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Blue Carbon Regulations and Implementation in Several Countries: Lessons for Indonesia

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A B S T R A C T

This research seeks to examine novel concepts in global carbon emission reduction initiatives. According to several kinds of literature, the mitigation of carbon emissions can be achieved through the Blue Carbon Ecosystem (EKB) idea. EKB is a concept that enhances aquatic regions to sequester carbon emissions. EKB aims to mitigate carbon emissions and positively influences the national economy, particularly benefiting coastal areas. This study employs a normative legal research methodology utilizing a conceptual, legislative, and comparative law approach. Research findings indicate that Indonesia has established regulations regarding blue carbon in Presidential Regulation 98 of 2021 pertaining to Carbon Economic Value. Nonetheless, the existing regulation has inadequately facilitated the implementation of blue carbon in Indonesia. The findings indicate that 1) The blue carbon concept in Indonesia presents a significant opportunity to mitigate emissions and serve as an economic resource through the Carbon Economic Value scheme; 2) Various countries have successfully implemented blue carbon initiatives to harmonize environmental and economic considerations, emphasizing legal protection, institutional frameworks, and community engagement; 3) The regulatory framework for blue carbon in Indonesia exhibits several deficiencies, including a lack of regulatory coherence, overlapping authorities, insufficient community involvement, and an absence of equitable benefit distribution.

KEYWORDS: ***Blue Carbon; Climate Change; Environmental Policy;***

1. I N T R O D U C T I O N

Blue carbon is a policy concept developed in response to worldwide concerns regarding the climate problem, particularly carbon emissions. The Paris Agreement is not merely a

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transient accord; it necessitates a substantial commitment from all nations to attain carbon neutrality. By 2050, all nations must achieve the 1.5-2.0 degrees temperature increase limit. This temperature threshold necessitates that all stakeholders mitigate and equilibrate carbon emissions. A potential mechanism is natural ecosystems, which are crucial for sustaining active carbon sequestration and mitigating excess human-generated emissions. Nature-based solutions must be integrated with extensive efforts to mitigate greenhouse gas emissions. Analogous to terrestrial carbon in forests, blue carbon employs the marine environment to sequester carbon (coastal, deep sea, and open ocean), frequently providing many additional advantages to foster collective wealth within civilization.[1]

Blue carbon was introduced a decade ago to denote the significant role of coastal plant ecosystems in global carbon sequestration and the necessity of safeguarding natural resources. Mangroves, salt marshes, and Lamu ecosystems generate the highest quantities of organic carbon in coastal areas. Carbon sequestration via blue carbon ecosystems can attain 1,000 tCha-1, significantly surpassing the majority of terrestrial ecosystems. Elevating atmospheric CO2 concentrations leads to ocean acidification; nevertheless, heightened CO2 levels in seawater can enhance photosynthesis, facilitating carbon removal.[2]

Initially, blue carbon was not broadly acknowledged, resulting in its exclusion from the priority of the National Greenhouse Gas Inventories (NGGIs) initiative. With advancements in science, the Intergovernmental Panel on Climate Change (IPCC) issued guidance in 2013 regarding the accounting of blue carbon in marine regions by countries involved in the Paris Agreement as part of their national carbon inventories and Nationally Determined Contributions (NDCs).[3] In 2021, the National Oceanic and Atmospheric Administration (NOAA) initiated the Blue Carbon Inventory Project to promote the blue

[1] Paul Upham, Benjamin Sovacool, and Chukwuka Monyei, 'Digital Bricolage: Infrastructuring Lower Carbon Digital Space via Nordic Datacentre Development', *Political Geography*, 96 (2022), p. 102617, doi:https://doi.org/10.1016/j.polgeo.2022.102617.

[2] Arpad Todor and others, 'Policies to Bring about Social-Ecological Tipping Points in Coal and Carbon Intensive Regions', *Global Environmental Change*, 90 (2025), p. 102952, doi:https://doi.org/10.1016/j.gloenvcha.2024.102952.

[3] Ritika Chopra and others, 'The Role of Renewable Energy and Natural Resources for Sustainable Agriculture in ASEAN Countries: Do Carbon Emissions and Deforestation Affect Agriculture Productivity?', *Resources Policy*, 76 (2022), p. 102578, doi:https://doi.org/10.1016/j.resourpol.2022.102578.

carbon concept. The project seeks to facilitate the enduring sustainable management of coastal blue carbon ecosystems and aid nations in integrating these habitats into their inventories of carbon sources and sinks, as well as their strategic strategies for mitigating carbon emissions and adapting to climate change.[4]

Globally, blue carbon ecosystems can sequester 30 percent of carbon emissions produced by human activities. The carbon sequestration potential is 24 million tonnes for mangrove forests, 13.4 million tonnes for salt marshes, and 43.9 million tonnes for seagrass meadows. The overall blue carbon sequestration amounts to 81.2 million tonnes per year. The escalating population density and urbanization adversely affect vegetated marine environments globally, primarily due to fisheries, aquaculture, pollution, and sedimentation. Approximately 62% of global mangroves were eradicated between 2000 and 2016, with a 90% reduction in salt marsh habitats, while seagrass carbon reserves are diminishing in numerous areas worldwide.[5]

Blue carbon programs are crucial in helping Indonesia meet its Nationally Determined Contribution (NDC) targets. It emphasizes preserving and rehabilitating coastal habitats, including mangroves, seagrass beds, and salt marshes. The effort seeks to enhance carbon sequestration and storage within coastal ecological habitats. Coastal ecosystems in Indonesia frequently suffer erosion due to extensive human activity. Blue carbon is a crucial mechanism for enabling nations to achieve their NDC objectives and participate in global initiatives to address climate change. Moreover, blue carbon might generate novel economic prospects for local communities via sustainable fisheries and ecotourism. Investing in blue carbon initiatives constitutes a mutually beneficial solution for the environment and the economy in Indonesia and abroad.[6]

Indonesia joined the Paris Agreement by Law No. 16 of 2016 and presented its

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[4] Yuyuan Song, Hengjun Huang, and Xuewei Gan, 'Collaborative Governance on Industrial Pollution and Carbon Emissions through Synchronous Development of Factor Markets: Impact and Mechanism', *Environmental Impact Assessment Review*, 105 (2024), p. 107355, doi:https://doi.org/10.1016/j.eiar.2023.107355.

[5] Edi Iswanto Wiloso and others, 'Indonesia's Contribution to Global Carbon Flows: Which Sectors Are Most Responsible for the Emissions Embodied in Trade?', *Sustainable Production and Consumption*, 48 (2024), pp. 157–68, doi:https://doi.org/10.1016/j.spc.2024.05.005.

[6] Assa Nsabiyeze and others, 'Tackling Climate Change in Agriculture: A Global Evaluation of the Effectiveness of Carbon Emission Reduction Policies', *Journal of Cleaner Production*, 468 (2024), p. 142973, doi:https://doi.org/10.1016/j.jclepro.2024.142973.

Nationally Determined Contribution (NDC) during the climate change negotiations in Marrakech in November 2016.[7] Indonesia aims to decrease emissions by 29% by 2030 through domestic initiatives and 41% with international support, using 2010 as the baseline year. The objective is presented below:

> Indonesia has committed to reduce unconditionally 29% of its greenhouse gasses emission against the business as usual scenario by the year of 2030. The BAU scenario is projected approximately 2,869 GtCO2e in 2030 wich is updated form the BAU scenario on the INDC due to current condition on energy policy development in particular in coal fired power plant".

Indonesia has significant potential for implementing blue carbon due to its geographical capability. Indonesia's mangrove forest spans 3.31 million hectares, with an estimated carbon sequestration above 3.3 gigatonnes, potentially reaching billions of carbon. Furthermore, Indonesia possesses 300,000 hectares of seagrass beds that hold significant promise and require further exploration. Salt marshes are currently being studied for their carbon sequestration capabilities. This promising potential may influence the attainment of the NDC, which has presently been elevated to 31.89% through its initiatives. The objective is to suppress and reduce 915 million tonnes of carbon by 2030. This accomplishment depends on the forestry sector for up to 55%.[8]

Indonesia has established a FOLU Net Sink initiative to balance blue carbon absorption and emissions by 2030. The FOLU Net Sink 2030 document identifies mangroves as a potential tool. Indonesia intends to compile and publish a second enhanced Nationally Determined Contribution (NDC) in 2025, incorporating elements of blue carbon into its adaptation and mitigation strategies. These projects aim to enhance the potential for

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[7] Bhavesh Choudhary, Venerability Dhar, and Anil S Pawase, 'Blue Carbon and the Role of Mangroves in Carbon Sequestration: Its Mechanisms, Estimation, Human Impacts and Conservation Strategies for Economic Incentives', *Journal of Sea Research*, 199 (2024), p. 102504, doi:https://doi.org/10.1016/j.seares.2024.102504.

[8] Yunmeng Cao and others, 'How to Build an Efficient Blue Carbon Trading Market in China? - A Study Based on Evolutionary Game Theory', *Journal of Cleaner Production*, 367 (2022), p. 132867, doi:https://doi.org/10.1016/j.jclepro.2022.132867.

carbon sequestration outcomes, as outlined in the Carbon Economic Value roadmap.[9]

Blue carbon represents the attainment of the Nationally Determined Contribution target and serves as an alternative for establishing a sustainable economy. Ecological Economics, a theoretical foundation for economic development emphasizing ecological dimensions, is no longer grounded in environmental considerations. Ecology and economy are interdependent characteristics that cannot be dissociated.[10]

Constanza recognizes that the prevailing economic paradigm aligns with capitalism, socialism, or a synthesis of both, positing that economic growth alongside sustainability permits the unrestricted exploitation of natural resources by implementing advanced technology and economic efficiency. Ecological economics is a suitable framework for addressing diverse global environmental issues that lead to ecological disasters. Faber contends that the primary focus of ecological economics is to achieve justice in a comprehensive sense, thereby imbuing the concept with significance as a vision for a better and sustainable existence, not only for humans but also for all living beings and natural entities.[11]

Indonesia's abundant natural resources hold significant promise for blue carbon initiatives, particularly due to its extensive aquatic environments. Indonesia possesses significant potential for using blue carbon ecosystems in climate mitigation efforts, as blue carbon deposits account for 17% of the global total. Indonesia's coastline land area is expected to sequester up to one-fifth of the global carbon total. A High-Level Panel for a Sustainable Ocean Economy report indicates that safeguarding and rehabilitating Blue Carbon Ecosystems (BEC) in various nations is among the most economical ways to

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[9] Anna E Murphy and others, '"Whose Carbon Is It?" Understanding Municipalities Role in Blue Carbon Ecosystems Management in Canada', *Nature-Based Solutions*, 4 (2023), p. 100089, doi:https://doi.org/10.1016/j.nbsj.2023.100089.

[10] Faming Wang and others, 'Coastal Blue Carbon in China as a Nature-Based Solution toward Carbon Neutrality', *The Innovation*, 4.5 (2023), p. 100481, doi:https://doi.org/10.1016/j.xinn.2023.100481.

[11] Xiaodong Yan, Junfei Chen, and Shuhan Zhou, 'Carbon Metabolism Mechanisms and Evolution Characteristics Analysis of the Food-Water-Energy Nexus System under Blue-Green Infrastructure Changes', *Science of The Total Environment*, 951 (2024), p. 175763, doi:https://doi.org/10.1016/j.scitotenv.2024.175763; Natalia Beloto and others, 'Blue Carbon Stock Heterogeneity in Brazilian Mangrove Forests: A Systematic Review', *Marine Pollution Bulletin*, 197 (2023), p. 115694, doi:https://doi.org/10.1016/j.marpolbul.2023.115694.

mitigate greenhouse gas emissions.[12]

Indonesia has cultivated partnerships with other countries to advance blue carbon development. During the G20, as the host, Indonesia and other countries reached a consensus on the Bali Leaders' Declaration. Article 15 asserts that blue ecosystems, including peatlands, mangroves, seagrasses, and coral reefs, contribute to climate change mitigation and adaptation. Consequently, Indonesia and other G20 nations pledge to enhance initiatives to prevent and mitigate biodiversity loss, particularly by implementing nature-based solutions and ecosystem-based strategies to support NDC objectives, including preserving, managing, and conserving BHS.[13]

The 2021 National Mangrove Map indicates that Indonesia's mangrove forests encompass 3,365,076 hectares. These ecosystems yield considerable economic advantages, with the annual value of ecosystem services from these mangroves estimated at US$1.5 billion. The World Bank analysis indicates that over 30 years, each mangrove region in Indonesia has possessed an ecosystem service value ranging from US$2 million to US$50 million. Mangrove regions in Indonesia have a significant carbon storage capability, totaling 3.14 billion tonnes of sequestered carbon stock.[14]

At the worldwide level, carbon markets are developing alongside carbon pricing regulations in reaction to increasing atmospheric CO_2 concentrations and decreasing carbon sequestration capacity. Carbon pricing presents a complex policy challenge. Global carbon pricing schemes currently encompass around eight gigatonnes of carbon dioxide emissions, representing about 20% of worldwide fossil fuel emissions and 15% of total CO_2

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[12] M F Adame and others, 'The Role of Blue Carbon in Reversing Mangrove Degradation Trends in Mexico', *Biological Conservation*, 298 (2024), p. 110775, doi:https://doi.org/10.1016/j.biocon.2024.110775.

[13] Jay Mar D Quevedo, Yuta Uchiyama, and Ryo Kohsaka, 'Progress of Blue Carbon Research: 12 Years of Global Trends Based on Content Analysis of Peer-Reviewed and "Gray Literature" Documents', *Ocean & Coastal Management*, 236 (2023), p. 106495, doi:https://doi.org/10.1016/j.ocecoaman.2023.106495; Samadder Chandrani and others, 'Role of Macroalgal Blue Carbon Ecosystems in Climate Change Mitigation', *Science of The Total Environment*, 958 (2025), p. 177751, doi:https://doi.org/10.1016/j.scitotenv.2024.177751.

[14] Samadder Chandrani and others, 'Role of Macroalgal Blue Carbon Ecosystems in Climate Change Mitigation', *Science of The Total Environment*, 958 (2025), p. 177751, doi:https://doi.org/10.1016/j.scitotenv.2024.177751; Lindsay Wylie, Ariana E Sutton-Grier, and Amber Moore, 'Keys to Successful Blue Carbon Projects: Lessons Learned from Global Case Studies', *Marine Policy*, 65 (2016), pp. 76–84, doi:https://doi.org/10.1016/j.marpol.2015.12.020.

equivalent greenhouse gas emissions. The volatility of the carbon market is a hurdle, particularly for small projects dependent on blue carbon schemes for return on investment. Carbon pricing can be implemented via two primary mechanisms: the Emissions Trade Scheme (ETS), which facilitates the trade of greenhouse gas emission permits by establishing a cap on total permissible emissions, or through a carbon tax, which directly determines the cost of carbon emissions.[15]

Carbon pricing deters heightened emissions and encourages communities, organizations, corporations, and governments to adopt more economical methods for emission reduction. Nonetheless, carbon emissions from the deterioration of coastal ecosystems, including mangroves, seagrasses, and salt marshes, are infrequently incorporated into emissions assessments or standard carbon markets and protocols. To advance blue carbon initiatives in regulated carbon markets, accurate financial evaluations are essential to assess blue carbon compensation. This encompasses forecasts of the survival rates of newly established or rehabilitated plants within blue carbon ecosystems and assessments of various hazards and benefits that could impede or enhance revenue streams (both positive and negative externalities).[16]

An integrated strategy can effectively bolster current and developing carbon markets while advocating for preserving vital ecosystems and mitigating atmospheric carbon levels. Restricting the degradation of coastal habitats may prove more advantageous than undertaking massive restoration initiatives in regions with limited carbon benefits. The carbon sequestration capability of coastal ecosystems, such as mangroves, is frequently undervalued due to reliance on measurement techniques designed for terrestrial ecosystems, which fail to consider root and soil sequestration capabilities. A recent assessment project in Cispatá, Colombia, encompassing 29,000 hectares of mangroves, seeks to incorporate the complete carbon potential of these ecosystems as carbon credits, which will differ from conventional forestry credits in terms of pricing potential and

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[15] Kaixuan Zhang, Xinting Zhang, and Lili Ding, 'How to Incentivize Bank Credit Development in Blue Carbon Projects? A Study of Refinancing Mechanisms with Evolutionary Game', *Ocean & Coastal Management*, 241 (2023), p. 106671, doi:https://doi.org/10.1016/j.ocecoaman.2023.106671.

[16] Tiziana Luisetti and others, '7.6 - Blue Carbon: Challenges for Definition, Valuation and Governance', in *Treatise on Estuarine and Coastal Science (Second Edition)*, ed. by Daniel Baird and Michael Elliott, Second Edi (Academic Press, 2024), pp. 132–53, doi:https://doi.org/10.1016/B978-0-323-90798-9.00059-7.

management requirements for a stable market.[17]

The acknowledgment of carbon utilization as a facet of economic enhancement in Indonesia is explicitly governed by the constitution, specifically in Article 33, paragraph (3) of the 1945 Constitution of the Republic of Indonesia, which asserts that the nation's natural resources are to be employed for the welfare of the populace. Paragraph (4) declares that the national economy is founded on environmentally sustainable economic democracy.[18] Moreover, the valuation of the carbon economy is explicitly governed by Presidential Regulation Number 98 of 2021, which pertains to the Implementation of Carbon Economic Value for Attaining Nationally Determined Contribution Targets and Regulating Greenhouse Gas Emissions in National Development. Article 8 stipulates that the carbon sequestration sector in aquatic environments is under the jurisdiction of the ministry responsible for marine affairs. Article 46 further elucidates that the ministry, local Government, corporate entities, and the community execute the carbon economic value policy. Article 47 delineates the mechanisms for actualizing the carbon economy's value, including carbon trading, performance-based payments, carbon taxes, and additional methods established by the minister.

The carbon trading mechanism is governed by Articles 48 to 54. Carbon trading is conducted via emission trading systems and greenhouse gas emission offsets that can occur across several sectors. The transaction is modified to align with SRN PPI or the utilization of GHG emission reduction certificates applicable in local and/or international trade. The distinction between emission trading and GHG emission offsets pertains to establishing emission limitations. Emission trading has established upper and lower thresholds determined by the ministry for specific enterprises. Emission offsets lack emission restrictions; nonetheless, a predetermined baseline exists. Carbon trading yields non-tax state money, which can be used for environmental rehabilitation. Ministerial regulations from the pertinent ministries additionally govern technical provisions

[17] Nandan Das and others, 'Anthropogenic Litter Pollution in the Mangrove Blue Carbon Ecosystem: Unveiling the Spatial Distribution, Composition, Source Delineation and Mitigation Measures along the Goa Coast, India', *Journal of Hazardous Materials Advances*, 18 (2025), p. 100679, doi:https://doi.org/10.1016/j.hazadv.2025.100679.

[18] Maryam Jamilah and others, 'Socioeconomic Impacts Linked to Land Use and Land Use Changes Affecting Blue Carbon Ecosystems in Southeast Asia: A Systematic Map', *Ocean & Coastal Management*, 267 (2025), p. 107643, doi:https://doi.org/10.1016/j.ocecoaman.2025.107643.

concerning carbon trading.[19]

The subsequent mechanism is performance-based remuneration, as delineated in Articles 55 through 58. This incentive or remuneration mechanism is contingent upon verified and/or certified emission reduction outcomes and other advantages beyond validated carbon. Diverse ministries, agencies, local governments, and enterprises across multiple tiers, including international, national, and provincial levels, may implement performance-based payments.[20]

International entities may offer performance-based payments to central or local governments, contingent upon governmental approval. Concurrently, at the national level, the central Government can offer these incentives to local governments across several tiers, enterprises, and communities. At the provincial level, the provincial Government possesses the jurisdiction to allocate performance-based payments to district or municipal governments, enterprises, and/or communities. Mitigation outcomes attained via this approach are utilized to facilitate attaining national Nationally Determined Contribution (NDC) objectives. The performance-based payment plan includes beneficiaries, specifically parties that contribute to emission reduction efforts, who are eligible to benefit from this method. Beneficiaries encompass ministries, agencies, local governments, enterprises, and communities, which will receive benefit sharing based on their performance and efforts in emission reduction.[21]

The final measure outlined in Article 58 and Article 59 is carbon levies. This tax is a state contribution, applicable at both central and local levels, imposed on commodities and/or services that contain carbon or can emit carbon. This charge is also imposed on economic sectors or activities that generate carbon emissions, adversely affecting the environment and the attainment of mitigation efforts. Carbon levies can be implemented

[19] Yoshihisa Sugimura and others, 'New Possibilities for Climate Change Countermeasures in Ports: Organic Carbon Containment and Creation of Blue Carbon Ecosystems through Beneficial Utilization of Dredged Soil', *Marine Policy*, 141 (2022), p. 105072, doi:https://doi.org/10.1016/j.marpol.2022.105072.
[20] Jan Kopp, Pavlína Hejduková, and Tomáš Hejduk, 'Perception of New Trends in Rainwater Management in Czech Cities: Barriers and Tools of Implementation', *Land Use Policy*, 153 (2025), p. 107551, doi:https://doi.org/10.1016/j.landusepol.2025.107551.
[21] Xuan Xu and others, 'Blue Carbon Governance for Carbon Neutrality in China: Policy Evaluation and Perspectives', *Heliyon*, 9.10 (2023), p. e20782, doi:https://doi.org/10.1016/j.heliyon.2023.e20782.

in multiple forms, including central and local taxes, customs duties, excise taxes, and other governmental charges. The tariffs are determined by carbon content, emission potential, and the quantity of carbon emitted. One of these taxes is the carbon tax, established by Law No. 7 of 2021 concerning the Harmonization of Tax Regulations. A carbon tax is imposed on carbon emissions that adversely affect the environment, determined by either the carbon content of a product or the volume of emissions produced by an activity. Indonesia presently has a cap-and-tax system, mandating that firms exceeding greenhouse gas (GHG) emission thresholds meet their obligations via carbon trading. Otherwise, they will incur a carbon tax based on the quantity of carbon they fail to offset.[22]

Effective NEK implementation for emission reduction necessitates capacity building and inter-agency coordination to formulate methodologies and oversee NEK infrastructure, including carbon exchanges and the National Registry System for Climate Change Control (SRN PPI). Moreover, robust verification systems and standards are essential to guarantee the implementation of mitigation efforts and to avert emission leakage in specific sectors. Intersectoral policy coherence is crucial for NEK to effectively diminish GHG emissions and fulfill Indonesia's Nationally Determined Contribution (NDC) objective. The document elucidates the mechanics of the REDD+ agreement between Indonesia and Norway. Indonesia has incorporated blue carbon habitats into its carbon sequestration calculations. The Green Climate Fund, a prominent institution providing substantial money for REDD+, has acknowledged mangroves as integral to the REDD+ system.[23]

Furthermore, Indonesia has classified mangroves as forests, encompassing primary and secondary forests by the Forest Reference Emission Level. Conversely, the REDD+ initiative 'East Kalimantan Jurisdictional Emission Reduction Program, Indonesia,' is a component of the FCPF-CF. Mangroves are also considered for their carbon sequestration capacity. This initiative assesses the carbon sequestration capacity of both aboveground and belowground biomass. In 2022, the Indonesian Government received its inaugural

[22] Yuyan Wang and others, 'Evolution of Blue Carbon Trading of China's Marine Ranching under the Blue Carbon Special Subsidy Mechanism', *Ocean & Coastal Management*, 222 (2022), p. 106123, doi:https://doi.org/10.1016/j.ocecoaman.2022.106123.

[23] Dominique Benzaken and others, 'From Concept to Practice: Financing Sustainable Blue Economy in Small Island Developing States, Lessons Learnt from the Seychelles Experience', *Marine Policy*, 163 (2024), p. 106072, doi:https://doi.org/10.1016/j.marpol.2024.106072.

payment of USD 20.9 million from a preliminary allocation of USD 110 million. The initiative has yielded favorable outcomes and will continue until 2025.[24]

An instance of carbon finance application in Indonesia is the Berau Forest Carbon Programme (PKHB) in East Kalimantan, particularly in Berau Regency. This program is a component of the REDD+ initiative, piloted in several regions as an initial execution phase. Berau Regency was designated as one of the experimental locations, facilitated by multiple stakeholders, including The Nature Conservancy (TNC), the national Government, and province and local administrations.[25] The objective is to establish the PKHB as a paradigm of regional development grounded in sustainable and low-emission management of natural resources. To attain these objectives, PKHB employs two primary tactics: enhancing enabling conditions and implementing site-specific strategies. The program is executed in three stages: 1. The planning and scoping phase occurred in 2008. 2. The development phase transpired from 2009 to 2010. The pilot phase occurred from 2011 to 2015.

The primary funding source for the PKHB is Tropical Forest Protection, a debt-for-nature swap mechanism in which the Indonesian Government relinquishes a portion of its debt to the US Government for environmental protection. TNC and WWF endorse this initiative. Conversely, supplementary funding is allocated by various organizations to facilitate the execution of the PKHB and enhance community engagement in the Berau Regency. TNC has established a community-based funding scheme to facilitate community participation, encompassing three program categories: 1) Programs for the mitigation and management of natural resources, 2) Economic development initiatives associated with sustainability considerations, and 3) Programs for strengthening enabling conditions.[26]

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[24] Ellen McHarg and others, 'Valuing the Contribution of Blue Carbon to Small Island Developing States' Climate Change Commitments and Covid-19 Recovery', *Environmental Science & Policy*, 132 (2022), pp. 13–23, doi:https://doi.org/10.1016/j.envsci.2022.02.009.

[25] Jack Sheehy and others, 'Redefining Blue Carbon with Adaptive Valuation for Global Policy', *Science of The Total Environment*, 908 (2024), p. 168253, doi:https://doi.org/10.1016/j.scitotenv.2023.168253.

[26] Md Asaduzzaman and others, 'Advancing Low-Trophic Extractive Mariculture (LTEM): Strategies for a Thriving Blue Economy in Bangladesh', *Marine Policy*, 173 (2025), p. 106557, doi:https://doi.org/10.1016/j.marpol.2024.106557.

The global commercial sector is exhibiting heightened interest in acquiring carbon credits derived from blue carbon as nature-based alternatives. Nevertheless, the quantity of qualified and developed blue carbon initiatives remains significantly lower than the potential market need. At the 2021 UNFCCC COP in Glasgow, the technology firm Salesforce committed to acquiring one million tonnes of premium carbon credits. Other funding sources exist to augment the quantity of funded blue carbon projects, including the Blue Carbon Accelerator Fund (BCAF), which emphasizes the development of investment-grade blue carbon and restoration initiatives. The BCAF was established in 2022 by the IUCN and the Australian Government.[27]

A blue carbon guidance document, High Quality Blue Carbon Principles & Guidelines, also exists. The guidelines encompass essential concepts for developing high-quality blue carbon credits and projects. The principles were established by governmental and non-governmental organizations experienced in blue carbon initiatives, including Conservation International, Meridian Institute, The Nature Conservancy, Ocean Risk and Resilience Action Alliance, Salesforce, and the World Economic Forum.[28] Considering the distinctive attributes of blue carbon and the significant risks and uncertainties associated with calculating and selling credits, the handbook seeks to unify scientific knowledge and practical application worldwide. Furthermore, it offers superior blue carbon criteria for diverse stakeholders, including investors, credit purchasers, suppliers, and project developers.

Realizing the Economic Value of Carbon (NEK) via blue carbon offers potential for the nation's economy while considering environmental factors. NEK can be actualized through multiple mechanisms, including carbon trading and performance-based remuneration. The execution of the mechanism entails multiple stakeholders, including the government, corporate entities, and the community. Consequently, a rule is required

[27] Mariana Almeida and others, 'The Needs and Challenges of the Blue Economy Sector in Portugal: Bridging National and European Strategies with the Perceptions of the Stakeholders', *Journal of Environmental Management*, 384 (2025), p. 125468, doi:https://doi.org/10.1016/j.jenvman.2025.125468.

[28] Yoseop Lee and Jae-Seong Lee, 'Blue Carbon Ecosystems for Hypoxia Solution: How to Maximize Their Carbon Sequestration Potential', *Marine Environmental Research*, 2025, p. 107202, doi:https://doi.org/10.1016/j.marenvres.2025.107202; Almeida and others, 'The Needs and Challenges of the Blue Economy Sector in Portugal: Bridging National and European Strategies with the Perceptions of the Stakeholders'.

to actualize the NEK via blue carbon and enhance community welfare.

To illustrate the originality of this work, the author contrasts it with several previous studies, both from Indonesia and elsewhere, including: Firstly, Elda Sofia's research titled 'Legal Implications of the Paris Agreement through Blue Carbon-based REDD+ Programmes in Indonesia.' This study's findings indicate that Indonesia's ratification of the Paris Agreement to the UNFCCC entails legal ramifications, including developing certain legislation concerning REDD+ in the forestry industry. The Indonesian government's initiatives to execute the Paris Agreement under the UNFCCC in the forestry sector encompass establishing several legal laws pertaining to REDD+. The legal challenges faced have impeded the attainment of Indonesia's NDC targets, namely law enforcement and legal certainty in forest regions. It is advisable to establish legislation for the conservation of mangrove forests.[29]

Secondly, research by Muhammad Syaiful Anwar, et al entitled 'Blue Carbon: Integrative Management of Coastal Ecosystems Based on Regional Autonomy'. The results of the study show that "Coastal ecosystems are unlimited natural resources owned by archipelagic countries. The division of management of coastal areas in the use of blue carbon between the central government and regional governments based on regional autonomy needs special attention. The article implies a strategy that recognizes the importance of coastal ecosystems, particularly in blue carbon sequestration, and advocates for a comprehensive and decentralized management approach that considers the unique characteristics and needs of different regions. This approach aligns with the concept of regional autonomy, emphasizing the involvement of local authorities in decision-making processes related to the management of coastal ecosystems. The focus of this article is to determine the urgency for the state to have absolute control over coastal areas in utilizing blue carbon based on regional autonomy and to determine the extent to which the pattern of sustainable blue carbon policy management in coastal areas is a form of state accountability. This article shows that regional government participation in blue carbon management in coastal areas must be done based on their restricted autonomy rights, a systematic and structured sustainable, integrative policy pattern in environmental

[29] Elda Sofia, 'Implikasi Hukum Paris Agreement Melalui Program REDD+ Berbasis Blue Carbon Di Indonesia', *Jurnal Magister Hukum Udayana (Udayana Master Law Journal)*, 8.2 (2019), p. 174, doi:10.24843/jmhu.2019.v08.i02.p03.

management as a form of environmental protection".[30]

Third, research by Susanti and Yanti entitled 'The urgency to strengthen blue carbon ecosystem settings based on theory law development to use to realise sustainable development in Indonesia'. The results of the study show that "As for the conclusion of the discussion above, there are two things, first there are many regulations governing good blue carbon ecosystems in the constitution and various laws and regulations, including Law Number 32 of 2009 concerning the Protection and Management of the Environment and Law Number 41 of 1999 concerning Forestry. In addition, this includes Law Number 32 of 2014 concerning Maritime Affairs and Law Number 27 of 2007 concerning the Management of Coastal Zone and Small Islands as well as various other laws and regulations. However, there are still many areas that have not made regional regulations to protect mangrove areas, resulting the blue carbon ecosystem not being protected optimally. The second, It is very necessary to establish regulations explicitly to protect blue carbon ecosystems both from laws and regulations, as well as derivative regulations used to protect the use of blue carbon ecosystems to achieve sustainable development in Indonesia".[31]

This research concludes that the paper introduces a novel approach to establishing optimal rules for blue carbon in Indonesia by comparing practices and legislation from other countries to derive ideal standards.

2. RESEARCH METHODS

This study constitutes normative legal research, employing legal methodologies. These encompass conceptual methodologies, legislative frameworks, and comparative legal analyses.[32] The conceptual method involves analyzing the notions of Blue Carbon and

[30] Muhammad Syaiful Anwar, Maya Ruhtiani, and Rani Hendriana, 'Blue Carbon: Integrative Management of Coastal Ecosystems Based on Regional Autonomy', *Jambe Law Journal*, 6.2 (2023), pp. 185–204, doi:10.22437/jlj.6.2.185-204.

[31] H. Susanti and E. Yanti, 'The Urgency to Strengthen Blue Carbon Ecosystem Settings Based on Theory Law Development to Use to Realize Sustainable Development in Indonesia', *IOP Conference Series: Earth and Environmental Science*, 1181.1 (2023), doi:10.1088/1755-1315/1181/1/012023.

[32] Willy Naresta Hanum, Tran Thi Dieu Ha, and Nilam Firmandayu, 'Eliminating Ecological Damage in Geothermal Energy Extraction : Fulfillment of Ecological Rights by Proposing Permits Standardization', *Journal of Law, Environmental and Justice*, 2.2 (2024), pp. 205–28, doi:10.62264/jlej.v2i2.105; Agung Basuki and

Ecological Justice in diverse legal and non-legal literature to ascertain the authentic meaning of the concepts referenced by the author.[33] The legislative strategy entails examining several legal instruments in Indonesia and worldwide to ascertain the norms regulating Blue Carbon and its current use in Indonesia. The legal frameworks and international accords encompass the Paris Agreement under the United Nations Framework Convention on Climate Change, Law No. 32 of 2009 concerning Environmental Protection and Management, Law No. 41 of 1999 on Forestry, Law No. 32 of 2014 regarding Marine Affairs, Law No. 27 of 2007 on Coastal Zone and Small Island Management, and Presidential Regulation No. 73 of 2012 addressing the National Strategy for Mangrove Ecosystem Management. A comparative legal analysis examined practices and rules in Kenya, India, and Vietnam.

3. RESULTS AND DISCUSSION

Blue Carbon Practices and Regulations in Kenya: Prospects and Challenges

Mikoko Pamoja is a project underway in Gazi Bay, Kenya. The project encompasses 117 hectares of state-owned mangrove forest, with the potential for annual expansion. The predominant Gazi Bay populations rely on mangroves for their sustenance, with 80% of these groups deriving their income from marine resource-related activities. The Gulf of Gazi region serves as a livelihood for coastal residents while offering construction, tourism, and coastal preservation resources. Nonetheless, environmental damage frequently transpires, particularly due to mangrove destruction. The degradation is executed by those seeking to exploit mangroves for alternative advantages.[36]

Mikoko Pamoja is a community-led initiative financed with voluntary carbon credits.

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others, 'Establishing Ecological Justice in the Governance of Land Inventory , Ownership , and Utilisation in Indonesia', *Journal of Law, Environmental and Justice*, 18.2 (2023), pp. 137–54, doi:10.62264/jlej.v1i2.12.

[33] Rian Saputra, Albertus Usada, and Muhammad Saiful Islam, 'Ecological Justice in Environmental Criminal Sanctions for Corporations in Indonesia: Problems and Solution', *Journal of Law, Environmental and Justice*, 2.1 (2024), pp. 1–17, doi:10.62264/jlej.v2i1.19; Muhammad Bagus Adi Wicaksono and Wiwit Rahmawati, 'Ecological Justice-Based Reclamation and Post- Mining Regulations in Indonesia : Legal Uncertainty and Solutions', *Journal of Law, Environmental and Justice*, 2.2 (2024), pp. 109–36, doi:10.62264/jlej.v2i2.103.

[36] Steven W J Canty and others, 'Implications of Improved Remote Sensing Capabilities on Blue Carbon Quantification', *Estuarine, Coastal and Shelf Science*, 319 (2025), p. 109275, doi:https://doi.org/10.1016/j.ecss.2025.109275.

The project's objectives are to promote regional development, rehabilitate mangrove ecosystems, provide ecosystem services (including carbon sequestration), foster sustainable income related to mangroves, and serve as a model for future initiatives, especially for coastal communities. The Gazi Bay community has entered into a Payment for Ecosystem Services (PES) arrangement with Plan Vivo, which oversees the credits, and research on carbon storage potential has been undertaken for five years. The project has been successfully executed and has concluded its initial crediting period. Revenue generated from credit sales has been used toward project execution (mangrove planting and conservation) and community development initiatives.[37]

The Mikoko Pamoja initiative functions under the regulatory framework regulating the conservation and management of mangrove forests in Kenya. The Kenya Forestry Act provides a legislative framework that governs the ownership of mangrove forests in Kenya. The mangrove region in Gazi Bay is government-owned and administered by the Kenya Forest Service (KFS). KFS oversees the management and preservation of forest resources, encompassing mangroves. As shown by the Mikoko Pamoja project, KFS collaborates with local people to issue licenses and offer assistance for mangrove conservation and restoration efforts.[38]

The Kenyan government has a National Mangrove Ecosystem Management Plan that emphasizes coastal and marine environments. The Mikoko Pamoja initiative can substantially enhance the creation of this plan. This plan delineates principles for the conservation and sustainable utilization of mangrove habitats nationwide, ensuring that initiatives such as Mikoko Pamoja conform to national policy.[39]

Mikoko Pamoja is certified by the Plan Vivo Foundation, an international benchmark for community-based carbon projects in blue carbon development. This certification

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[37] Ahalya Suresh and others, 'Tourism and Recreation in Blue Carbon Ecosystems: Exploring Synergies, Trade-Offs and Pathways to Sustainability', *Ocean & Coastal Management*, 266 (2025), p. 107697, doi:https://doi.org/10.1016/j.ocecoaman.2025.107697.

[38] Bijeesh Kozhikkodan Veettil and others, 'Blue Carbon Ecosystems in Sri Lanka: A Review', *Estuarine, Coastal and Shelf Science*, 306 (2024), p. 108907, doi:https://doi.org/10.1016/j.ecss.2024.108907.

[39] Jing Sun and others, 'Enhancing Carbon Neutrality through Blue Carbon Fisheries: Spatial Analysis in Shandong', *Regional Studies in Marine Science*, 85 (2025), p. 104125, doi:https://doi.org/10.1016/j.rsma.2025.104125.

guarantees that projects meet stringent standards concerning climate, environmental, and social advantages. Project documentation, encompassing the Project Design Document (PDD), technical specifications, annual reports, and audit reports, is publicly accessible, ensuring transparency and accountability in project execution. In Kenya, blue carbon initiatives are bolstered by both local and international organizations, notably the Mikoko Pamoja Community Organization (MPCO), which comprises representatives from Gazi and Makongeni villages. MPCO oversees field implementation and community engagement in all conservation activities.[40]

Furthermore, the Mikoko Pamoja Steering Group (MPSG) offers MPCO technical guidance to guarantee the project's success. The Association for Coastal Ecosystem Services (ACES), a European NGO, offers assistance for blue carbon development. ACES serves as the project organizer, oversees the sale of carbon credits, and guarantees that revenue is reinvested into local communities to promote sustainable development. Mikoko Pamoja effectively combines mangrove conservation with community participation and creative funding mechanisms, supported by national legislation, international accreditation, and numerous institutions, establishing itself as a global model for other blue carbon initiatives.[41]

Credits are administered by the Edinburgh organization Plan Vivo via Payment for Ecosystem Services (PES) agreements with communities. Annually, 2215 credits are allocated for sale, and the project undergoes re-accreditation every five years. These credits are not associated with any UNFCCC procedures; nonetheless, these mechanisms have designed the project. In 2013-2014, the price of carbon credits fluctuated between 6.50 USD and 10.00 USD. Mikoko Pamoja's carbon credit assessment excludes soil carbon, focusing solely on carbon sequestered inside the mangrove forest. Any public or private

[40] Lina Ke and others, 'Estimation of Blue Carbon Stock in the Liaohe Estuary Wetland Based on Soil Thickness and Multi-Scenario Modeling', *Ecological Indicators*, 171 (2025), p. 113201, doi:https://doi.org/10.1016/j.ecolind.2025.113201.

[41] Benjamin K Sovacool and others, 'The Sociotechnical Dynamics of Blue Carbon Management: Testing Typologies of Ideographs, Innovation, and Co-Impacts for Marine Carbon Removal', *Environmental Science & Policy*, 155 (2024), p. 103730, doi:https://doi.org/10.1016/j.envsci.2024.103730.

entity may acquire carbon credits.[42]

To date, Mikoko Pamoja's credit purchasers are people, NGOs, and corporations, and they have acquired them via personal outreach and market channels. To date, annual sales of carbon credits have totaled USD 12,500, which the community utilizes for project implementation. The Mikoko Pamoja team aims to expand the amount of safeguarded mangrove forest progressively. The project has other advantages beyond carbon, including carbon sequestration, enhancement of offshore fisheries, conservation of biodiversity, and coastal protection. These advantages serve the local community and enable the international community to investigate alternate payment methods and ecological services that can support local populations and foster alternative lifestyles.[43]

Mikoko Pamoja achieved its objectives in 2014 via mangrove planting and conservation efforts. Local communities have profited from varied income streams related to mangroves, including the upkeep of ecotourism linked to the 'Gazi Bay Boardwalk.' The earnings have financed school construction initiatives, the acquisition of books, and the installation of water pumps. Furthermore, alternative lumber sources from interior forests have been developed near the project locations, supplying local people with substitute construction materials. These projects are overseen by Gazi women, who derive significant advantages from their involvement in alternative livelihood opportunities frequently inaccessible to women in these regions. Motivated by the success of Mikoko Pamoja, the Association for Coastal Ecosystem Services (ACES) aimed to initiate a comparable initiative on the Vanga coast and has supported other NGOs.[44]

Notwithstanding these hurdles, the project is currently achieving its objectives and is classified as successful. The success of the Mikoko Pamoja project is likely attributable to several fundamental factors. The local community has actively endorsed and engaged in

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[42] Shuqin Li, Lin Chen, and Yungang Liu, 'Actors, Themes, Approaches, and Imbalances in Blue Economy Cooperation: A Systematic Review and Future Prospects', *Ocean & Coastal Management*, 267 (2025), p. 107698, doi:https://doi.org/10.1016/j.ocecoaman.2025.107698.

[43] Xin Hou and others, 'Distinct Impacts of Microplastics on the Carbon Sequestration Capacity of Coastal Blue Carbon Ecosystems: A Case of Seagrass Beds', *Marine Environmental Research*, 202 (2024), p. 106793, doi:https://doi.org/10.1016/j.marenvres.2024.106793.

[44] Abhilash Dutta Roy and others, 'Remote Sensing-Based Mangrove Blue Carbon Assessment in the Asia-Pacific: A Systematic Review', *Science of The Total Environment*, 938 (2024), p. 173270, doi:https://doi.org/10.1016/j.scitotenv.2024.173270.

the project, which has been executed through a transparent process. A substantial body of scientific study on mangroves and carbon sequestration in the region has established a robust scientific underpinning for the project. Furthermore, Dr. James Cairo of the Kenyan Government effectively united local people, the scientific community, and the Kenyan Government to enhance the project's efficacy. Dr. Cairo has substantial institutional expertise, having resided within the community for 20 years and sponsored regional scientific programs. Due to the partnership orchestrated by Dr. Cairo, the community has successfully developed robust scientific, administrative, and governance capabilities for the project.[45]

The efficacy of Mikoko Pamoja illustrates that voluntary carbon markets may finance small-scale, community-oriented blue carbon mangrove restoration initiatives while providing advantages to local communities in developing nations. The project did not employ UNFCCC protocols, presumably due to ambiguity regarding the advantages small community-based initiatives might derive from REDD+, as money must be routed through governments, posing challenges for numerous poor nations. Moreover, international climate finance channels may fail to acknowledge the urgent requirements of the affected populations.[46]

Mikoko Pamoja, an initiative endorsed by other nations, encounters some problems. Credit costs can vary because of market volatility. The project's limited scale hinders the realization of economies of scale and the ability to sell carbon at global market prices, complicating the search for carbon purchasers. The project faces additional challenges, including (1) difficulties in securing funding for infrastructure development to deter illegal mangrove cutting by residents; (2) unprecedented alterations in rainfall and sedimentation patterns that have impeded the planting process and resulted in the Mortality of certain mangrove seedlings; and (3) a transition in the project coordinator

[45] Yizhou Sun and others, 'Exploring the International Research Landscape of Blue Carbon: Based on Scientometrics Analysis', *Ocean & Coastal Management*, 252 (2024), p. 107106, doi:https://doi.org/10.1016/j.ocecoaman.2024.107106.

[46] Shan-Shan Jiang and Jing-Mei Li, 'Pricing Blue Carbon to Promote the Protection and Restoration of the Marine Environment: A Real Option Model', *Ocean & Coastal Management*, 259 (2024), p. 107475, doi:https://doi.org/10.1016/j.ocecoaman.2024.107475.

position.[47]

Moreover, although the initiative sequestered approximately 3,000 tonnes of CO_2 annually and earned about 2.5 million Kenyan Shillings (almost £16,500), issues over transparent revenue sharing persist. Ensuring that the revenue distribution method is transparent and equitable is essential for all communities experiencing the project's advantages.[48]

A further constraint is the exclusion of soil carbon, which results in a substantial portion of the climate mitigation potential of these ecosystems remaining unexploited; however, this necessitates much extra scientific effort to measure and quantify soil carbon. Furthermore, the project failed to evaluate the ramifications of sea level rise and climate change throughout its design phases, which could be crucial as these effects intensify.[49] Notwithstanding these constraints, the achievements of Mikoko Pamoja have motivated the East African Forum for Payments Ecosystem Services (EAFPES) to advocate for analogous initiatives in the eastern African region by collaborating with Tanzania, Madagascar, Mozambique, and Kenya.

Blue Carbon Practices and Arrangements in Vietnam: Prospects and Challenges

Vietnam has a rich history of mangrove forest management, which is crucial for coastline protection and sustaining coastal populations' livelihoods. During the 1940s, the mangrove forests of Vietnam encompassed around 408,500 hectares. Nonetheless, due to warfare, overexploitation, and land conversion for aquaculture, this region has significantly diminished to 209,741 hectares in 2006.[50]

The Vietnamese Government has enacted multiple policies and programs to tackle

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[47] Nadia Selene Zamboni and others, 'Impacts of Land Use Change on Mangrove Blue Carbon Services: A Future Perspective in Northeastern Brazil', *Estuarine, Coastal and Shelf Science*, 317 (2025), p. 109185, doi:https://doi.org/10.1016/j.ecss.2025.109185.

[48] Iddi Ramadhani Mwanyoka and others, 'Artisanal Fishers and Seaweed Farmers' Engagement in Blue Economy in Zanzibar', *Marine Policy*, 174 (2025), p. 106587, doi:https://doi.org/10.1016/j.marpol.2025.106587.

[49] Pedro C González-Espinosa, Gerald G Singh, and Andrés M Cisneros-Montemayor, 'Implementing the Blue Economy: Analysis of Indicator Interrelationships across Countries and over Time', *Ocean & Coastal Management*, 262 (2025), p. 107589, doi:https://doi.org/10.1016/j.ocecoaman.2025.107589.

[50] Bijeesh Kozhikkodan Veettil and Vikram Puri, 'Blue Carbon Ecosystems in Vietnam: A Review', *Ocean & Coastal Management*, 267 (2025), p. 107711, doi:https://doi.org/10.1016/j.ocecoaman.2025.107711.

these concerns. In 2009, a mangrove restoration and development plan for 2008-2015 was adopted, aiming to expand the mangrove area to 307,295 hectares by replanting. The plan encompasses 29 coastal provinces and prioritizes the allocation of forest contracts to households and local groups. In 2010, the National Strategy for Environmental Protection to 2020 and Vision to 2020 established the objective of augmenting total forest cover to 43%. It advocated for expanding the mangrove area to 80% of 1990 levels.[51]

Vietnam participates in international efforts for mangrove conservation. The Mangrove Alliance for Climate (MAC) was inaugurated at COP27, aiming to secure an investment of USD 4 billion to safeguard 15 million hectares of mangroves globally by 2030. Vietnam was one of over 80 nations to incorporate mangrove forests in its Nationally Determined Contributions (NDC) statement, acknowledging these ecosystems' substantial carbon sequestration potential and the imperative to safeguard coastal and marine environments. Vietnam exhibits a robust dedication to managing and conserving mangrove forests via national legislation and engagement in global initiatives despite substantial problems in execution.[52]

The Market and Mangrove (MAM) project, initiated in 2012, is situated in Ca Mau, one of the twelve provinces of the Mekong Delta. The project site encompasses 3371 hectares, of which 1715 hectares consist of mangroves. Market and Mangrove aims to conserve the mangrove ecology in this region by assisting shrimp farmers in acquiring organic certification for their aquaculture practices, thereby providing farmers with a premium price for their shrimp. The certification prohibits further Mangrove destruction for shrimp farm development, thereby preventing approximately 23.5 hectares of mangrove loss annually within the project area, and requires each farmer to maintain or attain 50% mangrove cover, resulting in the conservation or reforestation of mangrove forests. During the initial five years of the project, an average of 12.5 hectares of mangroves must be reforested, resulting in a cumulative total of 63 hectares after five years to achieve the

[51] Tomohiro Kuwae and others, 'Implementation of Blue Carbon Offset Crediting for Seagrass Meadows, Macroalgal Beds, and Macroalgae Farming in Japan', *Marine Policy*, 138 (2022), p. 104996, doi:https://doi.org/10.1016/j.marpol.2022.104996.

[52] Tianze Gu and Chuck Chuan Ng, 'Utilising Coastal Blue Carbon (CBC) to Mitigate the Climate Crisis: Current Status and Future Analysis of China', *Ocean & Coastal Management*, 266 (2025), p. 107699, doi:https://doi.org/10.1016/j.ocecoaman.2025.107699.

requisite 50% mangrove coverage for certification.[53]

Vietnam has established multiple legal frameworks to facilitate mangrove forest management and the development of carbon markets as components of climate change mitigation and sustainable development initiatives. Initially, the Mangrove Restoration and Development Plan 2008-2015 was established, followed by the Vietnamese Government's approval in 2009 to expand the mangrove forest area from 209,741 hectares to 307,295 hectares via a replanting initiative. The strategy encompasses 29 coastal provinces and prioritizes the allocation of contracts and forest resources to individuals and local communities. Additionally, the National Strategy for Environmental Protection extends to the year 2020. The policy aims to elevate total forest cover to 43% and advises augmenting mangrove forest area to 80% of 1990 levels.[54]

Additionally, the establishment of the carbon market was governed by Decree No.06/2022/N-CP in January 2022. The regulation governs the diminution of greenhouse gas emissions and the preservation of the ozone layer while facilitating the creation of a domestic carbon trading market. According to this decree, Vietnam intends to establish a legal framework for carbon credit transactions and operational regulations for a carbon trading platform by 2027, with a pilot test of the platform scheduled for 2025 and regular operations commencing in 2028. The Prime Minister of Vietnam, Pham Minh Chinh, has initiated a National Blueprint for a carbon market.[55]

The national strategy has created a framework for the carbon market, encompassing compulsory and voluntary measures. Vietnam's carbon market is anticipated to be fully implemented by 2029. The Law on Environmental Protection 2020, Law No. 72/2020/QH14, establishes a legal framework for the execution and oversight of carbon credit activities in Vietnam. Supportive policies and mechanisms enable the state to

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[53] Ping Li and Dahai Liu, 'How Blue Carbon Financing Can Sustain Blue Carbon Ecosystems Protection and Restoration: A Proposed Conceptual Framework for the Blue Carbon Financing Mechanism', *Ocean & Coastal Management*, 265 (2025), p. 107644, doi:https://doi.org/10.1016/j.ocecoaman.2025.107644.

[54] Annaleena Vaher and others, 'Modelling and Mapping Carbon Capture Potential of Farmed Blue Mussels in the Baltic Sea Region', *Science of The Total Environment*, 947 (2024), p. 174613, doi:https://doi.org/10.1016/j.scitotenv.2024.174613.

[55] Wenju Wang and others, 'Research on Sustainable Development of Marine Ranching Based on Blue Carbon Trading', *Ocean & Coastal Management*, 249 (2024), p. 106988, doi:https://doi.org/10.1016/j.ocecoaman.2023.106988.

promote the advancement of carbon markets and environmental conservation initiatives. The bill also tackles the matter of green bonds.[56]

Effective mangrove forest management and carbon market development necessitate collaboration among multiple ministries and Government agencies to fulfill environmental protection and climate change mitigation objectives—initially, the Ministry of Agriculture and Rural Development (MARD). The Ministry of Agriculture and Rural Development (MARD) oversees the administration of forest resources, encompassing mangrove forests. MARD supervises mangrove restoration and conservation initiatives and collaborates with local people to guarantee sustainable management. MARD is engaged in advancing carbon markets, particularly concerning the forestry sector, to facilitate the integration of greenhouse gas emission reduction initiatives within carbon market frameworks.[57]

The subsequent entity is the Ministry of Natural Resources and Environment (MONRE). MONRE is involved in the management of natural resources and the conservation of the environment. It is also engaged in policy formulation concerning the conservation of mangrove ecosystems and the mitigation of human-induced environmental impacts. Besides its function in environmental management, MONRE spearheads the establishment of a carbon market framework in Vietnam and is tasked with devising policies, rules, and processes that facilitate local and international carbon trading. The Ministry of Foreign Affairs is also involved in MAM. It promotes international cooperation in carbon market development, including partnerships with organizations like the OECD to analyze global practices and tailor them to Vietnamese contexts.[58] Vietnam is firmly committed to mangrove forest protection and carbon market development through its legal framework and inter-agency coordination. It is part of its

[56] Siegmund Nuyts and others, 'Mapping Tidal Restrictions to Support Blue Carbon Restoration', *Science of The Total Environment*, 949 (2024), p. 175085, doi:https://doi.org/10.1016/j.scitotenv.2024.175085.
[57] Miriam Montero-Hidalgo and others, 'Mapping and Assessing Seagrass Meadows Changes and Blue Carbon under Past, Current, and Future Scenarios', *Science of The Total Environment*, 872 (2023), p. 162244, doi:https://doi.org/10.1016/j.scitotenv.2023.162244.
[58] Nipuni Perera and others, 'Quantification of Blue Carbon in Tropical Salt Marshes and Their Role in Climate Change Mitigation', *Science of The Total Environment*, 820 (2022), p. 153313, doi:https://doi.org/10.1016/j.scitotenv.2022.153313.

national policy to combat climate change and attain sustainable development.

Although carbon funding was previously considered significant for the MAM project, organic certification emerged as a more advantageous and judicious financial option. The project collaborates with Minh Phu, a global seafood export enterprise that procures organic shrimp and markets them at a premium price. European, American, and Canadian shrimp markets offer a 10% premium for organic shrimp due to the increasing global demand for organic and ecological seafood. Enhanced mangrove coverage has been associated with heightened shrimp production, providing farmers additional motivation to certify their farms. Consequently, local businesses have prospered, and farmers are experiencing tangible economic advantages from preserving their mangroves.[59]

Profit estimates for integrated shrimp-maize farmers fluctuate significantly, with an average of approximately US$900 per hectare per year in years devoid of serious diseases; this figure excludes labor expenditures, which are estimated at $600 per hectare per year for two workers often sourced from the owner's home. Farmers might also gather more species, such as crabs and fish, from their farms, perhaps resulting in a marginally increased total income.[60]

The International Federation of Red Cross and Red Crescent Societies reports that replanting mangroves in Vietnam from 1998 to 2002 decreased dyke maintenance costs by $7.3 million annually, at an investment of $1.1 million (IFRC, 2002). The Markets and Mangroves project establishes a clear correlation between community income and mangrove ecosystems since local farmers are now financially motivated to conserve mangroves, benefiting from a guaranteed increased revenue due to their recently obtained organic certification.[61]

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[59] Milica Stankovic and others, 'Quantification of Blue Carbon in Seagrass Ecosystems of Southeast Asia and Their Potential for Climate Change Mitigation', *Science of The Total Environment*, 783 (2021), p. 146858, doi:https://doi.org/10.1016/j.scitotenv.2021.146858.

[60] He Yuan, Leïla Choukroune, and Pierre Failler, 'Centring Justice for Labour in the New Blue Economy: Principles for Applying Emerging Evidence and Theoretical Critiques to Policy and Practice', *Marine Policy*, 168 (2024), p. 106327, doi:https://doi.org/10.1016/j.marpol.2024.106327.

[61] Jay Mar D Quevedo, Yuta Uchiyama, and Ryo Kohsaka, 'A Blue Carbon Ecosystems Qualitative Assessment Applying the DPSIR Framework: Local Perspective of Global Benefits and Contributions', *Marine Policy*, 128 (2021), p. 104462, doi:https://doi.org/10.1016/j.marpol.2021.104462.

One thousand one hundred fifty farmers in Ca Mau have received certification from Naturland, a globally acknowledged organic aquaculture and agriculture norm. Given the project's success, MAM intends to increase the number of participating farmer households to 6000. While not using the UNFCCC carbon funding system, the project attains equivalent emission reduction objectives through alternate methods, simultaneously enhancing the profitability of Vietnam's shrimp sector. The IUCN refers to the organic certification scheme as a 'kind of international PES,' albeit indirectly. By maintaining 50% mangrove coverage at the project site, MAM mitigates deforestation and safeguards existing forests, enhancing the region's capacity to generate additional carbon sinks. The variety of parties engaged in MAM certainly facilitated the project's success.[62]

Vietnam encounters obstacles in establishing carbon markets and managing mangroves, especially with regulation, land tenure, and community involvement. The regulatory structure for the carbon market remains in progress and is anticipated to be completely operational by 2029. Furthermore, most mangrove forests are overseen by Forest Management Agencies, complicating community-based management and benefit distribution. Challenges in facilitating efficient collaboration among Government entities, local communities, and the commercial sector impede the optimization of mangrove ecosystems' blue carbon economic potential.[63]

Economic pressures and the effects of climate change provide significant concerns. Numerous coastal regions undergo land conversion for aquaculture and development, frequently resulting in the deterioration of mangrove forests. Although local communities acknowledge the advantages of mangroves in catastrophe mitigation and economic sustenance, sustainable financial assistance remains constrained. Certain communities are prepared to support conservation funds; however, inadequate long-term investment and economic incentive systems impede sustained mangrove protection initiatives.

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[62] Shihui Zhang and others, 'Global Readiness for Carbon Neutrality: From Targets to Action', *Environmental Science and Ecotechnology*, 25 (2025), p. 100546, doi:https://doi.org/10.1016/j.ese.2025.100546.

[63] Alberto González-García and others, 'National Blue Carbon Assessment in Spain Using InVEST: Current State and Future Perspectives', *Ecosystem Services*, 53 (2022), p. 101397, doi:https://doi.org/10.1016/j.ecoser.2021.101397.

Blue Carbon Practices and Arrangements in India: Prospects and Challenges

The Sundarbans is the largest global mangrove ecosystem, sequestering substantial carbon in its biomass and soil sediments. Spanning around 4,200 km² in India, it significantly contributes to climate change mitigation via blue carbon, the carbon sequestered in coastal ecosystems like mangroves, seagrasses, and salt marshes. The Sundarbans is an archipelago between West Bengal in India and southern Bangladesh. The area contains the largest estuarine mangrove forest globally. Regrettably, over 28% of its territory has been diminished in the past four decades due to climate change-induced sea level rise, which is swiftly obliterating mangrove habitats.[64]

Anthropogenic influences, including population increase, ecosystem disturbance, and shrimp fishing, have contributed to mangrove degradation in this region. The mangrove regions offer essential ecosystem services to around five million residents, serving as natural barriers that safeguard artificial dykes constructed for flood and storm mitigation following the devastation caused by typhoon Aila in 2009. Furthermore, the mangroves shield the settlement from regular tide fluctuations of up to 20 feet. The Sundartians Indian Mangrove Restoration Project aims to cultivate 6,000 hectares of mangroves over three years, which is expected to sequester 700,000 tons of carbon in its biomass and soil over 20 years.[65]

The primary aims of the project are the reduction of carbon emissions, climate adaptation, and the conservation of biodiversity. Research on the applicability of carbon standards was conducted for this project, concluding that carbon funding is a feasible option. New mangrove plantations can yield timber and create aquaculture opportunities for residents. The initiative has been executed as a Verified Carbon Standard (VCS) project, encompassing four regions in the Sundarbans. Most of the funding is allocated to communities as compensation for labor, while the residual funds are utilized for technical surveys and scientific monitoring necessary for carbon offset certification. Local communities receive training in cultivating human gardens and are compensated for their

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[64] Nisha Yadav and Fincy Pallissery, 'International Investments and Environmental Protection in India - Policy and Implementation Gaps in Mitigating the Carbon Footprints', *Global Transitions*, 5 (2023), pp. 217–24, doi:https://doi.org/10.1016/j.glt.2023.10.001.

[65] A.Chathurika S Perera, Peter J Davies, and Petra L Graham, 'A Global Review of Urban Blue-Green Planning Tools', *Land Use Policy*, 140 (2024), p. 107093, doi:https://doi.org/10.1016/j.landusepol.2024.107093.

efforts, offering them a modest alternative source of income.[66]

India joined the Paris Agreement in 2016 and pledged to decrease its greenhouse gas emissions intensity by 33 to 35% by 2030 relative to 2005 levels. In February 2023, the Government of India initiated the Mangrove Initiative for Shoreline Habitats and Tangible Incomes (MISHTI) to enhance mangrove planting, particularly in coastal regions and salt pond territories. The program underscores the significance of mangrove conservation in mitigating disaster risk and enhancing the livelihoods of local populations. Numerous statutes and regulations facilitate the execution of blue carbon. The Environment Protection Act of 1986 establishes a framework for preserving and enhancing environmental quality in India. The Government is empowered to establish guidelines and implement measures to safeguard fragile ecosystems, such as the mangroves in the Sundarbans.[67]

Additionally, the Forest Conservation Act of 1980. This legislation governs the non-forestry utilization of forested land and seeks to avert deforestation. Any alteration in the utilization of forest land, including mangroves, necessitates central Government authorization, hence affording enhanced protection for ecosystems like the Sundarbans. The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act was enacted in 2006. This Act acknowledges the rights of indigenous and traditional groups residing in and adjacent to forests, encompassing the right to preserve and sustainably manage forest resources. This is a crucial element for local community engagement in mangrove protection. India has implemented a carbon credit trading mechanism for the energy, steel, and cement sectors to facilitate the transition to greener fuels. The system permits non-mandatory organizations to engage in the carbon credit market, with the compliance sector set to commence in 2025-2026.

Managing mangroves in the Sundarbans, India, and establishing a carbon market in the nation necessitates collaboration among multiple Government ministries and agencies

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[66] David A Gill and others, 'Triple Exposure: Reducing Negative Impacts of Climate Change, Blue Growth, and Conservation on Coastal Communities', *One Earth*, 6.2 (2023), pp. 118–30, doi:https://doi.org/10.1016/j.oneear.2023.01.010.

[67] Jeffrey J Kelleway and others, 'A National Approach to Greenhouse Gas Abatement through Blue Carbon Management', *Global Environmental Change*, 63 (2020), p. 102083, doi:https://doi.org/10.1016/j.gloenvcha.2020.102083.

to fulfill objectives related to environmental protection and climate change mitigation. The Ministry of Environment, Forest and Climate Change (MoEFCC) oversees the conservation and management of forest resources, including the mangroves in the Sundarbans. The MoEFCC formulates policies and guidelines to safeguard mangrove habitats and supervises their execution at the national level. [68]

Blue carbon initiatives are also inside jurisdictions like the West Bengal State Government. As a local authority, the state Government is crucial in executing mangrove protection initiatives. They collaborate closely with the central Government and nongovernmental organizations to oversee and safeguard mangrove forests in the Sundarbans region. Research institutions and academia contribute to the development of Sundarbans programs, with CIFOR-ICRAF engaged in mangrove monitoring and research while supplying data and recommendations for better management.[69]

In addition to the blue carbon ecosystem restoration and conservation sector, many ministries and agencies are also engaged in carbon trading. The Bureau of Energy Efficiency (BEE), operating under the Ministry of Power, is tasked with establishing and supervising the domestic carbon market. It establishes greenhouse gas emission targets and facilitates the exchange of carbon credit certificates. The Ministry of Electricity supervises the execution of the carbon trading scheme, encompassing the notification and enforcement of legislation pertinent to the carbon market. Besides its function in forest conservation, the MoEFCC is formulating policies about climate change and carbon markets. Energy corporations in India are collaborating to establish carbon markets and engage in carbon trading initiatives to mitigate greenhouse gas emissions. Nongovernmental organizations, like Caritas India, are regenerating mangrove biodiversity within the Sundarbans Biosphere Reserve, highlighting the significance of

[68] Qi Zhang, Xifeng Wu, and Yu Chen, 'Is Economic Crisis an Opportunity for Realizing the Low-Carbon Transition? A Simulation Study on the Interaction between Economic Cycle and Energy Regulation Policy', *Energy Policy*, 168 (2022), p. 113114, doi:https://doi.org/10.1016/j.enpol.2022.113114.

[69] Ha Eun Lee and others, 'Comparative Life Cycle Assessment of Carbon-Free Ammonia as Fuel for Power Generation Based on the Perspective of Supply Chains', *Energy*, 312 (2024), p. 133557, doi:https://doi.org/10.1016/j.energy.2024.133557.

ecological restoration and catastrophe risk mitigation through mangrove planting.[70]

Restoration of Mangroves in India The Sundarbans fall under the Verified Carbon Standard (VCS) sectoral scope, pertaining to Agriculture, Forestry, and Other Land Uses (AFOLU) projects. This project falls under the Afforestation, Reforestation, and Restoration (ARR) category for mangroves within AFOLU. Since soil carbon was incorporated into the project's scope, it was also required to adhere to Wetland Restoration and Conservation (WRC) standards. Initially, project planners aimed to implement the Clean Development Mechanism (CDM) in small-scale cooperative initiatives.[71]

Subsequently, when large-scale mangrove restoration became feasible with VCS, the project transitioned to a validation process for VCS clustered projects. In September 2015, the initiative received validation, and the UNFCCC provided emission reduction credits for Livelihoods. The Government presently has no intention to sell the credits; instead, it employs them as components of a socially and environmentally beneficial emissions reduction strategy for the corporation and corporate branding purposes.[72]

Thus far, the Government has financed project expenses encompassing support for local community restoration initiatives. Individuals regarded as 'forest friends' who first assisted in safeguarding the mangroves from threats like illegal logging have garnered minimal revenue, primarily to cover expenses amounting to $45 monthly. The project is transitioning to a voluntary monitoring system for Mangrove Forest Management, which local people will manage to oversee their mangrove forests. Communities engaged in planting typically operate for approximately 4 hours daily during low tide, earning around $2.54 per day, equating to approximately $50-56 USD monthly. The project manager receives approximately $120 monthly, while the field officer makes $225 monthly. Current prices range from 0.015 to 0.0375 USD per seedling, contingent upon the

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[70] Nesar Ahmed and others, 'Solutions to Blue Carbon Emissions: Shrimp Cultivation, Mangrove Deforestation and Climate Change in Coastal Bangladesh', *Marine Policy*, 82 (2017), pp. 68–75, doi:https://doi.org/10.1016/j.marpol.2017.05.007.

[71] Jay Mar D Quevedo, Yuta Uchiyama, and Ryo Kohsaka, 'Linking Blue Carbon Ecosystems with Sustainable Tourism: Dichotomy of Urban–Rural Local Perspectives from the Philippines', *Regional Studies in Marine Science*, 45 (2021), p. 101820, doi:https://doi.org/10.1016/j.rsma.2021.101820.

[72] Sebastian Thomas, 'Between Tun Mustapha and the Deep Blue Sea: The Political Ecology of Blue Carbon in Sabah', *Environmental Science & Policy*, 55 (2016), pp. 20–35, doi:https://doi.org/10.1016/j.envsci.2015.08.017.

species (Le, Avicennia, Ceriops, Rhizophora, Hereteira, Ex-coecuria), with 0.8 million seedlings having been allocated as part of the long-term strategy.[73]

The mangrove forests in the Sundarbans, India, have attained significant achievements in conservation and sustainable management. A notable accomplishment is the establishment of Protected Areas and Wildlife Sanctuaries, exemplified by the Sundarbans Tiger Reserve, which spans over 2,585 square kilometers. These initiatives seek to safeguard the habitat of endangered species, such as the Bengal tiger, and preserve the area's biodiversity.[74]

A report from the Ministry of Forests in India indicates that the quantity of carbon stored is about threefold the anticipated amount. The initiative has yielded various supplementary ecological advantages, including establishing biological habitats and the gradual economic improvement of local communities through mangrove restoration. The project provides social advantages by equipping the local populace with significant employment opportunities in an area where most residents exist below the poverty threshold.

The mangrove restoration initiative has effectively involved local populations in the planting and upkeep of mangrove forests. Nongovernmental organizations, including the World Wildlife Fund (WWF) and the International Union for Conservation of Nature (IUCN), spearheaded this initiative, which not only rehabilitated the ecosystem but also enhanced the livelihoods of local populations. The international acknowledgment of the Sundarbans as the largest mangrove ecosystem globally, encompassing over 10,000 square kilometers, is another success. This acknowledgment underscores the significance of conservation and sustainable management in saving biodiversity and the livelihoods of

[73] Nesar Ahmed and Marion Glaser, 'Coastal Aquaculture, Mangrove Deforestation and Blue Carbon Emissions: Is REDD+ a Solution?', *Marine Policy*, 66 (2016), pp. 58–66, doi:https://doi.org/10.1016/j.marpol.2016.01.011.

[74] Shimeng Liu, Xiong Xiong, and Ya Gao, 'Market-Based Environmental Regulations and Green Innovation: Evidence from the Pilot Carbon Markets in China', *Research in International Business and Finance*, 77 (2025), p. 102896, doi:https://doi.org/10.1016/j.ribaf.2025.102896.

populations reliant on this ecosystem.[75]

The Indian Sundarbans encounter numerous obstacles in establishing carbon markets and managing mangrove ecosystems. A primary obstacle is the inadequate legal and regulatory framework to facilitate blue carbon trading successfully. Most Sundarbans are designated as a protected area, restricting mangrove-related economic operations, such as carbon trading initiatives. The intricate land ownership and management rights among the Government, local populations, and conservation organizations hinder the equitable and sustainable implementation of blue carbon programs.[76]

A further challenge is the influence of climate change and escalating economic pressures. The Sundarbans frequently encounter natural calamities, including cyclones and rising sea levels, which jeopardize mangrove ecosystems and impede long-term rehabilitation initiatives. Land transformation for aquaculture, agriculture, and habitation further exacerbates the strain on these delicate ecosystems. Despite local populations relying on mangroves for their livelihoods, restricted access to funds and an absence of explicit economic incentives hinder their involvement in conservation initiatives. The interplay of ecological, economic, and regulatory issues renders mangrove management in the Indian Sundarbans a complicated challenge, necessitating a multi-sectoral approach for sustainable resolution.

Regulating and Implementing Blue Carbon in Indonesia to achieve Ecological Justice

A deeper understanding of ecological justice allows for reflection on the ideas of Nicholas Low and Brendan Gleeson in their work Justice, Society and Nature and Brian Baxter's exploration of the concept in The Theory of Ecological Justice. To what extent has the Government continuously embraced the principles of environmental justice and comprehensively institutionalized ecological justice in the management of blue carbon in Indonesia?

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[75] Inés Mazarrasa and others, 'Drivers of Variability in Blue Carbon Stocks and Burial Rates across European Estuarine Habitats', *Science of The Total Environment*, 886 (2023), p. 163957, doi:https://doi.org/10.1016/j.scitotenv.2023.163957.

[76] Yiwen Zeng and others, 'Global Potential and Limits of Mangrove Blue Carbon for Climate Change Mitigation', *Current Biology*, 31.8 (2021), pp. 1737-1743.e3, doi:https://doi.org/10.1016/j.cub.2021.01.070.

The 1945 Constitution, as the fundamental legal framework of the Republic of Indonesia, serves as the supreme authority in the hierarchy of laws and regulations in Indonesia, as outlined in Article 7, paragraph (1) of Law Number 12/2011. Consequently, the 1945 Constitution should serve as a reference for establishing all current legislation in Indonesia, encompassing those related to the administration and utilization of natural resources. The primary expression of the regulation governing the management and utilization of natural resources in Indonesia is articulated in Article 33, paragraph (3) of the 1945 Constitution, which asserts that 'the state shall control the earth and water and the natural resources contained therein and shall be utilized for the greatest prosperity of the people.' Moreover, to align with the stipulations in the article, Article 2 paragraph (1) of the Agrarian Law elucidates that the term 'controlled' by the state in Article 33 paragraph (3) of the 1945 Constitution does not equate to 'owned' by the state; instead, it signifies that the state is endowed with the authority to manage and utilize natural resources as a representation of the collective power of the populace.[77]

The authority to manage and utilize natural resources must also consider the stipulations outlined in Article 33, paragraph (4) of the 1945 Constitution of the Republic of Indonesia, which states that 'the national economy is founded on economic democracy, adhering to the principles of collective welfare, equitable efficiency, sustainability, environmental awareness, autonomy, and the preservation of progress and national economic unity.' This paragraph underscores the significance of implementing the national economy, namely the management and utilization of natural resources, grounded on economic democracy that adheres to the principle of sustainable development, bolstered by environmentally sound practices. Article 33, paragraph (4) of the 1945 Constitution embodies a concept related to the environment, specifically the notion of green democracy or ecological democracy (eco-democracy), which has led to the emergence of the word ecocracy.[78]

Ecocracy is the acknowledgment of nature, the environment, and its constituents.

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[77] Ines Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia', *Marine Policy*, 137 (2022), p. 104955, doi:https://doi.org/10.1016/j.marpol.2022.104955.

[78] Xu and others, 'Blue Carbon Governance for Carbon Neutrality in China: Policy Evaluation and Perspectives'; Wang and others, 'Evolution of Blue Carbon Trading of China's Marine Ranching under the Blue Carbon Special Subsidy Mechanism'.

Ecocracy can elucidate the ecosystem's finite carrying capacity and foster an understanding of sustainable ecology, thereby preventing humans from engaging in exploitative and harmful behaviors against nature without anticipating the consequences or adverse effects. Consequently, democracy is an extension of democracy that transcends state lines, including a greater significance due to its interconnectedness with the Earth and its natural environment.[79]

Eckersley delineates democracy as a concept asserting that stakeholders potentially impacted by ecological hazards and risks should possess a substantive opportunity to engage or, at the very least, have their interests represented in formulating environmental policies. Jimly Asshidiqie characterizes democracy as a governmental acknowledgment of environmental sovereignty, drawing parallels with the concepts of theocracy, democracy, and nomocracy. Nonetheless, these interpretations often acknowledge the existence of additional creatures (nature) apart from people whose interests the state must account for through legislation.[80]

This recognition is expressed through moral considerations, indicating that all actions impacting the environment must consider its positive and negative aspects by ethical principles. This understanding illustrates that human moral responsibility extends beyond interpersonal relations to encompass the natural environment, which possesses both instrumental and intrinsic value. This indicates that these ethical obligations are not fulfilled solely to promote human welfare but rather for the intrinsic value of the environment itself.[81]

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[79] Sugimura and others, 'New Possibilities for Climate Change Countermeasures in Ports: Organic Carbon Containment and Creation of Blue Carbon Ecosystems through Beneficial Utilization of Dredged Soil'; Kopp, Hejduková, and Hejduk, 'Perception of New Trends in Rainwater Management in Czech Cities: Barriers and Tools of Implementation'.

[80] Xu and others, 'Blue Carbon Governance for Carbon Neutrality in China: Policy Evaluation and Perspectives'; Géraldine Pérez and others, 'A Conceptual Framework to Help Choose Appropriate Blue Nature-Based Solutions', *Journal of Environmental Management*, 352 (2024), p. 119936, doi:https://doi.org/10.1016/j.jenvman.2023.119936.

[81] Benzaken and others, 'From Concept to Practice: Financing Sustainable Blue Economy in Small Island Developing States, Lessons Learnt from the Seychelles Experience'; McHarg and others, 'Valuing the Contribution of Blue Carbon to Small Island Developing States' Climate Change Commitments and Covid-19 Recovery'.

The green constitution establishes a nation's foundational political connections to be more environmentally sustainable. The proposed political structure, which does not prioritize humans, recognizes the need to preserve and promote entities beyond human interests. The 1945 Constitution, as the fundamental and supreme law of the state, serves as a philosophical foundation that delineates essential regulations for governance and outlines key state policies requiring further elaboration, particularly in the environmental sector, including the execution of blue carbon initiatives.[82]

Consequently, the 1945 Constitution embodies the fundamental and supreme legal principles, serving as a reference for formulating and implementing laws, particularly in the environmental sector, emphasizing blue carbon. Before analyzing the orientation of ecological justice in the control of blue carbon in Indonesia, it is essential to comprehend the indicators employed by the author in this analysis to justify the subject under examination. The aforementioned signs stem from the author's analysis of two comprehensive studies by Nicholas Low, Brendan Gleeson, and Brian Baxter, which will be further discussed below.[83]

Low and Gleeson, in their work Justice, Society, and Nature: An Exploration of Political Ecology, Discuss environmental justice and ecological justice, which entails acknowledging the intrinsic worth of the environment for all entities. An environment comprises human entities and a diverse array of non-human things, including animals, plants, landscapes, and ecosystems. The pursuit and maintenance of justice is a perpetual human endeavor, intrinsically linked to political discourse, which is, in turn, intertwined with the contest for power within society. Consequently, the quest for justice constitutes

[82] Asaduzzaman and others, 'Advancing Low-Trophic Extractive Mariculture (LTEM): Strategies for a Thriving Blue Economy in Bangladesh'; Sheehy and others, 'Redefining Blue Carbon with Adaptive Valuation for Global Policy'; Lee and Lee, 'Blue Carbon Ecosystems for Hypoxia Solution: How to Maximize Their Carbon Sequestration Potential'; Almeida and others, 'The Needs and Challenges of the Blue Economy Sector in Portugal: Bridging National and European Strategies with the Perceptions of the Stakeholders'.
[83] Canty and others, 'Implications of Improved Remote Sensing Capabilities on Blue Carbon Quantification'; Suresh and others, 'Tourism and Recreation in Blue Carbon Ecosystems: Exploring Synergies, Trade-Offs and Pathways to Sustainability'; Veettil and others, 'Blue Carbon Ecosystems in Sri Lanka: A Review'.

a dialectical endeavor within society.[84]

This work must be acknowledged as foundational to ecological justice within the vocabulary and requirements of global environmental political theory, as articulated by Baxter. The phrase' ecological justice' appears to have been initially introduced by Low and Gleeson in 1998. They present it in the following manner: The pursuit of justice, influenced by environmental politics, has two interrelated dimensions: the equitable distribution of environments among populations and the fairness of interactions between humans and the natural world. We designate these facets of justice as environmental justice and ecological justice. They represent two facets of the same relationship.[85]

While it does not explicitly propose indicators of ecological justice at a normative level, Low and Gleeson's work, as foundational to ecological justice theory within global environmental politics, delineates several essential characteristics and principles that can assist in identifying indicators of ecological justice. The first principle asserts that every natural entity possesses the right to fully experience its form of life, thereby granting non-human entities moral consideration. The second principle emphasizes the interdependence of all forms of life on non-living entities.

Based on these principles, the attributes of the ecological justice theory emerge, which can be encapsulated in four key characteristics: firstly, the equitable distribution of environmental benefits and burdens among all living entities, encompassing both humans and non-human organisms, including access to clean air, water, and healthy ecosystems. Secondly, it facilitates a participatory decision-making process in environmental matters, acknowledging individuals' subjective and nature's rights, including those of future generations and non-human entities. Thirdly, it safeguards the Earth's ecological integrity for future generations, ensuring they inherit a healthy and sustainable environment. Fourthly, it recognizes the intrinsic value of nature and ecosystems independent of their utilitarian value to humans. Moral and ethical responsibility for the environmental

[84] Sovacool and others, 'The Sociotechnical Dynamics of Blue Carbon Management: Testing Typologies of Ideographs, Innovation, and Co-Impacts for Marine Carbon Removal'; Ke and others, 'Estimation of Blue Carbon Stock in the Liaohe Estuary Wetland Based on Soil Thickness and Multi-Scenario Modeling'.

[85] Li, Chen, and Liu, 'Actors, Themes, Approaches, and Imbalances in Blue Economy Cooperation: A Systematic Review and Future Prospects'; Dutta Roy and others, 'Remote Sensing-Based Mangrove Blue Carbon Assessment in the Asia-Pacific: A Systematic Review'.

existence of non-human creatures necessitates the conservation and restoration of biodiversity.

Building upon the work of Low and Gleeson, the author subsequently develops several indicators, influenced by their concepts, for evaluating blue carbon initiatives in Indonesia through the lens of ecological justice: 1) Regulatory framework and legal foundation; 2) Institutionalization; 3) Community engagement; 4) Sustainability and equitable advantages. The significance of blue carbon in Indonesia necessitates regulation grounded in ecological justice to achieve community welfare in both environmental and economic dimensions.

The regulation and legal foundation are the most essential aspects, as the author elucidated at the outset of this paper. It is acknowledged that in Indonesia, initiatives for the protection, conservation, and management of the BHS are encompassed within various legal frameworks, including forestry, coastal and marine, and environmental protection and management regimes. Nonetheless, these regulatory frameworks have not effectively handled and safeguarded all BHS. Protected forest and marine conservation areas comprise around 49 percent of the mangrove region in the Indonesian archipelago, with 3 percent designated as marine conservation zones. Nonetheless, anthropogenic activities persist in jeopardizing mangroves beyond designated conservation zones. Furthermore, excluding clauses introduced post-enactment of the Job Creation Law may undermine the safeguarding and administration of BHS, particularly within national strategic policies.

The Constitution ought to include environmental protection inside many statutes. In Indonesia, multiple legal frameworks regulate the conservation and protection of EKB. These regimes encompass environmental, forestry, coastal, and marine legislation and conservation initiatives; however, they are not exclusive to BHS. Terrestrial and coastal marine legal frameworks govern mangrove regions between land and sea. Due to the absence of particular restrictions regarding BHS, they are still regarded as 'fragile and susceptible' ecosystems and lack robust protective measures. At this juncture, the author asserts that it must be modified to align with the factual circumstances inside the community, as exemplified below: In regions where local populations constitute the majority of blue carbon-dependent individuals (BCDP), the Government may implement

protective measures that facilitate sustainable utilization. This guarantees that individuals can continue to utilize natural resources without harming the ecosystem. Moreover, community involvement in management is crucial for effective safeguarding. In regions devoid of settlements, the Government may enforce stringent protections by restricting all forms of exploitation, such as designating areas as core conservation zones. This measure necessitates rigorous oversight and enforcement of the legislation.[86]

The institutional dimension of blue carbon implementation presents challenges due to the distribution of duties, roles, and authority among multiple ministries and agencies involved in blue carbon ecosystem management. This is attributable to the existence of mangroves distributed between forest regions (managed by KLHK), coastal zones (overseen by KKP), and APL areas under the jurisdiction of local administrations. The demarcation between coastal mangrove habitats and forested regions is dictated by the forest utilization framework developed by the Ministry of Environment and Forests (MoEF).[87]

At the local level, under the Local Government Law, PWP3K Law, and Forestry Law, mangrove management by the local Government is executed through DLHK and DKP at the provincial and district/city tiers. Following implementing the Ciptaker Law, local governments retain certain powers in managing forests, including mangroves. The authorities encompass forest management, conservation of SDAHE resources, education and training, counseling, and watershed management (DAS) that traverse multiple districts or cities within a single provincial territory.[88]

In the coastal and marine sector, local administrations possess complete authority to manage coastal resources within a 0-12 mile radius from the shore, as stipulated by the Regional Government Law. Nonetheless, the functions of DKP and DLHK in each

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[86] Purwanto Purwanto and others, 'Spatiotemporal Evolution and Influencing Factors of Blue Carbon Resilience in the East Java, Indonesia', *Science of The Total Environment*, 973 (2025), p. 179128, doi:https://doi.org/10.1016/j.scitotenv.2025.179128.

[87] Hou and others, 'Distinct Impacts of Microplastics on the Carbon Sequestration Capacity of Coastal Blue Carbon Ecosystems: A Case of Seagrass Beds'; Jiang and Li, 'Pricing Blue Carbon to Promote the Protection and Restoration of the Marine Environment: A Real Option Model'.

[88] Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia'; González-García and others, 'National Blue Carbon Assessment in Spain Using InVEST: Current State and Future Perspectives'.

province may differ. In East Kalimantan, the DKP solely coordinates with the DLHK concerning mangrove degradation. In certain provinces, a consensus exists on differentiating mangroves in forested and non-forested regions to clarify the allocation of authority.[89]

The administration of mangroves by these diverse ministries and organizations necessitates efficient cooperation to prevent task duplication or bureaucratic competition. This rivalry can exert two primary effects: (1) competition for constrained budgetary allocations (allocation rivalry) and (2) competition for authority and bureaucratic independence (functional rivalry). In the policy development process, the budget emerges as a pivotal issue that frequently incites conflict among institutions due to constrained resources. Simultaneously, rivalry for authority may foster policy innovation; however, it can also create a developmental disparity among institutions, with one institution advancing more swiftly. This overlap may impede and delay attempts to effectively protect and conserve mangrove regions. Considering the technological issues is crucial for ensuring successful implementation.[90]

The subsequent issue pertains to community participation in blue carbon policy; community engagement in the management of Blue Carbon Ecosystems must be integrated from the design phase through policy formulation and site-specific execution. Community involvement in blue carbon management, particularly in blue carbon initiatives, is crucial for enhancing social resilience, preserving cultural values, and safeguarding environmental services that significantly impact their lives. Despite legislation in Indonesia governing community engagement in the policy process, implementation encounters numerous hurdles, rendering community involvement frequently superficial. A significant barrier is the insufficient access to information within the community necessary for effective participation. Consequently, significant public engagement is essential to guarantee greater participation in planning and policy-making

[89] Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia'; Murphy and others, '"Whose Carbon Is It?" Understanding Municipalities Role in Blue Carbon Ecosystems Management in Canada'.

[90] Frida Sidik and others, 'Blue Carbon: A New Paradigm of Mangrove Conservation and Management in Indonesia', *Marine Policy*, 147 (2023), p. 105388, doi:https://doi.org/10.1016/j.marpol.2022.105388; Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia'.

processes.[91]

In site-based ecosystem management, communities can contribute through several mechanisms, including (1) social forestry, (2) customary forests, (3) community-based conservation initiatives, (4) engagement in the National Economic Recovery (PEN) program, (5) blue carbon management via funded projects, and (6) participation in monitoring activities. Nonetheless, these diverse initiatives continue encountering obstacles, including restricted access to information for communities to engage in the process. To address these challenges, the Government and civil society organizations should offer support and create multi-stakeholder forums that engage communities in EKB management to guarantee substantial participation. The Government can streamline the licensing procedure for communities seeking to manage blue carbon via social forestry projects, customary forests, and other legislatively established systems.[92]

Numerous rules in Indonesia assure community involvement in policy formulation and decision-making for BHS management. Article 28 of the 1945 Constitution affirms the right of communities to organize, congregate, and express opinions, whereas Article 18B acknowledges and respects Masyarakat Hukum Adat (MHA) and their customary rights. Secondly, Article 65 of the Environmental Protection and Management Law grants communities the right to engage in environmental policy, raise objections to activities affecting the environment, and file complaints regarding purported environmental contamination or degradation. Article 66 safeguards those advocating for environmental rights from the risk of criminalization and litigation under the Anti-SLAPP (Anti-Strategic Lawsuit Against Public Participation) principle. Article 70 delineates the modalities of public engagement in environmental preservation and management, affirming the people's right to extensive participation in environmental conservation initiatives.

Third, the Spatial Planning Law, along with the Ciptaker Law, delineates public participation in spatial planning across many phases: (a) production of spatial plans, (b)

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[91] Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia'; Zhang and others, 'Global Readiness for Carbon Neutrality: From Targets to Action'.

[92] Li He and others, 'Examining Ecological Risks of Metals in Downstream River Sediments: Researching Agricultural Carbon Emission Efficiency in Environmental Regulation Perspective', *Heliyon*, 10.17 (2024), p. e37383, doi:https://doi.org/10.1016/j.heliyon.2024.e37383; Ayostina and others, 'Network Analysis of Blue Carbon Governance Process in Indonesia'.

spatial utilization, and (c) oversight of spatial utilization. Community engagement and involvement in spatial planning is governed by Government Regulation No. 45/2017 on Community Participation in Local Government Implementation, which asserts that communities possess the right to participate in formulating local regulations and policies that directly impact them, including licensing matters. This law indicates opportunities and avenues for community involvement in many policy processes, including planning, decision-making, oversight, enforcement, and the execution of sustainable development.

Fourth, the PWP3K Law grants communities the right to manage coastal areas and small islands (WP3K) actively, encompassing the planning, implementation, and monitoring phases. This involvement encompasses the right to apply for customary zones in zoning plans, acquire information, and, within a specified timeframe, lodge objections to activities affecting WP3K. This rule provides the community with legal safeguards against potential adverse effects from activities occurring in coastal regions.

In conjunction with the Job Creation Law and Government Regulation No. 23/2021, the Forestry Law governs community participation in managing protected and productive forests via social forestry initiatives. Sixth, the Presidential Regulation on the Economic Value of Carbon (NEK) and Minister of Environment and Forestry Regulation Number 21 of 2022 allow communities to participate in climate change mitigation initiatives via carbon trading and performance-based payment schemes in mangrove management and conservation.

While Indonesia's legal structure facilitates community engagement in decision-making, legislation alone is insufficient to guarantee the efficacy of such involvement. Additional influential factors include transparency and information accessibility, representation of specific groups (including women), acknowledgment of Indigenous knowledge in decision-making, and community motivation to actively engage in policy development and management of blue carbon ecosystems.

4. CONCLUSION

Research findings and legal comparisons across many nations indicate that carbon emission reduction can be achieved using the Blue Carbon Ecosystem (EKB) idea. EKB is a strategy that enhances aquatic regions' ability to sequester carbon emissions more

effectively than terrestrial areas. EKB aims to mitigate carbon emissions and positively influences the nation's economy, benefiting coastal communities. Indonesia has established regulations about blue carbon in Presidential Regulation No. 98 of 2021 concerning the Economic Value of Carbon. Nevertheless, the existence of this law has not facilitated the deployment of blue carbon in Indonesia; the study's findings indicate that: 1). The notion of blue carbon in Indonesia presents a significant possibility for emission reduction and serves as a potential economic resource for the nation via the Carbon Economic Value scheme. Various countries have implemented blue carbon initiatives to reconcile environmental and economic factors, including the legislative framework, institutions, and community involvement. The governance of blue carbon in Indonesia has several deficiencies, including insufficient regulatory synchronization, overlapping jurisdictions, inadequate community involvement, and the lack of equal benefit distribution.

5. CONFLICTING INTEREST STATEMENT

The authors state that there is no conflict of interest in the publication of this article.

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