Prediction of future sea-level rise in land suitability for mangrove rehabilitation and restoration in Indonesia

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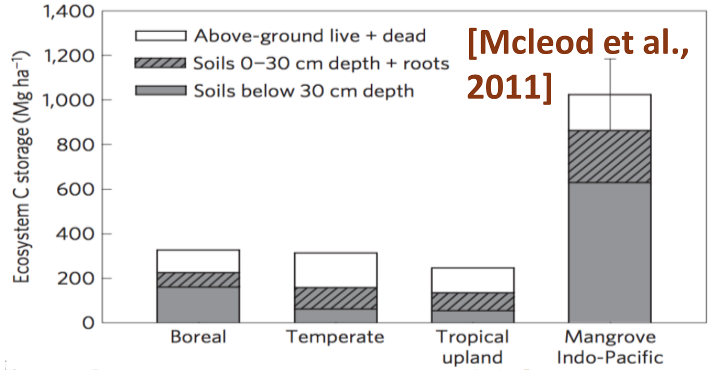
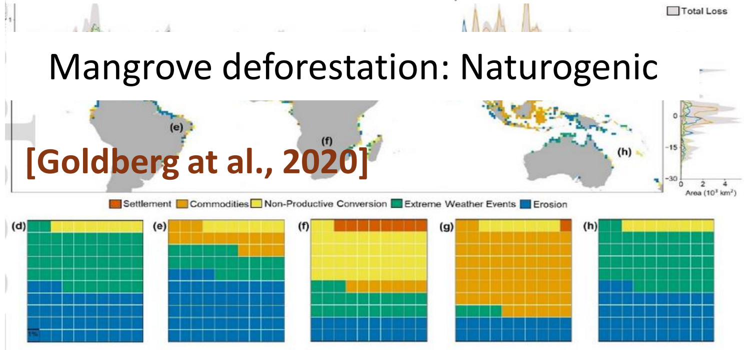
1. Introduction

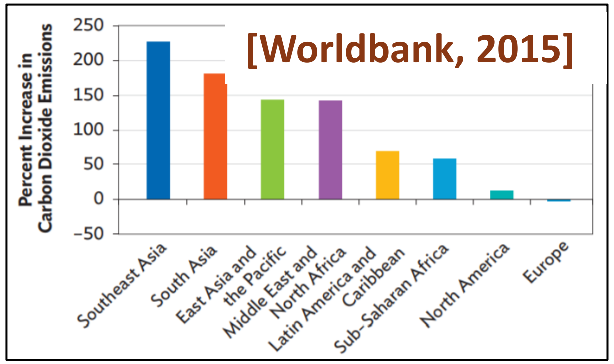
- Mangroves have many benefits, one of which is that they have **coastal blue carbon up to five times** greater than the total carbon storage of temperate, boreal and tropical forests (Mcleod et al., 2011).
- Although mangroves cover only about 0.7% of global tropical forests, they **store carbon equivalent to 2.5 times global carbon dioxide emissions** (Donato et al., 2011).
- However, the mangrove area has **decreased by 20-35%** of the total area between 1980 and 2015 (Richard and Friess, 2016; Sanderman et al., 2018) due to deforestation, thus contributing to **emissions of 3-19%** and causing **damage economy of $US 6–42 billion annually** (Pendleton et al., 2012).

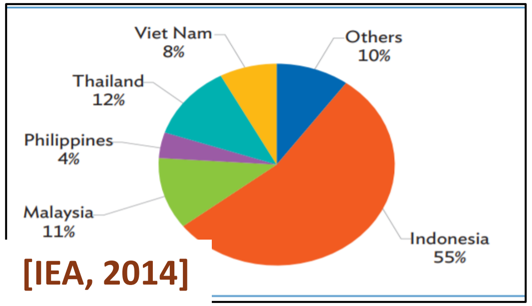
- **Indonesia** experienced **the highest increase in carbon dioxide emissions** from 1990 -to 2010 (Worldbank, 2015).
- One of the causes of naturogenic mangrove deforestation is due to **sea level rise as** a result of climate change (Gilman et al., 2008).
- To overcome the decreasing mangrove area, it is necessary to do **rehabilitation and restoration** (Andradi-brown et al., 2013).
- However, when rehabilitating mangroves, **10% - 20% of seedlings die** due to unsuitable between the sea level and the mangrove species planted (Primavera and Esteban, 2008).

A study is needed to examine the impact of sea level rise on mangrove planting sites.



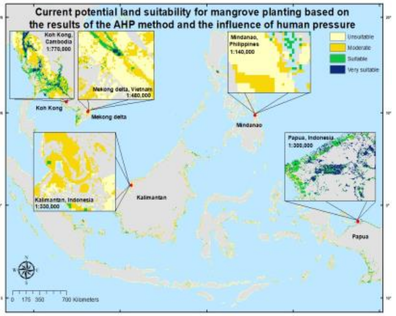




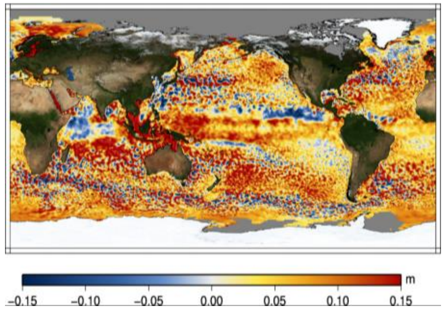


2.1. Data

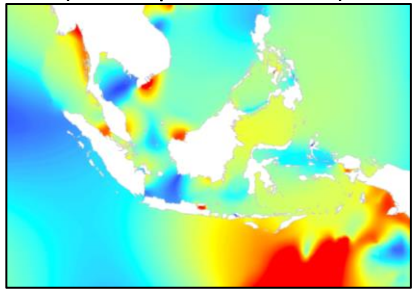
Mangrove land suitability model (Syahid et al., 2020)



Sea-level from satellite altimetry 1993-2020 (AVISO+)

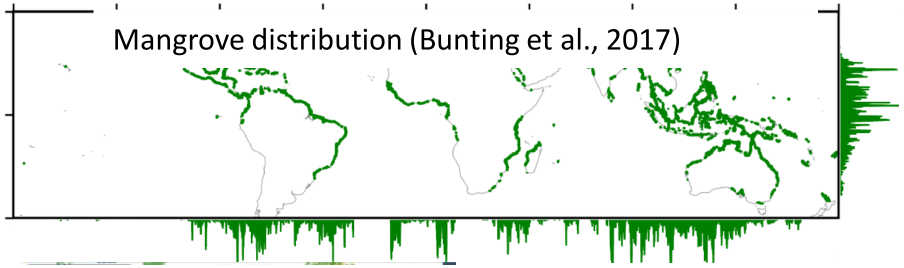


In-situ sea-level 2019 (Windupranata, 2020)

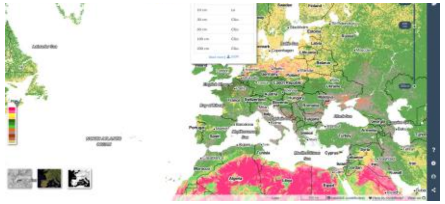


In-situ sea-level 1993-2020 (PSMSL)

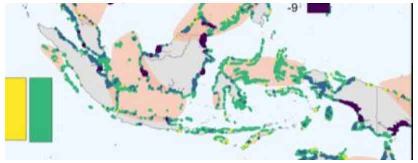
Mangrove distribution (Bunting et al., 2017)



Soil texture (Hengl et al., 2018)

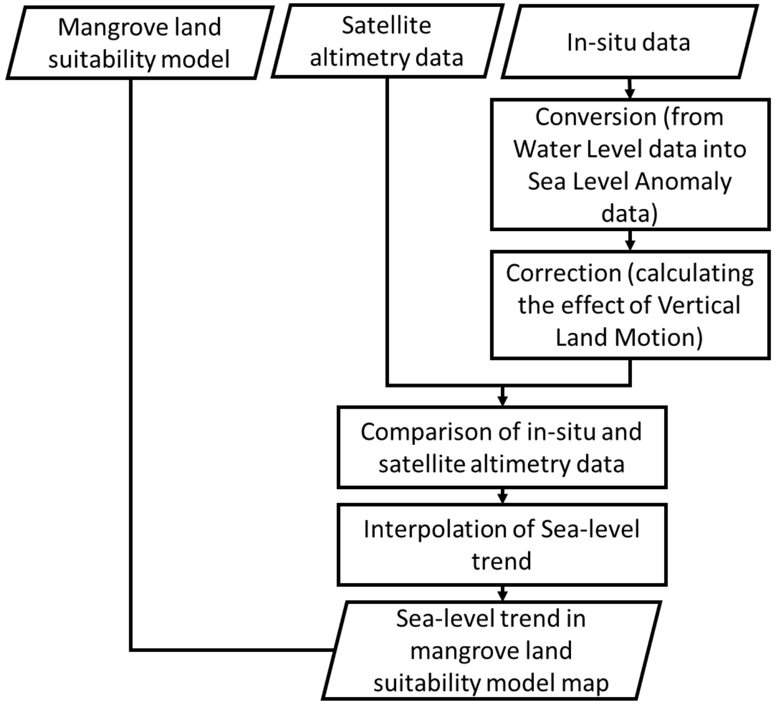


Biophysical typology (Worthington et al., 2020)

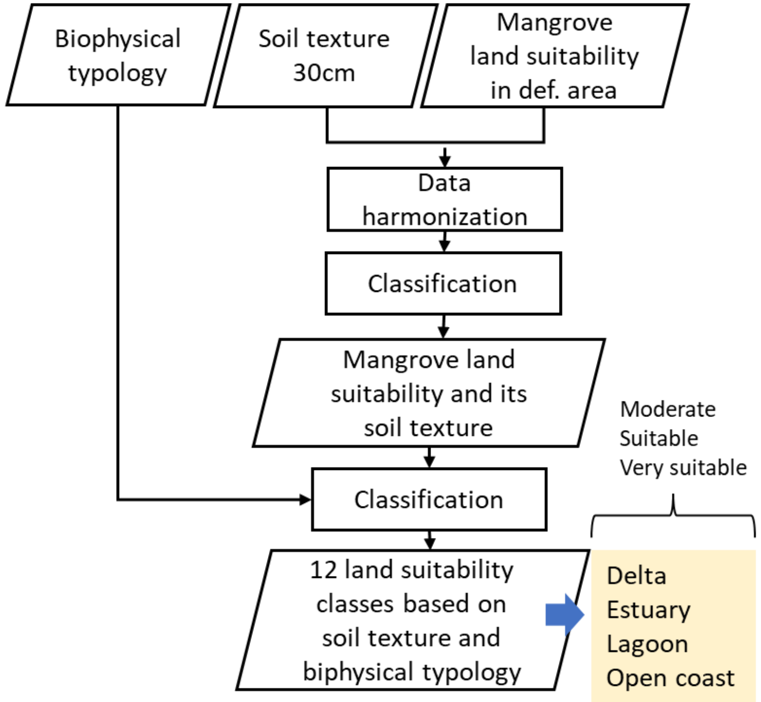


2.2. Methodology

Flow chart: Sea-level in land suitability model for mangrove restoration

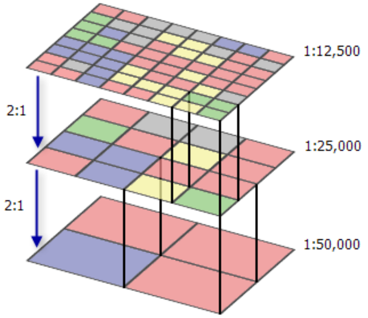


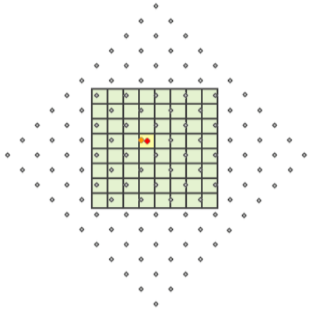
Flow chart: Geomorphological type in land suitability model for mangrove restoration



Resampling

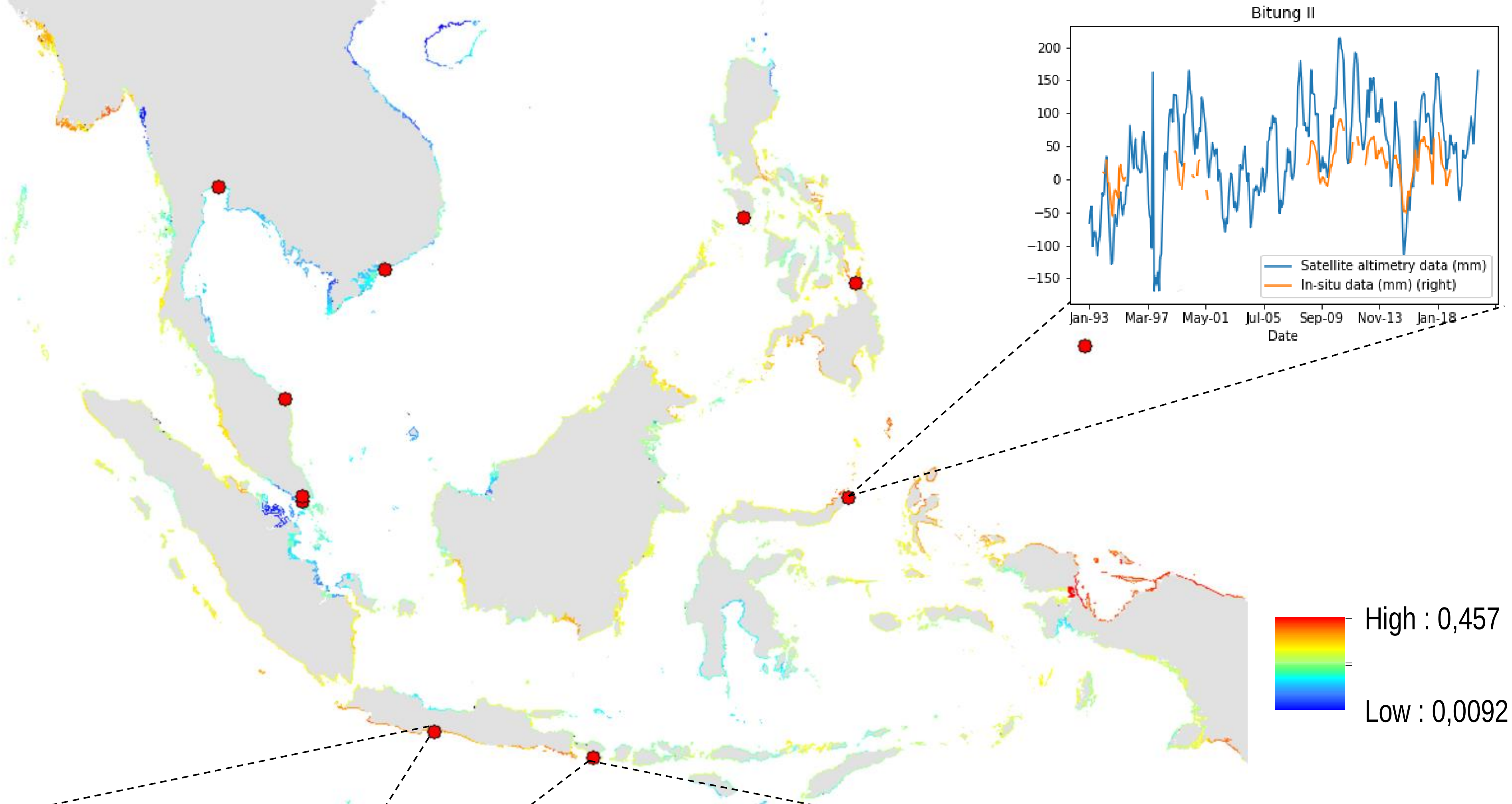
Resample the dataset to 250 m using the nearest-neighbor method.

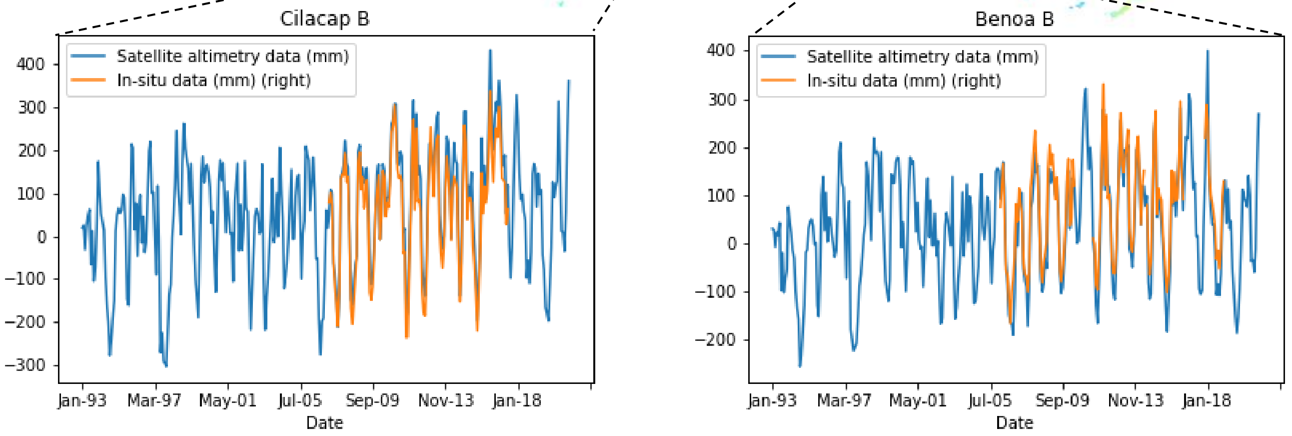




3.1. Result: Sea-level in land suitability model for mangrove restoration

This trend shows that both datasets are significantly correlated with the same pattern.

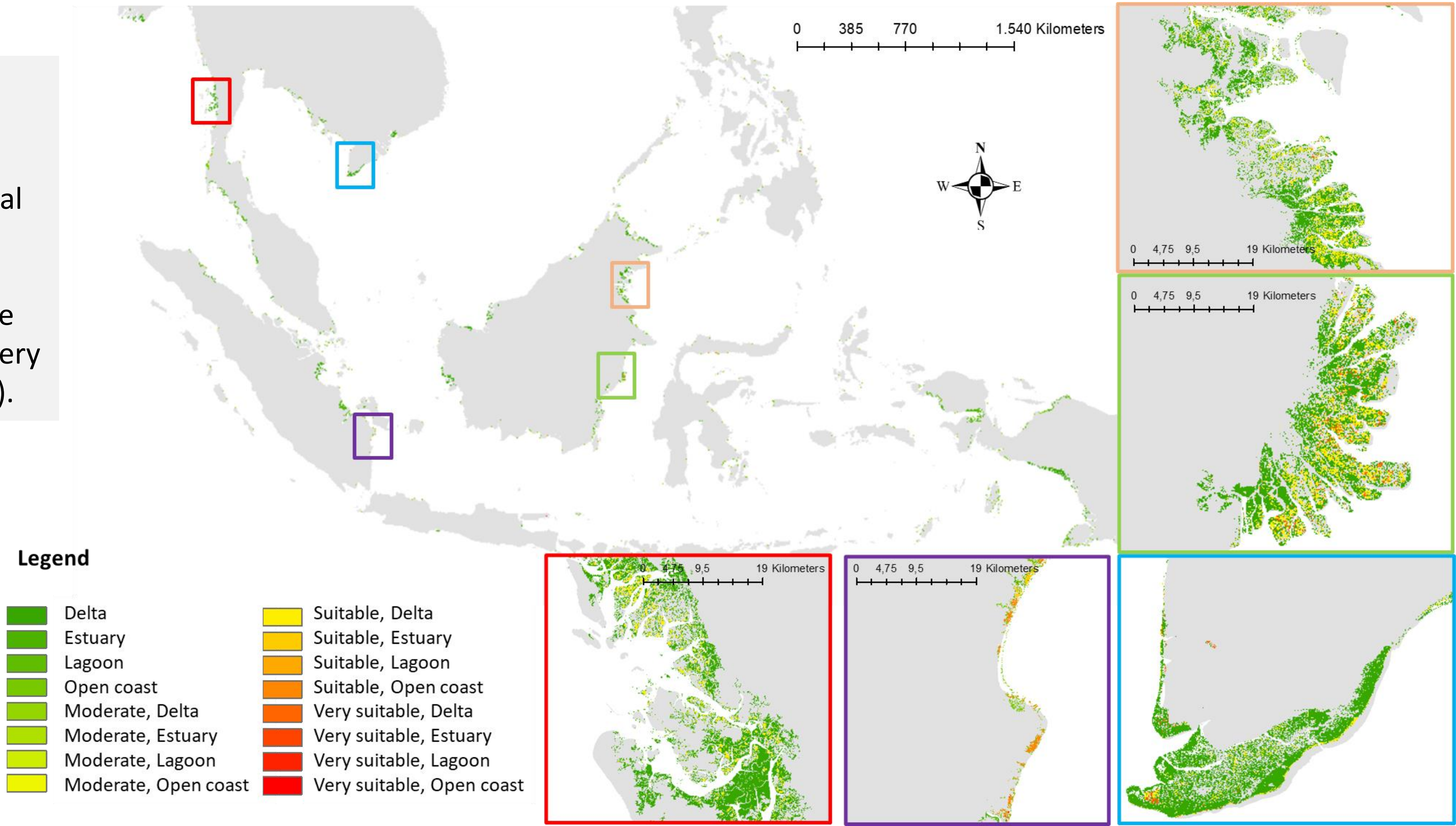




Cilacap B station experienced 314.7 mm sea level rise, while Benoa B and Bitung II stations showed 251.3 mm and 279.2 mm respectively for sea-level rise.

3.2. Result: Geomorphological type in land suitability model for mangrove restoration

The majority of geomorphological types are delta (57.31% of the total area), both in moderate class (8,969 ha), suitable (68,138 ha), and very suitable (7,513 ha).



3.3. Result: in progress

Geomorphological type in land suitability model for mangrove restoration

Sea-level in land suitability model for mangrove restoration

Sea-level change based on geomorphological type

Future sea level rise (RCP26, RCP45, RCP85)

Sea-level change based on geomorphological type (present, RCP26, RCP45, RCP85)

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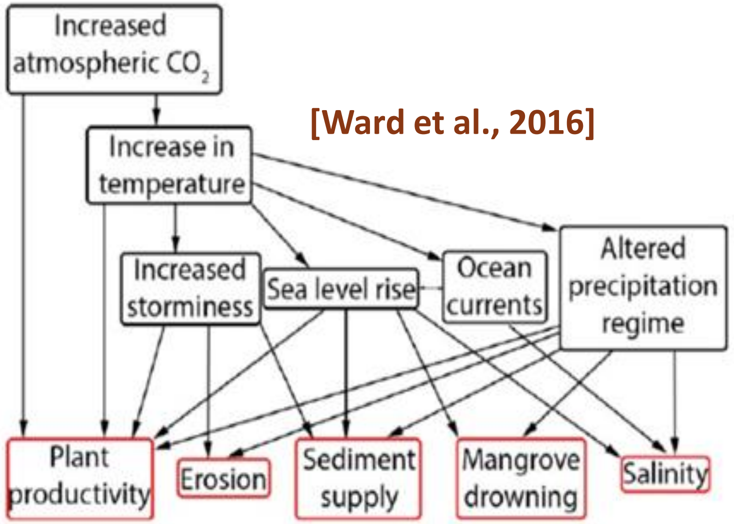
Based on those parameters



[Ward et al., 2016]

Thank you