



Carbon Assessment of the Mekong Delta

Final Report

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Abbreviations

AFOLU	Agriculture, Forestry and Other Land Use
AOI	Area of interest
APD	Avoiding Planned Deforestation
ARR	Afforestation, Reforestation and Revegetation
BCX	Bursa Carbon Exchange
BSM	Benefit Sharing Mechanism
CCB	Community, Climate and Biodiversity
CIFOR	Centre for International Forestry Research
CIX	Climate Impact X
CO ₂ e	Carbon dioxide equivalent - the number of metric tons CO ₂ emissions with the same global warming potential as one metric ton of another GHG
FMB	Forest Management Board
GHG	Greenhouse gas
GNI	Gross National Income
GNP	Gross National Product
Ha	Hectare
HKEX	Hong Kong Exchange
MRV	Monitoring Reporting and Verification
NBS	Nature-based solution
NER	Net emission reduction
PPC	People's Provincial Committee
REDD+ MF	Reducing Emissions from Deforestation and Forest Degradation Methodology Framework
RWE	Restoring Wetland Ecosystems
SFC	State Forest Company
SWAMP	Sustainable Wetlands for Mitigation and Adaptation Program
Tg Corg	Terragrams of organic carbon
T	Tonne
UEL	Useful economic life
VCM	Voluntary Carbon Market
VCU	Verified Carbon Unit



Introduction

Further to the policy analysis outlined in Part 1 of the Draft Report, the following Part 2 reviews the applicability of a mangrove carbon project to Vietnam, with a focus on Ca Mau province, based on the region's socio-ecological characteristics.

Analysis will be provided regarding the most suitable methodologies for conducting carbon sequestration measurements based on ecological and commercial considerations. The report considers both the productive forest areas in Camimex mangrove sites, as well as the wider Ca Mau province.

Beyond the most suitable methodology, the report outlines the steps for conducting a detailed feasibility study in order to determine whether the ecological and commercial inputs exist on the ground. Only once this study is conducted will we be able to determine whether a carbon project is practically viable or not.

Depending on the results of that detailed feasibility study, a roadmap will be established related to the project registration and the commercialization of the carbon credits that will be generated by the proposed blue carbon project. A number of different carbon credit issuing bodies will also be further evaluated based on the list provided in this report.

2.1 Regional trends in mangrove blue carbon

South East Asia is considered a blue carbon hotspot with regional mangrove ecosystems estimated to support organic carbon sedimentary stock of 3095.19Tg Corg (of which 34.37Tg is located in Vietnam).¹ There is increasing interest and activity in blue carbon, with the mangrove area in SE Asia representing one third of the global total. Additionally, the benefits mangroves afford in coastal protection are important for regional adaptation to climate change.

¹ *Coastal and estuarine blue carbon stocks in the greater Southeast Asia region: Seagrasses and mangroves per nation and sum of total*, A.Thorhaug et al, Marine Pollution Bulletin, Volume 160, November 2020, 111168



Figure 1: Global distribution of mangroves (in black)²

The International Blue Carbon Institute, launched by Amazon and Conservation International in November 2022 at COP 27, will be based in Singapore to serve as a knowledge hub to build capacity, expertise and standards to develop and scale blue carbon projects.

The institute will work with governments across SE Asia and the Pacific to integrate the use of blue carbon into policies for mitigating climate change, and expand education for policymakers and communities on blue carbon projects. Sustainable Wetlands for Mitigation and Adaptation Program (SWAMP), led by CIFOR (Centre for International Forestry Research) are examining how mangrove forests may adapt to sea level rise in Indonesia and are monitoring over the long-term sedimentation, surface accretion, and subsidence processes in mangrove ecosystems.³

During 2022 there has been expansion in the carbon exchange sector in the SE Asia region. In July 2022, HKEX announced the Hong Kong International Carbon Market Council to develop Hong Kong as an international carbon market and a hub for Asia. Malaysia launched a voluntary carbon market Bursa Carbon Exchange (BCX) in December 2022.

Climate Impact X (CIX), a global exchange for quality voluntary carbon credits headquartered in Singapore, launched Project Marketplace in March 2022 to facilitate carbon credit trade, and in November 2022 completed an auction to sell 250,000 credits from the Delta Blue Carbon project in Pakistan at USD27.80/tonne⁴. The CIX media release described the auction as oversubscribed with global demand and buyers concentrated in Asia, Europe and the US, and 30% of the auction bid volume was priced at USD30 or more/tonne.⁵

² United Nations Environment World Conservation Monitoring Centre (UNEP-WCMC), 2011

³ The Blue Carbon Initiative

⁴ Reuters: *Carbon exchange CIX completes 250,000 tonne carbon credit auction*, 4 November 2022

⁵ CIX media release, *Climate Impact X and Respira's landmark auction for blue carbon credits oversubscribed with global demand*, November 2022. Note *OPIS Global Carbon Offsets Report*, November 2022 average price of blue carbon credits of USD28.



As outlined in the April 2022 S&P Report on Asia's carbon trading outlook⁶, there is evidence that demand for carbon credits in the region is increasing, with a growing support and market framework. The Asia Pacific voluntary carbon credit market is expected to grow with major trends including the increasing interest in voluntary carbon offsetting from companies in the region.⁷

2.2 Potential for mangrove carbon credit projects in the Mekong Delta

The Mekong Delta region (which consists of 12 provinces and the city of Can Tho in the south of Vietnam) plays a significant role in Vietnam's economic activity. A highly productive region with respect to agriculture and aquaculture, it is important for providing food security and for maintenance of export potential. It covers 12% of the country's territory and 19% of the population,⁸ and generates 50% rice paddy output, 95% rice exports, 65% aquatic products and 60% of fish exports. Furthermore, it is located within the trade corridor between Vietnam, ASEAN countries and those of the Mekong River basin.

From the 1990s shrimp aquaculture in Vietnam has increased with respect to cultivated area and shrimp production from 230,000 ha and 56,000 tonnes (1991) to 706,000 ha and 701,000 tonnes (2017). Shrimp aquaculture is the biggest source of export income in Vietnam⁹, and the country is considered the leading exporter of valued-added shrimp to the United States of America, Japan and the EU. The Mekong Delta accounts for 90% of the total shrimp farming area in Vietnam, contributing 75% to national production.¹⁰

The Mekong Delta's ecosystem undergoes serious degradation through frequent droughts, inundations, water salinization, and soil erosion. The Delta is low lying and therefore highly vulnerable to inundations caused with the sea-level rise, being a consequence of climate change. Given the serious problem of coastal erosion and the importance of protective forest areas in the Ca Mau Cape area of the Mekong Delta, with the rate of erosion in some subsections of the East coast reaching 25–37 m/year (2016-2020)¹¹; consideration of a blue carbon project needs to be within the context of a larger scale region-wide initiative that encompasses coastal protection, with priority given to preventing degradation of protected forests. Anthropogenic deforestation in protected areas has not been identified as significant.

⁶ S&P Global Commodity Insights, *Asia's ramp up in carbon trading will drive commoditization of carbon: experts*, 31 March 22, *The rise of Asia's carbon trading hubs*, 6 April 2022

⁷ According to 6Wresearch, the Asia Pacific Voluntary Carbon Credit market is expected to grow at a CAGR of 47.87% during 2021-2027. India and China account for 31.8% of total active voluntary offsets projects, while Thailand and Vietnam account for 2.72% of total active voluntary offsets projects.

⁸ 10 March 2022, *2021-2013 Master Plan for Mekong Delta*, Vietnam Plus Mega Story

⁹ *A closer look into shrimp yields and mangrove coverage ratio in integrated mangrove-shrimp farming systems in Ca Mau, Vietnam*, Le Dinh et al 2021

¹⁰ *A Sustainable Energy Model for Shrimp Farms in the Mekong Delta*, 2018 Nguyen et al

¹¹ *Coastal erosion trend analysis using a combination of remote sensing and hydrodynamic models: Case study of Ca Mau Cape, Mekong Delta*, March 2022



To date carbon sequestration has not been widely recognised as an option by local communities. While local authorities and forest management boards in Ca Mau (representing the lowest level of local government for mangrove protection and management in Vietnam) are all aware of mangrove blue carbon, other stakeholders, including companies and households, have limited understanding of the concept. The feasibility of implementing payment for mangrove carbon services was analysed in Ca Mau Province in a 2022 report.

The results show that stakeholders are generally aware of climate change issues. Although they understand the importance of mangroves in generating environmental values, awareness of mangrove carbon sequestration is limited. This may lead to challenges for the future implementation of such projects in this region and, therefore, education training programs will be a requirement¹².

Conversion of existing mangrove ecosystems

Mangrove forest area in Vietnam had decreased from 400,000 ha in 1943 to 270,000 ha by 2015.¹³ There was widespread destruction of mangroves during the Vietnam War and subsequent planting efforts during the 70s and 90s. More than 80% of the total mangrove forest area in Vietnam is in the south, either in the Mekong Delta or in the Can Gio Estuary.

Vietnamese mangroves are composed of 92 species (true mangroves and mangrove associates), unevenly distributed along the Vietnam coastline depending on temperature, rainfall, salinity, tidal flooding regime, and wave exposure.¹⁴

A study of the distribution and drivers of deforestation from 1995 to 2019 identified that, spatially, mangrove extent decreased in southern regions, but increased in northern and central regions. Aquaculture and agriculture expansion were the major drivers, accounting for 43.4% and 24.8% of total Vietnam mangrove loss, respectively.

In northern and central regions, infrastructure development was also identified as an additional driver of mangrove deforestation, while in the southern regions, erosion was identified as an increasing threat to mangroves.¹⁵

A CIFOR report published in 2022 reviewed the change in mangrove area between 2016-2020, and identified both gains and losses within Ca Mau Province (Table 1).

¹² *Examining local community understanding of mangrove carbon mitigation: A case study from Ca Mau province, Mekong River Delta, Vietnam*, Hai Nguyen et.al 2022

¹³ *Carbon stocks and fluxes in tropical mangrove (Southern Vietnam)*, Truong Van Vinh, 2018 (PhD Thesis)

¹⁴ *Carbon stocks and fluxes in tropical mangrove (Southern Vietnam)*, Truong Van Vinh, 2018 (PhD Thesis)

¹⁵ *Distribution and drivers of Vietnam mangrove deforestation from 1995 to 2019*, Tinh et al, 2022

Table 1: Change in mangrove area from 2016 to 2020 by district within Ca Mau Province

District	Mangrove area 2016 (ha)	% of land area in 2016	Mangrove area in 2020 (ha)	% of land area in 2020	Change in area (ha) from 2016 to 2020	% change in mangrove area from 2016 to 2020
Dam Doi	5,505.5	6.7	5,115.3	6.3	-390.2	-7.1
Nam Can	11,844.8	24.9	12,215.9	25.7	371.1	3.1
Ngoc Hien	32,039.2	45.9	34,092.9	48.8	2,053.7	6.4
Phu Tan	2,930.4	6.7	3,058.9	7.0	128.6	4.4
Tran Van Thoi	1,136.1	1.6	881.8	1.3	-254.3	-22.4
U Minh District	467.9	0.6	378.3	0.5	-89.7	-19.2
Total	53,923.8	13.8	55,743.1	14.3	1,819.3	3.4

Source: *Opportunities and challenges for mangrove restoration in the Mekong Delta: Status, policies and stakeholder outlook, 2022, CIFOR*

Consultations with provincial stakeholders revealed the main reasons for mangrove forest cover gain in Ngoc Hien and Nam Can were international and national mangrove restoration projects and payments for mangrove environmental services in these areas.¹⁶ Losses were in part attributed to various inconsistent sectoral policies with major impacts on mangroves (water, infrastructure, agriculture and economic development) and a large part due to rapid and persistent erosion on the eastern coast of the Mekong Delta.

Although there was a net increase across the entire Ca Mau province, there were a number of districts which experienced a net loss, notably in Tran Van Thoi, U Minh and Dam Doi. In those districts, there could be a case made for developing a long-term forest carbon project.

¹⁶ *Opportunities and challenges for mangrove restoration in the Mekong Delta: Status, policies and stakeholder outlook, CIFOR 2022*



The 2022 CIFOR report quotes a provincial regulation in Ca Mau which changed the required minimum area of tree cover in mangrove-shrimp farming systems to:

- 70% for pond areas > 5 hectares,
- 60% for pond areas 3-5 hectares, and
- 50% for pond areas < 3 hectares,

This has contributed to increases in mangrove area in the province. Note that in discussion with Huynh Le Dinh, this regulation is old and has not been followed, nor is it actively monitored, and the 70% requirement is unconfirmed.

A 2021 CIFOR report found that in Vietnam priority is given to planting new mangroves over providing incentives for conserving existing mangrove forests. Conservation is particularly a challenge when major drivers of mangrove deforestation and degradation are closely linked to national economic development priorities. The report proposed a stronger political will from the government to balance economic development and mangrove conservation, as well as participatory decision-making processes where the private sector and local communities are incentivised to engage in mangrove protection.¹⁷

From a blue carbon perspective, conservation is particularly important to preserve carbon stocks. Conversion of mangrove ecosystems to aquaculture ponds results in the release of accumulated carbon stock. Potential emissions from such conversion were found to be among the largest measured carbon emissions in the tropics.¹⁸

In northeastern Brazil conversion of mangroves to shrimp ponds resulted in losses of 58%–82% of ecosystem carbon stocks, with mean potential emissions of 1,390 Mg CO₂e/ha. Carbon losses from soils accounted for 81% of the total emission. Soil carbon losses from shrimp pond conversion are equivalent to approximately 182 years of soil carbon accumulation.¹⁹

¹⁷ *A decade of mangrove conservation achievements and challenges in Vietnam*, CIFOR 2021

¹⁸ *Carbon stocks of intact mangroves and carbon emissions arising from their conversion in the Dominican Republic*, Kauffman et al, 2014

¹⁹ *Shrimp ponds lead to massive loss of soil carbon and greenhouse gas emissions in northeastern Brazilian mangroves*, Ecology and Evolution, Kauffman et al, 2018



Figure 2: Cut mangroves - image taken during Blue Forest site visit to Ca Mau, November 2022

The Ca Mau region is ecologically conducive to natural mangrove growth, however, remains at continued risk of degradation from both natural and anthropogenic causes. Given its great socio-economic importance, additional restoration and protection through leveraging blue carbon finance would be beneficial.

According to the CIFOR report, mangrove management was more effective in areas with international projects. By comparison, PFES is relatively small, and thus does not usually provide a major incentive for mangrove protection and growth. However, as part of the subsequent Feasibility Study phase, PFES should be examined as a potential option.

2.3 Current VCM accounting methodologies for mangroves

Voluntary carbon credits to be sold on the voluntary carbon markets must be verified by an independent third party and adhere to existing standards. Global best practice carbon accounting standards include Verra, Gold Standard, American Carbon Registry (ACR), Climate Action Reserve (CAR), and Plan Vivo. ACR is applicable to tidal saltmarsh ecosystems, CAR applies to wetland forest, not mangroves specifically, with all registered projects based in the US and Mexico, and the GS mangroves methodology is still in development. The methodologies applicable to blue carbon derived from mangrove ecosystems are detailed in Table 2.