

Estimating Mangrove Above-Ground Biomass Loss Due to Deforestation in Malaysian Northern Borneo between 2000 and 2015 Using SRTM and Landsat Images

ABSTRACT

Mangrove forests are highly productive ecosystems and play an important role in the global carbon cycle. We used Shuttle Radar Topography Mission (SRTM) elevation data to estimate mangrove above-ground biomass (AGB) in Sabah, Malaysian northern Borneo. We developed a tree-level approach to deal with the substantial temporal discrepancy between the SRTM data and the mangrove's field measurements. We predicted the annual growth of diameter at breast height and adjusted the field measurements to the SRTM data acquisition year to estimate the field AGB. A canopy height model (CHM) was derived by correcting the SRTM data with ground elevation. Regression analyses between the estimated AGB and SRTM CHM produced an estimation model ($R^2 : 0.61$) with a root mean square error (RMSE) of 8.24 Mg ha^{-1} (RMSE%: 5.47). We then quantified the mangrove forest loss based on supervised classification of multitemporal Landsat images. More than 25,000 ha of mangrove forest had disappeared between 2000 and 2015. This has resulted in a significant decrease of about 3.96 million Mg of mangrove AGB in Sabah during the study period. As SRTM elevation data has a near-global coverage, this approach can be used to map the historical AGB of mangroves, especially in Southeast Asia, to promote mangrove carbon stock conservation.