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# 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 (*ABG*) 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 ($\rho_m$) 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 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 $\rho_m$ 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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