

## Abrasion Disaster Mitigation Efforts at Naras Beach, North Pariaman District

Elvi Zuriyani<sup>a,1,\*</sup>, Erna Juita<sup>b,2</sup>, Irwan<sup>b,3</sup>, Arie Zella Putra Ulni<sup>b,4</sup>, Rika Despica<sup>b,5</sup>

<sup>a</sup> Fakultas Ilmu Sosial dan Humaniora Universitas PGRI Sumatera Barat, Padang, Indonesia

<sup>b</sup> Fakultas Ilmu Sosial dan Humaniora Universitas PGRI Sumatera Barat, Padang, Indonesia

<sup>1</sup> [elvizuriyani@upgrisba.ac.id](mailto:elvizuriyani@upgrisba.ac.id); <sup>2</sup> [ernajuita@upgrisba.ac.id](mailto:ernajuita@upgrisba.ac.id); <sup>3</sup> [irwan@upgrisba.ac.id](mailto:irwan@upgrisba.ac.id); <sup>4</sup> [ariezellaputraulni@upgrisba.ac.id](mailto:ariezellaputraulni@upgrisba.ac.id);

<sup>5</sup> [rikadespica@upgrisba.ac.id](mailto:rikadespica@upgrisba.ac.id)

\*Elvi Zuriyani



Received 21 March 2023; accepted 15 Juli 2023; published 20 Juli 2023

### ABSTRACT

Abrasion is a process of eroding the beach by sea waves and ocean currents which are destructive. In the coastal area of Naras, North Pariaman District, there was abrasion which had an impact on the people in the coastal area. The purpose of this study was conducted to determine the form of disaster mitigation carried out by the community in the Naras coastal area. This research was conducted using a qualitative descriptive approach. Data collection techniques were carried out by field observations, documentation and interviews with the community in the Naras Beach area. Efforts made by the community and government against coastal abrasion are by making embankments from sand, building wave-retaining rock grips, building T-type groins, and planting mangroves.

### KEYWORDS

Abrasion  
Mitigation Efforts

This is an open-access article under the [CC-BY-SA](https://creativecommons.org/licenses/by-sa/4.0/) license



### 1. Introduction

Pariaman City is one of the cities whose territory is located in the province of West Sumatra, which is in the coastal area and directly facing the Indian Ocean. Astronomically, Kota Pariaman is located between 00° 33' 00" – 00° 40' 43" south latitude and 100° 04' 46" – 100° 10' 55" east longitude. It is recorded as having an area of 73.36 km<sup>2</sup>, with a coastline length of 12.00 km (<https://pariamankota.go.id>).

Generally, areas on the coast are areas that have the potential to be affected by erosion, seawater intrusion and abrasion (Bethary et al., 2022). Abrasion is an event of retreating coastline in coastal areas that are vulnerable to activities that occur on land and at sea (Triatmodjo, 1999 in Abda, 2019). According to Tarigan, MS (2010), abrasion is the erosion of coastal grooves accompanied by erosion as a result of the weathering of rocks and the beach surface which has no cover vegetation so that it is easily hit by waves and causes beach abrasion.

Abrasion is a source of problems that will destroy the condition of coastal areas and also threaten or change the coastline and threaten buildings such as residential buildings on the outskirts of the coast. The condition of Naras Beach has resulted in damage to various facilities and infrastructure for coastal tourism objects and has threatened residents' housing and other facilities along the coast.

The cause of abrasion consists of two factors, namely natural factors and human factors. Some of the activities that cause abrasion are the logging activities of mangrove forests, sand mining, and the phenomenon of high waves and sea tides which then have an impact on abrasion or beach erosion. Erosion that occurs on the mainland of the coastal area causes sediment transport to move from its place of origin and follow the direction of the incoming waves, thereby affecting changes in the coastline. This has resulted in the impact of ecosystems and settlements around coastal areas (Abda, 2019).

Based on data analysis from the Shoreline analysis system (DSAS) which can calculate the rate of change of the coastline and can observe what changes are occurring, it is found that the coastline in West Sumatra has changed quite significantly within 10 years, namely from 2011-2021. Based on the results of the data analysis, there is a change in the coastline in Pariaman City, namely abrasion (retreat of the coastline) of -136.11m and accretion (advancement of the coastline) of



571.55 m. If in total, the shoreline change that occurred in Kota Pariaman is 435.44 m (Aldian et al., 2022).

Naras Beach is located in North Pariaman District, Pariaman City. North Pariaman is the area with the longest coastline in Pariaman City, which is 4.40 km or around 36.6% of the total coastline in Pariaman City. Naras beach has considerable potential for abrasion with the type of beach being a sloping type. The activity of some people around this beach is fishing (as fishermen). Based on observations and literature, Naras beach is one of the points prone to abrasion in the coastal area of Pariaman City (Yuerisman, 2022). In 2015 the worst abrasion occurred in the coastal area of Balai Naras Village which resulted in seawater crashing into the houses of the people living on the outskirts of Balai Naras Village, and destroying 1 house of the people on the coast of the village of Balai Naras.

With this abrasion disaster, disaster mitigation activities are needed. Mitigation activities are one part of disaster management activities that are focused on reducing the potential impact that may be caused by disasters that are predicted to occur in the community (Jokowinarno, 2011). The abrasion disaster that occurs every year is often one of the factors that causes socio-economic losses for the community and physical buildings around the coast.

Some forms of handling the problem of beach abrasion in several coastal areas are arranging sandbags on the beach, planting mangroves and building rocks on the beach (constructing Type T Groins). Efforts to deal with the Naras beach abrasion disaster must also be carried out as a form of mitigation efforts by the community and the government. Based on the background of the problem, this research was conducted to analyze the forms and efforts made by the community and the government in dealing with the abrasion disaster which has eroded parts of the Naras coastal area and damaged some community settlements.

## 2. method

This research was conducted along the coast of Naras, North Pariaman District, Pariaman City. The data taken in this study is data on the form of mitigation efforts carried out by the community and the government in managing the abrasion disaster on the Naras coast. This research use descriptive qualitative approach. The data collection method in this study was the observation method of conducting interviews with people in the Naras beach area. Data collection was carried out by reducing interviews, direct observation, and documentation. In addition to collecting data directly in the field, literature studies were also carried out using published data from books and scientific journal articles.

## 3. Results and Discussion

Pariaman City is one of the coastal cities in West Sumatra Province. Geographically, Kota Pariaman is located between 0°33'00" - 0°40'43" South Latitude and 100°04'46" - 100°10'55" East Longitude. The land area is 79.22 km<sup>2</sup> and the sea area is 282.69 km<sup>2</sup> with 6 small islands namely Bando Island, Gosong Island, Ujung Island, Tengah Island, Angso Island and Kasiak Island with a beach length of approximately 12.7 km. Pariaman City consists of 4 (four) sub-districts, namely North Pariaman, Central Pariaman, East Pariaman and South Pariaman Districts with a total of 16 villages and 55 villages joined in 12 (twelve) villages (Haryani et al., 2019).

Based on the results of research that has been conducted in the coastal area of Naras Pariaman, data is obtained that frequent abrasion which has an impact on residents' settlements such as residents' houses that are destroyed due to waves of sea water that rise to the surface. The abrasion that occurred in the Naras Pariaman Beach Area has been happening for a long time. Based on research from Haryani et al. (2019) In 2003-2018 abrasion and accretion occurred in Pariaman, namely there were 13 abrasion locations with an abrasion area of 197.65 ha and 11 coastal accretion points with an accretion area of 285.38 ha. In 2015 the worst abrasion occurred in the coastal area of Balai Naras Village which resulted in seawater crashing into the houses of the people on the outskirts of Balai Naras Village, and destroying 1 house of the people on the coast of the village of Balai Naras (YUERISMAN, 2022). In addition, in 2017 there was also an abrasion

disaster along the coast of Padang Biriak-Biriak Village, North Pariaman District, which is quite densely populated. There are 12 houses that have experienced abrasion and have been eroded up to 80 meters inland (Haryani et al., 2019). Also based on (Haryani et al., 2019) there were abrasion and accretion events along the Naras coast during 2003-2018. The abrasion that occurs on the Naras beach is in Naras Downstream with an area of 7.77 Ha. Meanwhile, the area of accretion along the Naras coast is 7.79 Ha in Lower Naras, 4.09 Ha in Naras 1 and 27.06 Ha in Naras Hall. An abrasion event alone will reduce the coastline and accretion is an additional beach event. Meanwhile in 2020 there was also an abrasion incident in Balai Naras Village. Based on the respondents who were met at the research location, this abrasion event continues to occur every year as a result of a number of factors, one of which is a change in wind direction.

With the abrasion event at Naras Pariaman Beach, this resulted in the closer the shoreline to the surrounding community settlements. One respondent said that the distance between his house and the shoreline was 6 meters. In addition, abrasion in the Naras beach area has affected several gardens belonging to the surrounding community. The following is a picture of the impact of abrasion on people who live in the coastal area of Naras.



Fig. 1 Condition of community settlements affected by abrasion on Naras beach

In the picture, it can be seen that the impact of abrasion caused damage to several houses of residents living around the beach. Based on the data obtained in the field, the community has not been able to make repairs to the house, because the damage caused quite a lot of losses, up to approximately 20 million. In addition to damage to residents' settlements, damage to access roads has also occurred due to this abrasion. So that people who want to enjoy the atmosphere of the beach are a little difficult to get to the beach area.

With the impact of abrasion on the Naras beach, of course, appropriate mitigation efforts are needed to reduce the impact of this abrasion. Several forms of efforts that have been made by the local community are by making embankments from sacks filled with sand to prevent more widespread abrasion. The way to make an embankment from sand is to fill as much sand in the sacks as possible and then arrange it near the wave direction to minimize the impact of the abrasion. This activity is carried out by residents in mutual cooperation. In addition to these simple efforts, the government has also built grip stones in several areas affected by abrasion. However, only 2 grip stones have been built and of course they are not sufficient to resist coastal abrasion in the area. because from year to year the incidence of abrasion is increasing. In the following table are several forms and mitigation efforts that have been carried out by the community and the government in overcoming abrasion on the Naras beach, North Pariaman District.

Table 1. Forms of abrasion disaster mitigation efforts carried out by the community and government as well as alternative mitigation efforts that can be carried out

No	Mitigation Efforts that have been made	Done by	Function	Other Alternative Mitigation Efforts
1.	Making embankments out of sand	Public	Reducing erosion and retaining sediment and breaking waves	1. Increasing public understanding of abrasion disasters
2.	Build a rock grip retaining waves	Government (BNPB)	Reducing erosion and retaining sediment and breaking waves	2. Planting mangrove trees and other plants such as cypress trees to resist waves and sediments
3.	Constructing T-Type Groins	Government (BNPB)	Reducing erosion and retaining sediment and breaking waves	3. Customize buildings around the beach (stilt houses)
4.	Mangrove planting	Society and Government	As a breakwater	4. Create a disaster evacuation zone

Efforts to overcome abrasion certainly need to be done. This aims to prevent coastal abrasion disasters and reduce the impact on society. One of the efforts to overcome coastal abrasion is to increase disaster mitigation efforts. Disaster mitigation efforts are systematic efforts to analyze disaster risk both structurally and non-structurally (Abda, 2019). Structural mitigation is a physical measure to reduce the risk of catastrophic abrasion. The form of structural mitigation that has been carried out by the community and the government as a mitigation effort is to make embankments from sand, build rock breakwater, building Groin Type T. Apart from that, the community has also planted mangrove trees as a form of ecosystem-based mitigation. Another form of mitigation that is carried out is non-structural mitigation, namely non-physical efforts to reduce disaster risk by making relevant laws and regulations regarding the socialization of abrasion disaster mitigation efforts, as well as compiling Standard Operating Procedures (SOP) for self and mass rescue (Bappenas, 2006) in (Abda, 2019). The following is the condition of settlements and the forms of mitigation that have been carried out by the community.



Fig. 2. Pictures of settlements adjacent to the shoreline



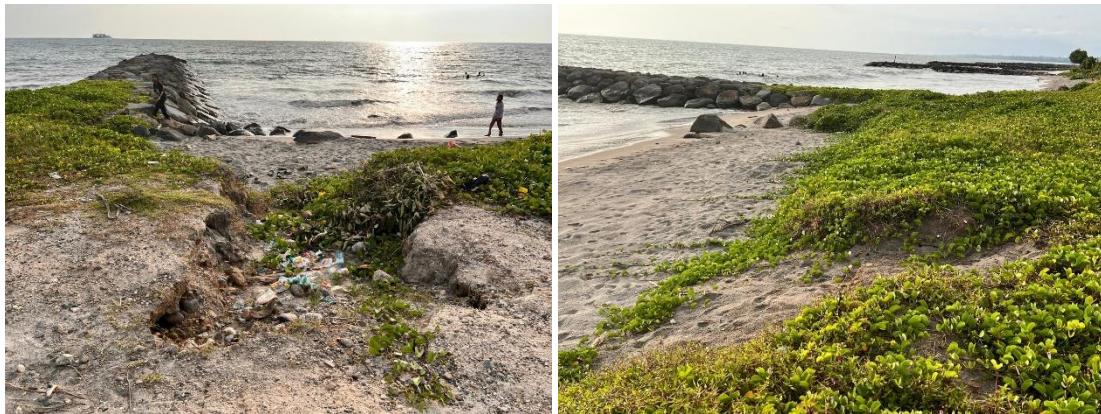


Fig. 3 The condition of the shoreline affected by abrasion and erosion



Fig. 4 Grip stones as wave barriers that have been installed on Naras Beach

Based on the several efforts that have been made by the community along the Naras coast in dealing with abrasion disasters, it is necessary to add several other efforts as a form of abrasion disaster mitigation, namely by increasing people's understanding of abrasion disasters and how to mitigate and adapt them. In addition to adjusting the buildings around the coast, namely by elevating buildings or settlements such as building houses on stilts. Based on the Regulation of the State Minister for the Environment Number 08 of 2010 concerning Criteria and Certification of Environmentally Friendly Buildings, states that environmentally friendly buildings are buildings that apply the principle of prioritizing and paying attention to elements of environmental function preservation in their design, construction, operation and management and important aspects of handling the impact of changes climate.(Cibro & Nasution, 2019). However, no one has built houses on stilts like those in several coastal areas in Indonesia, such as in Bulukumba and Makassar City.

Other mitigation efforts that can be carried out by the people of Naras Beach are planting mangrove trees and other plants such as cypress trees to resist waves and sediments. Mangroves are defined as communities that live in wet and muddy areas and are influenced by tides (Nur, M., & Nasruddin, JW, 2013). Mangroves serve as wave protection, abrasion protection, intrusion protection, habitat for various species and plants available for human use(Vitasari, 2015).As we know that mangrove forest is a type of forest that grows in tidal areas, especially on protected beaches, lagoons and river mouths which are inundated at high tide and free from inundation at low tide whose plant communities are tolerant to salt (Ledheng and Yustiningsih , 2018 inBaharu et al., 2021). Efforts made by the community to reduce coastal abrasion are by planting mangrove trees. Local residents make plans to jointly participate in efforts to mitigate abrasion on the Naras beach. In addition, the government should also be more aggressive in efforts to provide guidance and

counseling on the importance of planting mangrove trees as a form of mitigation efforts. Law Number 27 of 2007 mandates that in facing the threat of disasters in coastal areas and small islands, disaster mitigation efforts are carried out. Disaster mitigation is an effort to reduce disaster risk, both structurally or physically through natural and/or artificial physical development as well as non-structural or non-physical through increasing the capacity to deal with disaster threats in coastal areas and small islands (Article 1 PP No. 64 of 2010). Disaster mitigation in coastal areas and ppk is carried out through physical and non-structural/non-physical structural activities (Article 14 PP No. 64 of 2010). Structural/physical activities for mitigation of this type of tsunami disaster include providing an early warning system in this study carried out with coastal vegetation such as mangrove ecosystems, using tsunami absorber buildings, providing self-rescue facilities, using tsunami-friendly building construction, providing infrastructure and health facilities, (Santoso et al., 2019). But based (Fitri et al., 2021) the success rate of beach greening initiated by the government and other private entities that seek to implement programs to save coastal and coastal ecosystems. Among them planting coastal vegetation such as cypress, mangrove, hibiscus and ketapang. But only about 20% of the success of this program. An 80% success rate for beach greening is not successful. The failure of this program was caused by the absence or low awareness of coastal communities participating in the implementation and maintenance of coastal ecosystem rescue activities. Another reason is the absence of socialization by policy makers or implementers in carrying out activities to save coastal vegetation (Kamal, 2013) in (Fitri et al., 2021).

Apart from mangrove plants, other methods of mitigating against abrasion disasters are mixed methods. The mixed mitigation method is an effort to minimize abrasion by planting trees along with abrasion-resistant buildings. One of the abrasion-resistant buildings built is a buis and talud. Several buis were arranged and then casting was carried out to strengthen the building structure. The mixed method is considered to be effective because it considers the age factor of the abrasion-resistant building as well as applying the effectiveness of plants in reducing the risk of abrasion. The types of vegetation planted along the coast are cypress shrimp and Ketapang (Maulana et al., 2016).

Disaster evacuation zones are also very important as a form of disaster mitigation. The disaster evacuation zone is an area that can accommodate people affected by this abrasion disaster. This area must of course be safe from abrasion impacts that may occur with the characteristics of having to be at least 100 meters from the highest tide point towards land. This area is called the coastal border area which is an area with the main function as a barrier to the growth of settlements or other activities so as not to disturb the sustainability of the beach (Law No. 27/2007 concerning Management of Coastal Zone and Small Islands). However, each region has regulations that are adjusted to take into account the conditions and characteristics of the region as well as the RTRW. Several indicators or parameters in consideration of this evacuation zone are topography, biophysics, coastal hydro-oceanography, economic needs, local culture, natural disaster potential, beach position, existence of coastal protection structures and existing conditions of spatial use in the coastal area. This location must also be equipped with useful infrastructure in efforts to evacuate against abrasion disasters.

#### 4. Conclusion

Abrasion is one of the natural disasters that can occur in coastal areas which can change the coastline and threaten buildings such as residential buildings on the outskirts of the coast. The abrasion that occurred in the coastal area of Naras, North Pariaman District, resulted in damage to several residential areas close to the shoreline. Mitigation efforts made by the community against abrasion on the Naras beach are by making embankments from sacks filled with sand. In addition, the form of mitigation efforts carried out by the community and government is building wave-retaining rock grips, building T-type groins, and planting mangrove trees. Other efforts in the context of mitigating disasters that can be carried out through cooperation between the government and the community are increasing public understanding of abrasion disasters, planting mangrove trees and other plants such as cypress trees that resist waves and sedimentation, adjusting buildings

around the coast (stilt houses) and creating zones disaster evacuation. With the mitigation efforts carried out by the community in the Naras Beach area, it is hoped that the impact of this beach abrasion can be minimized.

### References

- Abda, M. K. (2019). Mitigasi Bencana Terhadap Abrasi Pantai di Kuala Leugekecamatan Aceh Timur. *Jurnal Samudra Geografi*, 02(01), 1–4.
- Aldian, R., Zuryani, E., & Ulni, A. Z. P. (2022). *Seminar Nasional “Geoliterasi dan Pembangunan Berkelanjutan” 2022 dan Seminar Nasional Manajemen Bencana PSB (SMBPSB 2022) SHES: Conference Series 5 (4) (2022) 152-161*. 5(Smbpsb), 152–161. <https://jurnal.uns.ac.id/shes>
- Baharu, M., Juli, N., Kawasan, K., Di, P., Pulau, D., Kecamatan, K., Harahap, F. S., Walida, H., Dalimunthe, B. A., Siregar, A., Susanti, R., Nazirah, L., Ritonga, Z., Rauf, A., & Manurung, I. R. (2021). *KONSERVASI KAWASAN PESISIR DI DESA PULAU KAMPAI KECAMATAN PANGKALAN SUSU KABUPATEN LANGKAT MELALUI PENANAMAN POHON MANGROVE*. 5(1), 27–33.
- Bethary, R., M Rizki, M., Saputra, A., Nurhafidah, W., Ramadhani, M., Juwita, I., Maldini, Chairunnissa, G., Puspaningrum, I., Musyahidah, L., & Iqom, S. (2022). *PENANAMAN POHON MANGROVE SEBAGAI MITIGASI BENCANA Pendahuluan Wilayah Desa Sawarna secara astronomis terletak di selatan Pulau Jawa pada*. 01(01), 8–15.
- Cibro, B. D., & Nasution, I. N. (2019). Kajian Desain Rumah Pesisir Pantai Di Kelurahan Bagan Deli Melalui Pendekatan Ramah Lingkungan. ... *Jurnal Pendidikan Teknik Bangunan Dan Sipil*, 5(1), 15–21. <https://jurnal.unimed.ac.id/2012/index.php/eb/article/view/14184>
- Fitri, Y., Yernawilis, Y., Harminto, H., & ... (2021). Analisis Partisipasi Masyarakat Tiram Tapakih Terhadap Rehabilitasi Ekosistem Pesisir Kabupaten Padang Pariaman. *Jurnal Ilmu-Ilmu ...*, 1–10. <https://jurnal.univpgri-palembang.ac.id/index.php/ikan/article/view/5303>
- Haryani, Irianto, A., & Syah, N. (2019). Study of coastal abrasion disasters and their causes in Pariaman City. *IOP Conference Series: Earth and Environmental Science*, 314(1). <https://doi.org/10.1088/1755-1315/314/1/012009>
- Jokowinarno, D. (2011). Mitigasi Bencana Tsunami Di Wilayah Pesisir Lampung. *Jurnal Rekayasa*, 15(1), 13–20.
- Maulana, E., Wulan, T. R., Wahyuningsih, D. S., Mahendra, I. W. W. Y., & Siswanti, E. (2016). Abrasion Risk Reduction Strategy on the Rembang Regency’s Coastal, Central Java (in Indonesian). *Proceedings of the 2016 UMS National Geography Seminar: Disaster Risk Reduction Efforts Related to Climate Change (in Bahasa)*, 2007, 389–398.
- Santoso, D., Yamin, M., & Makhrus, M. (2019). Penyuluhan Tentang Mitigasi Bencana Tsunami Berbasis Hutan Mangrove Di Desa Ketapang Raya Kecamatan Keruak Lombok Timur. *Jurnal Pengabdian Magister Pendidikan IPA*, 2(1). <https://doi.org/10.29303/jpmp.v1i2.242>
- VITASARI, M. (2015). Kerentanan Ekosistem Mangrove terhadap Ancaman Gelombang Ektrim/Abrasi Di Kawasan Konservasi Pulau Dua Banten. *Bioedukasi: Jurnal Pendidikan Biologi*, 8(2), 33. <https://doi.org/10.20961/bioedukasi-uns.v8i2.3870>
- YUERISMAN, A. G. (2022). *ANALISIS PARTISIPASI MASYARAKAT DALAM MENANGGULANGI ABRASI DI WILAYAH PESISIR DESA BALAI NARAS KECAMATAN*

*PARIAMAN UTARA KOTA PARIAMAN PROVINSI SUMATERA BARAT* [Universitas Sriwijaya].

[https://repository.unsri.ac.id/79783/11/RAMA\\_69201\\_07021381823136\\_0004057701\\_0011098204\\_01\\_front\\_ref.pdf](https://repository.unsri.ac.id/79783/11/RAMA_69201_07021381823136_0004057701_0011098204_01_front_ref.pdf)

- Nur, M., & Nasruddin, J. W. (2013). Penerapan teknologi plasma untuk mempercepat persemaian mangrove sebagai upaya rehabilitasi green belt untuk mengatasi abrasi. *Jurnal Riptek*, 7(1), 15-26.
- Tarigan, M. S. (2010). Perubahan garis pantai di wilayah pesisir perairan Cisadane, Provinsi Banten. *Makara Journal of Science*.