered into the Tourism Resource Suitability Index equation as stated in the previous section

Pangandaran Beach Environmental Condition

No.	Parameter	Weight	Skor Eksisting
1	Beach Type	0,200	2
2	Beach Width (m)	0,200	3
3	Basic Water Material	0,170	3
4	Depth of Water (m)	0,125	3
5	Water Brightness (%)	0,125	1
6	Flow Velocity (cm / sec)	0,80	0
8	Coastal Land Closure	0,010	3
9	Dangerous Biota	0,005	3
10	Freshwater Availability / Distance to Fresh Water Source (km)	0,005	2

RESULTS

- Land carrying capacity status in Pangandaran Sub-districts is overshot, inasmuch that the S_L value is below the D_L value by the year of 2020-2050 from its projection.
- Land Carrying Capacity Calculation Results

Year	SL (ha)	DL (ha)
2020	6077	6257
2030	6077	6621
2040	6077	7007
2050	6077	7414

DISCUSSION

The population in Pangandaran District is projected to be 75,401 people in 2050.
This means that 7,414 ha of land is needed to accommodate these residents if it refers to the decent living standard set by the Ministry of Environment and Forestry. Because the land area cannot be increased, the variable that must be addressed is the population itself. If possible, the Pangandaran Government should immediately make a firm policy regarding pregnancy control (family planning) or direct the planning of vertical housing development in order to meet the needs of residential land for residents in the Pangandaran area. It should be noted that marine tourism activities should not interfere with the lives of local residents (Pham, 2020), in fact, they should provide better livelihoods for local residents themselves (2016). Even so, the environmental conditions of Pangandaran Beach are still included in the category according to the index of 3,665 for marine tourism activities, even though there have been natural disturbances or anthropological interferences.

- CONCLUSION

- From the result of land carrying capacity and resource suitability analysis above, it can be concluded that the urgency of Pangandaran beach is not about its environmental condition and quality. The stakeholders should put some corncerns to the local life quality, considering the disparition of its D_L and S_L value of land carrying capacity in Pangandaran Sub-districts.