



Mangrove biomass estimation using canopy height and wood density in the South East and East Asian regions

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ABSTRACT

Mangroves aboveground biomass (AGB) estimation at a large scale is a crucial to understand their role in mitigating climate change. The large-scale estimation of AGB is generally conducted with remote sensing techniques using stand characteristics such as canopy height and species composition. In the present study, we employed Lorey's mean canopy height (H_m) and basal area weighted mean wood density (ρ_m) to develop models for estimating AGB of mangroves in Asian regions such as Indonesia, Philippines and Japan, considering its application toward large-scale AGB estimation covering different climatic zones of subtropical zone in the Eastern Asia and tropical zone in the Southeastern Asia. The best power function model for AGB estimation with H_m as a single explanatory variable was selected based on AIC ranks. The H_m – AGB relationship model varied significantly among study sites. We successfully developed common allometric model to estimate AGB for closed-canopy mangroves in the Asian regions. The common allometric model of the H_m – AGB relationship tended to show underestimation for old growth mangroves having $AGB > ca. 400 \text{ Mg ha}^{-1}$. The common allometric model showed a similar trend with a previously developed model for mangroves in Bangladesh. On the other hand, the common allometric model for mangroves showed distinct difference from the model for terrestrial tropical forests, i.e. the range of H_m was narrower in mangroves than in terrestrial tropical forests, and AGB was quite higher in mangroves than in terrestrial tropical forests at a same range of H_m . The difference of AGB specific to H_m was explained by higher ρ_m and cumulative basal area (BA) in mangroves than that in terrestrial tropical forests. In particular, mangrove showed quite high BA in a comparison with terrestrial tropical forests. This study confirmed that developing mangrove specific biomass model is important since mangroves showed its unique characteristics through comparisons with terrestrial tropical forests, and limitations of the use of H_m as a single variable. It should be noted that old growth mangrove AGB is underestimated with the developed common allometric models. For old growth mangroves, carbon stock should be fairly evaluated with more accurate models otherwise their contribution to blue carbon would be overlooked, which could lead insufficient efforts for conservation of old growth mangroves. Further accurate models for estimating mangrove AGB at large scale are urgently required.

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