

Konservasi  
Alam Nusantara  
Untuk Indonesia Lestari



## Indonesia NCS Science

# Unlocking the Potential of Mangrove Ecosystem for Climate Change Mitigation: A Case Study in Tabalar Muara, Berau, East Kalimantan

## OVERVIEW OF INDONESIA'S MANGROVE:

Indonesia is home to an estimated 20% of the world's mangroves, the largest in the world. This ecosystem is highly productive, despite the limited areas occupied by mangroves compared to dryland forests. Mangrove is a vital link between terrestrial and oceanic ecosystems which provides crucial services to humanity, including food provisioning, fisheries support, sediment regulation, and protection against storm surges and sea-level rise. Moreover, mangroves are carbon-rich ecosystems, that warrant protection and restoration as they capture and preserve high soil carbon densities per unit area relative to other ecosystems. Thus, they play a pivotal role in climate regulation. However, in recent years, vast areas of mangroves have been converted primarily to aquacultures, leading to mangrove deforestation and degradation. This conversion is associated with significant greenhouse gas (GHG) emissions, threatening global efforts to tackle climate change. This loss will erode coastal resilience and push the existing mangrove toward collapse. Thus, understanding ecosystem carbon stocks and GHG emissions from various land cover changes in the mangrove ecosystem is crucial as a piece of science-based information to strengthen the climate change mitigation policy.



# Importance of Mangroves in the Context of Achieving Indonesia's Climate Commitment

Indonesia has NCS mitigation potential of 1.3 GtCO<sub>2</sub>e yr<sup>-1</sup> (Novita et al., 2022), which is equivalent to about 6% of global NCS mitigation potential (Griscom et al., 2017) and 10% of NCS mitigation potential across the tropics (Griscom et al., 2020). About 3% of this potential comes from mangroves which can help carbon emission gaps to achieve the target of the Paris Climate Agreement of limiting global warming to below 2°C above the pre-industrial level. Our result showed that mangrove conversion and restoration could result in a mitigation potential equivalent to 8% of Indonesia's NDC target from the forestry sector.



[Figure 1] Settlements in Tabalar Muara Village

## Threats to Mangroves

Indonesian mangroves comprise about 2.6% of the forested area of Indonesia, and they remain vulnerable to deforestation and degradation. The net deforestation of mangroves in Indonesia is 1.3 times greater than that reported for all Southeast Asian mangroves (Richard and Fries, 2016), accounting for 10% of total GHG emissions from the forestry sector.

Mangrove forests are sensitive to the risk of climate change impacts because their intertidal location exposes them to sea level fluctuation, climatic oscillation, and tropical storm activity due to climate

change impacts. Human impacts have increased the vulnerability of mangroves to climate change. The principal cause of mangrove degradation in Indonesia is the construction of aquaculture due to the increased demand of aquacultural products.

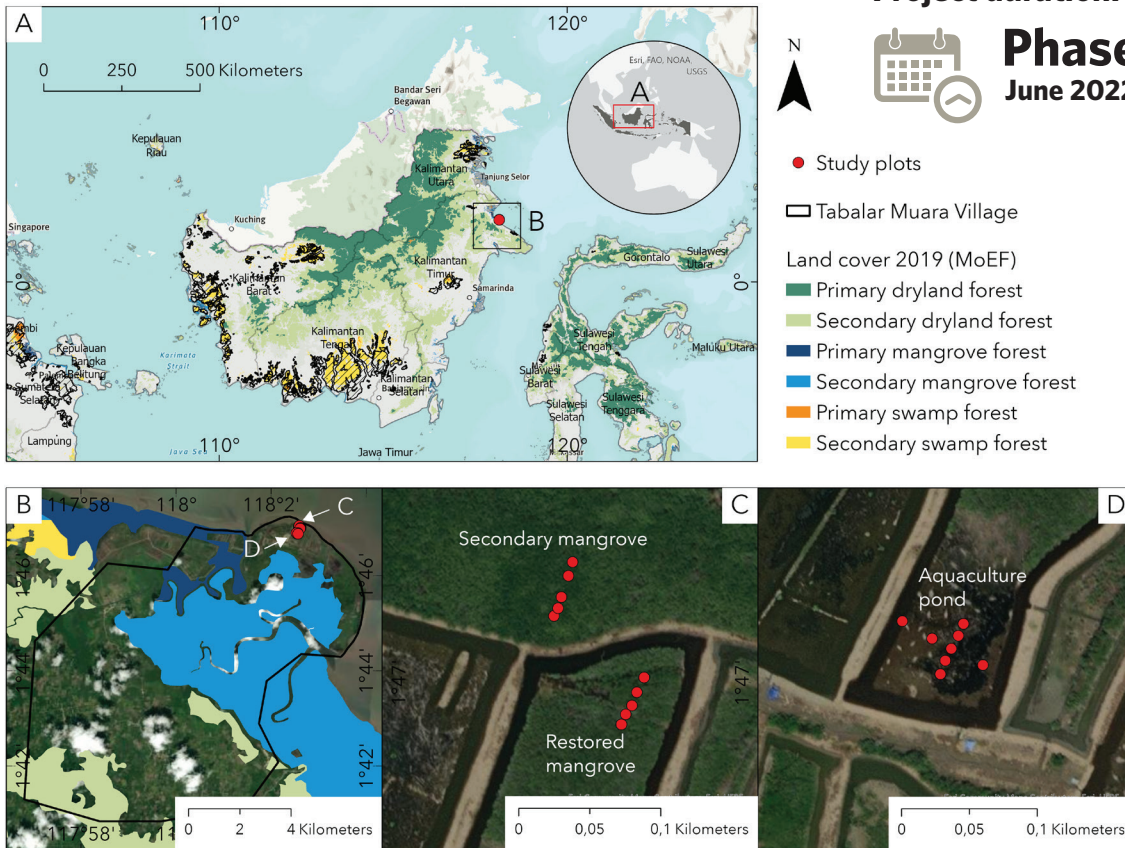
East Kalimantan has one of the largest shares of Indonesian mangroves, with a total area of about 157,802 ha. Within the past decade (2009-2019), ~13% of mangroves in East Kalimantan have been converted into other land uses. Aquacultures are the most prominent threats to mangroves deforestation and degradation, causing large carbon emissions that contribute to global climate change. Based on satellite imagery analysis in 2019, ~22% of the mangroves in East Kalimantan remains relatively intact (35,418 ha of primary mangrove forest). About half of these primary mangrove forest areas (16,263 ha) can be found in Berau. The rate of mangrove conversion in Berau is smaller than the average of East Kalimantan, with ~5% of the mangroves area converted into other land uses from 2009-2019. Nevertheless, mangroves in Berau face similar threats with aquaculture being the major driver for mangroves conversion.



[Figure 2] Mangrove conversion to aquacultures

# Project location: Tabalar Muara Village, Berau, East Kalimantan

**Project duration:**  
 **Phase 1**  
 June 2022 - Sept 2023



[figure 3] Project Location in Tabalar Muara

## Mangroves Elevating Impact Project in East Kalimantan

East Kalimantan is an area of focus for the Mangrove Elevating Impact project, due to its mangrove coverage, mitigation potential, and high vulnerability to climate change. We believe that protecting the remaining mangrove forests is the first step to increasing mangrove resilience to climate change. Yet, prioritizing mangrove conservation implementation may conflict with socioeconomic issues. Currently, restoration is attracting huge interest from various stakeholders, including the Government of Indonesia, where they have set an ambitious mangrove restoration target by 2024 (600,000 ha). One key parameter to understanding the impacts of land use conversion and restoration in mangroves on climate change ecosystems is a reliable measurement of carbon stocks ecosystem and GHG

emissions. Such information is crucial for managing mangrove ecosystems and guiding policy and action for the blue carbon initiative domain. In this regard, Yayasan Konservasi Alam Nusantara, is developing a study to investigate carbon stocks assessment and GHG fluxes from various land cover types (mangrove forests, restored mangrove and aquaculture practices) within the mangrove ecosystem in Tabalar Muara Village, Berau, East Kalimantan. We evaluate how deforestation or reforestation in coastal mangroves affects GHG emissions. The findings are expected to provide a quantitative estimate of higher Tier national GHG inventories and refine regional estimates of GHG emissions in mangrove ecosystems due to conversion or restoration strategy.





[Figure 4] GHG fluxes measurement in Tabalar Muara mangroves ecosystem

“Measuring GHG emissions from various land use management in the ecosystem is crucial to understand the impacts of mangrove conversion or restoration for climate change mitigation.”

**Nisa Novita**

Forest Carbon and Climate Senior Manager, YKAN

“Mangrove ecosystem in Tabalar Muara provides tremendous environmental benefits for the community, including but not limited to supporting fisheries and aquaculture practices, protecting the areas from coastal erosion and storm surges, and being the habitat for numerous wildlife.”

**Rukmana Paysal**

Local resident in Tabalar Muara



**About YKAN**

Yayasan Konservasi Alam Nusantara (YKAN) is a science-based organization which was established in Indonesia in 2014. With the mission to protect lands and waters on which all life depends, YKAN provides innovative solutions for realizing harmony between people and nature, through effective management, non-confrontational approaches, and building collaborative partnerships with all stakeholders for a sustainable Indonesia.

**Team members:**

Adi Gangga, Adibtya Asyhari, Chandra Agung Septiadi Putra, Nisa Novita, Rasis Putra Ritonga

**Contact:**

nisa.novita@ykan.or.id

**Office:**

Graha Iskandarsyah, 3<sup>rd</sup> Floor,  
 Jl. Iskandarsyah Raya No. 66C  
 Jakarta Selatan, 12160, Indonesia