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MANAGEMENT OF MANGROVE ECOSYSTEM TO SUPPORT SUSTAINABLE URBANIZATION IN EAST KALIMANTAN

Policy Brief

EXECUTIVE SUMMARY

East Kalimantan has been experiencing urbanization driven by a continuous influx of migrants and, more recently, the relocation of Indonesia's capital from Jakarta to Ibu Kota Nusantara (IKN). This rising population is anticipated to lead to rapid land cover changes, resulting from the development of settlements, infrastructure, and supporting facilities, as well as land clearing for food production. Our research indicates that such changes could significantly impact the mangrove ecosystem in East Kalimantan, affecting its vital ecological functions as barriers against coastal abrasion, filters for pollutants, and absorbers of carbon. Furthermore, these alterations are likely to disrupt the habitats of endemic wildlife, including proboscis monkeys (*Nasalis larvatus*).

Indonesia has a series of laws that highlight the significance of managing mangrove ecosystems. Law No. 32/2024, concerning the amendment of Law No. 5/1990 on the Conservation of Natural Resources and Their Ecosystems, along with Presidential Decree No. 32/1990 on the Management of Protected Areas and Government Regulation No. 27/2025 on the Protection and Management of Mangrove Ecosystems, demonstrates Indonesia's commitment to safeguarding essential life-support systems by preserving biodiversity, particularly outside designated conservation areas. Law No. 32/2024 represents a pivotal shift in conservation responsibilities, extending them beyond the central government to include local governments and communities. Complementarily, Government Regulation No. 27/2025 clarifies the role of communities in the protection and management of mangrove ecosystems. Both Presidential Decree No. 32/1990 and Government Regulation No. 27/2025 emphasize the need to integrate the protection and management of mangrove ecosystems with spatial planning and integrated coastal management.

However, the establishment of clear incentive mechanisms is essential to effectively foster public participation in the protection and management of mangrove ecosystems and to support broader conservation efforts aimed at promoting sustainable urbanization in East Kalimantan.

Our team conducted a comprehensive analysis of land cover changes in the IKN development area from 2001 to 2023. The findings indicate a 29% reduction in mangrove forest cover, primarily due to conversions into ponds, agricultural land, plantations, settlements, and mining activities. Currently, only about 8% of the mangrove ecosystems are situated in Conservation Areas and Protected Forests. The majority of these ecosystems are found in Limited Production Forests/HPT (54.6%), Other Land Use Areas/APL (36.9%), and Convertible Production Forests/HPK (0.3%). An overlay analysis with the habitat prediction distribution map for the proboscis monkey reveals that over 80% (15,147 hectares) of their habitat is located within mangrove ecosystems across the IKN Area (6%), the IKN Development Area (36%), and the surrounding watershed areas in the IKN National Strategic Area (58%). Fortunately, the mangroves within the IKN and IKN development areas face a relatively low risk of conversion, as the IKN is guided by a Master Plan for Biodiversity Management that emphasizes environmentally sustainable practices by adopting the "Forest City" concept. In contrast, mangroves outside the IKN boundaries are at a significantly higher risk, especially if urban expansion proceeds swiftly and without adequate regulation.

To effectively tackle the issue, it is imperative for both the Central and Local Governments to significantly enhance their coordination and alignment of frameworks focused on the sustainable management of mangrove ecosystems. Such coordination is not just beneficial but essential for achieving optimal outcomes for the community and

the mangrove ecosystem, while actively supporting the development of the IKN National Strategic Area and fostering sustainable urbanization in East Kalimantan. The Central Government needs to prioritize the creation of robust policies that integrate the protection and management of mangrove ecosystems beyond merely designated forest areas, including incorporating key elements of conservation, rehabilitation, and comprehensive monitoring, with the active involvement of all relevant stakeholders. Additionally, the Central Government needs to implement clear incentive and disincentive mechanisms, develop a national mangrove restoration plan with measurable targets and success indicators, and establish policies for alternative funding of mangrove-based ecotourism initiatives. It is crucial to promote the sustainable use of mangrove forest products to drive local economic development and ensure the long-term sustainability of mangrove ecosystems.

The Local Government needs to take immediate action to develop a Regional Regulation focused on sustainable mangrove management that prioritizes the protection and responsible use of mangroves for the benefit of local communities. It is imperative to integrate mangrove conservation into regional spatial planning without delay, including launching ecotourism initiatives that actively involve local communities in the management and upkeep of mangrove ecosystems. Additionally, establishing a habitat corridor for proboscis monkeys in Other Land Use Areas (APL) along Balikpapan Bay is essential to connect fragmented habitats. The Local Government needs to implement monitoring systems and enforce strict penalties against anyone who harms mangrove ecosystems. Collaboration with the private sector and local communities is not just important—it is essential for executing restoration and rehabilitation efforts of degraded mangroves through corporate social responsibility (CSR) programs and community empowerment initiatives. Moreover, developing impactful public awareness campaigns through education and outreach is crucial to enhance understanding of the importance of mangrove ecosystems, alongside rigorous enforcement of environment-based policies.

INTRODUCTION

Urbanization is a global phenomenon, with over 50% of the world's population now living in urban areas (World Bank Group, 2025). This trend is anticipated to continue as the population grows. Indonesia is among the countries witnessing relatively rapid population growth, currently at about 1% per year, and it is projected to reach approximately 328.93 million people by 2050 (BPS, 2023b). However, the distribution of Indonesia's population is highly uneven, with a significant majority (56%) residing on Java Island (BPS, 2025). To address this imbalance, the government has implemented a transmigration program aimed at redistributing the population from Java to other islands, fostering regional development outside of Java, and promoting national unity. Additionally, voluntary inter-regional migration also occurs, particularly in areas experiencing rapid economic growth. Jakarta, the capital city, is a favored destination for many migrants from various regions across Indonesia, drawn by the promise of better income opportunities and improved living conditions.

East Kalimantan stands as the second-largest migration destination after Jakarta (BPS, 2023a) and is undergoing rapid urbanization, primarily due to the proliferation of extractive industries that have emerged in the region since the 1970s. This urbanization has been further accelerated by the relocation of the national capital from Jakarta to East Kalimantan, a transition officially announced by the Indonesian government in 2019 with the establishment of the new capital, Ibu Kota Nusantara (IKN). A primary objective of the capital city relocation is to create a new economic center outside of Java, thereby promoting more balanced development across Indonesia. The development of IKN is expected to attract migrants and boost migration flows from other regions to East Kalimantan, driven by infrastructure improvements and supporting facilities that create new economic hubs around IKN. Consequently, the development of IKN is anticipated to expedite the urbanization process in East Kalimantan further.

Balikpapan Bay is strategically located as a vital water transport route connecting the IKN to various other regions. The complexity of this area is

increasing alongside the rapid growth of the industrial sector. In 2007, industrial expansion in Balikpapan Bay began to significantly impact the existence and sustainability of mangrove ecosystems. These impacts have become more pronounced with the implementation of the Balikpapan City Spatial Plan 2015-2032 (PERDA Kota Balikpapan No. 12/2012), which anticipates the conversion of coastal forests for the expansion of the Kariangau Industrial Complex (KIK). This situation presents a dilemma between the necessity for economic development and the imperative of environmental protection, which is essential for coastal resilience and biodiversity.

The relocation and development of the IKN have elicited critical responses from various stakeholders. A primary concern revolves around the potential impact of large-scale development on Kalimantan's tropical forest ecosystem, which serves as a habitat for endemic flora and fauna and is vital for the livelihoods of local communities. In response to these concerns, the government has adopted the 'Forest City' concept, which emphasizes environmental sustainability and harmony with nature in urban design. This initiative aims to create an eco-friendly living environment, characterized by extensive green spaces, effective ecosystem management, and a seamless integration of urban development with the surrounding natural landscape.

Despite adopting the Forest City concept within the IKN development framework, the development presents significant potential implications for biodiversity, particularly beyond the immediate vicinity of the IKN area, including the KIK. Anticipated rapid industrial growth, urban settlement expansion, and infrastructure development in areas surrounding IKN are projected to meet increasing demands for housing, food security, and other essential facilities. This trajectory poses considerable risks to the sustainability of surrounding forest ecosystems, notably mangrove forests, which are crucial habitats for various endemic species, such as the proboscis monkey (*Nasalis larvatus*). The conversion of land for industrial and residential use, coupled with extensive changes in land use practices, is likely to exacerbate habitat fragmentation and contribute to a decline in biodiversity.

Mangrove ecosystems are crucial for providing habitat for diverse species, maintaining essential ecosystem functions, and delivering social and economic benefits to surrounding communities (Murdiyarso et al. 2015). Furthermore, these ecosystems play a key role in advancing various Sustainable Development Goals (SDGs) in East Kalimantan. The sustainable management of mangrove ecosystems can significantly enhance the protection, restoration, and sustainable use of terrestrial habitats, promote sustainable forest management, and safeguard biodiversity (SDG 15). Additionally, mangrove ecosystems are crucial for maintaining the health of aquatic environments, particularly in coastal regions (SDG 14), and for sequestering blue carbon, which is essential for climate change mitigation efforts (SDG 13). Moreover, mangrove ecosystems support the green development initiatives commenced by the East Kalimantan Provincial Government and support sustainable urbanization in East Kalimantan (SDG 11).

POLICY GAP AND MAIN PROBLEM

The existing legal frameworks in Indonesia, including Law No. 32/2024 concerning the Amendment to Law No. 5/1990 on the Conservation of Natural Resources and Ecosystems, Presidential Decree No. 32/1990 on the Management of Protected Areas, and Government Regulation No. 27/2025 on the Protection and Management of Mangrove Ecosystems, unequivocally demonstrate the country's commitment to safeguarding critical ecosystems and preserving biodiversity beyond mere conservation zones. Law No. 32/2024 marks a pivotal advancement in conservation management as it transfers responsibilities from solely the central government to include local communities and local governments, thereby fostering local engagement. Furthermore, Government Regulation No. 27/2025 explicitly delineates the proactive role of communities in the stewardship of mangrove ecosystems, featuring incentive programs to reward those who voluntarily contribute to the restoration, maintenance, and conservation of these essential areas. However, to amplify community participation, it is imperative to enhance the clarity of the incentive mechanisms associated with these

initiatives to support sustainable urbanization in East Kalimantan.

Presidential Decree No. 32/1990 and Government Regulation No. 27/2025 establish the imperative of integrating the protection and management of mangrove ecosystems with spatial planning. Under Presidential Decree No. 32/1990, mangrove forested coastal areas are unequivocally designated as critical Nature Reserve and Cultural Reserve zones. These areas require rigorous protection to conserve their ecosystems, which are vital habitats for marine life and serve as natural buffers against coastal abrasion while also supporting aquaculture and agricultural activities. It is the responsibility of local governments to designate these protected areas through Regional Regulations. Moreover, Government Regulation No. 27/2025 mandates that plans for the protection and management of mangrove ecosystems need to form the cornerstone of regional medium-term development plans and be seamlessly integrated into comprehensive coastal zone management strategies. Local governments are also tasked with the restoration of mangrove ecosystems beyond

areas designated for business permits. In addition, local governments surrounding the IKN need to proactively prepare for the environmental changes induced by IKN development, ensuring the completion of essential technical documents, such as the Environmental Carrying Capacity assessment. Despite the establishment of these legal frameworks, it is crucial to demand greater alignment of the framework and coordination between the Central and Local Governments. Central and Local Governments need to work collaboratively to determine the most effective approaches that benefit both communities and the ecosystems.

CRITICAL FINDING

The analysis results of land cover/land use change, land allocation for conservation and development to support urbanization, and incentive schemes for sustainable mangrove management indicate that mangrove ecosystems around the IKN's development area are highly vulnerable.

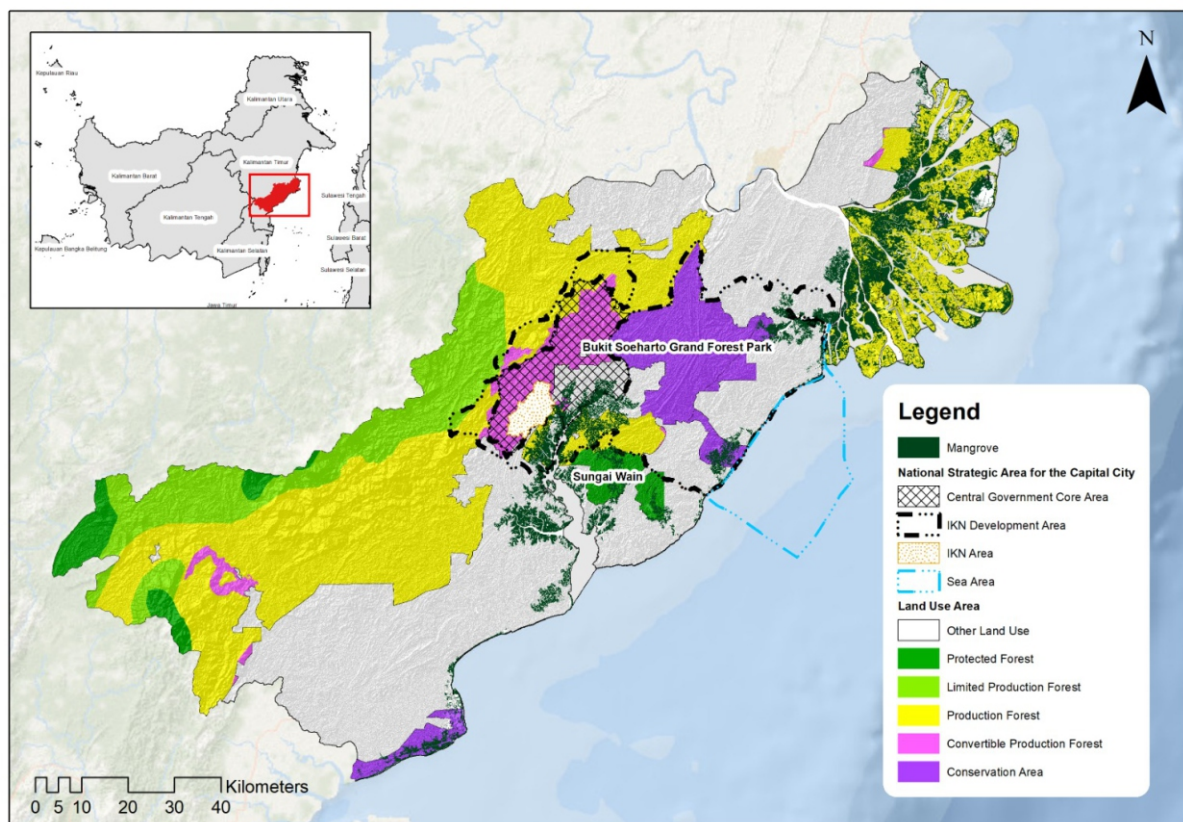


Figure 1. Map of the study site and beyond the IKN area with surrounding sub-watershed boundaries.

Land Cover/Use Change

In 2023, East Kalimantan was the province that experienced the highest total deforestation, both within and outside forest areas, in Indonesia (KLHK, 2023). (KLHK, 2023). Approximately 16.1% of mangrove forest ecosystems in East Kalimantan were converted to developed land, including settlements, agricultural land, and shrub, between 2000 and 2020 (Potapov et al., 2022). The landscape analysis result shows that there was an increase in the fragmentation of mangrove forest land cover as indicated by a decrease in the PLAND index (percentage of landscape), as well as an increase in the NP (number of patches), PD (patch density), and SPLIT (separation index) indices. In contrast, built-up land, including settlements, experienced consolidation or merging, indicating the development of built-up areas (Susanti et al., 2022, 2023). Meanwhile, the remote sensing data analysis focusing on the IKN development area shows that from 2001 to 2023, there was a decrease in mangrove forest cover area of around 29% (20,201 ha) due to land use change into ponds, agricultural land, plantations, settlements, and mines.

Mangroves serve as a vital natural habitat and primary living space for endemic wildlife, such as proboscis monkeys (Suwanto et al., 2016). This ecosystem provides essential resources such as food, shelter, and breeding grounds for the species (Azizah et al., 2020). However, land cover/use change leads to a reduction in the area of mangrove ecosystems, increasing the risk of proboscis monkeys losing their natural habitat. Increased fragmentation of mangrove ecosystems can lead to the isolation of proboscis monkey populations, which in turn increases the risk of inbreeding and decreases genetic diversity—both crucial for long-term population adaptation and resilience (Atmoko et al., 2012).

In addition, habitat fragmentation also increases the risk of proboscis monkey interactions with human activities, such as hunting, which can accelerate the decline of proboscis monkey populations (Misnawati and Miliyati, 2024). A notable example of habitat disturbance is the construction of a toll road in the Wain River area and the development of a loading and unloading port in Balikpapan Bay, which has further increased

pressure on current proboscis monkey habitats and populations and is likely to continue in the future.

Land Allocation

Mangroves are often recognized as crucial components of 'blue infrastructure' for climate change adaptation and mitigation, primarily due to their numerous benefits for both the environment and society, as well as their similarities to artificial infrastructure. These ecosystems safeguard coastlines from erosion and storm surges, filter pollutants from water, and sequester significant amounts of carbon (Murdiyarso et al. 2015, Griscom et al. 2017). Additionally, mangroves serve as essential natural habitats for wildlife, including proboscis monkeys, and play a crucial role in the economy of coastal communities by supporting fisheries and nature tourism activities (Sawitri et al. 2013).

The analysis of land cover and land use data in the IKN and its surroundings reveals that only about 8% of mangrove ecosystems are situated within conservation and protected forest areas. In contrast, a significant 54.6% are found in the Limited Production Forest (HPT). In comparison, 36.9% are categorized as Other Land Use Areas (APL), and a mere 0.3% fall within Convertible Production Forest (HPK), as illustrated in Figure 1. The considerable proportion of mangroves located in APL renders them especially susceptible to conversion for alternative land uses. According to Yayasan Konservasi Alam Nusantara (YKAN), mangrove conversion in East Kalimantan has been taking place since the mid-20th century. To date, the Mahakam Delta has experienced the most extensive mangrove conversion, with 75% of its mangroves being transformed into shrimp ponds (Prakoso, 2023).

The overlay of the habitat distribution prediction map for the proboscis monkey with the IKN area map reveals that over 80% (15,147 ha) of their habitat is situated within mangrove forests throughout the IKN Area (6%), the IKN Development Area (36%), and the watersheds surrounding the IKN National Strategic Area (58%), as illustrated in Figure 1. The mangroves in both the IKN area and the IKN development area are at minimal risk of conversion, primarily due to the existing

Biodiversity Management Master Plan and the implementation of the "Forest City" concept. In contrast, the mangroves located in the watersheds surrounding the IKN National Strategic Area may face a greater risk of conversion, particularly if urbanization in these regions progresses rapidly and uncontrolled.

Rapid population growth and urbanization are likely to heighten the likelihood of human-wildlife interactions. A lack of environmental awareness regarding protected species, particularly among newcomers, may contribute to the rising incidence of human-wildlife conflict. Furthermore, the increasing population and urbanization in IKN and its surroundings will drive up the demand for food, including aquaculture products. This surge in demand could incentivize the conversion of mangroves into ponds that promise greater financial returns. Implementing silvofishery practices can offer an incentive-based solution for aquaculture within mangrove ecosystems, as this method promotes both productive fish farming and the restoration of degraded mangrove habitats (Hardi et al., 2023).

Incentive, Alignment, and Coordination

Law No. 32/2024, which amends Law No. 5/1990 regarding the Conservation of Living Natural Resources and their Ecosystems, highlights the importance of incentive and disincentive schemes in protecting life buffers. Additionally, Government Regulation No. 27/2025 delineates the role of communities in the protection and management of mangrove ecosystems, including the provision of incentives for individuals or groups who successfully restore, maintain, or conserve these vital areas. However, the mechanisms for these incentives require further clarification to effectively stimulate community involvement in mangrove protection and broader conservation initiatives, both of which are essential for fostering sustainable urbanization in East Kalimantan. The absence of a well-defined incentive mechanism for sustainable mangrove management often results in limited participation from local communities knowledgeable about these ecosystems. As a consequence, these communities tend to engage in alternative activities that offer greater financial rewards, such as aquaculture.

The East Kalimantan Provincial Government is taking decisive action to promote sustainable mangrove ecosystem management with the enactment of East Kalimantan Governor Regulation No. 33/2024. This regulation sets clear guidelines for granting site approvals for essential conservation activities in peat and/or mangrove areas located outside of forest areas across regencies and cities. It emphasizes the urgent need for robust collaboration among government entities, local communities, and the private sector to ensure the preservation of mangroves—critical components of coastal ecosystems. Additionally, this regulation empowers local communities to play an active role in conservation efforts. However, it is imperative to enhance alignment and coordination to ensure that both Central and Local Governments collaborate effectively for the benefit of communities and ecosystems.

RECOMMENDATION

The Central and Regional Governments need to improve coordination and alignment of frameworks related to sustainable mangrove ecosystem management. Effective collaboration is crucial for achieving optimal outcomes for both local communities and the mangrove ecosystem, thereby supporting the development of the National Strategic Area of the New Capital City (IKN) and promoting sustainable urbanization in East Kalimantan. Consequently, the Central and Regional Governments should consider implementing policies that facilitate better coordination and alignment regarding sustainable mangrove ecosystem management, as outlined in the recommendations below.

For the Central Government:

1. **Develop a policy on mangrove management and protection outside forest areas that is integrated with spatial planning and integrated coastal area management,** encompassing aspects of conservation, rehabilitation, and monitoring, and involving all relevant parties, including local communities, the private sector, and local governments.

2. **Develop clear incentive and disincentive mechanisms** to encourage the protection and sustainable management of mangrove forests. Incentives can take the form of carbon service-based funding support, mentoring, or awards for regions that successfully conserve mangroves. At the same time, disincentives can include sanctions for those who damage mangrove ecosystems.
3. **Develop a national mangrove restoration plan** with measurable targets and indicators of success, involving active participation from local governments, the private sector, and communities.
4. **Develop a policy for funding mangrove ecotourism-based activities and sustainable utilisation of mangrove forest products** to support local economic development and maintain ecosystem sustainability.
4. **Prepare a monitoring scheme and strict law enforcement** against mangrove destruction perpetrators to ensure the protection of mangrove ecosystems by utilising the latest technology and the Internet of Things (IoT)
5. **Collaborate with the private sector and communities** in the implementation of restoration and rehabilitation of degraded mangroves through corporate social responsibility (CSR) programmes and local community empowerment.
6. **Develop an appropriate public awareness plan** through community outreach and education to increase understanding of the importance of mangrove ecosystems, including protected species, as part of conservation efforts and climate change risk reduction. This education programme is essential to involve the community in various activities, including the sustainable management of natural resources. Thus, it is expected that the current human resources can play an active role in maintaining the sustainability of the mangrove ecosystem.

For the Local Governments:

1. **Prepare local regulations related to sustainable mangrove management** that include the protection and sustainable use of mangroves for the benefit of local communities, such as ecotourism, silvofishery, and agroforestry. These regulations can emphasise the importance of environmentally friendly management, provide a strong legal basis for conservation activities, and integrate mangrove ecosystems as protected areas into regional spatial planning.
7. **Strictly implement environmental policies** to ensure that stakeholders properly adhere to the rules and regulations related to environmental preservation and can effectively synergize with other related sectors.

LIST OF REGULATIONS

- Law No. 32/2024 about the Amendment of Law No. 5 of 1990 on the Conservation of Natural Resources and Their Ecosystems
- Law No. 21/2023 about the Amendment of Law No. 3 of 2022 on the National Capital (State Gazette of the Republic of Indonesia Year 2023 Number 142)
- Law No. 3/2022 about the National Capital (State Gazette of the Republic of Indonesia Year 2022 Number 41, Supplement to the State Gazette of the Republic of Indonesia Number 6766)
- Presidential Decree No. 32/1990 about the Management of Protected Areas
- Government Regulation 27/2025 about the Protection and Management of Mangrove Ecosystems
- Presidential Regulation No. 63/2022 on the Details of the Master Plan of the Ibu Kota Nusantara
- Presidential Regulation No. 64/2022 on the Spatial Plan of the National Strategic Area of the Ibu Kota Nusantara Year 2022-2042



Decree of the Head of the Authority of the Ibu Kota Nusantara of the Republic of Indonesia No.36/ Year 2024 on the Master Plan for Biodiversity Management of the Ibu Kota Nusantara

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