



Conservation and biodiversity preservation activities a comparative insight between conservation regions in Cross River State, Nigeria and Berbak and Sembilang National Parks, Indonesia

Muhammad Rianzar^{1,*}, Raldi Hendro Koestoer¹

¹ Department of Environmental Science, Graduate School of Sustainable Development, Universitas Indonesia, Jakarta, Central Jakarta 10430, Indonesia.

*Correspondence: muhammadrianzar1991@gmail.com

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ABSTRACT

Background: Biodiversity conservation in protected areas is a global concern, requiring collaborative efforts across nations to safeguard Earth's ecological integrity. This study examines conservation and biodiversity preservation activities in the Cross River State Protected Areas, Nigeria, and the Berbak and Sembilang National Parks, Indonesia. **Methods:** Through an in-depth literature review, the research analyses the biodiversity conditions, threats, conservation approaches, legal frameworks, constraints, and strengths in both areas. **Findings:** Findings reveal significant biodiversity richness coupled with serious threats from unsustainable human activities, including deforestation, illegal hunting, and mining. Conservation initiatives involve governments, non-governmental organizations, and local communities, encompassing conservation education, alternative livelihood support, and law enforcement. However, constraints such as limited resources, inter-agency coordination, and community conflicts hinder conservation effectiveness. To enhance biodiversity preservation, a comprehensive and collaborative approach is proposed, emphasizing capacity building for local communities, strict law enforcement, incentive provision, and regional cooperation. **Conclusion:** An examination of the conservation and biodiversity preservation initiatives undertaken within the safeguarded regions of Cross River State in Nigeria and the Berbak and Sembilang National Parks in Indonesia reveals a tapestry of contrasting approaches and shared commonalities. Despite being endowed with exceptional biodiversity richness, both countries face severe threats to its sustainability, such as deforestation, illegal hunting, and unsustainable human activities. **Novelty/Originality of this article:** Ultimately, this research contributes to understanding the challenges and opportunities in biodiversity conservation, serving as a foundation for developing sustainable policies and strategies in Nigeria, Indonesia, and other countries with similar characteristics.

KEYWORDS: biodiversity conservation; community-based conservation; environmental policy; sustainable development; protected areas.

1. Introduction

Biodiversity in Nigeria, a country with significant natural wealth in Africa, faces serious threats. One protected area of concern is the Cross River State Protected Areas, comprising the Cross River National Park (Okwangwo Division), Spanning an expansive territory of roughly 1,186 square kilometers, the protected landscapes of this region encompass several distinct conservation areas, including the Mbe Mountains Community Forest and the Afi Mountain Wildlife Sanctuary, which collectively safeguard a remarkable diversity of flora

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and fauna. This area is a habitat for more than 280 species, including endemic species such as the Picathartes areas nesting in the Mbe Mountains (BirdLife International, 2023a). The major threats faced include illegal hunting, illegal logging, land burning, and harmful fishing practices. The Nigerian government has implemented the Biodiversity Conservation Act of 1992, which regulates the management and protection of protected areas and sets penalties for illegal activities (Federal Ministry of Environment, 2020). However, implementation and law enforcement remain significant challenges, particularly in remote areas and conflict zones.

The Cross River National Park was formally gazetted in 1991 through the National Parks Decree No. 36, which amalgamated the previously separate Okwangwo Forest Reserve, Boshi Extension Reserve, and Okwa Hills Reserve into a unified conservation zone covering approximately 100,000 hectares in the northern sector of Cross River State. The impetus for formal protection was rooted in the recognition of this landscape as one of the last refugia of the Guinea-Congolian rainforest biome outside the Congo Basin—a biome that had already suffered catastrophic losses elsewhere in West Africa due to agricultural conversion and timber exploitation (Ezealor & Garske, 2020). Indigenous communities of the Boki, Ekajuk, and Mfumte peoples had inhabited these forest margins for centuries, maintaining complex relationships with the forest that blended subsistence farming, ritual use of plants, and oral traditions encoding ecological knowledge. The establishment of formal protected area status, however, introduced a disjunction between these longstanding biocultural relationships and new governance regimes, as communities found traditional resource access routes restricted without adequate consultation or compensation (Enuamuse et al., 2022). This tension between state-centric conservation logic and community-embedded biocultural practices constitutes the foundational ethical challenge that the Wildlife Conservation Society (WCS) has attempted to navigate through its multi-pronged intervention programs since the mid-1990s.

In Indonesia, the second most biodiversity-rich country in the world after Brazil, threats to biodiversity are also very real. One area of concern is the Berbak and Sembilang National Parks located in Jambi and South Sumatra Provinces. This 2,042.5 km² area is a habitat for around 249 bird species, 69 mammal species, and 144 fish species (Balai Taman Nasional Berbak Sembilang, 2022). However, the area faces serious threats from unsustainable human activities, such as illegal logging, encroachment, illegal hunting, and forest fires (Wijaya et al., 2022). Indonesia has a legal framework related to biodiversity conservation, the nation has enacted a comprehensive legal framework that emphasizes the preservation of its invaluable natural heritage. Notably, the Conservation of Biological Natural Resources and Their Ecosystems Act, enacted in 1990, lays the foundational principles for safeguarding biological diversity. Additionally, the Forestry Act of 1999 establishes a robust regulatory mechanism for the sustainable management of forested areas and designated protected zones, further solidifying the country's commitment to environmental stewardship. However, implementation and law enforcement remain significant challenges in remote areas like the Berbak and Sembilang National Parks.

The Berbak National Park was first designated as a Wildlife Reserve in 1935 under Dutch colonial governance, making it one of the oldest formally protected areas in the Indonesian archipelago. Its original designation was driven primarily by the ecological significance of its vast lowland peat swamp forests—ecosystems recognized even in the early twentieth century as irreplaceable carbon sinks and hydrological buffers. The park was elevated to National Park status in 1992 under the authority of the Indonesian Ministry of Forestry, in partial alignment with Indonesia's ratification of the Convention on Biological Diversity. Sembilang was subsequently gazetted as a National Park in 2003, recognizing its critical role as a staging ground for migratory waterbirds along the East Asian-Australasian Flyway and as a nesting habitat for globally threatened species including the milky stork (*Mycteria cinerea*) and the lesser adjutant (*Leptoptilos javanicus*). The biocultural context of these parks is defined by the presence of the Melayu Sembilang and Kubu communities—forest-dwelling peoples whose subsistence economies depended on fishing in the tidal rivers and harvesting of non-timber forest products from the peat swamp margins. The

transformation of these landscapes into formally administered national parks introduced regulatory barriers to traditional access, generating socioeconomic displacements that subsequently became catalysts for encroachment and illegal resource extraction (Yulianti et al., 2020; Maulana et al., 2019). Understanding these historical trajectories is essential for contextualizing the persistence of community-level conflicts that continue to challenge conservation governance in both regions.

Despite conservation efforts in both countries, there are gaps in the effectiveness of implementation. In Nigeria, Safeguarding the ecological treasures within the Cross River Protected Areas involves a multidisciplinary approach that transcends geographical boundaries. Local initiatives are reinforced through strategic partnerships with global conservation entities. These collaborative endeavors encompass educational outreach programs that raise awareness about the region's natural heritage. Moreover, they provide sustainable livelihood alternatives to communities, reducing their dependence on exploiting finite resources. Concerted efforts also entail robust anti-poaching operations, conducted in synergy with international organizations like the Wildlife Conservation Society (WCS), to curb illegal hunting practices and ensure the long-term survival of vulnerable species (Obeten et al., 2024a). However, constraints such as limited financial resources, lack of inter-agency coordination, and political instability remain major challenges (Obeten et al., 2024b; Ogar et al., 2022). In Indonesia, conservation efforts in the Berbak and Sembilang National Parks include security patrols, area rehabilitation, conservation education, and empowerment of local communities (Yulianti et al., 2020; Fitriadi et al., 2021a). However, their effectiveness is limited by constraints such as budget limitations, inter-agency coordination, and conflicts of interest with local communities. To enhance conservation efforts in both countries, a comprehensive and collaborative approach involving governments, non-governmental organizations, local communities, and other stakeholders is crucial. Strengthening the capacity of local communities, strict law enforcement, providing incentives, and regional and international cooperation are key to overcoming the existing challenges and constraints.

This research aims to examine the conservation and biodiversity preservation activities in protected areas, focusing on case studies in the Cross River State Protected Areas, Nigeria, and the Berbak and Sembilang National Parks, Indonesia. Specifically, This study aims to critically evaluate the existing initiatives for safeguarding biological diversity in two distinct nations, Nigeria and Indonesia. By conducting a comprehensive assessment, the research endeavors to pinpoint areas that warrant further attention and remedial measures to strengthen conservation efforts within these countries. This is intended to understand the differences in approaches, strategies, and levels of success in conservation efforts in each study area, as well as the factors contributing to these gaps. Furthermore, this research aims to evaluate the legal and policy frameworks governing biodiversity conservation in Nigeria and Indonesia and identify the similarities and differences between them. In this regard, the research will examine relevant laws, regulations, and international agreements, as well as the effectiveness of their implementation in protecting biodiversity in protected areas. Additionally, this research aims to analyze the strengths and weaknesses of the biodiversity conservation legal frameworks in force in Nigeria and Indonesia, with the intention of providing recommendations for improving future policy and regulation formulation to enhance the effectiveness of conservation efforts in both countries.

By achieving these objectives, this research is expected to contribute significantly to understanding the challenges and opportunities in biodiversity conservation in protected areas and enhancing biodiversity preservation efforts in Nigeria, Indonesia, and other countries with similar characteristics. The findings from this investigative endeavor are anticipated to lay a solid groundwork, furnishing valuable insights that can inform and shape future conservation policies and strategic approaches. By identifying gaps and areas necessitating improvement, this research holds the potential to catalyze the formulation of more robust, effective, and sustainable measures aimed at preserving biodiversity for generations to come.

2. Methods

This research employs a systematic literature review (SLR) method to analyze and synthesize information from various literature sources relevant to the research topic. SLR is a structured and systematic method for collecting, evaluating, and presenting data from previous studies with the aim of answering predetermined research questions (Massaro et al., 2015; Munn et al., 2018). The rationale behind selecting this methodological approach stems from its ability to offer a holistic perspective, encompassing an in-depth examination of the prevailing circumstances, the obstacles encountered, and the conservation initiatives undertaken within the protected areas of both Nigeria and Indonesia.

2.1 Literature search process

To gather relevant literature, an extensive online search was carried out, leveraging reputable academic databases and search engines. The inquiry process involved the strategic use of specific keywords and their permutations, such as "biodiversity conservation," "protected areas," "Nigeria," "Indonesia," "Cross River State," "Berbak-Sembilang National Park," among others. This comprehensive approach ensured the identification and acquisition of pertinent scholarly materials from a diverse range of authoritative sources. The search was conducted considering predetermined inclusion and exclusion criteria (Aromataris & Munn, 2020).

2.2 Selection parameters for literature review

The search parameters were defined to encompass a diverse array of authoritative sources, including peer-reviewed scientific journals, scholarly publications, government-issued reports, and comprehensive assessments from reputable conservation organizations. To ensure the relevance and timeliness of the information, the literature search was confined to materials published within the preceding decade, spanning the years 2014 to 2024. The exclusion criteria include literature that does not specifically discuss biodiversity conservation in protected areas in Nigeria and Indonesia, as well as publications not in English or Indonesian (Massaro et al., 2015; Munn et al., 2018).

2.3 Data extraction and synthesis

The data extracted from relevant literature includes information about biodiversity conditions, threats to biodiversity, conservation efforts undertaken, challenges faced. Furthermore, the research encompassed an in-depth examination of the existing policies and regulatory frameworks pertaining to conservation efforts within the protected areas of Nigeria and Indonesia. The collected data, comprising a diverse array of sources, underwent a rigorous process of critical analysis and synthesis, with the aim of providing comprehensive answers to the research questions posed (Aromataris & Munn, 2020; Munn et al., 2018).

2.4 Quality assessment of literature

To ensure the integrity and credibility of the literature reviewed, a rigorous quality assessment process was employed. This evaluation was guided by a set of robust criteria adapted from the widely acclaimed Critical Appraisal Skills Programme (CASP) and the esteemed Joanna Briggs Institute (JBI) (Aromataris & Munn, 2020; Critical Appraisal Skills Programme, 2018; Joanna Briggs Institute, 2017). The assessment parameters encompassed a comprehensive examination of the validity and relevance of the studies, the robustness of the methodological approaches employed, and the direct applicability of the findings to the research topic under investigation.

2.5 Criteria for comparative analysis

A central methodological consideration in this study is the justification for comparing a state-level protected area complex in Nigeria (the Cross River State Protected Areas, incorporating the Okwangwo Division of the Cross River National Park, Mbe Mountains Community Forest, and Afi Mountain Wildlife Sanctuary) with a national-level park system in Indonesia (the Berbak and Sembilang National Parks). While these two cases occupy different administrative tiers within their respective national governance structures, the comparison is justified on the basis of four convergent criteria as follows.

Ecological parallelism, both study areas represent transitional forest-wetland mosaics situated at the interface between tropical lowland rainforest and seasonally inundated wetland ecosystems. The Cross River complex, positioned within the Guinea-Congolian biodiversity hotspot, and the Berbak-Sembilang complex, embedded within the Sundaland biodiversity hotspot, both harbor assemblages of globally threatened large mammals—including great apes and elephants in Nigeria, and big cats and elephants in Indonesia—whose persistence depends on large, contiguous protected landscapes. This ecological structural similarity renders conservation challenges and management responses comparable in meaningful ways (Ezealor & Garske, 2020; Maulana et al., 2019).

Socioeconomic and cultural parallels, communities peripheral to both protected areas share structural socioeconomic vulnerabilities: high rates of subsistence dependency on forest and aquatic resources, limited access to formal employment markets, and histories of inadequate consultation during the establishment of conservation boundaries. In both cases, the enforcement of conservation regulations has generated grievances rooted in the disjunction between traditional resource use rights and formal protected area law—a tension that scholars identify as a defining feature of biocultural conflict in the Global South (Jacobson et al., 2015; Enuamuse et al., 2022).

Comparable conservation intervention modalities, both conservation systems deploy analogous intervention frameworks encompassing conservation education, alternative livelihood programs, and law enforcement patrols—providing a basis for evaluating the transferability of strategies across geographic and institutional contexts. The involvement of international NGOs (most prominently the Wildlife Conservation Society in Nigeria and WWF and Wetlands International in Indonesia) introduces comparable donor-driven governance dynamics, enabling an analysis of how external institutional actors shape local conservation outcomes (Obeten et al., 2024a).

Legal framework comparability, although administrative designations differ—"state-level protected area" in Nigeria versus "national park" in Indonesia—the substantive legal frameworks governing both areas operate under analogous statutory instruments that confer formal protected area status, restrict land conversion and extractive activities, and assign enforcement responsibilities to state agencies Nigeria's National Parks Decree (1991) and Biodiversity Conservation Act (1992) function analogously to Indonesia's Law No. 5 of 1990 on the Conservation of Biological Natural Resources in terms of their regulatory scope, their stipulation of penalties for violators, and their allocation of management authority (Federal Ministry of Environment, 2020; Battisti et al., 2016).

3. Results and Discussion

3.1 Theoretical approaches and legal framework

Biodiversity conservation is a complex endeavor that requires a comprehensive approach. Consequently, various theoretical approaches have been developed by experts and conservation organizations to provide conceptual frameworks and effective strategies for addressing conservation challenges in protected areas. One relevant approach is the ecosystem approach, which emphasizes the importance of understanding and managing ecosystems holistically, considering the interactions between biotic and abiotic components, as well as the relationships between humans and the natural environment

(Maltby, 2022). This approach recognizes that conservation is not only focused on specific species but also on the functions and ecosystem services that support human life. Moreover, the community-centric conservation model underscores the pivotal role of actively engaging indigenous populations in environmental stewardship initiatives, recognizing their unique perspectives and traditional knowledge as invaluable assets in safeguarding natural resources respecting traditional knowledge, and providing economic incentives to support sustainable livelihoods (Jacobson et al., 2015). This approach is based on the understanding that long-term conservation success depends on the support and active participation of communities.

Within the realm of behavior modification, the conceptual frameworks that guide behavior change initiatives place a significant emphasis on developing a comprehensive understanding of the diverse factors that shape human attitudes and actions towards the natural environment, such as knowledge, attitudes, social norms, and economic incentives (Byerly et al., 2019). This theory provides a framework for designing effective interventions to change environmentally destructive behaviors into environmentally friendly ones. Finally, the adaptive management theory emphasizes the importance of continuous learning and adaptation of conservation strategies based on rigorous monitoring and evaluation. This theory acknowledges that ecosystems and conservation challenges are dynamic, necessitating a flexible and responsive approach to managing protected areas.

Biodiversity conservation efforts in Nigeria and Indonesia heavily depend on supportive legal frameworks and public policies. In Nigeria, The legislative landscape governing the preservation of biological diversity within the nation is underpinned by a cornerstone statute, the Biodiversity Conservation Act, which was promulgated in 1992, establishing a robust legal framework to safeguard the nation's rich natural heritage (Federal Ministry of Environment, 2020). This law governs the management and protection of protected areas and sets penalties for illegal activities such as illegal hunting and logging. Nigeria has also ratified various international conventions related to biodiversity conservation, The nation's commitment to environmental conservation is further reinforced by its adherence to several influential international treaties and accords. Notable among these are the Convention on Biological Diversity (CBD), the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), and the Ramsar Convention on Wetlands, all of which provide a global framework for collective action in preserving the planet's invaluable natural resources (Ardoin et al., 2020).

Conservation efforts in Nigeria involve various approaches, such as conservation education, Within the protected areas of Cross River State, various conservation initiatives are undertaken, encompassing educational programs aimed at raising awareness, providing alternative means of sustenance to local communities, and conducting regular anti-poaching patrols to safeguard the region's biodiversity (Obeten et al., 2024b). The main conservation goals in this area are to protect biodiversity, preserve natural ecosystems, and support sustainable livelihoods for local communities (Moore et al., 2018). However, conservation efforts in Nigeria also face significant challenges and constraints, such as poverty among local communities, lack of conservation awareness, limited human resources, lack of financial support, lack of inter-agency coordination, and political instability.

Indonesia has implemented a comprehensive legal framework to safeguard its rich biodiversity, encompassing various statutes and governmental decrees. These include, but are not limited to, the Conservation of Biological Natural Resources and Their Ecosystems Act of 1990, the Forestry Act of 1999, the Environmental Protection and Management Act of 2009, and the Regulation on the Management of Nature Reserve Areas and Nature Conservation Areas issued in 2011. This multifaceted approach underscores the nation's commitment to preserving its ecological heritage for future generations. Law No. 5 of 1990 serves as the primary legal basis for biodiversity conservation in Indonesia, regulating the protection and management of protected areas and establishing institutions and mechanisms for conservation.

In Indonesia, conservation efforts are carried out in various areas, including the Berbak and Sembilang National Parks. Conservation efforts in this area include security patrols, area rehabilitation, conservation education, empowerment of local communities, and research (Fitriadi et al., 2021a). The goals are to protect biodiversity, preserve peatland and mangrove forest ecosystems, and support sustainable livelihoods for local communities (Mahulu et al., 2019a). However, the constraints faced in Indonesia include limited resources, inter-agency coordination, and conflicts of interest with local communities.

Both in Nigeria and Indonesia, conservation efforts require a comprehensive and collaborative approach to overcome existing challenges and constraints. This approach includes strengthening the capacity of local communities through economic empowerment programs and sustainable conservation education, strengthening law enforcement and incentive systems, and regional and international cooperation (Roe et al., 2015a; Nugraha et al., 2021; Thomas et al., 2019). With comprehensive and collaborative efforts, the conservation areas in Nigeria and Indonesia can continue to contribute to protecting biodiversity and supporting sustainable development in both countries.

3.2 Review of the condition of conservation areas in Nigeria

Nigeria is a country with significant biodiversity richness in Africa, but faces serious challenges in its conservation and preservation efforts. According to a report from the World Resources Institute (2022), Nigeria loses around 350,000 hectares of forest annually over the last decade. Deforestation is primarily caused by agricultural expansion, settlements, and unsustainable exploitation of natural resources, which threatens the natural habitats of many endemic Nigerian species (BirdLife International, 2023b).

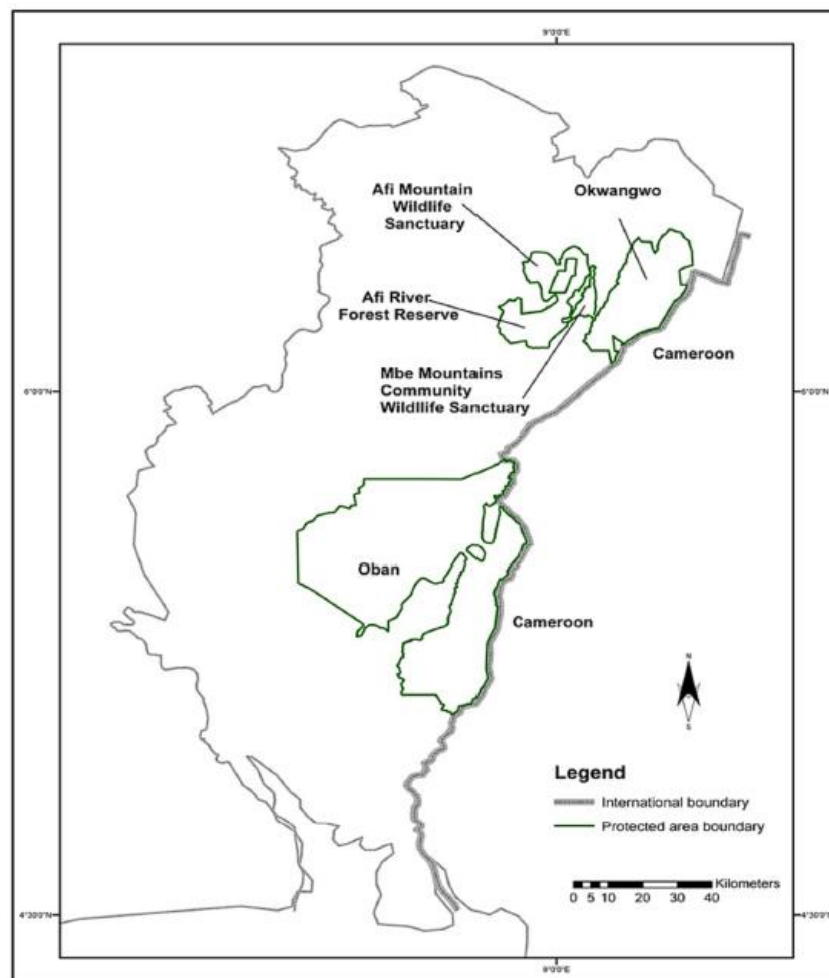


Fig. 1 Protected areas in cross river state, nigeria

Illegal hunting is also a severe threat to biodiversity in Nigeria. A study by Maltby (2022) revealed that more than 20,000 wild animals are killed each year in Nigeria for illegal trade. This not only threatens wildlife populations but also jeopardizes the overall balance of ecosystems. Mining activities also pose a threat to biodiversity, such as oil and natural gas mining activities in the Niger Delta region, which have caused severe damage to natural habitats and environmental pollution.

Amid these challenges, the nation has designated special zones, including the renowned Cross River National Park situated within Cross River State, as protected areas, safeguarding their ecological integrity and the biodiversity they harbor, have become crucial for safeguarding Nigeria's remaining biodiversity (Figure 1). However, these protected areas also face threats from unsustainable human activities, such as illegal logging, poaching, and human-wildlife conflicts (Obeten et al., 2024a). Local communities around the Cross River National Park heavily depend on forest resources for their livelihoods, such as collecting non-timber forest products and hunting wildlife, which exerts significant pressure on the biodiversity within the protected area.

To address these challenges, the Nigerian government has implemented various policies and regulations related to biodiversity conservation, such as the Biodiversity Conservation Act enacted in 1992 (Federal Ministry of Environment, 2020). Nigeria has also ratified various international conventions related to biodiversity conservation, to further bolster its conservation efforts, the nation has ratified and upheld several pivotal international accords aimed at preserving the planet's biological wealth. These include, but are not limited to, the global treaty dedicated to promoting sustainable use and equitable sharing of benefits arising from genetic resources, the multilateral agreement regulating cross-border trade of endangered species, and the intergovernmental treaty focused on the wise use and protection of wetland ecosystems. However, implementation and law enforcement remain major challenges, especially in remote areas and conflict zones.

Recognizing the importance of collaborative efforts, the government in Cross River State has forged partnerships with several non-governmental entities dedicated to environmental preservation. One such organization, known for its unwavering commitment to wildlife conservation, has implemented a multifaceted strategy that encompasses raising public awareness, providing sustainable alternative livelihood opportunities for local communities, and conducting regular anti-poaching operations to safeguard the region's precious fauna. This holistic approach underscores the collective resolve to protect and nurture the area's rich natural heritage (Obeten et al., 2024a). A community-based approach to biodiversity conservation in Nigeria can yield positive results if it actively involves local communities and considers the local socio-cultural context. However, a major challenge faced is the lack of adequate financial resources and technical capacity.

3.3 Review of the condition of conservation areas in Indonesia

The Indonesian archipelago, spanning over 17,000 islands, is a treasure trove of biological diversity, providing a sanctuary for a staggering array of species. According to scientific estimates, this nation harbors an impressive 12% of the world's mammalian fauna, 16% of all reptile and amphibian species, and an astonishing 17% of avian species. However, this natural wealth faces formidable challenges stemming from human activities such as widespread deforestation, unlawful hunting practices, illicit wildlife trafficking networks, and the looming threat of global climate change. Preserving this remarkable biodiversity requires concerted efforts and a multifaceted approach to mitigate these pressing environmental concerns (Dewi et al., 2022).

Recognizing the urgency of safeguarding its rich biological heritage, the Indonesian government has implemented a comprehensive strategy that involves designating specific regions as nature conservation zones. These protected areas encompass national parks, nature reserves, and marine sanctuaries, all under the stewardship of the Ministry of Environment and Forestry, in collaboration with other relevant governmental bodies. This nationwide network of protected areas serves as a bulwark against the threats faced by the

nation's invaluable biodiversity, ensuring its preservation for generations to come. Nevertheless, conservation efforts in Indonesia often face challenges such as limited resources, conflicts with local communities, and weak law enforcement.

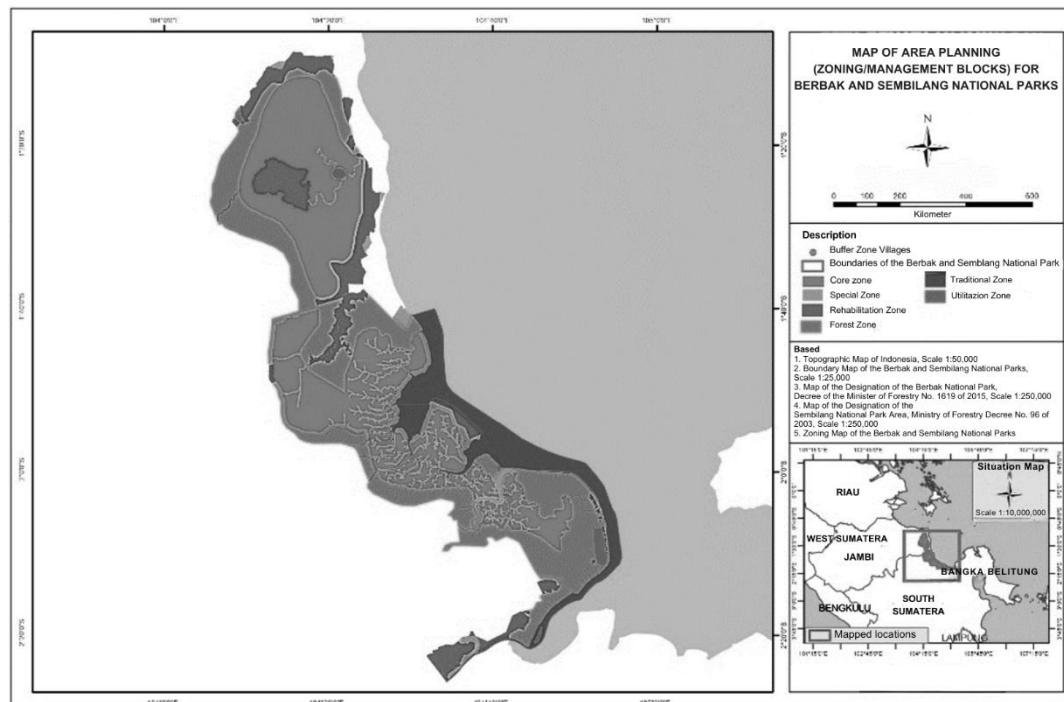


Fig. 2 Berbak and Sembilang national parks

Within the provinces of Jambi and South Sumatra, the Berbak and Sembilang National Parks have been designated as critical conservation zones, collectively spanning an expansive area of 2,042.5 square kilometers. These protected regions serve as vital habitats for a diverse array of rare and endangered species, providing sanctuary to iconic creatures such as the majestic Sumatran tiger, the magnificent Sumatran elephant, and the elusive sun bear. The preservation of these ecological havens is paramount in ensuring the survival and thriving of these remarkable fauna, which hold immense ecological and cultural significance (Balai Taman Nasional Berbak Sembilang, 2022). However, these national parks face serious threats from unsustainable human activities, such as illegal logging, forest encroachment, illegal hunting, and forest fires.

Conservation efforts in the Berbak and Sembilang National Parks involve various stakeholders, including the government, non-governmental organizations, and local communities, with approaches such as conservation education, alternative livelihood support, and routine patrols (Obeten et al., 2024b). Nevertheless, the effectiveness of these efforts remains limited due to a lack of community awareness, poverty, and weak law enforcement (Risdianto et al., 2016). To enhance the effectiveness of conservation, the capacity and coordination among stakeholders in managing conservation areas need to be improved. Additionally, law enforcement and sanctions for environmental offenders need to be strengthened. The involvement and empowerment of local communities in conservation efforts are crucial (Jacobson et al., 2015), as well as promoting green economic development and sustainable alternative livelihoods (Mahulu et al., 2019b).

3.4 Analysis of biodiversity conservation and preservation activities

Situated in the western region of Africa, the protected areas within Cross River State, Nigeria, stand as vital bastions for biodiversity conservation. This network of safeguarded zones encompasses the Okwangwo Division of the Cross River National Park, the Mbe Mountains Community Forest, and the Afi Mountain Wildlife Sanctuary, collectively

spanning an impressive expanse of approximately 1,186 square kilometers, according to recent scientific assessments. The Okwangwo Division alone boasts a vast area of around 100,000 hectares, while the Mbe Mountains Community Forest covers 8,600 hectares, and the Afi Mountain Wildlife Sanctuary extends across 10,000 hectares. These protected regions play a crucial role in preserving the unique ecological heritage of West Africa, serving as sanctuaries for a myriad of plant and animal species, some of which are found nowhere else on the planet (Ezealor & Garske, 2020).

The Cross River State Protected Areas are habitats for more than 280 species, including endemic species such as the Picathartes areas nesting in the Mbe Mountains. The area is also home to various wildlife, including the Cross River gorilla (*Gorilla gorilla diehli*), Preuss's monkey (*Cercopithecus preussi*), and the Nigeria-Cameroon clouded leopard (*Neofelis nebulosa*) (Ezealor & Garske, 2020). The biodiversity in this area is rich and holds significant conservation value.

Ensuring the long-term preservation of the Cross River State Protected Areas requires a concerted effort from multiple stakeholders, including governmental agencies, non-governmental organizations, and the local communities that call these regions home. A cornerstone of this collaborative endeavor is the implementation of comprehensive conservation education initiatives. Through these programs, tailored educational resources and outreach activities are designed to foster a deeper understanding and appreciation for the region's rich biodiversity among the local populace, underscoring the critical importance of safeguarding this natural heritage for present and future generations (Obeten et al., 2024a). Additionally, efforts are made to support alternative livelihoods for communities dependent on natural resources, such as ecotourism, sustainable agriculture, and micro-enterprise development (Ezealor & Garske, 2020). Anti-poaching patrols are also conducted regularly to prevent illegal hunting in the area (Obeten et al., 2024a).

The main conservation goals in the Cross River State Protected Areas are to protect biodiversity, preserve tropical rainforests and montane forests, and support sustainable livelihoods for local communities. However, these conservation efforts face challenges such as poverty among local communities, lack of conservation awareness, and limited human resources (Obeten et al., 2024a). Additionally, lack of financial support and inter-agency coordination are also significant challenges (Enuamuse et al., 2022).

One strength of the conservation efforts in the Cross River State Protected Areas is the collaboration with international conservation organizations such as the Wildlife Conservation Society (WCS) (Ezealor & Garske, 2020). The involvement of local communities in conservation efforts is also a strength, as they possess valuable traditional knowledge in managing natural resources sustainably (Enuamuse et al., 2022). However, conservation efforts in this area also have weaknesses, such as lack of financial support and political instability in Nigeria, which can threaten the sustainability of conservation efforts (Obeten et al., 2024b).

The Berbak and Sembilang National Parks in Indonesia are important conservation areas located in Jambi and South Sumatra Provinces. The Berbak National Park has an area of approximately 190,000 hectares, while the Sembilang National Park covers 202,896.5 hectares (Maulana et al., 2019). These two national parks are habitats for around 249 bird species, 69 mammal species, and 144 fish species (Sulistiyawan et al., 2019). The biodiversity in the Berbak and Sembilang National Parks is incredibly rich, with various rare and endangered species such as the Sumatran tiger (*Panthera tigris sumatrae*), sun bear (*Helarctos malayanus*), and Sumatran elephant (*Elephas maximus sumatranus*) (Yulianti et al., 2020). The area is also an important habitat for waterbirds and wildlife living in peatland and mangrove forest ecosystems.

Conservation efforts in the Berbak and Sembilang National Parks include security patrols, area rehabilitation, conservation education, empowerment of local communities, and research (Fitriadi et al., 2021a). Security patrols are conducted to prevent illegal activities such as illegal hunting, illegal logging, and forest fires. Area rehabilitation is also carried out to restore ecosystems damaged by fires or other human activities. The main conservation goals in the Berbak and Sembilang National Parks are to protect biodiversity,

preserve peatland and mangrove forest ecosystems, and support sustainable livelihoods for local communities. However, these conservation efforts face challenges such as limited budgets, inter-agency coordination, and conflicts of interest with local communities (Yulianti et al., 2020). One strength of the conservation efforts in the Berbak and Sembilang National Parks is the government's commitment to conservation and support from non-governmental organizations (Maulana et al., 2019). Additionally, the area's high biodiversity is an attraction for conservation efforts. However, conservation efforts in these national parks also have weaknesses, such as weak law enforcement, lack of incentives for local communities, and threats from climate change (Fitriadi et al., 2021b).

Table 1. Analysis of conservation activities

Aspect	Cross River State Protected Areas, Nigeria	Berbak and Sembilang National Parks, Indonesia
Location	Cross River State, Nigeria	Jambi and South Sumatra Provinces, Indonesia
Area Size	Okwangwo Division : 100,000 Ha, Mbe Mountains Community Forest: 8,600 Ha, Afi Mountain Wildlife Sanctuary: 10,000 Ha	Berbak National Park: 190,000 hectares, Sembilang National Park: 202,896.5 hectares
Biodiversity	More than 280 species, including the Picathartes areas nesting in the Mbe Mountains, Cross River gorilla, Preuss's monkey, and Nigeria-Cameroon clouded leopard	Around 249 bird species, 69 mammal species, and 144 fish species, Sumatran tiger, sun bear, and Sumatran elephant
Challenges and Threats	Illegal hunting, illegal logging, land burning, and harmful fishing practices	Forest fires, illegal logging, illegal hunting, agricultural and plantation activities, and illegal mining
Conservation Efforts	The multifaceted conservation strategy encompasses imparting knowledge through educational outreach initiatives, providing sustainable alternative livelihood opportunities to local communities, and conducting regular anti-poaching operations to safeguard the region's vulnerable wildlife populations.	Security patrols, area rehabilitation, conservation education, empowerment of local communities, and research
Conservation Goals	Protect biodiversity, preserve tropical rainforests and montane forests, and support sustainable livelihoods for local communities	Protect biodiversity, preserve peatland and mangrove forest ecosystems, and support sustainable livelihoods for local communities
Constraints	Poverty among local communities, lack of conservation awareness, limited human resources, lack of financial support, lack of inter-agency coordination, and political instability	Limited budgets, inter-agency coordination, and conflicts of interest with local communities
Strengths	Collaboration with international conservation organizations (WCS), involvement of local communities, and efforts to preserve traditional culture	Government commitment to conservation, support from non-governmental organizations, and high biodiversity
Limitations	Lack of financial support, lack of inter-agency coordination, and political instability	Weak law enforcement, lack of incentives for local communities, and threats from climate change

Biodiversity conservation efforts in the Cross River State Protected Areas, Nigeria, and the Berbak and Sembilang National Parks, Indonesia, involve various aspects that need to be comprehensively analyzed. Table 1 provides a detailed analysis of conservation activities, including location, area size, biodiversity, challenges and threats, conservation efforts, conservation goals, constraints, strengths, and weaknesses of the two conservation

areas. By understanding these aspects, we can identify similarities and differences in the applied conservation approaches and formulate appropriate recommendations to enhance the effectiveness of biodiversity preservation efforts in both areas (Obeten et al., 2024b; Ezealor & Garske, 2020; Maulana et al., 2019).

The location and size of the conservation areas are important factors in determining the management and protection strategies for biodiversity. The high biodiversity in both areas is the main reason for the importance of conservation efforts, but they also face significant challenges and threats, such as illegal hunting, illegal logging, and unsustainable human activities (Enuamuse et al., 2022). The conservation efforts undertaken in both areas share the same goal of protecting biodiversity and supporting sustainable livelihoods for local communities, albeit with different approaches (Yulianti et al., 2020; Fitriadi et al., 2021b).

3.5 Biocultural ethics of community conflicts and the role of incentive provision

The persistence of community-level conflicts in both the Cross River State Protected Areas and the Berbak and Sembilang National Parks cannot be adequately understood through a purely socioeconomic or law enforcement lens. These conflicts are fundamentally biocultural in character—they arise at the intersection of incompatible knowledge systems, divergent value frameworks, and asymmetrical power relations embedded in colonial and post-colonial histories of environmental governance. Biocultural ethics, as articulated by scholars working at the nexus of indigenous studies, conservation biology, and environmental philosophy, insists that the cultural dimensions of human-nature relationships must be treated as analytically and morally coequal with ecological considerations in conservation planning (Pilgrim & Pretty, 2010). From this perspective, the conflicts documented in Cross River State and Berbak-Sembilang are not merely operational obstacles but are diagnostic of a deeper ethical failure in conservation design—the failure to recognize that forest communities possess legitimate, historically grounded claims to the landscapes they inhabit.

In Cross River State, community conflicts have been consistently documented around the three principal axes of resource access, boundary enforcement, and benefit sharing. Field investigations by Enuamuse et al. (2022) and Ogar et al. (2022) identified that communities surrounding the Okwangwo Division express grievances rooted not simply in material deprivation, but in the symbolic erasure of their identities as stewards of the landscape. For the Boki communities in particular, the forest was not merely a source of food and medicine but a living repository of ancestral knowledge, ritual practice, and identity formation. When anti-poaching units intercept individuals gathering medicinal plants or hunting for ceremonial occasions, the enforcement encounter is experienced not as a legal infraction but as an assault on cultural sovereignty. This psychosocial dimension of conservation conflict significantly complicates the behavioral assumptions underpinning deterrence-based enforcement models, which presuppose that rational cost-benefit calculations govern resource extraction behavior (Byerly et al., 2019).

In the Berbak and Sembilang context, community conflicts exhibit analogous biocultural dimensions. The Melayu communities of the Sembilang river estuary maintain fishing traditions that predate the formal establishment of the national park by centuries. The imposition of catch restrictions and seasonal fishing prohibitions—implemented to protect nesting waterbirds and spawning fish populations—intersects directly with ritual calendars that govern when and how fishing activities are conducted documented that enforcement encounters frequently occur during periods of high cultural significance, generating resentments that persist far beyond the immediate incident and that become vectors for transmitting anti-conservation attitudes to younger generations, further observed that the exclusion of community leaders from park management decision-making processes undermines the moral authority of conservation regulations, even when communities possess intrinsic values aligned with ecosystem preservation. The ethical imperative, therefore, is not merely to reduce conflict incidence but to reconstitute the

governance relationship between conservation authorities and communities on terms that are mutually recognizable and culturally legitimate.

Against this biocultural backdrop, incentive provision emerges as more than a technical tool for redirecting livelihood behavior—it functions as a mechanism for repairing the relational damage caused by exclusionary conservation governance. The theoretical basis for incentive-based conservation is well-established in the literature: when communities derive tangible, equitable, and culturally meaningful benefits from the maintenance of protected area ecosystems, the opportunity cost of continued resource extraction rises sufficiently to motivate behavioral change (Roe et al., 2015b; Mahulu et al., 2019a). However, the effectiveness of incentive schemes is critically contingent upon the specificity of the incentive design, the reliability of benefit delivery, and the degree to which incentive structures are perceived as fair by recipient communities.

In Cross River State, WCS has implemented multiple incentive modalities targeting the most proximate drivers of illegal hunting. Cash-equivalent incentive programs have been deployed in communities surrounding the Mbe Mountains Community Wildlife Sanctuary, whereby households that refrain from poaching activities and actively report snare locations to ranger teams receive monthly stipends funded through international conservation grants. The behavioral logic of this approach draws on conditional cash transfer (CCT) theory, which has been applied successfully in public health and education contexts globally to modify embedded behavioral norms (Baird et al., 2011). When applied to wildlife poaching, CCT-analogous programs create a substitution incentive: the expected income foregone by non-participation in hunting is partially offset by the stipend, while the risk of sanction increases the effective cost of continued poaching. Empirical evidence from analogous programs in Uganda's Bwindi Impenetrable National Park suggests that cash-based incentives, when combined with community ranger employment, can reduce snare density by up to 40% within three years of program initiation (Archabald & Naughton-Treves, 2001).

Resource-based incentives operating through non-cash transfer mechanisms have demonstrated complementary effectiveness in both Nigeria and Indonesia. In the Cross River context, WCS has supported the development of community-managed apiaries and fish ponds that provide protein-equivalent substitutes for bushmeat. These programs operate on the principle of dietary substitution: by providing accessible, culturally acceptable protein sources, they reduce the nutritional dependency on wildlife that constitutes one of the primary motivations for subsistence hunting (Roe et al., 2015a). Critically, the design of these resource-based incentives incorporates gender-specific entry points—women's groups in several Boki communities have been preferentially enrolled in snail farming and vegetable cultivation programs, recognizing that women typically control household dietary decisions and therefore represent high-leverage behavioral change targets (Ogar et al., 2022).

In the Berbak-Sembilang context, incentive provision has taken a different but structurally analogous form. The Ministry of Environment and Forestry, in collaboration with NGO partners, has piloted a Payment for Ecosystem Services (PES) scheme in communities adjacent to the Berbak peatland zone. Under this arrangement, participating households commit to a set of conservation-compatible land use practices—prohibiting burning, maintaining riparian buffer strips, and monitoring for illegal encroachment—in exchange for quarterly payments indexed to household size and land area enrolled. Muttaqin et al. (2019) evaluated the early implementation of PES schemes in Berbak and found that enrollment rates were highest in communities with prior experience of flood events attributable to peatland degradation, suggesting that the incentive effect was amplified by direct experiential awareness of ecosystem service dependencies. This finding aligns with the broader literature indicating that pro-conservation behavior is more readily induced when communities perceive a clear causal chain between their behavioral choices and the integrity of the ecological systems upon which their livelihoods depend (Nugraha et al., 2021).

Despite these promising developments, the sustainability of incentive-based conservation programs in both regions remains vulnerable to several structural constraints. Financial dependency on international donor cycles creates temporal discontinuities in benefit delivery that erode community trust and program credibility. When cash transfers or PES payments are delayed or suspended due to administrative bottlenecks, communities frequently revert to extractive practices more rapidly than baseline levels—a "backlash effect" documented in multiple conservation incentive evaluations globally (Ferraro & Hanauer, 2014). Additionally, the absence of robust monitoring and evaluation frameworks in both Nigeria and Indonesia makes it difficult to distinguish genuine behavioral change from strategic compliance, whereby communities perform compliance during monitoring periods while continuing prohibited activities covertly. The development of participatory monitoring systems—in which community members themselves serve as data collectors and accountability actors—represents a critical institutional innovation needed to enhance the long-term fidelity of incentive programs in Cross River State and Berbak-Sembilang.

Viewed through the lens of biocultural ethics, the most durable incentive structures are those that converge financial sustainability with cultural recognition. Programs that create employment for community members as para-rangers, ecotourism guides, or traditional knowledge custodians do not merely redirect livelihood behavior—they reposit communities as active agents in conservation governance rather than passive recipients of externally designed interventions. This relational reframing is particularly significant in the contexts of both the Cross River gorilla sanctuary, where indigenous ecological knowledge holds irreplaceable scientific value, and the Sembilang waterbird habitat, where traditional calendrical knowledge of bird migration cycles could substantially enhance monitoring program design. Integrating these knowledge systems into formal conservation management through structured knowledge co-production processes would not only improve ecological outcomes but would constitute a meaningful step toward the ethical recognition that biocultural justice demands (Jacobson et al., 2015; Pilgrim & Pretty, 2010).

To enhance the effectiveness and sustainability of biodiversity conservation efforts in the Cross River State Protected Areas, Nigeria, and the Berbak and Sembilang National Parks, Indonesia, a holistic and integrated approach is required. One crucial aspect that needs attention is strengthening the capacity of local communities through sustainable economic empowerment and conservation education programs (Muttaqin et al., 2019; Roe et al., 2015b; Mahulu et al., 2019b). This approach aims to increase community awareness and participation in conservation efforts while providing environmentally friendly alternative livelihoods. Consequently, local communities not only understand the importance of preserving biodiversity but also have a sustainable source of income without damaging natural ecosystems. This approach has proven effective in increasing community support for conservation efforts and reducing threats to biodiversity in various conservation areas worldwide.

4. Conclusions

An examination of the conservation and biodiversity preservation initiatives undertaken within the safeguarded regions of Cross River State in Nigeria and the Berbak and Sembilang National Parks in Indonesia reveals a tapestry of contrasting approaches and shared commonalities. Despite being endowed with exceptional biodiversity richness, both countries face severe threats to its sustainability, such as deforestation, illegal hunting, and unsustainable human activities. In addressing these challenges, both nations have implemented conservation approaches involving governments, non-governmental organizations, and local communities.

The conservation initiatives in Cross River State, Nigeria, have adopted a multifaceted strategy that emphasizes raising public awareness through educational programs, providing sustainable alternative income opportunities for local communities, and conducting regular anti-poaching operations to protect the region's vulnerable wildlife populations. Meanwhile, in Indonesia, conservation efforts in the Berbak and Sembilang

National Parks encompass security patrols, area rehabilitation, community empowerment, and research. Despite sharing the common goals of protecting biodiversity and supporting sustainable community livelihoods, both countries face constraints such as limited resources, inter-agency coordination, and conflicts of interest with local communities.

In confronting these challenges, Nigeria can learn from Indonesia's experience in strengthening government commitment to conservation and leveraging support from non-governmental organizations. Conversely, Indonesia can adopt Nigeria's best practices in involving local communities and preserving traditional knowledge in natural resource management. Moreover, regional and international collaboration in sharing knowledge, technology, and resources can serve as a solution to overcome the limitations of both countries. Overall, biodiversity conservation and preservation efforts require a holistic and collaborative approach involving various stakeholders. By learning from each other's best practices and overcoming constraints through cooperation, Nigeria and Indonesia can continue to contribute to protecting biodiversity and supporting sustainable development in both countries.

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Biographies of Authors

Muhammad Rianzar, Department of Environmental Science, Graduate School of Sustainable Development, Universitas Indonesia, Central Jakarta, 10430, Indonesia.

- Email: muhammadrianzar1991@gmail.com
- ORCID: N/A
- Web of Science ResearcherID: N/A
- Scopus Author ID: N/A
- Homepage: N/A

Raldi Hendro Koestoer, Department of Environmental Science, Graduate School of Sustainable Development, Universitas Indonesia, Central Jakarta, 10430, Indonesia.

- Email: ralkoest@gmail.com
- ORCID: 0000-0003-1701-0419
- Web of Science ResearcherID: N/A
- Scopus Author ID: 6508263907
- Homepage: <https://sinta.kemdiktisaintek.go.id/authors/profile/5992062>