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Article

Development of A New City Patimban and Sustainability of the Mangrove Forest in Patimban, Subang, West Java

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Abstract: The New City of Patimban (NCP) in Subang, West Java, is being developed to meet the city's needs and protect the nearby mangrove forests. The development faces a challenge because allocating land for industry may harm the mangrove ecosystems. A Social-Ecological Systems (SES) lens shows that we need to understand how the development will affect the mangrove forests. The research, looks at how economics, society, and the environment are connected. The New City of Patimban faces environmental problems, including loss of habitat, damage to mangrove ecosystems, and greenhouse gas emissions. While new infrastructure can help the economy, it can also harm local jobs. The study says the government, local communities, and stakeholders should work together to restore and protect mangrove forests. It is important to keep checking that the rules, like the West Java Regional Spatial Planning Policy 2022-2042 and Subang Regent Regulation No. 38 of 2021, are followed so that the development does not harm the environment. Mangrove forests support the social and economic life of fishing communities. This article provides an overview of how they do this.

Keywords: New City Development; Sustainability; Mangrove Forests; Social-Ecological System; Patimban

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1. Introduction

The sustainable development of new cities represents a significant challenge, as does ensuring the sustainability of mangrove

forests in the context of urban expansion. The preservation of mangrove forests necessitates the participation of coastal communities and the government in the enforcement of legislation and the restoration of the ecosystem. The New City of Patimban (NCP) is situated within the Rebana area, which is located on the coast. As outlined in the Regional Spatial Planning Policy for West Java Province, the coastal area in question is undergoing a process of land conversion, with the intention of designating it as an Industrial Use Area within the Rebana Area. Such developments have the potential to disrupt the mangrove forest cover in the coastal area, leading to abrasion impacts that could affect the local economy in Patimban.

The question of whether this is an appropriate course of action is the subject of ongoing debate among academics. These debates include: 1) Sustainable urban development is becoming a mainstream concept in development (Ministry of Public Works and Housing, 2013); 2) Mangrove forests are damaged due to human activities such as land clearing for agriculture, city development, and pollution (Soedarmo, 2018); 3) Sustainable development includes the preservation of mangrove forests (Soedarmo, 2018); 4) The preservation of mangrove forests necessitates the involvement of coastal communities and the government in the enforcement of legislation and the restoration of the ecosystem (Soedarmo, 2018); 5) Indonesia has implemented regulations aimed at reducing emissions from deforestation and forest degradation, including mangrove forests (International Conference on Sustainable Mangrove Ecosystems (Directorate General of Natural Resources and Ecosystem Conservation, 2017). Additionally, mangrove forests have been utilized as a "laboratory" for the development of sustainable mangrove forest management through a participatory approach (Azis et al., 2010).

In the context of the Social-Ecological System (SES), the development of the New City of Patimban has the potential to impact the sustainability of the surrounding mangrove forests. The impact of the development of the New City of Patimban on the sustainability of mangrove forests has never been observed. This is despite the fact that the impact of development on the environment and surrounding communities has the potential to cause environmental damage, including loss of ecosystem services, decreased fish and shrimp populations, and increased coastal erosion. Consequently, research on the impact of the development of The New City of Patimban on the sustainability of mangrove forests is imperative to facilitate more optimal and sustainable land use and development decisions in coastal areas. This research can assist in analyzing the impact on ecosystems and the environment, as well as identifying economic potential and strategies for the sustainability of mangrove forests.

2. Materials and Methods

2.1. Problem Statement

In the delineation of The New City of Patimban area there are mangrove forests, the potential for deforestation or conversion of mangrove forests into supporting activities for industrial areas, this will of course have several impacts, including: 1) Loss of ecosystem services: Mangrove forests provide various ecosystem services, such as production nutrients, carbon, nitrogen and sulfur cycles, and habitats for various animal species. (Abita, 2022; Kompasiana, 2021); 2) Decrease in fish and shrimp populations: Loss of mangrove forests can cause a decline in breeding populations of fish and shrimp species, which can have a negative impact on the fishing industry and local communities that depend on these resources (Kompas.com, 2021; Kalor & Paiki, 2021); 3) Coastal erosion increase: Mangrove forests help stabilize coastlines and protect them from

erosion. The loss of mangrove forests can lead to increased coastal erosion, which can have negative impacts on the surrounding environment and communities. (Kompas.com, 2021; Hidayat & Rachmawatie, 2021); and 4) Social and economic impacts: For example, a decline in fish and shrimp populations could lead to a decline in the fishing industry, which could have a negative impact on the livelihoods of local fishermen. In addition, the loss of ecosystem services provided by mangrove forests can have a negative impact on the health and welfare of surrounding communities (Hafni, 2016); (Rinika et al., 2023).

Based on those things, in this paper, it is necessary to carry out research with the aim of identifying ecosystems and the environment through Social-Ecological Systems (SES) and knowing about the economic potential and sustainability of mangrove forests in order to help in making better and more sustainable decisions. in land use and development in coastal areas. Research can help to maintain a balance between economic, environmental and social aspects in sustainable development efforts. The research question according to the formulation of this research problem is **"What is the Impact of the Development of The New City of Patimban on the Sustainability of Mangrove Forests in Patimban?"**

2.2. Literature Review

2.2.1. The Concept of SES (Social Ecological System)

Berkes and Folke (1998) introduced the term Social Ecological System (SES) which emphasizes the concept of integration between humans and nature, where social and ecological systems are interrelated or interconnected and integrated. (Folke et al., 2003) integrates ecology, economics, socio-political culture and institutional dimensions of social-ecological interactions in a coherent model/framework that includes holism and complexity, where this model is a great hope in achieving sustainability. Meanwhile, (Hunt & Berkes, 2003) conceptualize SES as a network that is limited and consists of relationships between individual and system components. SES can be described through component descriptions, network relationships, the nature of relationships and the existence of boundaries.

2.2.2. Left Behind Places

Left behind places refer to areas experiencing economic stagnation or decline, especially post-industrial districts and rural areas (Pike et al., 2023). The term has gained prominence as part of the geography of discontent, denoting the types of economically disadvantaged and declining places that have expressed feelings of marginalization and abandonment through increased support for populist parties and movements. The problems of left behind places include loss of belonging and identity as well as reduced economic opportunities, social and cultural marginalization, political neglect, and reduced in public service provision and infrastructure investment (MacKinnon et al., 2021).

There are several potential solutions as strategies that can be applied to left behind places to overcome this, namely: 1) Investing in infrastructure (*The right way to help declining places - Leaders*, 2017); 2) Encouraging entrepreneurship (*The right way to help declining places - Leaders*, 2017); 3) Supporting education and workforce development (MacKinnon et al., 2021); 4) Promoting tourism (*Leaving Subang Jaya Truly Asia | arleneanddennis*, 2014); and 5) Encouraging regional collaboration (MacKinnon, *'Left-Behind' Places, Regional Inequalities and 'Levelling Up'*, 2021)

Overall, addressing the challenges faced by "left behind" places requires a multifaceted approach involving investments in infrastructure, education, entrepreneurship, and workforce development, as well as regional collaboration and tourism promotion. By implementing this strategy, it is possible to revitalize "left behind" places and create new opportunities for residents.

2.2.3. Subang Regent Regulation No. 38 of 2021

Subang Regent's Regulation Number 38 of 2021, which pertains to the Detailed Spatial Plan for the 2020-2040 Planning Area of the New City of Patimban, encompasses the spatial plan for the development zone of the aforementioned city. This regulation addresses several key issues, including: The spatial plan for the development area of the New City of Patimban encompasses the following elements: spatial planning of the New City of Patimban development area, development of the New City of Patimban development area, utilization of space in the development area of the New City of Patimban, and environmental protection and management of the development area of the New City of Patimban. Furthermore, this regulation can assist in maintaining equilibrium between economic, environmental, and social considerations in sustainable development endeavors. As a comprehensive spatial plan encompassing a multitude of elements, including spatial planning, investment strategies, and other factors instrumental to the development of a new city. Additionally, the regulation addresses environmental protection and management of the development area of the New City of Patimban, with the objective of maintaining environmental sustainability in the vicinity of the development area. However, there is a dearth of detailed information regarding mangrove forest areas in the Subang Regent's Regulation Number 38 of 2021 concerning Detailed Spatial Planning Plans for the Planning Area of the New City of Patimban for 2020-2040.

2.2.3. West Java Province Regional Regulation No. 9 of 2022

The West Java Province Regional Regulation Number 9 of 2022 concerns the regional spatial planning of West Java Province for the period between 2022 and 2042. This regulation addresses a number of key areas, including regional spatial planning, the development of industrial areas, the development of tourism areas, the development of agricultural areas, the development of fisheries areas, the development of residential areas, and the development of conservation areas. In West Java Regional Regulation No. 9 of 2022 concerning Regional Spatial Planning for 2022-2042, which has established zoning regulations in West Java, it can be seen in the comparison below that it has included zoning regulations extending to the sea. This includes the mangrove area, which is also part of this zoning. By determining plans for various types of activities in the surrounding area, it will of course affect the ecosystem in the mangrove area.

2.2.3. Patimban Strategic Environmental Assessment Study

Patimban Port is located in Patimban Village, Pusakanagara District, Subang Regency, West Java Province. Geographically, Patimban Port is located on the north coast of West Java. The planned location of Patimban Port is located at 107^0 54′ 8.54″E and 6^0 13' 50.08″S. Carried out with an investment value of Rp. 43.2 trillion, through the National Revenue and Expenditure Budget funding scheme with Foreign Loans, Regional Revenue and Expenditure Budget, and Private. The Ministry of Transportation is responsible for the project with plans to start construction in 2018, and plans to start operations in 2019 (Phase 1).

Strategic Environmental Assessment is a series of systematic, comprehensive and participatory analyzes to ensure that the principles of sustainable development have become the basis and are integrated in the development of a region and/or policies, plans and/or programs (Law No. 32 of 2009 concerning protection and Management of the environment). Strategic Environmental Assessment is carried out by the government and regional governments in formulating Long Term Development Plans, Medium Term Development Plans, and Regional Spatial Planning Policies as well as Policies, Plans, and/or Programs that have the potential to cause environmental impacts and/or risks. The principle of Strategic Environmental Assessment is self-assessment, which means that the policy, plan and/or program itself carries out the Strategic Environmental Assessment. Strategic Environmental Assessment is designed to encourage decision makers to become aware of environmental issues in their own region so that sustainable development can be implemented well. Strategic Environmental Assessment Detailed Spatial Plan for The New City of Patimban carried out by the District Government. Subang is intended to assess whether the policies, plans and/or programs prepared in the Detailed Spatial Planning Plan for The New City of Patimban have taken into account the principles of sustainable development.

At the planning location for The New City of Patimban (Pusakanagara District), the National Strategic Project for the Development of the Patimban Port is located. When talking about planning locations, you should examine land use conditions. Land use in BWP The New City of Patimban (Pusakanagara District) is dominated by Technical Irrigation Rice Fields with an area of 3,078.16 Ha which reaches a percentage of 52% of the total land use. Based on the Strategic Environmental Assessment of the Detailed Spatial Plan for The New City of Patimban for 2020-2040, there are four land conversion issues in the delineation area of the New City of Patimban spatial plan, the first concerns the transition of agricultural land into residential and industrial areas (ports) , secondly, the transition of pond land into gardens, thirdly, the reduction in protected areas, and fourthly, the need for land to develop the patimban area into a New City.

In regional planning, the economy is a significant factor, as it informs the assessment of community welfare based on the per capita income of the population. The population of Pusakanagara District exhibits a low economic level, which can be attributed to several factors. Firstly, the community demonstrates a limited capacity to transition from traditional agricultural and fishing occupations. Secondly, the region has a high concentration of families with limited economic prospects. Thirdly, the availability of human resources remains constrained, with the majority of individuals engaged in agricultural labor. Fourthly, the community's access to and participation in port-related activities is limited.

The northern part of the Pusakanagara District is in direct contact with the Java Sea, which has resulted in the formation of a coastal area. The coastline is utilized by the local community as a beach tourism destination, with Patimban Beach being a notable example. This beach attracts numerous visitors on weekends. Currently, the coastal area is integrated into the Patimban Port region, where excavations have been conducted at multiple locations. Additionally, there are indications that ships are engaged in sea reclamation activities to enhance the operational capacity of Patimban Port.

However, this relates to the risk of impacts on the environment, which are not only caused by natural disasters, but can also be caused by non-natural disasters or caused by impacts caused by development activities or irresponsible human activities. The results of a field survey conducted in October 2019 revealed that at least four points were affected by negative impacts,

including those caused by human activities. These impacts included a lack of water for irrigation, the continued use of dirt for road access surfaces, the blockage of drainage systems by rubbish, and the presence of dry rubbish.

3. Results

This research project aims to identify the ecosystem and environment surrounding the New City of Patimban in Subang, West Java, as well as to determine the economic potential and sustainability of the mangrove forests in the area. This research employs an SES approach that incorporates the West Java Regional Spatial Planning Policy (2022-2042), the Patimban Strategic Environmental Assessment (2020-2040), and Subang Regent Regulation 38 of 2021. A literature study was conducted to collect data from various sources, including journals, books, and related articles. A review of the literature reveals that the sustainability of mangrove forests can be maintained in the context of new city development through the implementation of a Social-Ecological System approach. The sustainability of mangrove forests is influenced by a number of factors, including human activities such as land clearance for agriculture, urban development, and pollution. In order to reduce emissions from deforestation and forest degradation, including mangrove forests, it is necessary for the government to implement strict regulations. In addition, coastal communities must play a role in maintaining the sustainability of mangrove forests by enforcing laws and restoring the ecosystem.

In the context of the environmental impact of new city development on the sustainability of mangrove forests, a Social-Ecological System approach reveals several impacts that warrant consideration. These include: The loss of habitat for wild animals that live in mangrove forests, the damage to the mangrove forest ecosystem, which can affect water availability and water quality in the surrounding area, and the increased greenhouse gas emissions due to deforestation and mangrove forest degradation are the primary environmental concerns. The construction of the New City of Patimban has an impact on the surrounding environment and ecosystem. The construction of infrastructure, such as ports and roads, has the potential to disrupt the mangrove ecosystem and reduce water quality in the surrounding area. Nevertheless, the development of the New City of Patimban also presents significant economic opportunities, particularly in the trade and industrial sectors. In order to ensure the continued sustainability of the mangrove forests in Patimban, it is essential to implement effective management strategies, rigorous supervision, and educational initiatives for the local community. Moreover, further research is required to ascertain the economic potential of mangrove forests, including the development of natural tourism and the utilisation of environmentally friendly firewood. In order to ensure the long-term sustainability of the environment and ecosystem in the vicinity of the New City of Patimban, it is essential to establish effective coordination and cooperation between the government, local community, and relevant stakeholders. In addition, it is essential to conduct periodic assessments of the implementation of the Regional Spatial Planning Policy for West Java 2022-2042 and the Strategic Environmental Assessment Patimban 2020-2040. Furthermore, Subang Regent Regulation 38 of 2021 is to be observed to guarantee that the development of The New City of Patimban is conducted in accordance with the aforementioned principles, specifically the principles of sustainability and environmental protection.

4. Discussion

The SES framework was originally designed to be applied to relatively well-defined areas, in common-pool resource management situations, where resource users obtain/produce resources from an existing resource system (ecosystem). Resource use also provides for the maintenance of resource systems in accordance with the rules and procedures determined by the overarching governance system and within the context of related ecological systems and broader socio-political-economic settings (Mc Ginnis & Ostrom, 2014). Basically, resource use in coastal areas includes a social multiple use context, where there are various forms of ownership and conflict over resource use. Ecological systems in coastal areas are closely related to/and influenced by one or more social systems, where the contemporary approach to coastal and ocean management based on social-ecology, is basically an integration between ecological understanding and socio-economic values (socio-economic value) (Hafsaridewi et al., 2018).

If observed collectively, the use of coastal and marine resources has so far not been optimal and sustainable, where one of the main causes is the planning and implementation of coastal and marine resource development which has so far been carried out on a sectoral and disaggregated basis. The ecologically interconnected characteristics of coastal and marine ecosystems require that optimal and sustainable management of coastal and marine resources can only be realized through an integrated and holistic approach (Hafsaridewi et al., 2018). The aim of SES-based coastal and marine management is to maintain and maintain the sustainability and integrity of the ecosystem, so that at the same time it is able to guarantee the sustainability of the supply of resources for human socio-economic interests.

In the context of SES, mangrove forest transition can affect the surrounding ecosystem and environment, as well as the economic and social potential of local communities. The following is the link between mangrove forest transition and SES based on search results: 1) Community participation development in Mangrove Forest Management (Murni & Alikodra, 1995): Case studies in Segara Anakan, Cilacap Regency, Central Java show that community participation in mangrove forest management can improve the economic and social welfare of local communities. However, mangrove forest transition can disrupt community participation in mangrove forest management and reduce the economic and social benefits obtained by the community. 2) Economic Valuation as a Basis for Sustainable Mangrove Resource Management (Suharti et al., 2016): This research shows that mangrove forests have social, economic and ecological functions for the surrounding community. The transition of mangrove forests can reduce the economic and social benefits obtained by the community, such as reducing fish and shellfish production. 3) Review of The Use of Mangrove Forests in Supporting the Social-Economic Life of Fishing Communities (Untari et al., 2020) This research shows that mangrove forests have an important role in supporting social life and fishing community economy. The transition of mangrove forests can reduce the economic and social benefits obtained by fishing communities, such as reducing fish and shellfish production. 4) Mangroves as Social-Ecological Systems Viability, Conservation, Restoration, Management and Governance (Oles et al., 2020): The transition of mangrove forests can disrupt the balance of the ecosystem and the surrounding environment, as well as reducing the economic and social benefits obtained local community. Therefore, efforts need to be made to maintain the sustainability of mangrove forests, such as good management, strict supervision and education to local communities. Apart from that, further research needs to be carried out regarding the economic potential of mangrove forests, such as the development of natural tourism and the use of environmentally friendly firewood.

There are several regulations related to legislation that are concerned with mangrove forests, such as: 1) Law no. 5 of 1994; 2) Presidential Decree No. 48 of 1991; 3) Presidential Regulation no. 121 of 2012; 4) Presidential Regulation no. 73 of 2012; 5) Minister of Maritime Affairs and Fisheries Regulation No. 24 of 2013; 6) Regulation of the Coordinating Minister for the Economy No. 4 of 2017; 7) RI Presidential Decree No. 73 of 2012 concerning National Strategy for Mangrove Ecosystem Management; and 8) RI Presidential Regulation No. 120/2020 concerning the Peat and Mangrove Restoration Agency.

Mangroves are forest areas that grow on alluvial mud soil in coastal areas and river estuaries which are influenced by sea tides, and consist of plant species *Avicennia* sp., *Sonneratia* sp., *Rhizophora* sp., *Bruguiera* sp., *Ceriops* sp., *Lumnitzera* sp., *Xylocarpus* sp., etc. Mangrove forests are a natural resource in tropical areas that have great benefits both ecologically and economically (Ramena et al., 2020). Indonesia is an archipelagic country that has mangrove forests in the world reaching an area of approximately ± 16,530,000 ha, spread across Asia 7,441,000 ha, Africa 3,258,000 ha and America 5,831,000 ha, while in Indonesia it is reported to be 3,735,250 ha (FAO, 1982). Mangrove forests should be prioritized as well as protected forests, production forests and tourist forests according to the potential of the local ecosystem. All policies related to the use of mangrove areas designated as development areas should be supported by adequate legislation for related sectors (Irman & Akbar, 2021). In Law no. 5 of 1994 discussed biodiversity, which aims to protect biodiversity and its sustainable use for human welfare as well as sharing the benefits and use of biological resources fairly and evenly between the stakeholders involved.

There is a National Strategy for Mangrove Ecosystem Management regulated in Presidential Regulation No. 73/2012, which aims to regulate the conservation and rehabilitation of coastal areas by maintaining biodiversity and mangrove ecosystems. In this regulation, a long-term strategy for coastal area management is discussed, where the strategy clearly separates conservation objectives from coastal area rehabilitation objectives, because both have the same goal of achieving sustainable development and low-carbon development. This Presidential Regulation also stipulates that mangrove operations will be integrated into planning documents at the national level, such as the National Long Term Development Plan 2025-1045, the National Medium Term Development Plan 2025-2029, and regional level planning documents from various stakeholders.

Apart from the regulations above, there is also RI Presidential Decree No. 120/2020 concerning the Peat and Mangrove Restoration Agency which aims to accelerate and increase the effectiveness of peat restoration and mangrove rehabilitation in Indonesia. This Presidential Decree explains in detail the role of the Peat and Mangrove Restoration Agency, namely regarding the acceleration of mangrove rehabilitation in several areas in Indonesia. This Presidential Decree establishes the regulatory framework, management, community participation, monitoring and evaluation framework, and law enforcement in the management and protection of mangrove and peat ecosystems. The hope is that the existence of the Peat and Mangrove Restoration Agency can accelerate the rehabilitation and restoration of mangrove and peatland ecosystems effectively and sustainably.

5. Conclusions

Based on the results of the matters that have been discussed, several things that can be concluded to be recommended are: 1) The government must implement strict regulations to reduce emissions from deforestation and forest degradation, including mangrove forests with a

Social-Ecological System approach; 2) Coastal communities must be involved in maintaining the sustainability of mangrove forests by enforcing laws and restoring ecosystems using a Social-Ecological System approach. 3) Further research needs to be carried out on the development of sustainable mangrove forest management through a participatory approach with a Social-Ecological System approach. 4) Education and outreach to the community is needed about the importance of maintaining the sustainability of mangrove forests in the development of new cities using a Social-Ecological System approach.

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