

**SUSTAINABLE COASTAL MANAGEMENT
FOR HANDLING ABRASION
(CASE STUDY OF KUWARU COAST, BANTUL,
YOGYAKARTA)**

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One of the coasts in Srandakan that experiences abrasion is Kuwaru Coast. The Kuwaru Coast has a high economical value. The threat of abrasion in the high economical area will impact on socioeconomic of the society, such as loss of property, infrastructure, ecological damage, and societal problems. At the same time, the protection is expensive. Therefore, it is needed to handle the abrasion appropriately and environmentally friendly. This study aims to: (1) create a sustainable coastal to cope the abrasion and (2) formulate policies and integrated strategies for sustainable coastal ecologically, economically, and socially.

This study is a field research study using observation and interview method for collecting data. The data analysis uses quantitative descriptive and qualitative descriptive analysis. To handle the abrasion in Kuwaru Coast is by planting vegetation (mangrove) and making a simple breakwater (from woven bamboo strips called Apo-apo). Apo-apo is made not to hold back the waves but to reduce the force of the waves and protect the mangroves until they grow. Whereas planting the vegetation is divided into three zones.

The results show that abrasion in Kuwaru Coast caused coastline change. Coastline change in Kuwaru Coast is approximately 20 meters in 2006-2013. The mangrove type that is suitable to be planted in Kuwaru Coast is *Rhizophora apiculata*. The availability of water is the main factor of the success of mangrove planting. One of the local society ability in Kuwaru Coast in handling abrasion is planting pandanus around the little *Casuarina* spp to protect it from salt steam of sea water. Apo-apo, mangrove, and pandanus can be planted alongside Kuwaru Coast, so that it will look like a mangrove and pandanus garden with bamboo fence because the unification of the three of them has an esthetical value that is definitely amendable to be a tourism. The planting method of Apo-apo

and mangrove is an environmentally friendly way that can be done in reducing the abrasion in Kuwaru Coast.

Keywords: abrasion, coastal management, sustainable.

INTRODUCTION

Background

Coastal areas of DIY South Coast have many experience abrasion. Along the DIY South Coast, there are 33 coastal villages that are spread from Kulon Progo Regency, Bantul Regency, to Gunung Kidul Regency. In Kulon Progo Regency, there are 10 coastal villages that are spread at 4 districts. In Bantul Regency, there are 4 coastal villages that are spread at 3 districts. While in Gunung Kidul Regency, there are 19 coastal villages that are spread at 6 districts. Some villages in DIY South Coast is an area that have a high economic value. The main potential in that areas is fisheries and aquaculture, agriculture, and tourism activities that can improve the welfare of community. Threats of abrasion in important economic areas will impact on socio-economic of society. It is necessary for the prevention and mitigation of abrasion.

Coast erosion is the process of wearing away material from a coastal profile due to imbalance in the supply and export of material from a certain section. It takes place in the form of scouring in the foot of the cliffs or dunes or at the subtidal foreshore. Coastal erosion takes place mainly during strong winds, high waves and high tides and storm surge conditions, and results in coastline retreat and loss of land. The rate of erosion is correctly expressed in volume/length/time, e.g. in $m^3/m/year$, but erosion rate is often used synonymously with coastline retreat, and thus expressed in $m/year$ (Marchand, 2010).

One of the coastal areas in DIY South Coast that is coastal in Srandakan Subdistrict, Bantul Regency experience coast morphological changes cause the vulnerability of the coast due to abrasion and accretion; tidal; wave height; slope of beach; and coast morphology (Savitri, 2012).

Based on the research results of Savitri (2012), the level of coast vulnerability in Srandakan Subdistrict are abrasion and accretion. Abrasion that occurs resulting shoreline changes as big as 4.99 Ha and accretion that occurs resulting shoreline changes as big as 32.31 Ha.

High waves in Srandakan coastal showed very high levels of vulnerability because the value of maximum wave height is 3 meter. Coasts in Srandakan have a sandy coast types so that the level of coasts morphology vulnerability are very high.

Table 1. Wide Area of Coastal Vulnerability in Bantul.

Subdistrict	Wide Area of Physical Vulnerability (Ha)			
	Low	Medium	High	Very High
Kretek	100.71	19.59	20.28	91.85
Sanden	117.24	0	0	52.14
Srandakan	93.35	0	52.80	0
Total	311.3	19.59	73.08	143.99

Source: Savitri (2012)

Based on the table, can be seen that Srandakan have a high physical vulnerability as big as 52.80 Ha and low physical vulnerability as big as 93.35 Ha. One of the coasts in Srandakan that experience abrasion is Kuwaru Coast. Coastal erosion in Kuwaru causes ecological damage, societal problems, loss of property, infrastructure, and beach width annually. At the same time protection is expensive. So it is needed to handle the abrasion with environmentally friendly solutions.

Research Purposes

This study aims to:

1. create a sustainable coastal to cope abrasion; and
2. formulate the policies and integrated strategies for sustainable coastal ecologically, economically, and socially.

Research Method

This study is trial study that uses observation method. To handle abrasion in Kuwaru Coast is by planting vegetation (mangrove) and making a simple breakwater (from woven bamboo strips called Apo-apo). Apo-apo is made not to hold back the waves but to reduce the force of the waves and protect the mangroves until they grow big. Tools and materials are used as follows.

Table 2. Tools and Materials

No	Tools/Materials	Useful
1	Bamboo	- As mangrove prop against buckling (stake) - As a means of breakwaters (Apo-apo)
2	Cetok	For holes in the ground
3	Raffia	To bind the mangrove with stake
4	Scissors	To cut the rope
5	Meter	To measure the bamboo strips
6	Mangrove seedlings	For wave absorbers

Mangrove will serve as a drag abrasion after approximately five years old because its roots have been strong so as to reduce the force of the waves. Therefore, before planting of mangroves, the first made-

making breakwater (Apo-apo). Breakwaters that we use are woven bamboo strips with low budget and environmental friendly. In addition, the raw materials can also be obtained from local residents so as to empower citizens to participate in the project (Priyono, 2010).

The Design of Apo-apo

Apo-apo be in front of mangrove because it functions as a protective mangroves from the wave. Making Apo-apo is stake bamboo poles and add wood or transverse board, so that the structure becomes more dense and solid.

The Design of Planting Vegetation

Planting vegetation is divided into three zones. The first zone, use of mangrove species *Rhizophora stylosa* because this type is more tolerant of the environment more open to a wave as compared to other types. In addition, also used *Avicennia* and *Sonneratia spp* because of this kind of liked the sandy soil on the edge of the beach. Second zone, use *Rhizophora apiculata* because it has roots denser and stronger. In addition, it is also used kind of *Avicennia spp* and *Bruguiera spp*. The third zone, uses of mangrove species associations such as *Ceriops spp*, *Pandanus spp*, *Calophyllum inophyllum*, and *Casuarina sp*. In addition, used also *Terminalia catappa* and *Cocos nucifera* (Pulumahuny, 2003; Priyono, 2010). The width of the vegetation that is 200 meters calculated from the highest tide level to shore accordance DIY Local Regulation No. 16/2011 section 87.

Techniques of planting mangrove (Priyono, 2010), that are:

- a. take a mangrove seedlings;
- b. open polibek covering sediments and roots of seedlings. Do not waste polibek arbitrarily, but put polibek above marker (bamboo strips with a length of 1 m and a diameter of 1 cm);
- c. planting directly of mangrove seedlings into the ground by punching holes in the ground with a trowel until enough deep so that the roots can be embedded with either;
- d. tie rod mangrove seedlings to stake by using raffia;
- e. piled with soil. Do not be too hit the ground so that oxygen can freely outward and into the ground; and
- f. take polibek located above the marker. Gather together. Polibek can be recycled into a wide range of recycled plastic goods.

After planting, the next step is replanting. Replanting is done by replacing the died mangrove seedlings with the new mangrove seeds. In addition, also carried out pest eradication programs. Given mangrove including plants that are resistant to extreme natural conditions, it is recommended preventive measures in the replanting phase, ie use of

sprinkling with sea water for mangrove seedlings have been planted. Watering can be done every single day once in a location that is detected to have the type of high pest abundance.

The next stage is maintenance. Things to do at this stage is thinning program, that is cutting some young mangrove rod, if mangrove seedlings grown have a very high density. It is important to maximize the growth of other mangrove trees. In addition to thinning, also conducted a purge of pests and weeds as well as management of water channels if found to be the closure of waterways as a result of natural changes in the coastal areas. Maintenance phase started at least 3 months after completion of planting. Furthermore, make a rules and regulations such as a ban on harvesting of mangroves. In addition, it should also be given information and education to the public about the importance of conservation of mangroves in the coastal guard (Priyono, 2010). Illustration of laying Apo-apo and planting mangrove is presented in the following figure.

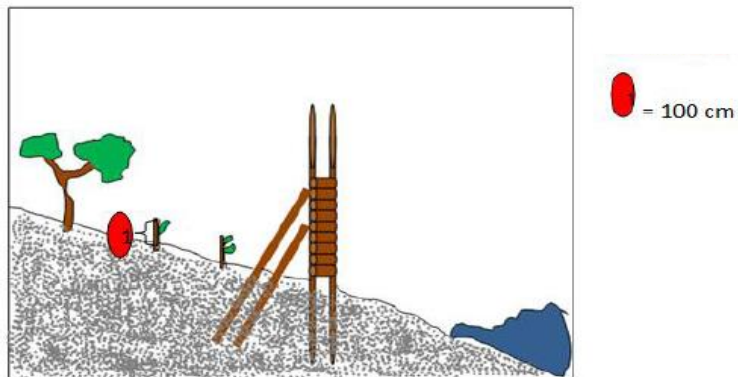


Figure 1. Laying Apo-apo and Mangrove

The illustration of abrasion reduction in Kuwaru Coast use Apo-apo and vegetation is presented in the following figure.

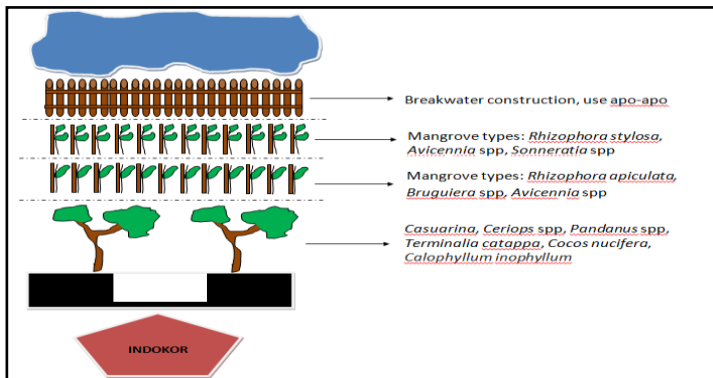


Figure 2. Illustration of Abrasion Prevention in Kuwaru Coast

RESULTS AND DISCUSSION

Abrasion caused coastline change. Coastline change in Kuwaru Coast in 2006-2013 approximately 20 meter. So, in seven years the coastline experience retreat as far as 20 meter.

The trial study was done at Community Outlet. The trial activity includes installation of Apo-apo and planting of mangrove and pandanus. Planting pandanus is the one of the local society ability in Kuwaru Coast. When they planting *Casuarina* spp so was done planting pandanus around to protect it from salt steam of sea water.

- Tuesday, 28 April 2015, installing Apo-apo at Community Outlet.



Figure 3. Installation of Apo-apo

- Thursday, 30 April 2015, planting of mangrove and pandanus. Pandanus planted around mangrove at Community Outlet.



Figure 4. Planting of Pandanus and Mangrove



Figure 5. Apo-apo, mangrove, and pandanus at Community Outlet



Figure 6. Apo-apo is installed in the frontage to decrease the coming wave power

Observation Results

Monitoring 9 Mei 2015

- Apo-apo
Physical condition of Apo-apo is still good
- Mangrove

No	Species of mangrove	Life	Dead	Withered
1	<i>Avicennia</i> spp	2	10	-
2	<i>Rhizophora apiculata</i>	10	-	2



Figure 7. Extra pandanus on the left and right

Monitoring 22 Mei 2015

- Apo-apo
Physical condition of Apo-apo is still good

- Mangrove

No	Species of mangrove	Life	Dead	Withered
1	<i>Avicennia</i> spp	-	12	-
2	<i>Rhizophora apiculata</i>	7	4	1

Mangrove type of *Avicennia* spp is changed with *Rhizophora apiculata*. Based on the observation result, *Rhizophora apiculata* type is the most suitable mangrove to be planted in Kuwaru Coast.



Figure 8. (a) *Rhizophora apiculata* lives well; (b) *Avicennia* spp is dead



Figure 9. The Condition of Apo-apo, Mangrove, and Pandanus

Monitoring 26 Mei 2015

- Apo-apo

Physical condition of Apo-apo is still good

- Mangrove

No	Species of mangrove	Life	Dead	Withered
1	<i>Rhizophora apiculata</i>	18	4	2



Figure 10. The condition of Apo-apo is still good and strong



Figure 11. The Condition of Apo-apo, Mangrove, and Pandanus

The Obstacles of Trial Study

- **Accretion occurs**
Sand surface which grows higher because the tidal wave carries sand then it is precipitated in coast (around society outlet) affects mangrove heaped under sand. However, with Apo-apo and pandanus as mangrove protector so mangrove which is heaped under sand can be minimized.
- **Rubbish**
The tidal wave takes along rubbish which is then left in the coast. It affects the rubbish hooks onto mangrove. Apo-apo and pandanus function as mangrove protectors so that the rubbish which hooks onto mangrove can be minimized.
- **Irrigation**
Water need is a prior thing for mangrove life because sand in Kuwaru Coast is a type of ferruginous sand which is extremely hot if it is exposed to the sun. As a result, it makes mangrove stem brownish-black (burnt) because of heat. Besides, sand is porous so it cannot store water.

CONCLUSIONS

1. Abrasion in Kuwaru Coast caused coastline change. Coastline change in Kuwaru Coast is approximately 20 meters in 2006-2013.
2. The trial study activity which is done by installing Apo-apo and planting mangrove and pandanus is an eco-friendly way which can be done to reduce abrasion in Kuwaru Coast.
3. The mangrove type that is suitable to be planted in Kuwaru Coast is *Rhizophora apiculata*. The availability of water is the main factor of the success of mangrove planting.

4. One of the local society ability in Kuwaru Coast in handling abrasion is planting pandanus around the little *Casuarina* spp to protect it from salt steam of sea water.
5. Apo-apo, mangrove, and pandanus can be planted alongside Kuwaru Coast, so that it will looks like a mangrove and pandanus garden with bamboo fence because the unification of the three of them has a esthetical value that is definitely amendable to be a tourism.
6. The planting method of Apo-apo and mangrove is an environmentally friendly way that can be done in reducing the abrasion in Kuwaru Coast.

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