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## The Detection of Environmental Degradation Cause in Mangroves Area: Case in the Surabaya Coast

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**Abstract:** Only 22% of existent mangroves in the world are spread throughout Indonesia's coastal areas. However, mangrove degradation in Indonesia is higher than in other countries. The mangrove deforestation rate in Indonesia is 52,000 ha/year or 6% per year on average. There has also been mangrove degradation in Surabaya, Indonesia. This is contradictory because mangrove environmental management efforts in the Surabaya Coast are ongoing. Therefore, the purpose of this study is to analyze the causes of mangrove degradation as well as to evaluate the environmental sustainability management model in the observation area using the quantitative descriptive method. Based on this study, mangrove area degradation still occurs on the Surabaya Coast due to human activity, the mangrove environment used for tourism has less degradation than other areas, and the mangrove areas in several locations have created ownership authorization disputes between communities or a community and the government. To maintain mangroves' environmental sustainability, environmental conservation, enforcement of strict regulations, and development of mangrove tourism areas and education centers are recommended.

**Keywords:** degradation, environment, mangroves.

### 红树林地区环境退化原因的发现-以泗水海岸为例

**摘要：**世界上只有22%的红树林分布在整個印尼沿海地区。但是，印度尼西亚的红树林退化率高于其他国家。印度尼西亚的红树林砍伐率为52,000公顷/年，或平均每年6%。印度尼西亚泗水的红树林也遭到了破坏。这是矛盾的，因为泗水海岸的红树林环境管理工作正在进行中。因此，本研究的目的是分析红树林退化的原因，并使用定量描述方法评估观察区的环境可持续性管理模型。根据这项研究，泗水沿岸的红树林区域由于人类活动仍在发生退化，用于旅游业的红树林环境的退化程度低于其他地区，而且在几个地方的红树林区域在社区之间或社区之间引起了所有权授权纠纷。政府。为了维护红树林的环境可持续性，建议环境保护，执行严格的法规以及开发红树林旅游区和教育中心。

**关键词：**退化，环境，红树林。

## 1. Introduction

Mangroves are an essential coastal ecosystem component, particularly from an ecological standpoint, as an aquatic productivity guard and the local people's economic support [12]. Mangrove forest ecosystems are distributed at the land-sea interface in tropical and subtropical regions and play an important role in carbon cycles and biodiversity [1, 13]. In Indonesia, the word "mangrove" has been used extensively to describe mangroves as a plant, community, or

ecosystem. The word "mangrove" actually describes mangrove species from the *Rhizophora* genus [2].

For coastal areas, this ecosystem can be in a green belt along the coast or river estuary; it is vital for fish and shrimp and maintains the quality of the fishery, agricultural, and settlement ecosystems from disturbances of abrasion, intrusion, and strong sea breezes. The river estuaries have declivous or flat slopes, protected from the waves' onslaught and strong tidal currents; temperatures between 20–40 degrees Celsius; saltwater values range from 10 ppm to 30 ppm. In 1932, mangroves in Indonesia covered around

600,000 hectares (ha) but only 100,000 ha in 2010—a degradation of 500,000 ha. From all of the mangroves population in the world, the amount of Indonesia mangroves area represents 22% of the amount of mangroves population in the world, and Brazil, Austria, and Nigeria represent 6%; Bangladesh and Malaysia

represent 4%; Cuba, Mexico, and India represent 3%; and other countries represent 30% of the global mangrove population (the total of mangroves population in some countries except Brazil, Austria, Nigeria, Bangladesh, Malaysia, Cuba, Mexico, India, and Indonesia [14]).

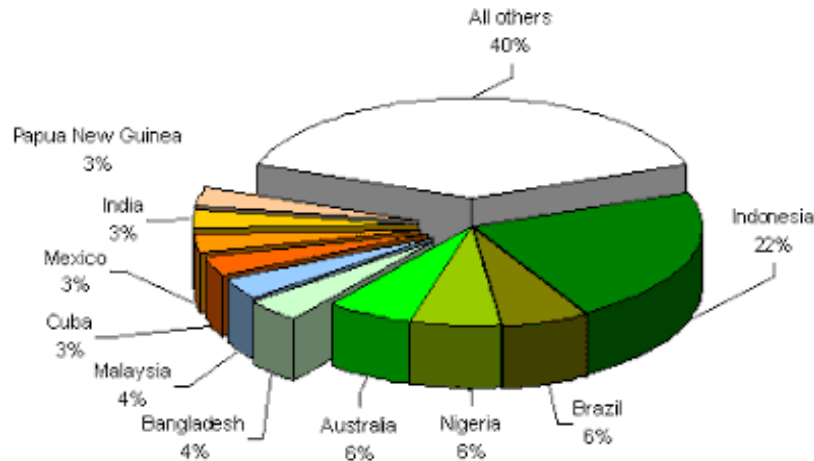


Fig. 1 The mangrove population amount in the countries [14]

Mangrove deforestation in Indonesia is higher than in other countries. The mangrove deforestation rate in Indonesia is about 52,000 ha/year or 6% of the national rate and is mainly located in Papua, Kalimantan, and Sumatera. Approximately 500 mangrove tree species have been found in Indonesia and are dominated by *Rhizophora spp.* In Luwu, the Ponrang sub-district, there was a mangrove area reduction phenomenon from 1994 to 2002. In 2002, the Ponrang sub-district mangrove area decreased 26,916 ha, while the Ponrang sub-district fishpond area increased 58,765 ha.

In 2020, mangrove conditions on Java Island decreased compared with 2019: West Java Province decreased 8%, Central Java Province decreased 30%, and East Java Province decreased 1%. The central and regional governments have created policies about mangroves. The central and regional governments have made policies about mangroves, such as by the Surabaya Regional Government. The Surabaya Regional Government issued Surabaya Local Government Regulation Number 12 of 2014 regarding the Surabaya Spatial Territory Plan in 2014–2034. This regulation described Surabaya's mangrove conservation area and coastline conditions from year to year. From 2002 until 2014, Surabaya coastline conditions changed annually. Surabaya had 5,387 meters of coastline area in 2002, 5,428 meters in 2007, 5,128 meters in 2011, and 7,431 meters in 2014. In 2011, Surabaya had 47,115 ha of mangrove area and 2,047 ha of degradation. The novelty of this study is the newest field observation data presentation in 2021 about the cause of mangrove degradation as well as the analysis of the environmental management implementation model in the Surabaya Coast mangrove area.

## 2. Methods/Material

The quantitative descriptive method of the survey is used in this study of the mangrove area on the Surabaya Coast. The data collected in this study by field observation and secondary data documentation are used to analyze the cause of mangrove degradation and evaluate the mangrove management model. The field observation was done by tracing the observation area from the Northern Surabaya Coast in Lamong Bay to the Eastern Surabaya Coast in Gununganyar. Then, for collecting and studying information, the researcher chose the observation area points proportionally by random sampling.

The Eastern Surabaya Coast mangrove area is three times wider than the Northern Surabaya Coast mangrove area, so the researcher used a proportional random sampling method to choose three mangrove area field observation points in the Eastern Surabaya Coast mangrove area, while the Northern Surabaya Coast mangrove area had one field observation point. Kenjeran mangroves area, Keputih mangroves area, and Gununganyar mangroves area are represented as the sample of the mangroves area in the Eastern Surabaya Coast, while Benowo mangroves area is represented as the sample of the mangroves area in The Northern Surabaya Coast. The field observation results are captured in the field photo form.

## 3. Result

In Surabaya, there are two areas with the most mangroves planted. They are on the north coast and east coast. The north coast has  $\pm$  9 kilometers of coastline and  $\pm$  1,000 hectares of mangroves area. There are 5 districts in the Northern Surabaya Coast: Benowo (including Romokalisari Subdistrict and Tambak Osowilangun Subdistrict), Asemrowo

(including Tambak Sarioso Subdistrict and Genteng Kalianak Subdistrict), Krembangan (including Morokrembangan Subdistrict and West Perak Subdistrict), Pabean Cantikan (including North Perak Subdistrict), and Semampir (including Ujung Subdistrict). The Northern Surabaya Coast, usually referred to as the shortened “Panturbaya”. is predicted to have 150,29 hectares of mangroves area ecosystem, only 15% of the Eastern Surabaya Coast mangroves area ecosystem. The mangroves area in the Northern Surabaya Coast is directly bordered by the residential and warehousing area. This condition puts pressure on the mangroves ecosystem either directly or indirectly [3].

Based on the result of this study, there are 3 causes of mangroves degradation in the Surabaya Coast. They are the conflict between the communities and the government for mangroves area authorization; the new settlement development for factory, office, and residential needs; and the Lamong Bay port development for Indonesia Port Corporation 3 Inc., Ltd needs, especially in the Northern Surabaya Coast mangroves area. Generally, based on the field observation on December 26, 2020, the occurrence of mangroves degradation in the Surabaya Coast is presented in Table 1.

Table 1 The location and phenomenon of mangroves degradation cause in the Surabaya Coast

Number	Coastal Area	Observation Location	Mangrove Degradation Cause
1.	The Eastern Surabaya Coast	Gununganyar Mangroves Area	The conflict between the communities and the government for mangroves area authorization
		Keputih Mangroves Area	New settlement development for the factory, office, and residence needs
		Kenjeran Mangroves Area	New settlement development for the factory, office, and residence needs
2.	The Northern Surabaya Coast	Benowo Mangroves Area	New settlement development for the factory, office, and residence needs; Lamong Bay port development for Indonesia Port Corporation 3 Inc., Ltd needs

The struggling of the Gununganyar mangroves area land ownership can be seen in Fig. 2. In Fig. 2, there is a nameplate in the middle of the mangroves area that indicates that someone can not use the mangroves area for any purposes without permission of the government

as the owner. From the nameplate, we can see that the mangroves area conflict problem between the communities and the government in the Gununganyar mangroves area has reached the realm of law.



Fig. 2 Mangroves area ownership conflict

The mangroves area changing for office and housing development needs are in Kenjeran mangroves area, Keputih mangroves area, Gununganyar mangroves area, and Benowo mangroves area. Thus, it can be seen that almost all of the mangroves area in the Surabaya Coast has changed for office and housing development needs or it can be concluded that office

and housing development needs are the main factor causing the mangroves degradation. Based on the field observation in Fig. 3, there is a new multilevel settlement around the mangroves area in Kenjeran. Because there is a new multilevel settlement around the mangroves area, the width of the Kenjeran mangroves area is getting smaller. Among the mangroves area in

the Surabaya Coast are the Kenjeran mangroves area and the Keputih mangroves area, which has changed

into a settlement.



Fig. 3 The new settlement in Kenjeran Mangrove Area

In the Romokalisari Village, which is still in the Benowo mangroves area, a container and loading port has been built through reclamation. The container and loading port built by reclamation can damage the coast ecosystem, especially mangroves. To reduce the reclamation effect, Indonesia Port Corporation 3 Inc., Ltd has tried to replant the broken mangroves area in Lamong Bay. In the Benowo mangroves area has been found the mangroves area transformation has become a garbage dump. The mangroves area transformation has become a garbage dump can be seen in Fig. 4. The

mangroves management system in The Surabaya Coast is dominated by law enforcement and education. The law enforcement model of the mangroves management system in the Surabaya Coast is majorly offered in all of the Surabaya Coast mangrove areas. However, the educated model is only offered in some mangrove areas, such as in Wonorejo, Gununganyar, and Romokalisari. The law enforcement model of the mangroves management system in the Surabaya Coast will give sanctions to whoever violates the law as a punishment.



Fig. 4 Plastic waste in Benowo

#### 4. Discussion

Based on the study results, there is a degradation in The Eastern Surabaya Coast and The Northern Surabaya Coast mangroves area. The mangroves ecosystem degradation is one of the abrasion causes in

The Indonesian coastal areas [4]. In this study, abrasion has occurred in the observation area, especially in Kenjeran. Many mangroves transform to become settlement needs because of the increasing demand for land to live in. In Indonesia, the housing needs were



about 11,4 million in 2014, but in 2020, it will increase by around 15,4 million [5]. Also, the occurrence of mangroves area formed by the coast sedimentation process will make this area free, and everyone can own it individually. Thus, it needs a mangroves management to avoid a conflict because mangroves area become individual ownership. The mangroves area ownership conflict between the communities and government can be found in Gununganyar. In the Gununganyar mangroves area, there is an individual mangroves area transition. Based on the existing regulations, all government coastline and green stripes are government property, but the communities make them for their property without government permission. Based on Surabaya Local Government Regulation Number 3 of 2007 about the Surabaya Spatial Plan, the mangroves area is a conservation area on the Eastern Surabaya Coast and covers 2.500 hectares. Unfortunately, in 2015 it only covered 440,13 hectares [6].

Based on the field observation in Fig. 4, the Benowo mangroves area has transformed and become a plastic garbage dump by the communities. Managing plastic waste properly is still difficult. Developed countries doubt the plastic waste management in developing countries. As the waste management infrastructure in developed countries is more sophisticated than those in developing countries, the increasing plastic waste levels in the latter were not followed by an increase in the quality of waste management infrastructure [7]. If the garbage dumps in mangroves such as Benowo or the Surabaya coast continues and no preventive efforts are made, the mangroves will be degraded by the plastic waste. In Indonesia, human activities have had an impact on mangrove degradation not only on the Surabaya coast but also in Tanjungpinang [8].

Based on the results of the study, there are two environmental management approach models for the Surabaya coast: the rule enforcement or regulate and supervise model and the educational model. The Surabaya local government issued the Surabaya Local Government Regulation Number 12 of 2014 regarding the Surabaya Spatial Territory Plan in 2014–2034 to protect the mangroves around the Surabaya coast. Based on the regulation, the spatial pattern plan is divided into protected ( $\pm 40.13\%$ ) and cultivated ( $\pm 59.87\%$ ) areas [3]. However, according to the law or regulation enforcement implementation evaluation in the mangroves, it still needs decisive action from the regulator. The signs or board ownership installation phenomenon in the Gununganyar mangroves, as shown in Fig. 2, is an example of a land authorization effort by an individual in the observation area.

Then, the educational approach is applied in the Surabaya coast mangroves area in the form of making a tourist area. It can be found in Romokalisari mangroves area, Wonorejo mangroves area, and Gununganyar mangroves area. The Surabaya coast's environmental

management approach models through education can be categorized as a successful strategy to avoid mangrove area degradation. Even in the mangroves education area, which is also a tourist area, mangroves nursery also did in there. The restoration effort in the mangroves area is needed to balancing the degradation of the mangroves. In mangroves area management with the educational approach, environmental management's community participation spirit is very important. The organizing mangroves area management skill helps increase the community revenue and make the mangroves utilization regulation and mangroves management violation rules based on the community [9].

The community must do what is written in the regulations as interpreted by the authorized officials. Kenjeran Beach is an example of reclamation by the community due to a lack of knowledge and understanding of the regulations. The best approach for environmental management is through education, as is done in Wonorejo and Gununganyar, and it is the most suitable proposal for lack of knowledge and understanding in the community, but the main objective is law enforcement by the relevant parties.

Based on field observations by a researcher, the application of the spatial regulations of coastal areas has not been implemented in the area that is being studied. The government of the Republic of Indonesia has issued the Ministry of Forestry Regulation Number P.35/MENHUT-II/2010, regarding Republic of Indonesia Minister of Forestry Affairs Regulation Number P.32/MENHUT-II/2009, an amendment to the Forest and Watershed Area Rehabilitation Technique Organization Plan to regulate the ecosystem of the coastline. The coastline is an area that has an important role in maintaining coastal function and sustainability, and has the same proportional area as the beach which is at least 100 meters from the highest tide point until solid land.

The conflict between the community and government about the ownership of the mangrove area always occurs when there is an election held for the next mayor of Surabaya. In this case, one of the candidates in the running for being the mayor of Surabaya fought for the community to obtain the area containing mangroves for their needs. In 2020, when there was an election for the mayor of Surabaya, the unclear ownership of mangrove land has become the campaign material for Machfud Arifin as one of the candidates. He said if he won the election, he would give the community land ownership certificates [10]. The plan to resolve the ownership conflict through the protection of management is still so far off that we expect the mangrove area to become a continuous political commodity.

Everyone knows the importance of the function of mangroves in the ecosystem and the need for sustainability in the coastal areas. We need to monitor

the sustainable development of the mangrove areas closely, especially in the Surabaya coastal district [11]. We cannot let individuals with a frontier mentality dominate our environment. Based on the facts and data discovered in the coastal Surabaya mangrove area, there has been a battle between individuals that have a frontier mentality and those with a drive for sustainable development. Those different views collide, and it is especially visible on the Northern Surabaya coast where it would seem like the degradation of the mangroves happen faster than the restoration. In the Eastern Surabaya coast the two forces are alike and therefore degradation and restoration are equal.

## 5. Conclusion

- 1) The mangrove area degradation is still occurring along the Surabaya coast.
- 2) The mangrove environment used for tourism has degraded less compared to other environmental uses.
- 3) The major cause of mangrove degradation in the Surabaya coastal area is human activity.
- 4) In several locations there are ownership and authorization disputes between community members or between the community and government regarding the mangrove area.

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