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Policy Model of Physical Changes in The Environment of Mandeh Area From 2008-2018

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Abstract

The purpose of this study was to see the physical changes in the environment of Mandeh area, South Pesisir Regency, from 2008-2018 and formulate an environmental policy model for the Mandeh area. The analysis technique was carried out by overlaying map of Mandeh area land use from 2008-2018, to determine the policy model of the physical changes in the environment of Mandeh area was analyzed by FGD and AHP. As for the results of the land use map overlay shows many physical changes. Based on the results of the analysis and discussions that have been done previously, it can be concluded that Physical Changes in Environment of Mandeh area from 2008-2018 have their own impact on the environment, For this reason, it is necessary to have an environmentally sound policy model. Based on the results of the analysis, there are five alternative policy priorities are: (1) it is expected that the government to analyze the utilization of natural resources does not exceed the environmental carrying capacity value of 0.752, (2) zoning of land use and marine waters of mandeh area value 0.791 (3) cultivating the main functions of natural resources potential, human resources and artificial resources value 0.794 (4) conservation for mangroves and coral reefs that have been damaged value 0.732 (5) analysis of the system plan and road network of sea and land transportation value 0.726.

Keywords: Environmental Physical Changes, Mandeh Region.

Introduction

The policy on environmental management in Indonesia has changed with the issuance of Law Number 32 of 2009 in Purnaweni (2014) concerning Environmental Protection and Management. The issuance of this Law is due to environmental damage has been increased so that needs a policy that not only requires environmental management but also protection of the environment to be issued (Hermon, 2009). The reason for the issuance of the public policy is to expect a change in the development paradigm from being focused on growth that focuses on economic interests to be focused on sustainable development (Oktorie, 2017). The change of this paradigm is certainly very demanding Regional Government implementation to have better performance with the expectation they pay more attention to the better environmental management, which is the source of guarantee of sustainable development. Environmental management is a very important thing to do considering humans always try to maximize all manifestations of their desires and often do the dirty job to make it happen faster like they tend to sacrifice their environmental interests (Hermon, 2015).

The environment is a combination of physical conditions that include the state of natural resources such as land, water, solar energy, minerals and flora and fauna that grow on land and sea with institutions that include human creation such as decisions on how to use the environment can also be interpreted into everything that exists around humans and influence the development of human life (Hermon, 2010; Hermon, 2012).

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According to Law Number 32 of 2009 Article 22 paragraph (1) that "every business and/or activity that has an important impact on the environment must have an EIA" and Article 34 paragraph (1) that "any business and/or activity that is not included in the Amdal compulsory criteria must have UKL-UPL ". This environmental document is used as an instrument to prevent pollution and to minimize the impact resulting from the business, then each proponent whose efforts to produce negative impacts to the physical and non-physical environment is required to make environmental feasibility documents before the business runs, Andini *et al.,* (2012).

After obtaining UKL-UPL recommendations and running activities, the initiator must periodically report to environmental agencies in its administrative area (Said, 2006; Oktorie, 2018). According to Sabaruddin (2007), the agency who is responsible for the environmental sector has the authority to control environmental impacts, pollution and environmental damage and oversee the implementation of UKL-UPL in its area. Land use is an important aspect to know the extent of human activities in interacting with nature. Even the conditions of land use can be the basis for in-depth research on human behaviour in utilizing the land. Land use data and the changes can be taken into consideration for spatial planners and their control, so there is no misuse of land use in (Andini *et al*.,2012; Hermon, 2016; Hermon, 2017).

Every time there is development, it always has a positive and negative impact, but in the development process, the most important thing is to know the potential of resources owned by a region, both physical and human resources, especially with the implementation of regional autonomy, where each region must have a regional resource balance. This resource balance can be obtained with the help of GIS. GIS is able to provide new information about resources owned by an area, both in terms of distribution and quantity (Hermon *et al*., 2018a). According to Hadi (2002); Hermon *et al*.,(2018b), GIS has an important role in development, namely at the planning, implementation, and evaluation stages. GIS is able to present which priorities must take precedence, provide information about the types of development needed.

Gunn (1994); Fandeli and Nurdin (2005) explained that ecotourism has an important value for the conservation of coastal Pesisir ecosystems because there are several things, including; (1) providing economic value to regions that have the purpose of carrying out conservation activities in protected areas, (2) providing economic value can be used for conservation programs in protected areas, (3) increasing income directly and indirectly to communities around ecotourism sites, (4) encourage sustainable use of natural resources, and (5) reducing threats to biodiversity. The development of the tourism sector in South Pesisir Regency, especially throughout the Mandeh area of Tarusan district has been directed at one of the developments of marine tourism objects since 2002 through the Tourism Office that will be a National area. In the last few years, especially from 2013 to 2014 there has been a significant increase in the frequency of the number of tourist visits Mandeh area reaching 80% of domestic tourists and 5% of foreign tourists (South Pesisir Regency Tourism Office, 2015). Pesisir ecotourism itself is a beach tourism by relying on the advantages of Pesisir area which must be environmentally oriented by prioritizing the principles of tourism that sustainable tourism principles which are expected to be able to maintain the environmental quality of Pesisir.

Syam (2015) Mandeh area is declared as a centre for maritime tourism development for the western part of Indonesia. This area has several large and small islands that have the potential as national and international tourist attractions. Geographically, this area has a bay, relatively calm sea waters, and this area is rich with coral reefs and mangrove vegetation. Mandeh area and surrounding are located in South Pesisir and Padang City, consisting of Carocok Tarusan Village, Mandeh, Nyalo River, Mudiak Aie, Sungai Pinang, which are part of the South Pesisir Regency and Sungai Pisang village which is located in Padang City. This area is about 61 km from Padang City and around 17 km from Painan.

Mandeh area is currently a centre of development to prevent environmental pollution, land functions that change from 2008 to 2018 will be analyzed for policy models for physical changes in environmental of Mandeh area which certainly has a positive and negative impact on the environment and society.

Method

This research was conducted in the Mandeh area of South Pesisir Regency, West Sumatra Province. Physical changes of Mandeh area were analyzed using 1: 250,000 Topographic Maps with GIS-Global Mapper 5.1 analysis tools to compile contour modification and simulation. Whereas to see changes in land use analyzed by GIS-ArcGIS 10.1 Network Analyst (Syam 2016; Putra and Mutmainah, 2016). Formulation

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of policy models for physical changes in the environment using FGD and AHP (Syam 2014; Kristian and Oktorie, 2018).

Results and Discussion

Mandeh tourism area consisted of several villages, namely Mandeh, Sungai Nyalo, and Sungai Pinang, which for a long time can only be reached by boat, that was if they come from Padang City (± 61 Km) or even from Painan (± 17 Km) as the Capital South Pesisir Regency through Carocok Tarusan. This area was in the form of bays covered by islands such as Cubadak Island, Marak Island, Pagang Island and Bintangor Island, and small islands such as Nibbana Island, Sironjong Gadang, Sironjong Kaciak, Gadang Devils and Kaciak Satan and Taraju Island, which made the sea waters relatively calm and rich with coral reefs where the local areas were still overgrown with mangrove forests.

The topography of the Mandeh area was undulating because of the large differences in height between one location and another, mountainous and hilly with an altitude of 0 - 575 m. In general, the western part of the area was a lowland with a slope of 0 - 5% considering its location adjacent to the beach and the eastward the higher the slope level. Slope conditions were dominated by large slopes of 40% (covering an area of 54.69%). This area had a height of sea level ranging from 2 meters above sea level, 100 meters above sea level, and 1000 meters above sea level.

The conditions of mountainous & hilly topography with an altitude of 0 - 575 m, there were primary forests & community forests. Along with white sandy beaches/quartz. The access to this area through: (a) Land route, from Padang City to Painan towards Carocok. From Carocok, there was already 33 km of roads through the hills and the shoreline connecting the villages of Mandeh, Sungai Nyalo, and Sungai Pinang, (b) Sea lanes, from the Muaro pier in Padang City using motorized motorboats and fishing boats.

Based on the results of the analysis of land use change maps from 2008 to 2018, it was obtained forest area results in 2008 amounted to 7516 ha. After the construction of forest areas divided into 317.17 ha of shrubs, 9 ha of water bodies built, 1.2 hectares of land, and 1.5 ha of open land. The flat land area was mostly located on the west (coast), generally in the form of swamps overgrown by forests, which in 2008 covered an area of 2400 ha after analyzing land use maps in 2018, an area of 2400 ha was divided into several parts such as the current forest area of 57 ha , rice fields had not changed with an area of 10m water body 2.6 ha open land 17.3 ha, land built 50.8 ha mangrove 1.9 ha and garden 102.ha. Most of the Mandeh area was a protected forest with slopes> 40% covering an area of + 50% of the total planning area. The length of the coastal of this regency reaches 218 km. The flat land area was mostly located on the west (coast) overgrown with sago palm forests and mangrove forests. This land was used by the community to accommodate all coastal-related activities both for fishing settlements, agricultural land for food crops, dry crops, annual crops and fisheries.

The use of land in the Mandeh area was mostly as forest and plantation areas, rice fields and shrubs. This condition indicates that the Mandeh area still had a natural beauty that had not been or had not been developed in a luxurious way and prioritizes the element of naturality. In some parts of Mandeh areas also had been developed as residential areas, both for local residents, resorts, and other regional support facilities.

In the area of the garden itself, which used to be 16 ha, now it had been turned into 15 ha of the bush, 2.7 ha of built land. After carrying out large-scale land clearing, there were still payments for open land which had now become a bush of 73 ha. Damage to mangroves and coral reefs due to the opening of roads along tourist attractions was also seen, namely in 2008 mangroves covering an area of 388 ha had become forests of 38.7 ha, bushes of 68 ha and land built of 1 ha. As for damage to living coral reefs covering 191.3 ha and damaged 427.4 ha. Smooth coral reefs were caused by road opening materials, tourism boat lines (Tarusan, Carocok) and PLTU boat lines (Sirih bay coal).

Distribution of residential areas was only a few points in the middle and south of the area. Most of the forest land in the Mandeh area was used for annual crops and plantation crops. For food or seasonal crops only spread in several parts in the north and south of the Mandeh Region. While the distribution of land use as mangrove plants was spread in most areas along the coast.

Access to or pass through the South Pesisir Regency area could only be reached by road. The land transportation route can provide ease of achievement for tourists with a total length of road network in the South Pesisir Regency area of ± 1,640.80 km. Until 2004, various road and bridge management activities were carried out including the construction, improvement, rehabilitation and maintenance of roads and

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bridges. Some of the problems would be faced in achieving the goals of road and bridge management included the high reduction in road conditions due to the age of service plans that had been exhausted, the occurrence of natural disasters and the increase in traffic both in volume and load capacity that exceeded the heaviest Axis Load (MST). For more details could be seen in the table below:

Table 1. Changes in Land Use from 2008-2018 in Mandeh Tourism Areas

No	Land Use in 2008	The area in 2008 (ha)	Land Use in 2008	The area in 2018 (ha)	Change
1	Forest	7516.135769	Forest	7282.64635	Forest
2	Forest	7516.135769	Bush	2712.794863	Forest becomes bush
3	Forest	7516.135769	Body of Water	81.17165605	The forest becomes the body of water
4	Forest	7516.135769	Open Land	93.2501801	The forest becomes open land
5	Forest	7516.135769	Built Land	270.9047674	The forest becomes built land
6	Bush	2404.060678	Forest	7282.64635	Bush becomes forest
7	Bush	2404.060678	Bush	2712.794863	Bush
8	Bush	2404.060678	Rice Field	346.9089402	Bush becomes rice field
9	Bush	2404.060678	Body of Water	81.17165605	Bush becomes the body of water
10	Bush	2404.060678	Open Land	93.2501801	Bush becomes open land
11	Bush	2404.060678	Built Land	270.9047674	Bush becomes built land
12	Bush	2404.060678	Mangrove	280.9899946	Bush becomes mangrove
13	Bush	2404.060678	Farm	335.6075959	Bush becomes farm
14	Built Land	168.7434455	Bush	2712.794863	Built land
15	Body of Water	76.10701102	Bush	2712.794863	The body of water becomes water
16	Body of Water	76.10701102	Body of Water	81.17165605	Body of water
17	Body of Water	76.10701102	Built Land	270.9047674	The body of water becomes built land
18	Body of Water	76.10701102	Mangrove	280.9899946	The body of water becomes mangrove
19	Farm	171.0665126	Bush	2712.794863	Farm becomes bush
20	Farm	171.0665126	Built Land	270.9047674	The farm becomes built land
21	Farm	171.0665126	Farm	335.6075959	Farm
22	Open Land	173.900751	Forest	7282.64635	Open land becomes a forest
23	Open Land	173.900751	Bush	2712.794863	Open land becomes bush
24	Open Land	173.900751	Open Land	93.2501801	Open land
25	Open Land	173.900751	Built Land	270.9047674	Open land becomes built land
26	Rice Field	508.2213671	Bush	2712.794863	Rice field becomes bush
27	Rice Field	508.2213671	Rice Field	346.9089402	Rice field
28	Rice Field	508.2213671	Body of Water	81.17165605	Rice field becomes the body of water
29	Rice Field	508.2213671	Open Land	93.2501801	Rice field becomes open land
30	Rice Field	508.2213671	Built Land	270.9047674	Rice field become built land
31	Rice Field	508.2213671	Farm	335.6075959	Rice field becomes farm
32	Mangrove	388.400057	Forest	7282.64635	Mangrove becomes forest
33	Mangrove	388.400057	Bush	2712.794863	Mangrove becomes bush
34	Mangrove	388.400057	Body of Water	81.17165605	Mangrove becomes the body of water
35	Mangrove	388.400057	Built Land	270.9047674	Mangrove becomes built land
36	Mangrove	388.400057	Mangrove	280.9899946	Mangrove
37	Rice Field	508.2213671	Bush	2712.794863	Rice Field becomes bush

Based on the analysis of land use change maps from 2008 to 2018 it could be seen that changes were very significant, physical changes in the environment itself had a positive impact and negative impacts on the environment and society.

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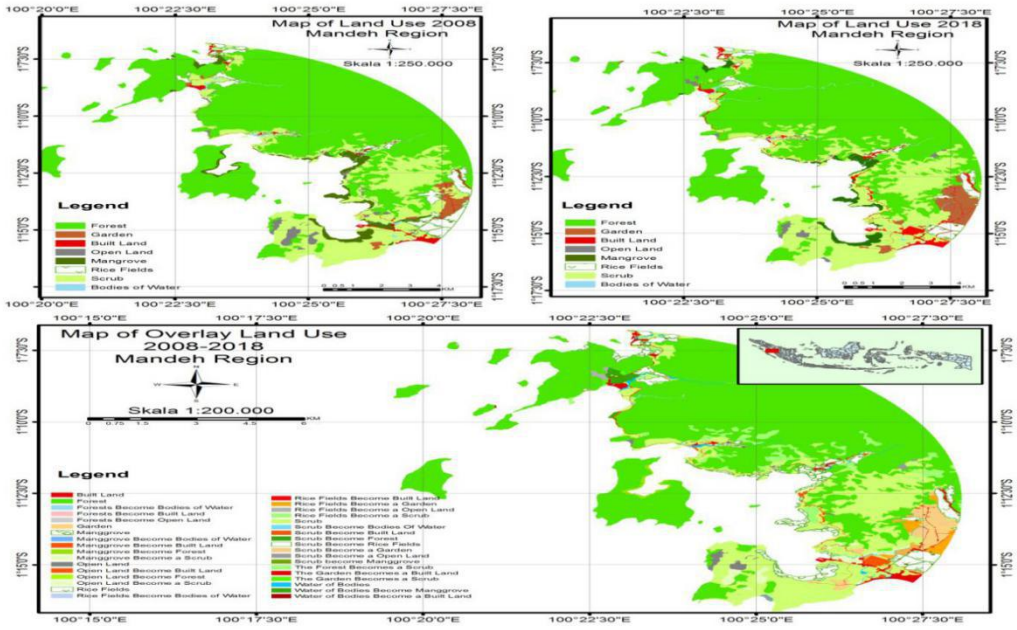

Figure 1. Land Use Change Maps from 2008 to 2018

Based on the map above, land use changes that occurred for the tourism sector itself would certainly have a positive impact where access, beauty, and tourist attraction would be higher in value than before development. There would be many tourists that visit that place, and the economy would sustainably increase. However, we also had to pay attention to the environment in each development that will have a negative impact on the environment for that environmentally friendly and environmentally friendly development were needed so that the beauty and function of the coastal physical environment itself did not change. Based on this problem, a need model was needed for Policy Model of Physical Changes in the Environment of Mandeh area from 2008-2018. In the policy model on physical changes in the environment would be seen from 3 priorities, namely 1) physical changes in the environment 2) spatial planning or meta-plan of Mandeh area 3) preservation of cultivation areas. For more details, see the picture below:

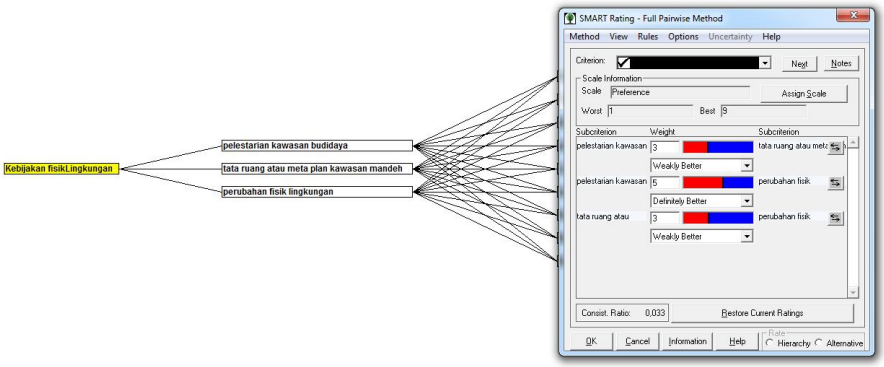

Figure 1. Hierarchy of Policy Models of Physical Changes in Environment of Mandeh Area from 2008-2018

To produce the criteria of priority, FGD Focus Group Discussion was conducted with several people who played a role in the tourism development of the Mandeh area. Based on the results of the discussion for the criteria for the policy model of physical changes in environment was to do various things as follows: 1) it

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was expected that the government to analyze the utilization of natural resources did not exceed the carrying capacity of the environment 2) for land that had been opened, the government was expected can optimize the utilization 3) conservation for mangroves and coral reefs that had been damaged 4) analysis of the impact of land built on the physical beach 5) zoning of land and space use of marine waters in the Mandeh area 6) analysis of planned sea and land transportation systems and road networks 7) cultivating the main functions of natural resources potential, human resources and resources artificial 8) cultivation of plantation areas 9) eco-friendly tourism areas. Based on the results of the AHP analysis, the following results are obtained:

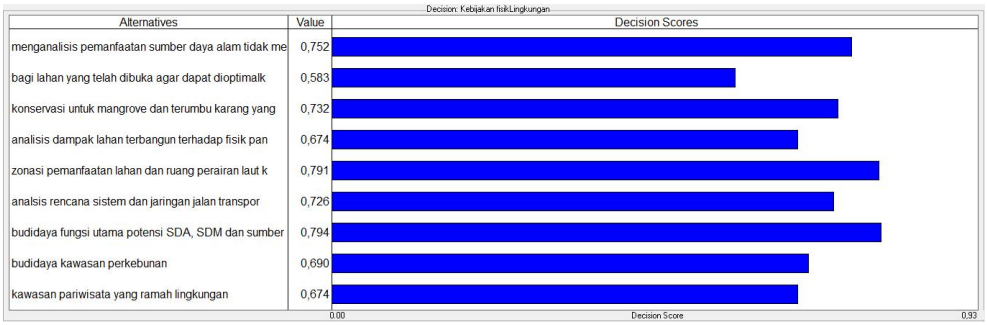

Figure 2. Priority of Policy Models of Physical Changes in Environment of Mandeh Area from 2008-2018

Based on the results of the analysis and discussion that has been done previously, it can be concluded that the Policy Models of Physical Changes in Environment of Mandeh Area from 2008-2018 has its own impact on the environment so that it requires an environmentally sound policy model. Based on the results of the analysis, it is obtained five alternative priority policies: (1) It is expected that the government to analyze the utilization of natural resources does not exceed the environmental carrying capacity value of 0.752 (2) zoning of land and space use of marine waters made area value 0.791 (3) cultivation of the main functions of natural resource potential, human resources and artificial resources value 0.794 (4) conservation for mangroves and coral reefs that have been damaged in value 0.732 (5) analysis of the system plan and road network of sea and land transportation value 0.726.

Conclusion

Based on the results of the analysis and discussion that has been done previously, it can be concluded that the Policy Models of Physical Changes in Environment of Mandeh Area from 2008-2018 has its own impact on the environment so that it requires an environmentally sound policy model. Based on the results of the analysis, it is obtained five alternative priority policies: (1) It is expected that the government to analyze the utilization of natural resources does not exceed the environmental carrying capacity value of 0.752 (2) zoning of land and space use of marine waters made area value 0.791 (3) cultivation of the main functions of natural resource potential, human resources and artificial resources value 0.794 (4) conservation for mangroves and coral reefs that have been damaged in value 0.732 (5) analysis of the system plan and road network of sea and land transportation value 0.726.

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