

Disaster Mitigation based network analysis and spatial analysis to support the sustainability of settlements in the island micro

Case Study: Thousand Islands, DKI Jakarta

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Abstract: *Indonesia is geographically located in the path of ring of fire and the confluence of three major plates overlapping, so with that condition Indonesia located in disaster-prone areas. In developing a culture of safety against the threat of catastrophic disaster-prone areas should not be allocated for use. If the compulsion occupying risk areas, the houses and buildings should be constructed with friendly concept disasters in accordance with the characteristics of the area and the type of disaster that pose a threat. Thousand Islands is a micro maritime territory in the area administrative of Jakarta, with hazards and characteristics of different regions with most areas of Jakarta, where there are 11 island settlements, two of which are in force Pramuka Island. Disaster mitigation undertaken should be in accordance with the type of disaster and the characteristics of the area, especially the area with the characteristics of the islands. Then in analyzing the disaster done through spatial analysis and network analysis. In disaster management of the islands are very different from onshore disaster mitigation. For that, we need a better understanding of the archipelago to be able to formulate a suitable disaster mitigation to be applied in micro archipelago in an effort to support the sustainability of the settlement area of the islands.*

Keywords: *disaster mitigation, islands*

1. INTRODUCTION

Indonesia is a disaster-prone areas because it lies in the path of fire ring (Ring of Fire) and the confluence of three major plates that are overlapping. It is therefore necessary mitigation and adaptation , especially catastrophic climate change that aims to reduce the impact. Disaster mitigation is an effort for reducing the risk of disaster , either structurally or physically (physical development of natural and/or artificial) and non-structural or non-physical through increased ability to face the threat of disaster in coastal areas and small islands.

Thousand Islands is an archipelago of Jakarta , in addition to the location of the Thousand Islands regency tourism is an area settled 22 704 inhabitants with a population density of 2,610 people / km² (Thousand Islands Statistics 2015), spread over 11 islands in the Thousand Islands . High population is not proportional to the area of land that is in the Thousand Islands , including 11 island that is intended as the location of settlements , two of which included most populous island is Panggang Island and Pramuka Island. It is necessary for both forms of disaster mitigation of natural and non- natural disasters are influenced by environmental degradation due to development ongoing and not in accordance with the characteristics of the islands .

Mitigation measures should be implemented at the design stage is to prepare plans for the management and utilization of coastal areas and small islands of integrated , government and regional governments must make disaster mitigation in accordance with the type and characteristics of the region by making three attempts : prevention, mitigation, and preparedness.

Geographic Information Systems (GIS) is one of our most advanced computer science today . The notion of the SIG is very diverse . This is in line with the development of GIS itself since it was first SIG developed by Tomlinson in 1967. Murai (1999) defines GIS as an information system that is used to input, store, recall, process, analyze and output geographically referenced data or geospatial data to support decision making in the planning and management of land use, natural resources, environment, transportation, municipal facilities, and other public services. Although GIS has many definitions, in principle, not be separated from the use of GIS hardware and computer software as well as the

management of data and information relating to the earth's surface. (Elly, Jafar, Muhammad. 2009). This network analysis will greatly assist local governments to prepare plans for the development of marine tourism flow in the Thousand Islands cluster, especially in Pramuka Island. The application of GIS technology can be an alternative to the development potential of the area associated with coastal and marine environment, namely marine tourism. Because many factors that lead to a pattern of development of coastal and marine resources for this are not optimal and unsustainable.

The purpose of this study in identifying disaster mitigation in the form of Pramuka Island Cluster that contains : Identify the types of disasters that occurred in Pramuka Island Cluster and Evaluate disaster management in the region Cluster Pramuka Island based on network analysis.

2. DATA AND METHODS

2.1. Disaster Mitigation

Disaster mitigation is a term used to refer to all measures to reduce the impact of a disaster that can be done before the disaster struck, including preparedness and risk reduction measures long term . Disaster mitigation covers both the planning and implementation of measures to reduce the risks that endanger caused by human activity and natural hazards are already known , and the planning process for effective response to disasters that actually happened.

Mitigation structurally by performing the technical effort, well run private natural or artificial, such as creating a breakwater and mangrove planting to mitigate tsunami, construction of embankments, canals diversion, the doors of the water flood control, river normalization, and the system ponder on the area prone to flooding, the plaster on the eroded coastal areas and disaster-resilient structures manufacture.

While the non-structural mitigation is non- technical efforts concerning the adjustment and regulation of human activities to be consistent and in accordance with structural mitigation efforts and other efforts. Nonstructural mitigation, among others by creating a policy regarding the standardization of disaster-resistant buildings, the economic policies of coastal communities, public awareness, as well as counseling and socialization about disaster mitigation. So as to create a good disaster mitigation should be well planned and comprehensively through various efforts and approaches both structural and nonstructural.

2.2. Suitability Analysis Region (Spatial)

Regional suitability analysis is done by using the Geographic Information System (GIS), a computer-based spatial information system involving Arc GIS software 10.1. In this analysis principle, in the form of a database of primary data and secondary data with actual data 2014, namely:

Table 1. Variable & Description

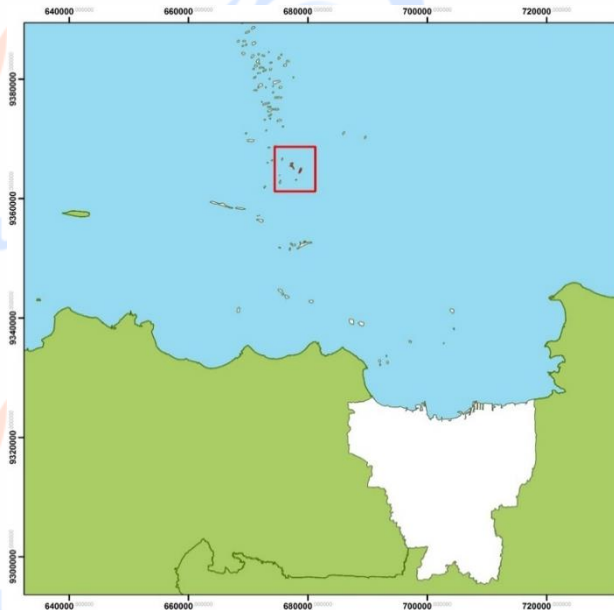
No	Variable	Indicator	Description
1	Physical	<ul style="list-style-type: none"> ✘ Breakwater ✘ seawall ✘ Mangrove forest ✘ Evacuation route ✘ Evacuation site ✘ Disaster-friendly buildings 	<p>Indicators contained in a physical variable structural mitigation measures that the physical development or use natural resources</p> <p>Indicators contained in a physical variable structural mitigation measures that the physical development or use natural resources</p>
2	Social and Cultural	<ul style="list-style-type: none"> ✘ awareness of disaster ✘ Utilization of natural resources as a form of mitigation ✘ Protecting the environment ✘ Waste management 	Community efforts in preserving the environment to minimize disasters both natural and non alama disaster caused by environmental degradation as a result of increasing population

No	Variable	Indicator	Description
3	Institusional	<ul style="list-style-type: none"> ✘ Organization on disaster community level ✘ Disaster relief on each island ✘ Disaster management scope village ✘ Disaster management scope district 	Mitigation nonstructural and structural, organizational forms of formal and informal, as a form of public awareness of disaster
4	Policy	<ul style="list-style-type: none"> ✘ Form disaster mitigation ✘ Management of natural resources ✘ Protecting the environment ✘ Waste management ✘ Land use 	Disaster mitigation efforts through policies and structuring of the territory as well as on the development plan in accordance with the characteristics of the island and the potential disasters that might occur

2.3. Overlay & Network Analysis

The ability to place a graphic of the map graphic above another map and display the results on a computer screen or on a plot. In a nutshell, overlay display a digital map on digital maps and their other attributes and generate maps that have a combination of both attribute information from both the map. The analysis can be done with a route network analysis is the analysis, which can determine the optimum route there are two or more points that must be overcome. Determination of the optimal route can be based on distance, time, or other indicators.

Figure 1. Map orientation of the study area



3. RESULT AND DISCUSSION

3.1. Pramuka Island Cluster Disaster Risk Assessment

To determine the potential disasters that warrant concern by the public force is necessary to study the Pramuka Island disaster risks which may occur. Disaster risk assessment consists of three components, namely the threat assessment, vulnerability and capacity/capability. This assessment is done by analyzing the historical data/history to explain the level of risk based on the disastrous events that have occurred in the Thousand Islands. Assessments conducted more focused on Panggang and Pramuka Islands. It is caused

by a function of both the island is the island settlements. While the work is only island serves as the seat of government, where the condition there are no permanent residents on the island.

1. Wind tornado

The whirlwind is the tomb of strong winds with a speed of 120 km/h or more. The cyclones are common in tropical regions between the Tropic of north and south, except in areas very close to the equator. This disaster caused by pressure differences in a weather system that often occurs in the transition period, which is around March and November in the afternoon or evening. The wind speeds that can reach 50 to 60 knots. Waterspout is spillovers cloud Cumulonimbus (Cb) is used to grow during the rainy period, but not all of the growth Cb clouds will cause a tornado. Its presence can not be predicted. It usually occurs suddenly (5-10 minutes) on a local scale area. If it happened last long, the tracks form a path of destruction. More often occur during the day and more in low-lying areas. West wind season (December-March) season is very prone to cyclones, can be seen from the data event of disaster, a tornado occurred during the peak of the rainy season in month of January. Under the direction of west monsoon, the western part of the panggang island a high risk area will be the impact of a tornado. Genesis cyclones that have happened before showing symptoms-gajala high rainfall and wind pressure into the tomb early emergence of wind. Although it takes a lot of victims, cyclones that occur can damage homes and other buildings.

2. Fire

Fires in Jakarta generally much happening around densely populated settlements, as well as on the condition of Panggang Island settlements. Dense settlements are spaces in urban areas are most vulnerable to the threat of fire hazards (Kidokoro 2008; Sufianto and Green, 2011). In addition to the physical condition of the building, one of the most important cause of the fire that is the behavior of the community. The people's behavior can be a cook's behavior, the use of electrical equipment careless, kerosene and candles, smoking is harmful, and others. People are often not aware of and ignore behavior that can be risky. Associated with the behavior of people, fires are divided into four classes based materials fire triggers, namely:

- ✓ Class A
Fires triggered from solid materials are flammable such as wood, plastic, fabric and more.
- ✓ Class B
Fires triggered from liquid or gaseous materials such as gasoline, diesel, benzene, butane, and others.
- ✓ Class C
Fires caused by electrical current on equipment such as machinery, generators, electrical panels, and more.
- ✓ Class D
Fires caused from metal materials, titanium, aluminum, and others.

Based on the grade and condition Cluster Pramuka Island triggered a fire due to electric current and combustible solid materials which are potential fire hazards tertapa in case of drought, where the conditions are dry, the temperature as well as wind gusts beach Lebab facilitate the fire to spread. Given the condition of the panggang island settlements impinge upon each other and some of the houses made of semi-permanent and temporary, increase the risk of fire occurred.

3. Marine Accident

Accidents at sea is one of the disaster caused by the failure of the technology disastrous events caused by faulty design , operation , human negligence and deliberate in the use of technology / industry . Technology failures can cause pollution (air, water and soil) casualties, damage to buildings and ecological stability. Not only boat accident, an accident on the rating that causes the victim is also a concern of the threat of disasters, in accordance with the required security standards to ensure the safety of the tourists when making travel in the cluster region Pramuka Island.

4. Damage Island Ecosystems

Damage to the ecosystem of the island one of which is the coastal erosion. Abrasion is the process of coastal erosion by wave power of the sea and ocean current destructive. Damage to the coastline due to erosion triggered by the disruption of the balance of the beach. Usually abrasion occurs due to natural causes, but in some cases may result from human activity. Island ecosystem conditions contained in the Cluster of Pramuka Island exacerbated by the accumulation of garbage in one part of each of the islands .

3.2. Network Analysis

Aronof (1993) says that the connectivity is the connectedness of different operations to collect values in a region that is traversed. Each of these connectivity functions should include three things , namely :

- a. Has a spatial element specifications as the facilities that can be used in the event of a disaster (boat ambulances, motor boats evacuation, the open space as a evacuation point, etc.) connected by road and water transport lines. Supporting facilities is very important in the success of disaster mitigation, support facilities located in each of the islands is now connected by boat taxis that connect these three islands. making the connection to Pramuka Island, Panggang Island and Karya island. For more details regarding the supporting facilities and spreading can be seen in Table 2.

Table 2. Number of Facilities Support Disaster Mitigation

No	Infrastructure	Pramuka Island	Panggang Island	Karya Island
1	Dock	5	3	2
2	Motor Boat	3	13	-
3	Taxiboat	1	11	-
4	Boat	178	182	-
5	Health Facility	2	2	-

Source : Thousand Islands statistic, 2015

- b. A set of rules that determine the potential or displacement is allowed along interconnectivity. The activities of the movement was based for their interest in an object that has an appeal, it makes their displacement. Transfer rules must be adapted to the conditions existing regulations, because this transfer using the water transport rules used are depths in accordance with the transportation of water used.
- c. And there is a unit of measurement (distance, time and cost). The unit of measurement is very important in the analysis of connectivity, the unit of measurement can determine the shortest distance, fastest time and lowest cost in the third to make the transition in the island. The measurement unit calculates the distance, time and cost to get to each of the islands as well as to each potential of the three islands.

Figure 2. Disaster Mitigation Tornado

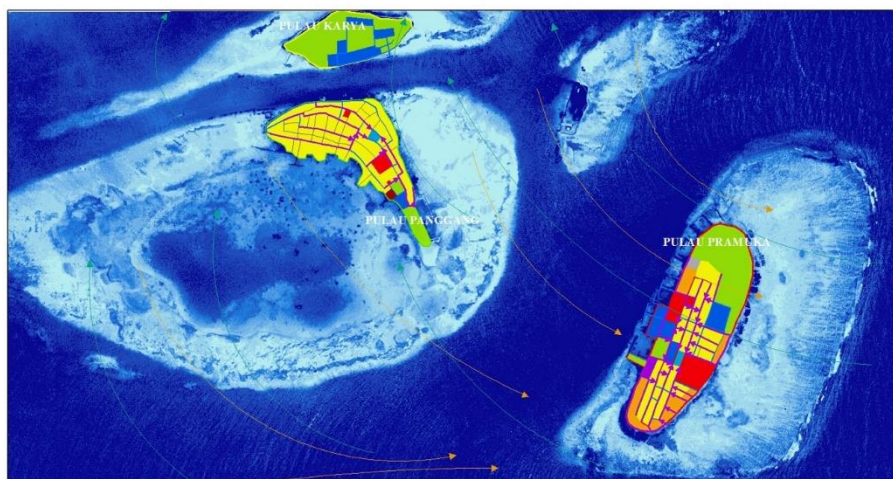
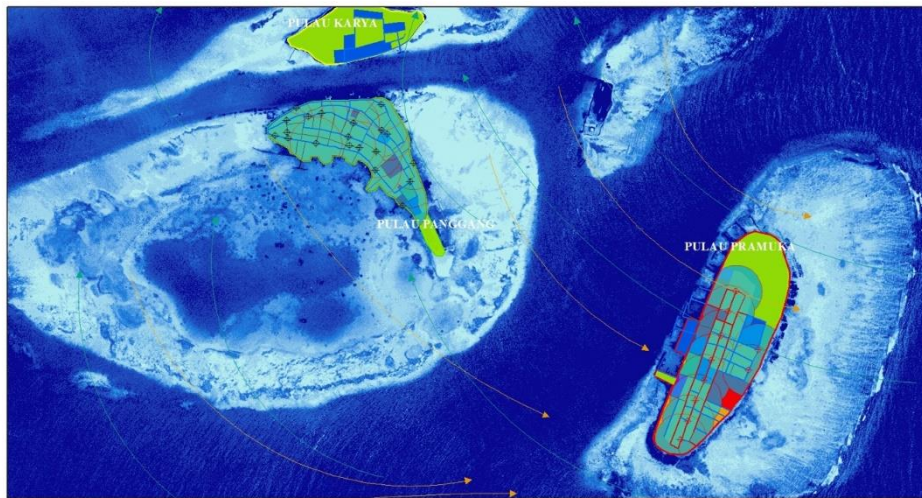


Figure 3. Disaster Mitigation Fire

4. CONCLUSION

Hazard contained in cluster Pramuka Island is a danger of damage to the island's ecosystem, windstorm, marine accidents and fires. Although intensity not often, but the vulnerability of society as well as governments thousand islands area is very high it can be seen from the public and the government 's readiness to face impending disaster. Based on the analysis of network in Cluster of Pramuka Island, network analysis must have three things : a spatial element, a set of potential or displacement rule and a measurement unit (distance, time and cost). From the analysis of connectivity, can be formulated some proposals that could be used for disaster mitigation in sustainability cluster of settlements in Pramuka Island. As for the proposal as the evacuation of the groove and the groove wind disaster evacuation fire disaster .

Disaster management by the government in the area of pramuka island cluster can now be considered ineffective. This assessment can be based on the government's efforts in the dissemination of threats of disasters on poor communities accepted by society. This is influenced by the public mindset about the disaster, it can be said people just "let go" when the disaster occurred. Knowledge of tornado disaster management through the conservation of mangroves on the island community was minimal, so most people assess mangrove forests serve only resist erosion so that they do not consider the mangrove forest is the most important region as the protector of the island. Protecting the environment and the rules of land use and zoning disaster-prone areas should be the government's attention to the Thousand Islands District of the region Force Pramuka Island where the two islands of which is the island designated as a settlement that required the concept of settlement in accordance with the characteristics of the island aimed at maintaining and preserving the ecosystem of the island.

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