

## COUNTERMEASURES ABRASION PROBLEMS IN DADAP COAST AND THE CHALLENGES

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**Abstract** - Coastal communities, especially Dadap Village, faced numerous challenges. One of these issues is coastal abrasion, which erodes communities' land, can caused tidal flooding, and devastates residents' economies. As a result, research is required to serve as a model and reference for the process of overcoming abrasion and increasing regional toughness. This research used a descriptive-analytic approach, semi-structured interviews, and semi-participant observations. The Village Head of Dadap and members of DAPALA are important informants (Dadap Pecinta Alam). The research data were analyzed using Miles and Hubermas' interactive model, which consisted of three stages: data reduction, data analysis, and research result determination. The main findings of the study indicate that the Dadap Village government has made efforts to reduce abrasion by building breakwaters from garbage, breakwaters from stone (revetment), and mangrove planting on many coastlines, which included the planting of 2000 mangrove trees and 25,000 mangrove seedlings. Continuous efforts were also required to ensure coastal sustainability due to a variety of challenges, including illegal logging of mangrove trees, removal of mangrove seedlings along the coast, construction of buildings without government approval, a lack of breakwater, and a lack of public awareness regarding the cultivation of mangroves and challenges from the nature.

**Keywords:** Countermeasures, Abrasion, Challenges, Mangrove Planting

## 1. INTRODUCTION

Indonesia is an archipelago country with a sizable ocean area. Three-quarters of Indonesia's territory is covered by the ocean, which covers an area of 5.9 million *km*<sup>2</sup>, giving Indonesia the world's second longest coastline at 95,161 km (Lasabuda, 2013). As a result, most areas in Indonesia are located along the coast. The location along the coast offers many advantages to the community. One of the advantages of being on the coast is the abundance of marine resources, which assist in fulfilling daily needs and increasing the income of the community. This is because the main economic activity of coastal communities is fishing, and coastal areas have an abundance of marine resources that can serve as the primary source of income for these communities (Kristiyanti, 2016). On the other hand, coastal places have several disadvantages or threats to human life, including the possibility of tsunamis, erosion, and abrasion. These issues must be addressed and resolved by the community and authorities in collaboration to avoid other problems.

Dadap Village, Juntinyuat Sub-District, Indramayu Regency, West Java is one of the coastal locations in Indonesia. Dadap village is located on a 215-hectare plot of land. Dadap Village, as a coastal community, also has several unresolved environmental problems. Abrasion is one of the primary environmental problems in the coastal area that affects Dadap Village. Abrasion is the process by which sand, soil, or other material is released onto the beach as a result of repeated sea waves that cause damage to the shoreline, reducing the land area along the coast (Munandar & Kusumawati, 2017).

Abrasion produces damage to the coastal environment, such as erosion or land loss. Land erosion occurred at Dadap Village between 2018 and 2021 along a 60-meter from the coastline. This resulted in the erosion of a large amount of agricultural land and settlements surrounding the Dadap beach, reducing the area. Abrasion also damages residents and creates tidal flooding in some regions during periods of high waves or tides. Additionally, the impact of abrasion influences the community's socio-economic conditions. Damaywanti claimed in a publication entitled "The Impact of Coastal Abrasion on the Social Environment (Case Study in Bedono Village, Sayung Demak)" that abrasion influences the socioeconomic community in addition to the environment and residential housing.

The study found that in Bedono Village, where the community initially worked as farmers due to the availability of sufficient agricultural land, after the abrasion in the 1990s caused agricultural land erosion and frequent seawater flooding, the residents switched their livelihoods as fisherman (Damaywanti, 2013). As a result, abrasion is one of the natural disasters that occur in coastal areas and leads to substantial losses, necessitating its review and mitigation.

Abrasion is produced by a variety of variables, including the type of soil and the height of the land surface along the coast, damage to mangrove forests, and damage caused by human activity. Abrasion is influenced by the type of soil and the height of the land surface along the coast. This is because many types of soil are abrasion-prone, including mud/clay soil and soil at a low elevation above sea level.

Due to the ease with which the qualities of mud/clay soil can alter in response to changes in sea water content, it is prone to land subsidence, which results in abrasion (Istijono, 2013). Dadap Village's land is quite low in height, ranging between 3 and 10 meters above sea level. As a result, Dadap Village is vulnerable to abrasion and tidal flooding. The second factor that contributes to abrasion is the loss of mangrove trees.

Mangrove forests are crucial parts of marine ecosystems because they protect the physical environment of the sea by preventing seawater incursion, acting as a wave barrier, harboring marine biota, absorbing abrasion, and storm absorbers (Novianty, Sastrawibawaa, & Prihadi, 2011). If the mangrove forest on a beach is damaged, the wave barriers and abrasion absorbers will disappear, causing abrasion. The third factor causing abrasion is damage caused by human activities. These human activities such as development on the coast that causes changes in currents, sand mining, coral reef extraction, and the creation of extensive ponds (Munandar & Kusumawati, 2017). To overcome abrasion, it is important for the government and community to understand the underlying causes in order to arrive at the best remedy.

Considering the impact and the factors contributing to the abrasion, the government and community in Dadap Village need to review and follow up on the abrasion problem to avoid further losses. Review and follow-up can be accomplished by examining the condition of the region affected by abrasion, the causal factors, and the most appropriate method of dealing with the field conditions, which in this case are along the Dadap Village coast. A review of the size of the abrasion along the coast of Dadap Village shows that the obstacles associated with addressing the abrasion are similarly substantial.

These issues must be addressed for the response process to be effective, efficient, and controlled. As a result, a study of how to overcome abrasion on the Dadap Village coast and its obstacles is necessary to provide a framework for the future improvement program. Thus, research on overcoming abrasion problems on the Dadap coast and its challenges will be conducted with the goal of determining and providing information on how to overcome abrasion on the Dadap coast by the government and students of KKN (*Kuliah Kerja Nyata*) 105 UIN Sunan Kalijaga Group 69, as well as the challenges associated with overcoming them both in the present and future, so that the government and environmental activists can get a suggestion and the best solution.

In a previous study entitled "Alternatives for Abrasion Management at Muara Gombang Beach, Bekasi", Alimuddin (2018) to overcome the problem of coastal abrasion in Muara Gombang District, Bekasi, a hard solution is used, namely the construction of a coastal protective structure. The selection of coastal protection buildings to be selected must be under an in-depth study based on the effectiveness of the building in overcoming coastal abrasion which includes aspects of the balance of the coastal system in an area without causing damage to other coastal areas and wasted development. In a further study entitled "Controlling Environmental Damage to Miangas Island Coastal Settlements with Prevention of Erosion and

Abrasion” by Sarbidi (2010) which addresses construction ideas for preventing damage to Miangas Island caused by coastal erosion and abrasion.

This research is clearly different from ours in that it discusses the importance of the construction model for preventing abrasion in the model area on Miangas Island, as well as data processing using the mathematical method and the Sverdrup-munk-Bretschneider (SMB) method, whereas our research discusses efforts to overcome coastal abrasion by examining the social and environmental conditions of the Dadap community, as well as the challenges encountered in carrying out those efforts. This research on efforts to resolve abrasion problems on the Dadap coast and the challenges associated with them can be used to illustrate the efforts and process flow undertaken by the government and students of KKN 105 UIN Sunan Kalijaga, as well as the difficulties encountered in implementing them, to be used as references and considerations by the government and other environmental activists to take the next steps necessary to resolve the abrasion problem and its associated challenges properly.

## **2. METHOD**

This research uses a descriptive-analytical technique with a qualitative approach. This sort of descriptive-analytical study tries to narratively explain an object using the data that has been obtained in its current state without reaching generalizable conclusions (Zulhijah, 2012). A qualitative approach is one that is used in a study to obtain results that are not obtained through statistical or other calculations (Fadila & dkk, 2020). This study collects field data and interviews data from research subjects or informants who are aware of and understand the subject of the research in order to get a detailed description and description of the condition of the coastal area of Dadap Village, the process of overcoming abrasion, and the realistic challenges without drawing widely accepted conclusions.

As a result, descriptive-analytic research methods with a qualitative approach are appropriate for this research. This research was conducted in Dadap Village, Juntinyuat District, Indramayu Regency, West Java, from Monday, July 12 to Sunday, August 29, 2021. Data collection used semi-structured interviews, site surveys, and observation. The semi-structured interview was done by asking the study subject, namely the Village Head of Dadap and one member of DAPALA (Dadap Pecinta Alam), questions based on the interview sheet and supplemented by additional questions during the interview.

The location survey was undertaken in this study to find out the location and state of the mangrove planting program conducted by students from KKN 105 UIN Sunan Kalijaga Group 69. Observations were conducted in the coastal area of Dadap Village to gain data on the condition of the coast in terms of geology, abrasion impact, and opportunities for the process of mangrove planting, as well as the implementation of government-led abrasion prevention programs. Researchers (human instruments), observation sheets, interview sheets, and cell phones were used in this study. The data analysis steps in this study are data reduction, data analysis, and determination of research findings. The researchers concentrated on describing how to overcome abrasion on the Dadap coast and the challenges

encountered during the process, which was carried out by the Government and Students of KKN 105 UIN Sunan Kalijaga.

### **3. RESULT AND DISCUSSION**

Abrasion has several negative impacts on the Dadap coast's environmental and residential aspects. The environmental impact is the erosion of land in Dadap Village over a three-year period, reaching 60 meters from the coastline. This erosion affects both vacant and agricultural land owned by residents. Meanwhile, abrasion has a detrimental effect on settlements, resulting in the damage of people's homes and the occurrence of tidal floods, particularly when the sea water is subjected to high tides or high waves. According to Setyandito (2007), the level of abrasion on the coast of Dadap Village is extremely very heavy, as the length of abrasion on the coast of Dadap Village exceeds 10 meters every year (Nisa, Rohmat, & Erdiana, 2016). Regarding the level of abrasion in Dadap Village, some actions are required to overcome abrasion. The Dadap Village government has taken many measures to prevent abrasion, including the installation of garbage breakwaters, rock breakwaters (revetment), and mangrove planting in several of the village's coastal areas. The primary objective of overcoming abrasion is to preserve the ecosystem along the coast, in the estuaries of several rivers, and in residential areas, as well as to develop into tourist destinations (Istijono, 2013).

The first countermeasure is to construct a waste-derived breakwater. Breakwater is a term that refers to a coastal structure that protects the beach from the waves and serves to break the waves to minimize its height and size (Akmal & Putra, 2021). A breakwater is a structure formed of stone or another material that protects the land from waves, hence reducing the probability of abrasion. The Dadap Village government constructs the breakwater from waste by using garbage collected by the village's cleaning workers. The collected waste is then deposited into holes dug along the coast. The breakwater waste serves to keep land around the beach and elevate the land along the shoreline, preventing it from being eroded by the sea. Additionally, the use of waste as a breakwater material helps to mitigate environmental contamination produced by garbage and is one of the initiatives being made to prevent waste accumulation in Dadap Village. Additionally, the Dadap Village Government constructed a stone breakwater (revetment) to prevent abrasion. Along the coast, parallel to the coast, rock breakwaters (revetments) are constructed of stacked stones.

The purpose of the rock breakwater (revetment) is to break up the sea water currents, consequently lowering the height of the sea waves. By lowering the height of the waves, it is possible to mitigate coastal land erosion caused by seawater. The process of constructing the waste and rock breakwaters (revetment) occurs in stages along the Dadap Village coast. The Head of Dadap Village intends to construct two breakwaters along the village's coast over the next two to five years. Along with the installation of garbage breakwaters and rock breakwaters (revetment), attempts to overcome abrasion in Dadap Village are being made through the pioneering planting of mangroves on the village's shore by the nature lover community in collaboration with the government. Planting mangroves in coastal areas is one method for reducing the potential and negative impacts of abrasion and

so preserving and protecting these coastal areas (Rini, 2019). Mangrove trees are important for mitigating coastal abrasion.

Mangroves are an important alternative in addressing abrasion because they may protect the area along the coast from the waves, preventing them from directly hitting the plains (Sumar, 2021). Therefore, mangrove planting is critical for overcoming abrasion. Abrasion prevention measures made by nature lovers and the government through mangrove planting have not been fully implemented on all Dadap coasts. The mangrove planting will be allocated in several places in stages due to the uneven development of breakwaters and residents' lack of awareness regarding the planting and care of mangrove trees. Breakwaters, whether constructed of waste or stone, are critical components of the mangrove planting process. This is because mangrove planting must take place in an area protected by a barrier, which ensures small waves and low tides. Due to the lack of and uneven distribution of mangrove planting along Dadap Village's coasts, the program must be considered and developed by both the government and other stakeholders.

Abrasion countermeasures were also implemented in Dadap Village by KKN 105 students from UIN Sunan Kalijaga Group 69 through a mangrove planting program. Mangrove planting was carried out with the participation of members of nature lover communities and organizations such as the Juntinyuat Koramil, DAPALA (Dadap Nature Lovers), KNPI Dadap, SMAN Juntinyuat Scouts, and the Youth Scientific Group of MAN 2 Indramayu.



**Figure 1. Mangrove Planting Participants**

The mangrove planting program comprises multiple stages, including preparation, implementation, and maintenance. The program preparation stage comprises program planning, fundraising, tool and material preparation, and distribution of activity leaflets. The mangrove planting program is planned by identifying a location, inspecting the location, and estimating the quantity of trees and seeds to be planted. This mangrove planting program was place on Dadap beach, specifically in Tamanan, Tutupan Block, Dadap Village. The location of mangrove

planting is determined by many factors, including natural conditions and the development of the mangroves to be planted.

Natural conditions to consider include the height of the waves on the beach, the direction and speed of the wind, the maximum length of tidal water from the planting site, and safety provided by mangroves from cattle and other nuisance animals. While other factors to consider include the development of mangroves to be planted, where seedlings will be placed in moist soil and polybags, while grown mangroves in the form of trees or growing leaves will be planted in sandy areas. This is because each grove develops differently, with undeveloped shoots and roots, necessitating the use of an appropriate planting medium (soil or sand) and a variety of treatments. As a result, it is critical to select a chosen area in order to ensure the success of the mangrove planting procedure.

Students from KKN 105 UIN Sunan Kalijaga planted 2000 mangrove trees and 25,000 mangrove seedlings as part of the mangrove planting program. Now, 2000 mangrove trees are being planted to prevent abrasion on the Dadap coast, while 25,000 mangrove seedlings are being seeded for future mangrove planting to prevent abrasion. Fundraising is the second stage of program preparation. The fundraising stage begins with the creation of a proposal for submitting funds to the Indramayu environmental service, which is then followed by the proposal's submission. The third stage of program preparation is tool and material preparation. At this step, money is obtained from the environmental service as mangrove trees, and seeds are collected from many mangrove sites across Dadap Village. Additionally, this stage involves the preparation of planting tools such as bamboo slats, for supporting mangrove trees, ropes, and other planting tools such as hoes and shovels.

Distribution of activity pamphlets is another preparation stage. The distribution acts as an invitation for people from all walks of life to engage in the planting activities, including environmental communities, students, and other communities. Next, the implementation stage of the mangrove planting program. It began with an opening ceremony attended by the committee and the village head of Dadap, followed by a procession of planting mangrove trees and seedlings. 2,000 mangrove trees were planted on sandy soil 5 meters from the shoreline, while mangrove seedlings (propagules) were planted on muddy soil placed in polybags. Participants were instructed in advance on proper planting and seeding methods. The maintenance stage of the mangrove planting program follows the establishment stage. During this stage of treatment, mangrove seedlings are watered every two days, while mangrove trees are not watered at all. Water mangrove seedlings once they have at least two leaves. After the seedlings have matured into mangrove trees, they are transferred from polybags to sandy soil. This is because mature mangrove seedlings already have strong roots and are therefore appropriate for planting in sandy soil.



**Figure 2. Mangrove Seedling**



**Figure 3. Mangrove Tree Planting**

Mangrove trees are a solution to the problem of coastal abrasion because their strong roots protect the soil in coastal areas from erosion (Istijono, 2013). Additionally, mangrove trees are resistant to wind and waves, making them an excellent natural fortress for protecting houses and residents' land from storm, large waves, and abrasion (Mustofa, 2018). As a result, the mangrove planting program has developed into a viable solution for overcoming abrasion on the Dadap Village coast. However, mangrove planting program designed to mitigate erosion on one of Dadap Village's beaches, but it also serves as a model and inspiration for subsequent mangrove planting programs on other Dadap Village beaches by other parties.

Efforts to overcome abrasion on the Dadap Village beachfront are not always straightforward. Many challenges were discovered during its implementation, which hindered the process of overcoming the abrasion. The first challenge to overcome abrasion is illegal mangrove tree logging. Large mangrove trees are frequently felled without the consent of the Dadap Village government; logging is frequently carried out by local residents for firewood, and the leaves are used as animal feed. This is what contributes to the decline of mangrove trees along the Dadap coast. Additionally, logging occurs in several mangrove forest areas for infrastructure development projects.

The second to overcome is the removal of mangrove seedlings along the coast. Children and adolescents that use the mangrove nursery as a play area remove the mangrove seedlings. As a result, the mangrove nursery process failed, necessitating the establishment of nurseries and replanting. The third challenge to overcome abrasion is the construction of buildings without official license along the Dadap coast. Currently, numerous residents continue to construct illegal structures on the Dadap coast in violation of government regulations. The bulk of residents living along the coast engage in illegal development through the construction of houses and stalls.

This development has decreased the number of locations suitable for planting mangroves and constructing breakwaters, even if no locations suitable for planting mangroves and constructing breakwaters exist. This renders coastal land more susceptible to erosion by sea water, resulting in abrasion. As a result, the government must take decisive action to repair and restore the Dadap beach to provide an area for breakwater development and mangrove planting. The absence of breakwater presents the next challenge in overcoming abrasion. Dadap Viillage's coastline is 4.5 kilometers long, placing it as the village with the longest coastline in Juntinyuat District and posing a high risk of coastal abrasion. The village government of Dadap has attempted to mitigate coastal erosion by constructing a breakwater. However, existing breakwater development is limited, and not all Dadap beaches are protected by breakwaters.

Additionally, the uneven construction of breakwaters on each of Dadap's beaches is a result of high development expenses and a lack of construction time. Due to the high cost and longer construction time involved in the construction of the breakwater, it must be completed gradually in several sites around Dadap Village. Additionally, the east season presents a challenge in constructing the breakwater. During the east monsoon, the wind blows west, causing the sea currents to travel eastward to westward (Setyawan & Pamungkas, 2017). This obstructs the construction of a breakwater on the Dadap Village coast. The last challenge is a lack of public awareness regarding the cultivation and care of mangroves.

The majority of residents in Dadap Village are unaware of the importance of planting and caring for mangroves. This is demonstrated when the government advocates for community mangrove planting but the community does not participate in the program. Additionally, when environmental groups and the government plant mangroves, local populations do not care for them and uproot them to feed livestock. These challenges may obstruct the process of overcoming abrasion, regardless of whether the government, communities, or other environmental activists are involved. As a result, decisive action, improvement, increased attention, and appropriate solutions are required to overcome these challenges and ensure the proper execution of abrasion control.

#### **4. CONCLUSION**

The Dadap Village government has taken countermeasures to minimize abrasion by constructing garbage breakwaters, rock breakwaters (revetment), and planting mangroves in several of the village's coastal areas. The creation of waste breakwaters and rock breakwaters (revetment) is a method of preventing abrasion

by reducing the height and speed of the waves that impact the coast, hence reducing land erosion caused by sea water. The breakwater can also protect mangrove plants from waves, since it acts as a barrier and breakwater, preventing waves from directly striking the mangrove planting site. Apart from being a response to abrasion, the development of a waste-based breakwater is one of the steps being taken to combat garbage accumulation in Dadap Village. This is because the entire amount of trash generated by the residents of Dadap Village is used to construct the breakwater. To prevent the government's most recent abrasion, the mangrove planting program has not been fully implemented because of the uneven construction of breakwaters throughout Dadap Village's coastal areas and a lack of public awareness about the need to plant them. KKN 105 students of UIN Sunan Kalijaga Group 69 also made an attempt to overcome abrasion on the coast of Dadap Village through a program of planting 2000 mangrove trees. The mangrove planting effort involved the planting of 2000 mangrove trees and 25,000 mangrove seedlings by volunteers from schools, communities in Dadap, and the government. It is related to the problems that may obstruct the conquering process when implementing abrasion control. The challenges to overcoming abrasion in Dadap Village include illegal logging of mangrove trees, removal of mangrove seedlings along the coast, construction of buildings without government approval, a lack of breakwaters, a lack of public awareness about the importance of cultivating and caring for mangroves, as well as natural challenges.

In conclusion, the government and stakeholders, particularly in Dadap Village, with an overview and information about the abrasion coverage program and the challenges associated with its implementation, allowing them to determine a continuation strategic plan and how to overcome these challenges so that the abrasion control program can continue to operate effectively. This study intended to use as a guide and motivation for communities and students to design an abrasion prevention program for Dadap Village and all coastal areas in Indonesia, supporting the community and government in resolving environmental concerns in coastal areas. Additionally, this research can serve as a reminder to the community that the problem of abrasion must be addressed and resolved to avoid further problems and raises public awareness about the importance of supporting and contributing to the government's and other environmental activists' abrasion prevention program. The researchers did not evaluate the efficiency of the abrasion control effort or how to overcome challenges associated with the response effort because of time constraints. Thus, authors can undertake additional research to ascertain the success of abrasion prevention efforts in Dadap Village and other coastal areas, as well as to learn how to overcome the problems associated with these countermeasures.

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