Developing Allometric Equations for More Accurate Aboveground Biomass and Carbon Estimation in Secondary Evergreen Forests, Thailand

Authors : Titinan Pothong, Prasit Wangpakapattanawong, Stephen Elliott

Abstract : Shifting cultivation is an indigenous agricultural practice among upland people and has long been one of the major land-use systems in Southeast Asia. As a result, fallows and secondary forests have come to cover a large part of the region. However, they are increasingly being replaced by monocultures, such as corn cultivation. This is believed to be a main driver of deforestation and forest degradation, and one of the reasons behind the recurring winter smog crisis in Thailand and around Southeast Asia. Accurate biomass estimation of trees is important to quantify valuable carbon stocks and changes to these stocks in case of land use change. However, presently, Thailand lacks proper tools and optimal equations to quantify its carbon stocks, especially for secondary evergreen forests, including fallow areas after shifting cultivation and smaller trees with a diameter at breast height (DBH) of less than 5 cm. Developing new allometric equations to estimate biomass is urgently needed to accurately estimate and manage carbon storage in tropical secondary forests. This study established new equations using a destructive method at three study sites: approximately 50-year-old secondary forest, 4-year-old fallow, and 7-year-old fallow. Tree biomass was collected by harvesting 136 individual trees (including coppiced trees) from 23 species, with a DBH ranging from 1 to 31 cm. Oven-dried samples were sent for carbon analysis. Wood density was calculated from disk samples and samples collected with an increment borer from 79 species, including 35 species currently missing from the Global Wood Densities database. Several models were developed, showing that aboveground biomass (AGB) was strongly related to DBH, height (H), and wood density (WD). Including WD in the model was found to improve the accuracy of the AGB estimation. This study provides insights for reforestation management, and can be used to prepare baseline data for Thailand's carbon stocks for the REDD+ and other carbon trading schemes. These may provide monetary incentives to stop illegal logging and deforestation for monoculture.