

## Remote Sensing-Based Assessment of Carbon Density in Ampara District: Integrating Sentinel-2 Imagery

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### Abstract

This study assesses the functionality of Sentinel-2 satellite facts to estimate aboveground carbon density (AGCD) in the Ampara district of Sri Lanka, which is known as a biodiversity hotspot vital for climate resilience. The look at advanced a linear regression version using Google Earth Engine, incorporating Sentinel-2 surface reflectance imagery from 2020 to 2021 alongside the World Conservation Monitoring Centre (WCMC) international carbon dataset. Key predictors comprised spectral bands, NDVI, and masks for dynamic world land cover to delineate vegetated areas. The model showed a strong relationship ( $r = 0.89$ ) between the predicted and actual carbon densities (tonnes/ha), described by the equation: Predicted Carbon Density =  $1.325 \times \text{Carbon tonnes per /ha} - 28.774$ . Systematic errors were observed in low-carbon zones, resulting in implausible negative estimates. Validation with more than 400 sample points showed a lot of differences in space: the measured AGCD went from 0.07 to 123.6 tonnes/ha, while the predictions went from -14.9 to 99.9 tonnes/ha. In dense forests, the measurements were close to each other, but differences in farming and damaged areas showed that adjustments are needed for varied landscapes. An RMSE of  $\pm 18.2$  tonnes/ha showed it was suitable for regional monitoring, but also pointed out challenges in dealing with detailed ecological details. The study indicates Sentinel-2 demonstrates capability in conducting inexpensive assessments of tropical ecosystem carbon stocks, which enables policymakers to implement sustainable management tools at different scales. Future initiatives must incorporate precise biomass measurement techniques like LiDAR for enhancing accuracy estimates for complex terrain features to support diverse species regions in climate change initiatives.

**Keywords:** carbon sequestration, Aboveground Carbon Density (AGCD), Sentinel-2, NDVI, climate mitigation