

DEVELOPMENT OF MANGROVE EXTENT ACCOUNTS IN THE PHILIPPINES

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Mangrove ecosystems play a critical role in coastal protection, carbon storage, biodiversity, climate resilience, and food security, yet their economic value remains underestimated in policy and planning. Recognizing these values, the Philippine Statistics Authority (PSA) has undertaken a new initiative to develop the Mangrove Accounts of the Philippines, a comprehensive natural capital account designed to quantify and demonstrate the ecological and economic value of mangrove forests. This work presents the development of mangrove extent accounting as part of the country's commitment to mainstream natural capital accounting as a foundation for evidence-based policy planning and conservation strategies.

Guided by international frameworks such as the System of Environmental-Economic Accounting Central Framework and Ecosystem Accounting (SEEA-CF and SEEA EA), this work contributes to tracking progress on three priority Sustainable Development Goals (SDG): SDG 6.6 (Protect and Restore Water-Related Ecosystems), SDG 14.2 (Protect and Restore Ecosystems), and SDG 15.1 (Conserve and Restore Terrestrial and Freshwater Ecosystems).

The mangrove extent accounts draw from methodology established by the PSA in collaboration with the United Nations Statistics Division and the National Mapping and Resource Information Authority in developing the 2020 Pilot Land Asset Accounts. To ensure alignment of the methodology within international standards, the compilation aligned Philippines' official land cover definitions with the International Union for Conservation of Nature (IUCN) Ecosystem Typology, following SEEA EA guidelines to estimate ecosystem extent data.

Preliminary results show that Philippine mangrove forests covered 311,216 hectares (ha) in 2020, representing 1.1 percent of the nation's total land area and an increase of 2.8 percent from 302,811 ha in 2015. This represents the first mangrove extent accounting in the Philippines and builds upon the 2020 Pilot Land Asset Accounts. The mangrove extent accounts integrate with the Philippine Ecosystem and Natural Capital Accounting System (PENCAS) and establish a foundation for future compilation of subsequent accounts on carbon stock and carbon sequestration, enabling support for long-term ecosystem monitoring and management.

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I. BACKGROUND

Among the many important natural resources in the Philippines, mangroves provide a wide range of ecosystem services closely linked to key government priorities of higher economic growth and climate change resilience, particularly provisioning (e.g., fishing, timber and non-timber products, and tourism) and shoreline and storm-surge protection services. Mangroves also play an important role in mitigating the impacts of weather-induced disasters.

Environmental-economic accounting has become an important tool for strengthening evidence-based policy and sustainable development planning in the Philippines. The institutional foundation for this work was strengthened with the enactment of the Philippine Ecosystem and Natural Capital Accounting System (PENCAS) Act on 22 May 2024, which institutionalizes ecosystem and natural capital accounting and provides a framework for integrating environmental information into policy and decision-making. Through PENCAS, the Philippines seeks to establish a systematic approach to compiling physical and natural capital accounts, generating natural capital statistics, valuing ecosystem services, and supporting the protection, conservation, and restoration of ecosystems. In addition, mangrove accounting plays a vital role in the Natural Capital Accounting (NCA) Roadmap in support of the Philippine Development Plan (PDP) 2023-2028.

The NCA, consistent with the System of Environmental-Economic Accounting (SEEA), provides a means of understanding the interrelationships between the economy and the natural resources and ecosystems that support economic activities and human well-being. By measuring changes in land, forests, water, and other ecosystems, environmental accounts can provide evidence on their contributions to production, livelihoods, resilience, and national wealth. This information complements conventional economic statistics by making the role and value of natural resources and ecosystem services more visible in planning, policy formulation, and resource management.

The development of the Mangrove Extent Accounts in the Philippines forms part of this broader effort to strengthen environmental-economic accounting. The accounts provide a structured basis for monitoring changes in mangrove extent and generating statistics that can support ecosystem management, conservation, and restoration efforts. More broadly, the development of such accounts contributes to a common evidence base that links environmental statistics with economic policy, climate action, sustainable development, and international commitments, including the Sustainable Development Goals and the Paris Agreement.

II. METHODOLOGICAL FRAMEWORK

The estimation of mangrove extent accounts is an important step in the development of other mangrove-related accounts, including mangrove carbon stock accounts and carbon sequestration accounts. The extent account aims to capture and describe changes in the country's mangrove areas over a defined reference period, providing information on the surface area of mangrove cover at the national level. In general, the mangrove extent accounts are derived from the analysis of land cover maps, which serve as the primary data source for measuring and monitoring spatial changes in mangrove ecosystems. For the Philippines, the mangrove extent accounts will involve extraction of spatial data using the Land Asset Accounts of the Philippines, published by the Philippine Statistics Authority (PSA) in 2024.

The land cover change matrix used two time periods of land cover maps, particularly the 2015 and 2020 land cover vector files, which were obtained from the National Mapping and Resource Information Authority (NAMRIA). Geometric errors, such as invalid polygons and inconsistencies, often arise during geoprocessing, digitizing, or data conversion and must be addressed to ensure data accuracy. Overlap and gap issues frequently occur during vector-to-raster conversion, leading to pixels with questionable or "NoData" values. Topological checking is conducted to identify and correct inconsistencies, ensuring each pixel represents only one land cover class. The PSA compiles datasets with identified errors and forwards them to NAMRIA for adjustments.

The process of generating the land cover change matrix begins by importing the adjusted land cover (LC) raster data for land cover change processing. The generated data of LC changes will be exported to an Excel worksheet template developed by the United Nations Statistics Division (UNSD), PSA, and NAMRIA. This worksheet template is used to identify improbable transitions, which flags improbable transitions at >100 hectares (ha). After readjusting the identified improbable transitions, the resulting data will be finalized.

Classifying mangrove ecosystems in the Philippines is constrained by the limited availability of geospatial data and local reference materials specific to mangrove areas, making consistent delineation from national datasets alone difficult. To address this constraint, the final step in accounting for mangrove extent involves reconciling the official land cover classifications of the Philippines—defined under Department of Environment and Natural Resources (DENR) Memorandum Circular 2005-05, or "Adopting Forestry Definitions Concerning Forest Cover/Land Use"—with the classifications used in the SEEA-Central Framework (SEEA-CF) and the International Union for Conservation of Nature (IUCN) Global Typology. This reconciliation ensures conceptual and definitional consistency of mangrove-related land cover categories across national and international accounting standards, thereby enabling comparability with ecosystem accounts compiled by other countries under the SEEA framework. A mangrove land cover class bridge table, shown in Table 1, was developed to operationalize this alignment.

Table 1. Mangrove Land Cover Class Bridge Table

IUCN Global Ecosystem Typology	SEEA-Central Framework Land Cover Class	DENR Memorandum Circular 2005-05
MFT 1.2 Intertidal Forests and Shrubland	Mangrove	Mangrove Forest

Land cover change data for mangroves from the land cover change matrix is translated into the SEEA EA table by identifying the ecosystem typology of mangroves based on the IUCN Global typology. The resulting land cover changes for mangroves in 2015 and 2020 are embedded into the opening and closing stocks, respectively. Additions and reductions in extent are recorded as increases and decreases in mangrove area resulting from transitions to and from different land cover classifications. Meanwhile, the net change in extent describes the gain or loss in area over the reference period.

III. RESULTS

Philippine Mangrove Extent 2015-2020

A significant increase in mangrove cover was observed between 2015 and 2020. In 2015, the Philippines had a mangrove extent of 302,811 ha. Specifically, a total of 35,222 ha additions to extent was recorded while 26,817 ha was recorded as reductions. A net change of 8,405 ha has resulted for the national mangrove extent in 2020 to reach 311,216 ha. In general, there was a 2.8% growth rate of mangrove extent recorded between 2015 and 2020. (Table 2)

Table 2. Mangrove Extent Accounts

Selected ecosystem types (based on Level 3 - EFG of the IUCN Global Ecosystem Typology)	
<i>Realm</i>	Marine-freshwater-terrestrial
<i>Biome</i>	MFT1 Brackish tidal
<i>Ecosystem Functional Group (EFG)</i>	Intertidal forests and shrublands
	MFT1.2
Opening Extent	302,811
<i>Additions to extent</i>	35,222
<i>Reduction in extent</i>	26,817
<i>Net change in extent</i>	8,405
Closing extent	311,216

in hectares (ha)

IV. CONCLUSION AND WAYS FORWARD

Mangrove ecosystems play a vital role in the Philippines as it offers various benefits like carbon storage, coastal protection, and support for biodiversity. Recognizing the importance of mangrove ecosystems, the preliminary estimation of the mangrove extent accounts of the Philippines is a step toward further developing the ecosystem accounting for mangroves, specifically in accounting for the mangrove carbon stock and mangrove carbon sequestration.

To add depth to the compilation of the mangrove accounts of the Philippines, disaggregating the additions and reductions in extent is important to give users a clearer picture of the factors driving these changes, rather than providing only the net figures. Moreover, the provision of data on several parameters used in accounting for the condition, regulating, and provisioning services offered by mangrove ecosystems is needed to develop the mangrove carbon stock and carbon sequestration accounts. Finally, the authors recognize the limitations of conducting this study, thus, efforts to advance the approach used in this study (such as updating the mangrove extent accounts to reflect the 2025 map data of the Philippines), are underway to keep pace with the increasing demand for natural capital accounting.