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ANALYSIS OF THE CO-MANAGING PROCESS IN THE MANAGEMENT OF THE MANGROVE BOTANICAL GARDENS CONSERVATION AREA IN SURABAYA CITY

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ABSTRACT

Global environmental issues are inseparable from mangrove deforestation. Mangrove areas continue to decline every year, while mangrove ecosystems are the most efficient carbon capture and storage systems in the world, currently storing carbon equivalent to more than 21 billion tons of CO2. Mangroves protect communities from the impacts of climate change and generate income through ecotourism and their products. Therefore, their preservation needs to be a focus of the government and the entire community, and efforts must be made to conserve these areas. Mangrove Botanical Gardens (KRM) is a mangrove conservation area in the center of Surabaya. This study uses a descriptive qualitative approach. This study aims to identify, analyze, and describe the management of the Mangrove Botanical Gardens in Surabaya City so that it can be used as updated information and enrich studies related to the importance of conservation areas. The results of the study show the roles of several actors, including the Surabaya City Food Security and Agriculture Service, NGOs, and the community.

INTRODUCTION

One of the global environmental problems is deforestation (Deena Robinson & Martina Igini, 2025). Deforestation is the process of clearing or destroying forests, either naturally or as a result of human activity. This phenomenon is often associated with the excessive exploitation of forest resources for economic gain. However, its impact is not limited to the loss of forest cover, but also affects the balance of ecosystems and human life (Admin, 2025). Forest deforestation also occurs in mangrove ecosystems. The State of The World's Mangroves 2022 explains that there are 147,000 km2 of mangrove forests remaining worldwide (Wetlands Team, 2022). Southeast Asia is home to nearly a third of all mangrove forests, with Indonesia alone accounting for nearly 20% of them (Alliance, 2021). Data on mangrove area based on the 2023 National Mangrove Map states that the existing mangrove area reaches 3.44 million hectares, and the potential mangrove habitat area reaches 777 hectares spread across the archipelago.

The sustainability of mangroves is threatened in various forms, both human or anthropogenic disturbance

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and natural factors or natural disturbance(National Mangrove Roadmap, 2022). The Center for International Forestry Research (CIFOR-ICRAF) released a study in 2015 stating that Indonesia has lost 52,000 hectares of mangrove forests over the past 30 years, annually producing 190 million tons of CO2-eq per year, and contributing 42% of the world's annual emissions due to the destruction of coastal ecosystems, namely swamps, mangrove forests, and seagrass beds (Position, 2023). Meanwhile, according to (Arifanti et al., 2021) Indonesia lost 182,091 hectares of mangroves between 2009 and 2019, and stated that the main drivers of mangrove deforestation are the conversion of mangrove forests to low-vegetation areas, aquaculture practices, and agriculture. This has the potential to produce significant emissions of 182.6 Mton CO2e into the atmosphere over a 10-year period. Stopping deforestation and conserving remaining mangrove forests is the most effective and efficient step to reduce CO2 emissions and mitigate the impacts of climate change. Therefore, consistent conservation of mangrove forest areas is needed for their sustainability and a better human life. Mangroves protect communities from the impacts of climate change and generate income through ecotourism and its products(Worldbank Team, 2021). Mangroves are the world's most efficient carbon capture and storage system and currently store carbon equivalent to more than 21 billion tonnes of CO2(Wetlands Team, 2022).

In this regard, the Indonesian Government established the Peat and Mangrove Restoration Agency (BRGM)

through Presidential Regulation Number 120 of 2020 to facilitate the acceleration of peat restoration and improve community welfare as well as accelerate mangrove rehabilitation in target provinces. The government also published the National Mangrove Map in 2021 as an effort to rehabilitate, conserve, maintain, and care for mangrove ecosystems through the One Map Policy Mangrove used as a basis for planning and policy-making in the context of mangrove ecosystem management (Administrator, 2021).

Table 1. Area of Mangrove Area on Java Island in 2024

No.	Province	Existing Mangrove (Ha)	Mangrove Habitat Potential (Ha)
1.	Banten	3,750	10,702
2.	DKI Jakarta	608	39
3.	West Java	12,429	39,039
4.	Central Java	16,100	42,862
5.	DI Yogyakarta	14	12
6.	East Java	30,839	43,795

Source: National Mangrove Map Processed by the Author, 2024

Based on the National Mangrove Map, East Java Province has 30,839 hectares of existing mangroves, with a potential habitat of 42,795 hectares. This region, with the largest area among other provinces on Java, presents significant potential for development. Despite the large number of mangrove areas and their potential, challenges also exist. For example, along the northern coast of Java, from Tuban and Lamongan to Madura, mangrove forests have been lost, evident in the beaches, which are now only sandy and gradually receding into the plains due to abrasion. Furthermore, many mangrove areas have been converted into fishponds in Gresik, Madura, and in Surabaya, many existing mangrove areas have been converted into elite housing (Wahyu Eka Setyawan, 2023).

Another example of a problem is overlapping regulations, which are a major factor in the difficulty of implementing the restoration and protection of mangrove areas, such as in Surabaya, which has been designated a National Strategic Area (KSN) Waterfront City. This contradicts the coastal protected area's status as it will trigger coastal degradation and damage to Surabaya's mangrove areas. The impact of this problem can lead to the indiscriminate issuance of development permits in areas that should be protected. The government often focuses on reforestation, while the annual conversion of mangrove areas is a major problem, and reforestation becomes merely a patchwork policy (Lucky Wahyu Wardana, 2024).

In an effort to manage mangrove areas, the City of Surabaya inaugurated the Mangrove Botanical Garden on July 26, 2023, by Megawati Soekarnoputri, Chairperson of the Indonesian Botanical Garden Foundation (YKRI). The Surabaya Mangrove Botanical Garden is the first and only thematic mangrove botanical garden in

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Indonesia. The Surabaya Mangrove Botanical Garden covers an area of 34 hectares, encompassing three areas: Gunung Anyar (11 hectares), Medokan Sawah (16 hectares), and Wonorejo (7 hectares). Management is carried out by the Technical Implementation Unit of the Surabaya City Food Security and Agriculture Service (Ulfa Arieza, 2023) The development of the Mangrove Botanical Garden (KRM) aims to prioritize biodiversity conservation, coastal protection, educational facilities, tourist destinations, nature conservation, and community empowerment in metropolitan cities in order to strive for a healthy, clean, and green environment for the future of the region (Nadira Hamamah, 2023).

To address the above issues, the author then uses the Co-Production in Conservation Framework in the Co-Managing Process as an analytical tool in this study. The Co-Managing Process is divided into three interactive and reflexive activity points. The Co-Production in Conservation Framework is an extension of Co-production itself. Co- Production is a concept that has emerged as a key to understanding the interaction between knowledge and policy. As policy challenges become increasingly complex and wicking (difficult to solve and full of uncertainty), the need for usable knowledge is also increasing, namely knowledge that is credible, legitimate, and relevant for decision-making. The concept of Co-Production is gaining increasing attention, both as an analytical term and as a practical strategy applied in the relationship between science and policy. However, its meaning is often not clearly defined, and this concept is also widely used across various disciplines and applied in various contexts, such as the environment and health (Bandola-Gill et al., 2023). Therefore, the Co-Production in Conservation Framework emerged in the development of co-production that is in line with values and rights in society. This is in line with (Buschman, 2022) which states that the Co-productive Conservation Framework recognizes that conservation practices can be implemented in a way that reflects and respects the values, perspectives, knowledge, rights, priorities, and livelihoods of indigenous peoples.

RESEARCH METHODS

This study uses a qualitative approach with a descriptive research type. Data collection techniques are carried out through observation, interviews, and documentation. Data analysis techniques use the interactive model of Miles, Huberman, Saldana. While the data validity test uses triangulation. This study aims to determine, analyze, and describe the management of the Mangrove Botanical Garden area from the perspective of Co-Production in conservation in the Co-Managing process with three descriptions of conservation activities starting from Delineating which focuses on the objectives of KRM development, and its boundaries. Allocating focuses on resource allocation and land use in

KRM. Regulating focuses on the cooperative relationship established by KRM managers with other parties, and empowerment of the community around the Surabaya City Mangrove Botanical Garden. Informants in this study include the Head of the Mangrove Botanical Garden UPT, the Mangrove Botanical Garden Field Team, and Community Groups.

RESEARCH RESULT

In this study, the author conducted a comprehensive review of the Surabaya City Mangrove Botanical Garden. The author conducted direct observations and interviews with key informants directly related to the management of the Surabaya City Mangrove Botanical Garden, namely the Technical Implementation Unit of the Food Security and Agriculture Service, specifically the Head of the Technical Implementation Unit. The following is a presentation of the research findings, which include three interactive and reflexive aspects or activities: Delineating, which contains a discussion of conservation objectives, and the determination of regional boundaries and the division of areas within the Surabaya City Mangrove Botanical Garden. Allocating, which includes land use planning and resource allocation. Regulating, which includes the cooperative relationship established by the management of the Botanical Garden. Mangrove with other parties, and community empowerment around the Surabaya City Mangrove Botanical Gardens.

***Delineating* (Description of Conservation Objectives and Area Boundaries) in the Management of the Mangrove Botanical Garden Conservation Area, Surabaya City**

Delineating is a process related to the description of objectives and the determination of territorial boundaries in a structured manner. According to (Buschman, 2022) In the delineation aspect, there are interactive and reflective activities, namely identifying critical targets and goals. Therefore, in the delineation aspect, the

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management of the Mangrove Botanical Garden (KRM) conservation area can be identified based on the objectives of the botanical garden development, the determination of regional boundaries such as management zones and protected areas. The regional boundaries referred to in this case include the Mangrove Botanical Garden's asset land and the zones within the Mangrove Botanical Garden's conservation area.

These findings indicate that the strategic objective of the Surabaya Mangrove Botanical Garden (KRM) development is based on a strong commitment to creating a conservation area in the heart of Surabaya, while simultaneously fulfilling five main functions: education, tourism, research, conservation, and the provision of environmental services. The initial idea for the KRM development was inspired by the Mangrove Restoration Center in Bali, which then encouraged the city government to adopt a similar concept in the Surabaya context. This inspiration was reinforced by the issuance of Surabaya Mayor's Decree Number 118 of 2018 concerning the Determination of the Location of the Surabaya City Mangrove Botanical Garden, which serves as the legal basis and policy direction for the area's development.

In addition to the need to provide an integrated conservation space, the development of the KRM also leverages the potential of the existing mangrove ecosystem along various coastal areas in Surabaya. This transformation of the area provides significant added value, considering that some of the land was previously unproductive fishponds or temporary waste storage sites. Through the development of the KRM, these lands are transformed into high-ecological green spaces, while also serving as learning, recreation, and environmental improvement facilities for the community.

Figure 1. Distribution of Mangrove Botanical Garden Land Areas
Source: Mayor's Decree, 2018

The boundaries of the Surabaya Mangrove Botanical Garden (KRM) are determined by Surabaya Mayoral Decree No. 188 of 2018. The decree stipulates that the total land area allocated for the development of KRM is 616,049 m², spread across 20 land assets in three different areas: Wonorejo, Gunung Anyar, and Medokan Ayu. This boundary and area determination not only serves as a legal basis but also provides clarity for the development of a more structured conservation plan. With clear delineation, the process of identifying ecosystem potential, zoning planning, and prioritizing conservation activities can be carried out in a more targeted and measurable manner, thereby supporting the goal of sustainable mangrove management.

Figure 2. Division of Areas in the Mangrove Botanical Garden
Source: Author's Documentation, 2025

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Figure 3. Zones in the Mangrove Botanical Garden

Source: Author's Documentation, 2025The KRM area is organized through a zone system that divides the KRM area into five main zones. The first is the Reception Zone which contains the main mangrove gate, ticketing gate, parking area, and merchandise to provide a neat and informative first impression before visitors explore deeper. The Plaza Zone contains an event plaza or small square that can be used as an open area for interaction and social activities, the Collection Zone contains a jogging track, a mangrove collection area, a bird collection aviary, a mangrove gazebo, and a mangrove collection where this zone functions for the management of mangrove species and related flora and fauna, the Nursery Zone contains a research center, production house, office, germination house, and open growth for the development of mangrove seedlings. The Supporting Facilities Zone contains food and drink stands, bridges, a symbolic plaza, and a viewing tower for educational and research infrastructure. This zoning allows for planned, balanced, and sustainable management of the Area between ecosystem protection and resource utilization. This is in accordance with the provisions of Presidential Regulation Number 83 of 2023 which explains that botanical gardens that have been inaugurated must have minimal infrastructure in the recipient zone, management zone, and collection zone (Government of Indonesia, 2023). Apart from that, it is also in accordance with research (Wang et al., 2024) which

recommends that general protected areas be further divided into several functional zones, so as to facilitate the integration between the diversity of area functions and ecological protection efforts more effectively.

The delineation aspect does not indicate any involvement of other parties or the community. This is because the delineation aspect encompasses territorial boundaries and the division of the area into zones, which are administrative matters and can only be discussed by the area manager. Furthermore, because the KRM conservation area is not confiscated or converted community land, determining territorial boundaries and other matters in this aspect can only be answered by the KRM management. Therefore, in the delineation aspect, full authority rests with the government through the Mangrove Botanical Gardens Technical Implementation Unit (UPT).

***Allocating* (Resource Allocation and Land Use) in the Management of the Mangrove Botanical Garden Conservation Area, Surabaya City**

Allocating is an aspect that includes resource allocation and land use planning. According to (Buschman, 2022) Interactive and reflective activities in the Allocating aspect include land use planning and establishing access and availability. Therefore, in this aspect, the management of the Mangrove Botanical Garden (KRM) conservation area is identified based on land use planning, resources, and outlining conservation activities. The results of this finding indicate that land use planning in KRM is listed and based on the master plan. Land management strategies such as dividing the land into the smallest units in the form of vak or plots serve to facilitate space allocation, identification, monitoring, and systematic collection management. The following is a map of the distribution of vak in the Mangrove Botanical Garden.

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Figure 4. Map of Mangrove and Vak Distribution
Source: Author's Documentation, 2025

There are a total of 12 vaks spread across the KRM collection area. Each vak has a distinct boundary and numbering, allowing for a more structured process of checking the type, quantity, ecosystem condition, and maintenance. This vak distribution strategy also addresses the limited land available, while supporting efficiency, control, and long-term planning in the management of the Mangrove Botanical Garden. With this approach, KRM can ensure optimal use of space and resources while maintaining the sustainability of the mangrove ecosystem. This was also explained by (Moore et al., 2021) which states that with limited resources, resource allocation decisions must be considered as well as possible.

Decisions to allocate resources optimally are also made by limiting planting to each designated area or zone. This is also a strategy in land-use planning. Limiting mangrove seedling planting refers to activities involving other parties. Typically, where a community or organization outside the KRM management intends to plant in the KRM, the planting will be directed to the estuary directly adjacent to the KRM area. A series of conservation activities are then carried out sequentially, including nursery, planting, maintenance, inspection, and replanting. Each activity is carried out by a different team, and replanting is a combination of conservation an

decision-making. This is because replanting is a conservation activity related to replanting previously planted areas due to dead mangroves, and determining whether a mangrove plant is truly dead is a careful process.

The previous descriptions represent strategies adopted or planned by KRM managers in their efforts to plan the use of their land and natural resources. This aligns with the opinion of (Harini Muntasib, 2022) which explains that allocation is one of the operational definitions of conservation which means strategies or actions taken for the best use of a resource.

In the allocation aspect, the involvement of other parties, including the community, is relatively minimal. This is not without reason. The allocation aspect encompasses discussions on land management, resource allocation, and conservation activities. Community involvement is only found in one common conservation activity, namely planting, which can be carried out by anyone who wishes to participate. Meanwhile, land management and resource allocation are administrative matters and fall under the full authority of the UPT KRM (Cultivation and Conservation Unit) as the official manager of the conservation area, based on Surabaya Mayoral Decree No. 188 of 2018. Therefore, the government still dominates this aspect of allocation.

Regulating (Cooperative Relations and Community Empowerment) in the Management of the Mangrove Botanical Garden Conservation Area, Surabaya City

Regulating is an aspect that includes cooperative relationships between KRM managers and other parties, and empowerment of the community around KRM. According to (Buschman, 2022) Interactive and reflective activities in the Regulating aspect include collectively deciding rules and regulations and developing adaptive capacity. Therefore, in the Regulating aspect, the management of the Mangrove Botanical Garden (KRM) conservation area can be identified based on the established cooperative relationships and empowerment of the community, including MSMEs, mangrove farmers, and fishermen around the KRM

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Figure 5. Silvofishery Demonstration Plot
Source: Author's Documentation, 2025

The Mangrove Botanical Garden management has established collaborative relationships with various parties, one example being a collaboration with Wahana Visi Indonesia to develop silvofishery. The development of the silvofishery demonstration plot by KRM Surabaya in collaboration with Wahana Visi Indonesia (WVI) is a form of participatory-based conservation regulation implementation. This activity balances the protection of the mangrove ecosystem with the sustainable use of fishery resources. Ecologically, technical regulations related to cultivation locations, mangrove planting patterns, and fishery types ensure that community activities do not damage the environment. In addition, the silvofishery demonstration plot serves as a non-formal regulatory instrument and educational tool, serving as a reference for responsible conservation practices while supporting the dissemination of knowledge to other stakeholders. Thus, this activity enforces adaptive, inclusive, and field- based regulations.

The Surabaya Mangrove Botanical Garden is assisted by BRIN in inspections and management, joining the Indonesian Botanical Garden Management Forum (BGCI), and expanding its network through membership in the

Indonesian Botanical Garden Management Forum (BGCI). This step strengthens the KRM's capacity as a center for mangrove knowledge based on scientific standards and international conservation practices. Through inspections, monitoring, and global collaboration, the KRM implements adaptive regulations and serves as an example of sustainable coastal management and an educational center for various stakeholders.

The Surabaya City Mangrove Botanical Garden management has established collaborative relationships with various parties, including government officials, research institutions, the private sector, and civil society organizations. This strategic effort aims to encourage the sustainable development of the Mangrove Botanical Garden as a conservation area and a center for environmental education, scientific research, and community empowerment. Through this collaboration, it is hoped that synergy will be created in resource management, capacity building, and program innovation that will strengthen the ecological, social, and economic functions of the mangrove area. This is in line with the opinion of (Bonaraja Purba et al., 2023) which states that conservation can be viewed from an economic and ecological perspective, where conservation from an economic perspective means trying to allocate natural resources for the present, while from an ecological perspective, conservation is the allocation of natural resources for the present and the future.

Figure 6. Forms of Involvement of Local Community Groups
Source: Processed by the author, 2025

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The Regulating aspect also includes strengthening the adaptive capacity of surrounding communities, including MSMEs, mangrove farmers, and fishermen, as part of fulfilling the environmental service function of KRM. MSMEs are empowered through food safety assistance from the Surabaya City Health Office in 2023 and halal certification and business development training initiated by Merdeka University Surabaya in 2024. Mangrove farmers are strengthened through various programs such as assistance in mangrove planting which generally provides training in conservation, coastal rehabilitation, and mangrove fruit processing to improve the local economy. Fishermen are involved in tourist boats as companions, captains, and local informants, thus playing a role in education, conservation, and economic improvement.

The regulatory aspect encompasses several aspects, including the collaborative relationship between the Surabaya City Government, as the manager of the Mangrove Botanical Garden, and various parties. The Mangrove Botanical Garden itself serves as a bridge for community empowerment activities and programs targeting various community groups in the surrounding area. This reflects the well-coordinated relationship between various parties, which is one of the efforts to develop a conservation area sustainably. Each actor plays a crucial role in ensuring balanced management. As stated in the opinion of (SLMP Indonesia et al., 2022) which states that the gap between science, society, and policy can be minimized by strengthening communication between scientists, policymakers, and other stakeholders through capacity building, outreach, and active involvement in the decision-making process (Nyamahono et al., 2025) Community participation in the management of protected areas is one indicator for realizing justice and ensuring that the needs of local

communities are met. As is the case with the opinion (Mwambeo et al., 2022) who argues that community empowerment is seen as a process and goal in which community members gain control over their lives and empowerment practices include knowledge, skills, and income-generating empowerment activities. Meanwhile, coordinated relationships between nature conservation areas and surrounding communities have significant impacts on both local communities and conservation management practices (Guo et al., 2023). Likewise with the opinion (Dixit et al., 2024) which explains that programs that focus on buffer zones or buffer zones aim to share the benefits of protected areas with local communities to meet their development needs as well as the relationship between the two.

CONCLUSION

Based on the results of the Co-managing analysis in the management of mangrove conservation areas which includes three aspects or interactive and reflexive processes including Delineating, Allocating, and Regulating. The results of the analysis show that the delineating aspect includes the process of describing objectives, determining regional boundaries, and dividing areas within the Mangrove Botanical Garden, the entire process is carried out only through the role of the government, namely the Mangrove Botanical Garden UPT. The allocating aspect includes the process of resource allocation, and land use. In this aspect, most of the processes are carried out by the government through the Mangrove Botanical Garden UPT. However, some others are roles carried out by other parties including the community. The regulating aspect includes the process of cooperative relationships with other parties, and community empowerment. In this aspect, the entire process can be said to be a perfect collaborative relationship because the entire process involves other parties, including the community.

Therefore, it can be concluded that the analysis of co-production in the management of the Surabaya City Mangrove Botanical Garden conservation area shows differences in the level of contribution between stakeholders. Although only one aspect fully demonstrates a collaborative character, this does not necessarily indicate that the management of the Mangrove Botanical Garden conservation area is not collaborative. Instead, the differences in the level of collaboration in each aspect actually reflect the variations in dynamics, roles, and forms of interaction of various parties that contribute to a series of overall management processes. This is similar to research (Manolache et al., 2018) where government institutions dominate the management of Natura 2000, while local companies and NGOs are only involved to a limited extent. The same is true for research (Iannuzzi et al., 2020) This shows that although the scope of actors involved in the decision-making process has expanded, their involvement remains consultative in nature. This condition shows that participation does not always have to be equal to be considered a form of collaboration. This finding is also in line with (Orach & Schlüter, 2021) which emphasizes that although collaboration may vary in intensity between aspects, the combination of interactions between actors still forms a transformation process towards co-management. In addition, (Loeffler, 2021) emphasizes that co-production

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consists of several modes and levels so it is unrealistic to expect all modes to emerge simultaneously, therefore, even if only one aspect shows full collaboration, the process is still categorized as co-production.

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