

Conference Paper

Mangrove Ecosystem Conservation Efforts: A Case Study of The Minajadri Monitoring Community Group in Pasir Putih Coastal Area, Cilamaya Kulon, Karawang

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ABSTRACT

Climate change has become an issue that is often discussed by many parties. One of the impacts is the erosion of the coast by sea waves. A group of environmentally conscious in Karawang are trying to reduce erosion by replanting damaged mangroves as a form of adaptation to environmental changes. The purpose of this paper is to reveal the results of mangrove planting carried out to reduce erosion by seawater. This study employs convergent parallel mixed-methods data collection, which included observation, and mapping with Google Earth and Landsat 8 satellite imagery. Semi-structured interviews with relevant key informants, and literature review. Afterward, descriptive techniques are used to analyze the data/ The findings of this study show that community-led mangrove revegetation initiatives have been successful in reducing seawater abrasion. An area of roughly 6.29 ha with a high-density level makes up the mangrove forest that has been successfully revegetated. It has also evolved into a habitat for numerous mangrove species. Additionally, the community practices ecotourism by using mangrove vegetation. On the other hand, the community's revegetation efforts are highly distinctive, notably by adding sand from sedimentation to generate additional land that is used by the community to build buildings, which may lead to future land ownership rights issues.

Keywords: Climate change, mangrove restoration, coastal erosion, Karawang

Introduction

In recent years, with increasing environmental awareness, climate change has been mentioned for several decades. The driver of climate change is still widely discussed by many researchers but is very clearly felt around us. One of them is sea level rise and erratic weather. Several studies report that climate change such as rainfall and natural disasters will become more intense and frequent (Reyer et al., 2017; Romero-Lankao et al., 2014) This has an impact on various aspects, one of which is the decline in environmental quality.

Coastal areas are areas that are heavily affected by climate change, one of which is erosion. Sea levels Rise (SLR), changes in storm climate, and human interference are aspects that are suspected of causing coastal erosion (Van Rijn, 2011; Zhang et al., 2004). Coastal erosion causes land degradation of the coastline. This can be exacerbated if native coastal vegetation such as mangroves is damaged. Erosion that occurs needs to be managed to reduce losses both long-term

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and short-term (Stripling et al., 2017; Toimil et al., 2020). In addition, conservation and mitigation efforts are needed to reduce the impact of climate change.

Erosion prevention efforts can be carried out through mangrove restoration (Allen et al., 2019; Chen et al., 2012; Gedan et al., 2011). Mangroves are well known to provide various functions such as protection from the wind (Das & Crépin, 2013), providing habitat for various animals (Londoño et al., 2020), and economic functions such as tourism (Spalding & Parrett, 2019). But on the other hand, research conducted by (Das, 2020) states that the presence of mangroves does not reduce erosion that occurs in coastal areas.

Coastal erosion is also found on the north coast of West Java, one of which is at Pasir Putih Cilamaya Kulon. This incident has been experienced decades ago to cause unrest in the local community because of the erosion of the land. Seeing this phenomenon, people who are aware of the local environment have been planting mangroves since 6 years ago. The community also added used tires to dampen the incoming waves and trap the sedimentation of sand and soil by the waves. Now, the community is still actively planting mangroves in the same area. This study was conducted to determine the success of mangrove planting and the addition of used tires to reduce coastal erosion.

Material and Methods

Study area

This Study was performed Pasir Putih Coastal Area, Cilamaya Kulon. This site had geographic coordinates at 6°10'40" S; 107° 32'34". This location is a location that has experienced considerable abrasion in recent years until now it is being developed by the community for Ecotourism. The annual rainfall is around 1,197 mm/year⁻¹. Topography was dominated by flat areas with slope levels varying from 0-2%. The dry season and rainy season were relatively the same.

Data collections

Data were collected in July 2022. Data was obtained using convergence parallel mixed-method which elaborate quantitative and qualitative methods in the same phase during the research (Creswell, 2007). Thus, both quantitative data and qualitative data are then analyzed separately and then the results of the analysis of each type of data are combined or compared with each other to build interpretations as part of data analysis (Cresswell, 2014). Quantitative data was obtained from observation, forest inventory, and mapping.

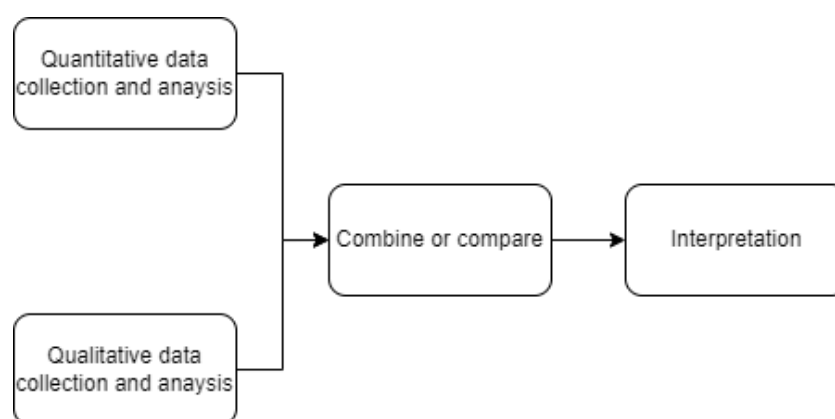


Figure 1. Research design with convergent parallel mixed methods (Cresswell, 2014)

Forest inventory was performed using a nested plot with 5% sampling intensity. a transect line method with a sampling plot size of 10 × 10 m and an interval from each 20 m. The vegetation data obtained will be calculated similarly to those (Eddy et al., 2015). The transect line was 500 m

long and 20 m wide. The mapping was carried out using Google Earth satellite imagery and Landsat 8 imagery with Q-Gis software to compare the mangrove area before and after rehabilitation.

Qualitative data was collected using a semi-structured interview. Semi-structured interviews were used in research with consideration of their flexible characteristics, but in general, the interview process was guided by a list of questions or problems to be explored (Merriam & Tisdell, 2016). We were using the snowball sampling method for determining the respondent.

Data analysis

Descriptive analysis was used in both qualitative and quantitative data. Descriptive analysis is the simplification of data by presenting what we know about capacities, needs, methods, practices, policies, populations, and specific settings in a way that is relevant to the research question.

Results and Discussion

Species distribution

The result of the vegetation inventory shows that only one species which found in the mangrove area namely *Avicennia officinalis*. This species belongs to the family *Acanthaceae*. This species is characterized by having flowers that are quite large compared to other *Avicennia* species, yellow and 6-10 cm in diameter. This species can grow up to 15 m in height. People plant this species with a spacing of 1x1 m. With a high-density level of trees and canopy, there are no other species that can grow due to competition for resources such as light, water, nutrients and space (Looney et al., 2016; Wirabuana et al., 2021). Furthermore, due to the very high density, the lateral growth of *A. officinalis* trees was inhibited.

In this study, we only found mangroves at the pole stage (<30cm diameter) with an average height of 4.5 m. In addition, species richness, heterogeneity, and evenness were dominated by *A. officinalis*. Similar to research conducted by (Matatula et al., 2021), mangroves plantation have lower biodiversity, and similar diameter and height. In contrast, mangroves plantation have the same regeneration capacity as natural mangroves (Matatula et al., 2021), but in this case, we have not found any saplings even though they are 6 years old.

Ecosystem dynamics

Coastal erosion threatens 930 families in the coastal area of Pasir Putih coastal area, Cilamaya Kulon, Karawang. The map of the mangrove condition in 2011 can describe the condition of the coastal area directly adjacent to the Java Sea (Figure 2). Community settlements observed using Google Earth Pro pose a big threat when a high wave occurs. The condition of the coastal area in Pasir Putih if left unchecked in the long term, the community will experience great losses because it can eliminate the settlements and assets.

A group of people is worried about the coastal conditions in Pasir Putih, Cilamaya Kulon, Karawang. The community group is called the Community Monitoring Group (POKMASWAS) Minajaladri which has a role in supervising illegal fishing, sand mining, and logging of mangrove trees. This group of people has the initiative to plant mangroves along the Pasir Putih coastal area. Mangrove planting aims to reduce the impact of coastal erosion that occurs in the Pasir Putih coastal area. Mangrove planting efforts were carried out on 20 hectares in 2016. Api-api (*A. officinalis*) is used for plantations. It is characterized by yellow flowers.

Community groups are trying to protect mangrove plantations from ocean waves by using used tires. The installation of used tires on the shoreline as a breakwater is considered by the community to be an effective step in protecting mangroves from strong waves. The used tire can trap sand or coral from the ocean, thus the trapped sand or coral is used by groups to form land. The uniqueness of this community group in making land in front of a mangrove plantation is by manually moving sand trapped in the breakwater using a hoe. The collected sand is then put into

a bag arranged behind the seawater breakwater as a barrier to sand or coral that has been raised so that the sand or coral is not carried away by the waves of seawater again.



Figure 2. Map of mangrove condition in 2011

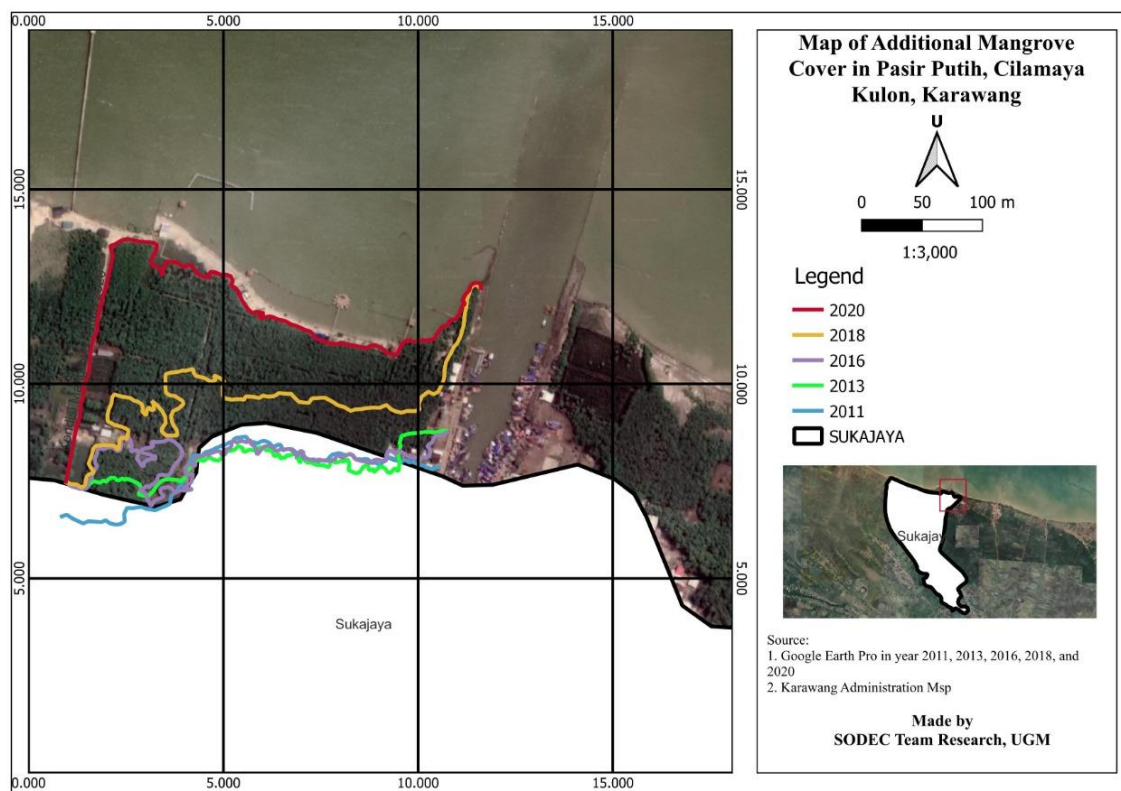


Figure 3. Map of additional mangrove cover in Pasir Putih, Cilamaya Kulon, Karawang

Table 1. additional mangrove cover in Pasir Putih

Year	Mangrove area (ha)
2011	0
2013	0.321
2016	0.436
2018	1.718
2020	6.29

The condition of mangroves after 6 years of planting has been able to create a microclimate in the area. The microclimate can be characterized by the presence of animals such as birds that make mangroves a place to live and breed. Mangrove canopy cover can be seen on the map of mangrove conditions in 2020 which has a dense canopy. Supporting data for mangrove plants that have a dense canopy can be seen in the incoming sunlight of 155 lx, compared to observations of sunlight in places that are not covered by a mangrove canopy of 835 lx. The addition of mangrove land regularly can be seen in Figure 3 and Table 1. The largest addition of canopy cover occurred in 2020 at 4,572 ha for 2 years. The condition of the increase in the mangrove canopy is accompanied by the addition of land which continues to be stockpiled by community groups.

Potential development and problem

Mangroves, which are currently well-developed, bring out various potentials. The potential developed by community groups is eco-tourism. The development of eco-tourism in the Pasir Putih is to increase the community income around the coast while still paying attention to the function of mangroves. Managers in the development of eco-tourism cooperate with various companies and governments such as PT. Pertamina, the Karawang Transportation Department, and the Karawang Department of Environment and Forestry (DLHK). Continuous mangrove planting can provide huge carbon storage that can contribute to reducing emissions. On the other hand, thinning management is needed to accelerate mangrove growth.

The problem that may arise at this location is the existence of land formed from the activity of stockpiling sand and coral. The land will be getting wider and without an official land certificate from the government. Potential conflicts of land ownership rights between the community and the government can potentially occur and have an impact on the preservation of the mangroves that have been planted.

Conclusion

Mangrove restoration carried out by environmentally conscious communities has been able to reduce coastal erosion that has occurred in recent years. In addition, the presence of mangrove forests generates an economic function through Edu ecotourism. The potential problems due to the new land formation from sand sedimentation need to be watched out for by the government.

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