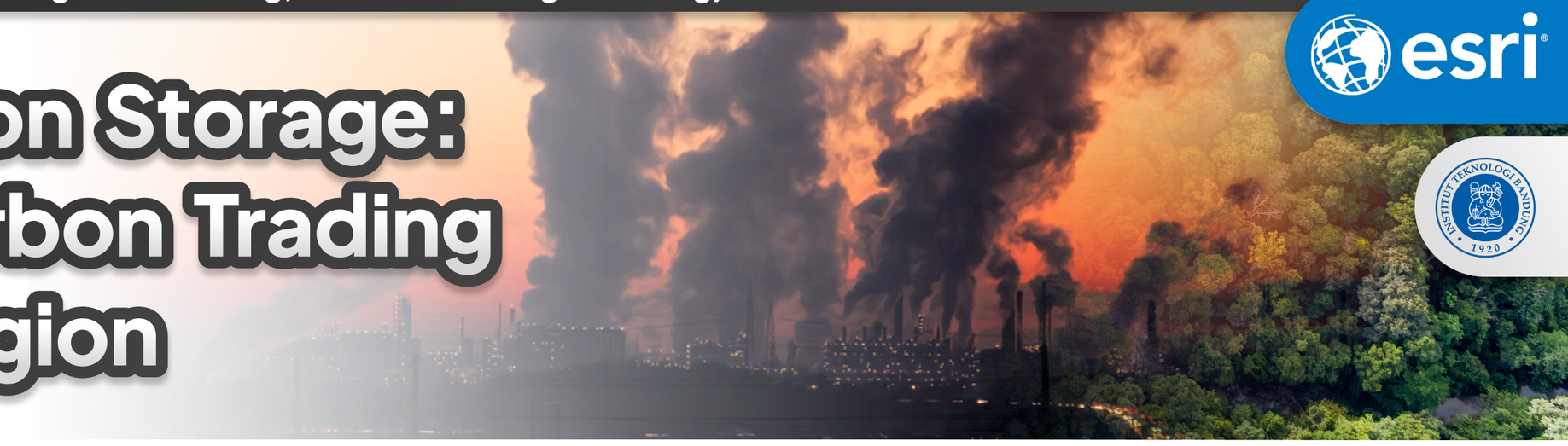
Mohammad Anas Ardiansyah (Urban and Regional Planning, Institut Teknologi Bandung)

Valuing Carbon Storage: A Path to Carbon Trading in Rebana Region



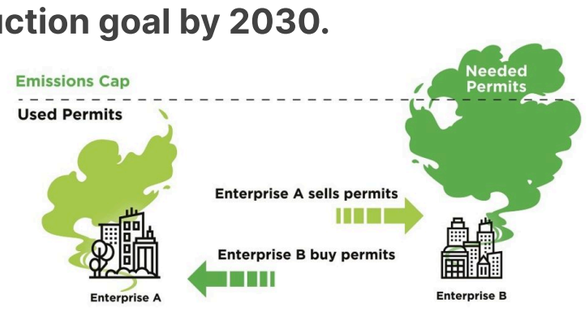
"Did you know that certain land cover classes can act as economic assets by storing carbon and generating value in carbon markets?" Through **spatial analysis (GIS),** we can strategically optimize carbon-rich areas to unlock **many financial benefits** while advancing **climate change mitigation efforts.**

1 Background

In 2022, Indonesia's GHG emissions reached **1.24 gigatons of CO_2,** driven by fossil fuel combustion and accounting for **2.3% of global emissions.** Under the **Paris Agreement,** Indonesia aims to limit global warming to **below 2°C,** but with the 2024 global average exceeding **1.5°C,** the country commits to reducing emissions by **29%** with domestically and **41%** with international support by 2030. Carbon trading, a **key economic** and **environmental tool,** generates up to **IDR 50 trillion** in **non-tax state revenue** and incentivize **low-emission technologies** through the **"Cap and Trade"** mechanism. It supports **SDGs 8, 13,** and **15** by creating green jobs, reducing emissions, and valuing forests as carbon sinks. All regulated by the **OJK** under **Law No 17/2004, Law No 16/2016,** and **Presidential Regulation No 98/2021.**

2 Literature

This study focuses on **Carbon Trading, Carbon Storage, Land Cover,** and **the Rebana Region. Carbon trading** is market-based mechanism under the Kyoto Protocol and Paris Agreement, carbon trading reduces emissions by trading **carbon credits** to support Indonesia's **29–41% emission reduction goal by 2030.**

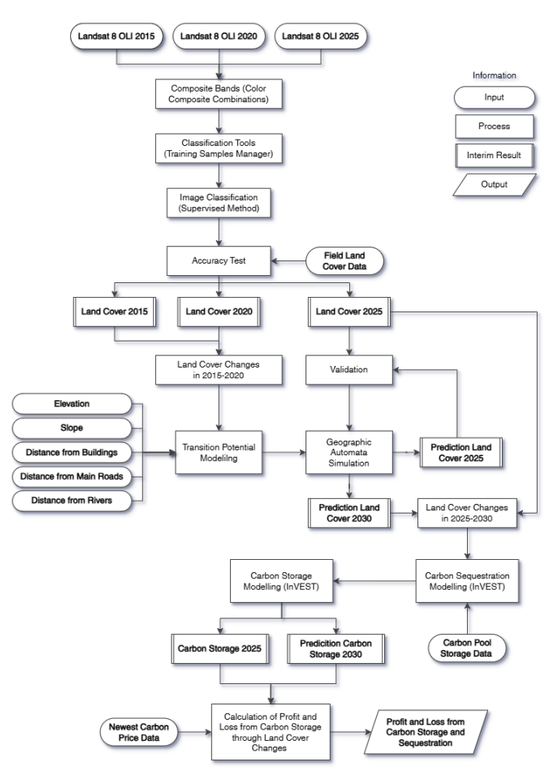


Carbon storage is capturing and storing CO_2 process in natural reservoirs like **forests** and **soils,** essential for climate regulation. Land cover includes **vegetated** (trees, crops) and **non-vegetated areas** (built-up, water), with changes like **deforestation** directly impacting carbon storage. Rebana region is a **priority metropolitan area** in West Java, consists Cirebon City, Sumedang, Indramayu Kuningan, Cirebon, Subang, and Majalengka. Rebana is a **carbon-rich zone.**

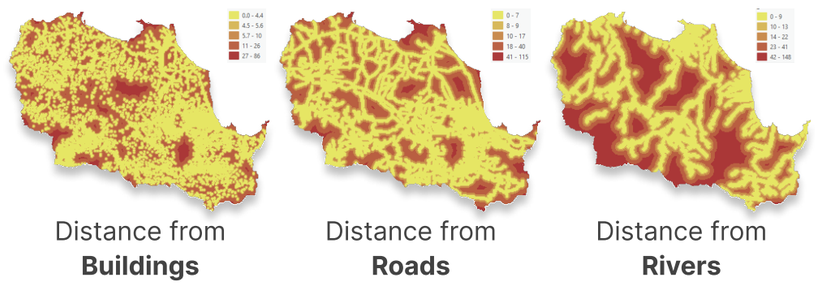
Rebana Region

3 Analysis

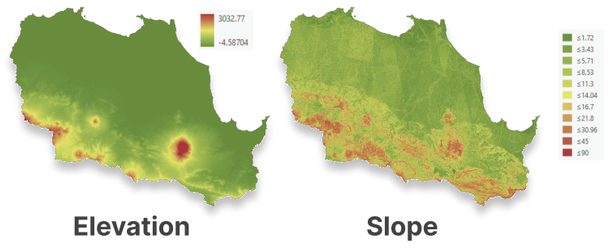
This is **Overall Analysis Flowchart** in study.



The analysis identifies **elevation, slope, and proximity to roads, rivers, and built areas** as key drivers of land cover change, with low-elevation and gentle slopes more prone to development, while remote and steep areas remain preserved.

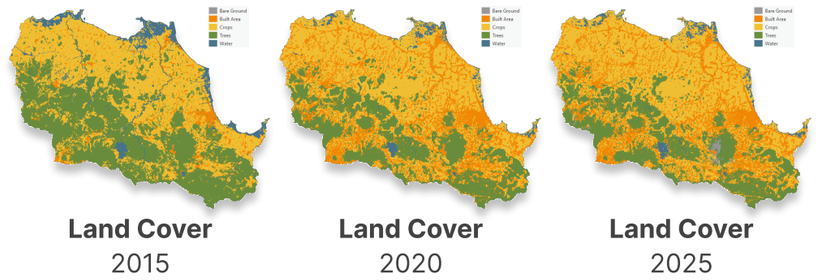


Distance from **Buildings** | Distance from **Roads** | Distance from **Rivers**



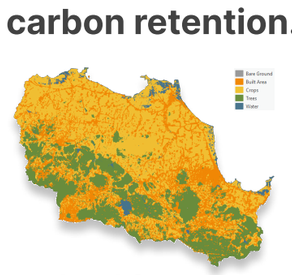
Elevation | **Slope**

Using **Landsat 8 imagery (2015–2025)**, the study reveals significant **urban expansion** and **deforestation,** with vegetated areas (trees, crops) converting to non-vegetated areas (built-up, bare ground), impacting **carbon storage** and **environmental quality.**

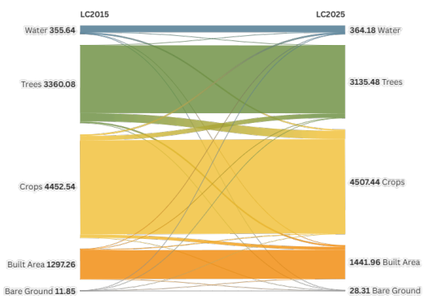


Land Cover 2015 | **Land Cover** 2020 | **Land Cover** 2025

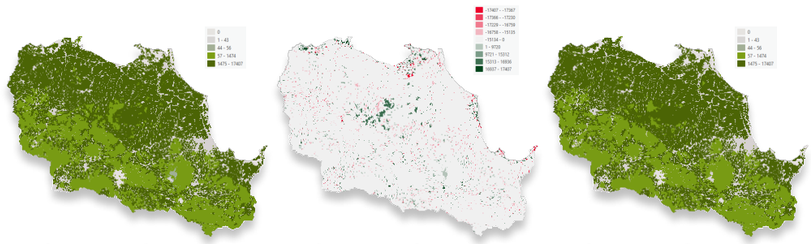
Land cover future scenarios (2030) predict continued **urban sprawl** and **deforestation,** with trees declining from 35% to **32%** and built areas increasing to **17%**, highlighting the need for **control zoning laws,** and **green infrastructure** to balance **development** and **carbon retention.**



Land Cover 2030 (Prediction)



Using **InVEST modeling,** the study quantifies carbon stocks, identifying crops as the largest carbon pool **(859.63 tons/ha),** but their conversion to built areas reduces sequestration, leading to a **IDR 122.7 billion** decline in carbon economic value by 2030.



Carbon Storage 2025 | **Carbon Storage Change** 2025-2030 | **Carbon Storage** 2030

4 Result

The Rebana Region can generate **IDR 39 trillion (USD 2.6 billion)** from carbon trading, but **IDR 122.7 billion decline** by 2030 is projected due to **deforestation** and **urban sprawl.** Crops are the largest carbon pool **(859.63 tons/ha),** but their conversion to built areas signals vulnerability. **Carbon pricing** and policies like **Presidential Regulation No 98/2021** are critical for balancing **economic growth** with **carbon retention,** ensuring a **low-carbon future.**

5 Recommendations

Poor coordination and limited understanding hinder implementation, requiring interdisciplinary collaboration and carbon literacy to simplify systems and encourage participation. **Lack of enforcement allows practices like greenwashing to persist,** necessitating stricter penalties and decentralized authority to align carbon trading with land use plans.

Unplanned urban growth destroys green spaces and threatens carbon sinks, calling for transit-oriented development (TOD) and land consolidation to balance development with carbon retention.

Check the StoryMaps!