Estimation of Aboveground Biomass at a High Spatial Resolution Using an Extensive Data Record of Satellite Derived Metrics: A Case Study with California

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Extensive studies are presently underway in estimating aboveground biomass over large regions across the globe at a moderate to coarse spatial resolution using remote sensing derived metrics and field inventory data, however, very few studies are present that demonstrate the ability of estimating biomass values at a high spatial resolution without utilizing field based inventory data. This is mainly due to processing incapability's, unavailability of requisite ancillary data at the same resolution and absence of robust algorithms that can be generalized across different regions of the globe. To this end, this research aims to bring together a platform for initially acquiring all necessary available data and further devising an algorithm than can be effectively used in computing biomass over large regions and with minimum uncertainty. In this study, we map the aboveground biomass for the state of California using functional relationships between Geoscience Laser Altimeter System (GLAS) derived height metrics (maximum height and Lorey's height) and Landsat derived Leaf Area Index for different forest cover types as delineated by the National Land Cover Database (NLCD) 2006 land cover map. Additional, the National Elevation Data (NED) data are utilized to screen for elevation and slope effects. The simple model based on extensive filtering of input data estimates aboveground biomass values that are comparable to the Forest Inventory and Analysis (FIA) estimates of biomass density and total biomass, both in terms of plot data and county to sub-ecoregion level aggregated data. We also undertake the exercise in preparing a framework for comparing biomass values obtained from different processing chains such as the Woodshole Research Group, United States Forest Service, NASA JPL to name a few. Intercomparison of our map with existing biomass data sets shows comparable results with FIA data and with the least bias and error attributed to our map. This is a promising result in terms of generalizing the algorithm for national-to global scale biomass estimates, where field level data is not a prerequisite for a model.