Engaging multi-stakeholders’ strategy toward strengthened mangrove rehabilitation program in Tangerang Regency

S M A H Mahardika¹,*, F Yulianda¹, Sulistiono¹, L Adrianto¹-² and M A Al Amin²

¹Department of Aquatic Resources Management, Faculty of Fisheries and Marine Sciences, IPB University (Bogor Agricultural University), Jl. Agatis Darmaga Bogor, Bogor 16680, Indonesia
²Center for Coastal and Marine Resources Studies (CCMRS), IPB University (Bogor Agricultural University), Jl. Raya Pajajaran, Bogor 16127, Indonesia

*Correspondence author: sma.hari.mahardika@gmail.com

Abstract. The Tangerang’s coastal area faces (1) decreasing environmental quality, and (2) poverty. The government developed Gerbang Mapan Program, an integrated coastal management (ICM) program designed to accelerate the recovery of coastal ecosystems and community development. To encourage the acceleration of the program, the government invites various parties (multistakeholders) to be involved in the program. This study aims to explore the processes of involving multistakeholders in the success of the mangrove rehabilitation, which has now succeeded transforms from damage to be good and have even become centers of community socio-economic activities. The method is an exploratory method with a coevolutive dynamic historical process approach from 2014 to 2020. The involvement of various parties i.e local government agencies/institutions in Tangerang Regency, the private sector, TNI/Polri, schools, universities, and coastal community groups in mangrove rehabilitation programs and awareness campaigns and public education have encouraged the acceleration of mangrove rehabilitation, where by 2020, rehabilitation has been carried out with planted 720,000 mangrove trees, with six species (Rhizophora sp, Avicennia sp, Bruguiera cylindrica, Bruguiera gymnora, Ceriop tagal and Sonneratia alba), where the survival rate reached 69.22%, with the most adaptive type Avicennia sp planted in Tangerang Regency with a survival rate of 90.71%.

Keywords: Gerbang Mapan, multistakeholders engagement, mangrove

1. Introduction
Two main problems in Tangerang Regency are poverty and environmental degradation. To overcome the issues, Tangerang Regency developed and implemented Gerbang Mapan, an integrated coastal management program designed to accelerate the development of coastal communities based on three development pillars; (1) Acceleration of Economic Development, which is supported by; (2) Acceleration of Infrastructure Development, and (3) Strengthening of Community Empowerment. One of the GERBANG MAPAN programs focuses on empowering coastal communities, to encourage the acceleration of the program, the government invites various parties (multi-stakeholders) to be involved in the program.

The mangrove ecosystem in Tangerang Regency is quite extensive, covering eight districts in the coastal area, the abrasion that occurred in the northern coastal area of Tangerang Regency is a negative impact of regional development activities that were not anticipated in past developments. Abrasion along
the coast causes losses such as a decrease in land area and the threat of settlements and population activities one of them shifts livelihoods from agriculture to ponds and fishermen due to land agriculture affected by abrasion or inundated by sea water [4]. Abrasion can be caused by several things, including the loss of mangrove trees (Rhizophora sp.) and Api-Api (Avicennia sp) which should be the main gate to save the coast from the threat of waves and strong wind, the total area of mangrove ecosystems in Indonesia. Mangroves share a suite of morphological, physiological, and functional traits that provide one of the most convincing cases for convergent evolution among diverse taxa in response to environmental constraints [5,6]. The regency is 79.12 hectares with nine mangrove species: Avicennia marina, A. alba, A. officinalis, A. lanata, Rhizophora stylosa, R. apiculata, R. mucronata, Sonneratia alba and Nypa frutican [1].

The rehabilitated and restored mangrove ecosystem has important ecological, economic, and social values for coastal communities, although the success of mangrove rehabilitation or restoration must pay attention to the hydrology of the surrounding waters, substrate and types of mangrove species being developed. This program is recorded, planned, implemented, and managed by the Tangerang Regency Fisheries agency which facilitates rehabilitation and restoration activities with the support of various related parties from 2014 to 2020.

The method was carried out by recording multi-stakeholder participation in the rehabilitation and restoration of mangroves in Tangerang Regency and analyzed using a descriptive statistical approach in the form of data on the number of plantings, survival of planting, stakeholders involved and the types of mangroves being rehabilitated. With this study we see an opportunity for an innovative approach to rehabilitation and restoration that involves more stakeholders to develop a rehabilitated and restored mangrove ecosystem.

2. Background
2.1. Mangroves
The management of coastal areas can have the understanding that the management of natural resources and coastal environmental services is carried out through a thorough assessment, determining the goals and objectives of utilization, and then planning and managing all utilizations. The development of coastal areas needs sufficient attention because coastal and marine assets and resources have great potential to support national development. Knowledge of “ecological boundaries” is the basis for planning and managing sustainable coastal and marine resource development.

Mangroves are a taxonomic diverse group of plants of about 70 species of trees, shrubs and ferns (in at least 25 genera and 19 families) that grow on anoxic and salty peat soils on protected tropical beaches [2]. Mangroves can be found in throughout the tropics, with representatives of the major mangrove genera Rhizophora and Avicennia present in the Indo-West Pacific (IWP) and Atlantic, Caribbean and East Pacific (ACEP) regions [3]. Mangroves provide a range of regulating services, including coastal protection [7,8] pollutant assimilation [9] and macroclimate regulation and mitigation of global climatic change through carbon (C) storage and sequestration [10].

An adaptive management approach needs to be taken to find techniques and best practices for mangrove rehabilitation and restoration, where adaptive management is a structured and iterative process of “learning by doing” and decision making in the face of continuous change (environmental, social, cultural, or political) or uncertainty. [2], can and should become the standard approach for any ecological restoration project, regardless of how well resourced the project is [2]. Adaptive management not only requires regular monitoring of key indicators to determine whether the goals and objectives of a rehabilitation or restoration project are being met, but also requires clear triggers or decision points for appropriate interventions and actions if goals or objectives are not achieved, meet [2]. For mangrove rehabilitation and restoration projects, long-term monitoring is infrequent [2] and adaptive management is
rarely applied. However [2] clearly show that adaptive management of the “ecosystem approach” improves outcomes associated with mangrove management for small-scale fisheries in Indonesia (Lombok), Philippines, Solomon Islands, and Tanzania. They used the Participatory Diagnosis and Adaptive Management framework [2].

Their goal is to define stakeholder priorities and identify key interventions to support the transition from purely exploitative fisheries to more sustainable fisheries. One of the key conclusions of is that strengthening governance is as important as mangrove rehabilitation, economic improvement, and other technical and data-based management aspects [2]. This conclusion is not limited to fisheries management, but applies more broadly to any mangrove protection, conservation, rehabilitation, or restoration project [2].

2.2. History of mangrove rehabilitation in Tangerang
Mangrove rehabilitation in Tangerang Regency began in 2015 with the implementation of the Gerbang Mapan Program (Coastal Community Development Movement) starting with identifying coastal damage in Tangerang Regency in collaboration with the Faculty of Fisheries and Marine Sciences, IPB, which resulted in surprising data that the area of land degraded due to abrasion from 1995 to 2015 was 579.8 hectares with the number of mangroves continuing to shrink and only 79.8 hectares remaining.

This data becomes the baseline for mangrove rehabilitation which will be carried out in stages in 5 main villages (Tanjung Pasir, Tanjung Burung, Ketapang, Patramanggala and Kronjo) based on the criticality of coastal environmental conditions, social support, community empowerment, land certainty and the ability of the Tangerang Regency Local Government Budget (APBD). The Gerbang Mapan program itself was inspired by the assistance task of the MOMAF carried out by the Fisheries Service through the Coastal Village Resilience Program (PDPT), and was strengthened by compiling the Gerbang Mapan Roadmap in collaboration with PKSPL IPB with an Integrated Coastal Management (ICM) approach.

The involvement of other stakeholders in rehabilitation and restoration efforts in Tangerang Regency has long been carried out with the initiative of the environmental care community, students and private companies but before 2015 it was not well recorded, in this study only counting mangrove rehabilitation activities from other stakeholders reported and recorded through Fisheries Agency and Cooperation Section of the Regional Secretariat. Tangerang Regency in the framework of participating in the Gerbang Mapan program.

In 2015 PLTU 3 Lontar Banten (Indonesia Power) carried out mangrove planting activities as many as 2000 mangroves through the Hijaunesia activity, but due to the lack of knowledge of companion activities and the extreme conditions of the waters of Patramangala, Kemiri District, Tangerang Regency, only 50 mangrove trees have survived. In 2017 PLN Lontar Generator and PLTU 3 Lontar facilitated 2 groups in the context of mangrove rehabilitation training which was held for 2 days in class for mangrove rehabilitation planning theory and outclass for mangrove planting and nursery practice but the results were still not satisfactory due to lack of motivation of training participants towards mangroves then in 2018 the PLTU was more serious in carrying out mangrove rehabilitation by establishing a cooperative bond that began with a memorandum of understanding (MOU) numbered: 002/060/UJPLBT/2018 and continued with a collaborative agreement on environmental management in Tangerang Regency, Banten Province with the development of the *Bruguiera cylindrica* mangrove species which is critical mangrove in Tangerang Regency because there are less than 5 trees in Kemiri District, Tangerang Regency.

In 2018 Gradually support for mangrove rehabilitation from private companies has experienced very fast and significant growth, this is with the joining of PT. YKK AP and PT. Indah Kiat Pulp and Paper to formally establish cooperation by implementing a memorandum of understanding which was followed by a Mangrove Rehabilitation Cooperation Agreement. PT. YKK AP is a multinational company engaged in
aluminum building material that has been concerned with the environment since 2015 through the Waste Bank of the community around the company and planting mangroves in the village of Margamulya, Kec. Mauk Tangerang, continued with planting mangroves in Patranggala Village, Kemiri District as many as 2000 stems of Rhizophora sp. in 2017 and in 2018 continued to start planting multi-species mangroves with an emphasis on the development of Sonneratia alba mangroves within the framework of biodiversity, starting in 2018 the target of mangrove rehabilitation as many as 5000 stems per year and has been carried out in the village of Patramangala, Tanjung Pasir and Ketapang villages. PT. Indah Kiat Pulp and Paper is a subsidiary of Sinar mas which is engaged in the paper industry after receiving a reference to planting mangroves in the CSR forum, the company immediately entered into an MOU and a cooperation agreement with the Tangerang Regency Government for a period of 5 years to develop 25,000 Avicennia sp. mangrove species per year. years, at the time of planting mangroves in 2018 there were planting problems because the waters of the planting site were too rich in organic matter so that silk moss appeared, and when moss moss covered the Avicennia mangroves so that a small part died, for that reason from the service of developing saline tilapia to be able to reduce the moss that appears while increasing pond productivity with tilapia (Oreochromis niloticus) culture, this activity is managed by the community around the mangroves so that it has the potential to increase the income of the mangrove group, currently PT. Indah Kiat Pulp and Paper is in the middle of a field test of community economic development with the culture of mud crab (Scylla serata).

Other stakeholder support reported to the local government agency from 2014 to 2020 was pretty much started by nature and environmental groups such as Coastal Teaching, Marine Children's School, Ruwat Bumi, Honda Motorcycle Lovers Club, Toyota Owner Community Velozity Car Club, High Schools, Middle Schools and Elementary Schools. in the coastal area of Tangerang Regency, Martine Buddies, Earth Hour Tangerang, Tzu Chi Foundation, TNI/POLRI, PT. Doulton, PT. ADIS, the Banten Provincial Fisheries Service and the Ministry of Marine Affairs and Fisheries with a total of 720,000 mangrove trunks with 6 mangrove species, namely Rhizophora sp., Avicennia sp., Bruguiera cylindrica, Bruguiera gymnoriza, Ceriop tagal and Sonneratia alba.

3. Mangrove rehabilitation and restoration activities

3.1. Multistakeholder

Initially, Mangrove rehabilitation and restoration was carried out independently with their respective goals and interests, since 2014 within the framework of Gerbang Mapan there has been a minimal cooperation effort to provide reports on the implementation of mangrove plantings carried out in the Tangerang Regency area, as shown in the following table 1.

It can be seen in the following figure that in general, before 2020 there was a trend of increasing the number of rehabilitation support from various parties, both the number of stakeholders involved and the
number of mangroves planted. Re-planting mangroves which mean repetition so that it can be concluded that they are satisfied with the implementation of the previous year so that they do replanting in the following year.

3.2. Multispecies rehabilitation and restoration

In general, it was stated in the previous information that there are 3 companies that are specifically involved in the development of certain types of mangroves for their rehabilitation program where PLTU 3 Lontar develops *B. cylindrica*, PT. Indah Kiat developed *Avicennia* sp. and YKK AP developed the *Sonneratia alba* species, but in reality the readiness of mangrove seeds is very dependent on the mangrove nursery community group, especially for the *Sonneratia* species it is not easy to breed in Tangerang Regency, so as to ensure the success of the number of planting species *Avicennia* sp. and *Rhizophora* sp. still planted by PT. YKK AP.

We are counted the number of mangroves at the beginning of planting and in 2020 based on the number of living stands, in general it was seen that the *Avicennia* sp. mangrove species had the highest survival rate of 90.71% followed by *Rhizophora* sp. with 79.34% this is because the seeds used are local species that have been proven adaptive to the surrounding environment, for the type of *B. gymnoriza*, the nursery technology and planting techniques are still being tested because this species was only developed in 2016 and was successfully restored in 2017 by producing 10,000 mangrove seeds of the type *B. cylindrica*, but it can be seen that until 2020 the survival rate is still at 55.97% because Substrate and mangrove suitability is very important considering that this type of mangrove zoning tends to be close to the mainland, which means tolerance to salt levels is relatively low, while the other 3 types of mangroves are the result of introductions from the Bali Mangrove Forest Development Center so that they require adaptation and adaptation. n adjustments to the new environment, but this is a step forward because it is able to add to the collection of mangroves in Tangerang Regency that can be used as learning.

![Figure 1. Multistakeholder mangrove rehabilitation development.](image-url)
3.3. Potential adaptive management of rehabilitated and restored mangroves

Observative monitoring of key indicators is needed to evaluate the success of rehabilitation or restoration and to guide adaptive management and decision making. Formal experiments, either within a before-after-control-impact (BACI) observational framework [2] or using manipulations with appropriate controls and adequate sample sizes, can improve interpretation. causality of the observed patterns and identify key processes [2]. Restoration and rehabilitation provide the ideal opportunity and location for “real world” scale experiments to determine whether, for example, specific engineering solutions, cropping patterns, or facilitative (positive) interactions between species can increase restoration success [2].

Information from this activity is expected to have the potential for adaptive management of mangrove restoration and rehabilitation activities in other areas, such as the use of local species for the rehabilitation of coastal areas with very good mangroves, both restoration activities can be carried out by developing local species that are already rare, the third activity the introduction and domestication of mangroves must be adjusted to the zoning so that the results are optimal.

4. Conclusion

The conclusions that can be conveyed in this activity are as the involvement of various parties, namely local government agencies/institutions in Tangerang Regency, the private sector, TNI/Polri, schools, universities, and coastal community groups in mangrove rehabilitation programs and public awareness and education campaigns have encouraged the acceleration of mangrove rehabilitation, which in 2020 rehabilitation has been carried out by planting 720,000 mangrove trees, with 6 species (Rhizophora sp, Avicennia sp, Bruguiera cylindrica, Bruguiera gymnorrhiza, Ceriop tagal and Sonneratia alba), where the survival rate reached 69.22%, with the most adaptive species being planted with Avicennia sp in Tangerang Regency with a survival rate of 90.71%. Support from various parties, namely local government agencies/institutions in Tangerang Regency, the private sector, TNI/Polri, schools, universities, and coastal community groups in the mangrove rehabilitation program is quite good. the number of mangroves increases.

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