

Improved allometric models to estimate the aboveground biomass of tropical trees

Terrestrial carbon stock mapping is important for the successful implementation of climate change mitigation policies. Its accuracy depends on the availability of reliable allometric models to infer oven-dry aboveground biomass of trees from census data. The degree of uncertainty associated with previously published pantropical aboveground biomass allometries is large.

We analysed a global database of directly harvested trees at 58 sites, spanning a wide range of climatic conditions and vegetation types (4004 trees ≥ 5 cm trunk diameter). When trunk diameter, total tree height, and wood specific gravity were included in the aboveground biomass model as covariates, a single model was found to hold across tropical vegetation types, with no detectable effect of region or environmental factors. The mean percent bias and variance of this model was only slightly higher than that of locally fitted models. Wood specific gravity was an important predictor of aboveground biomass, especially when including a much broader range of vegetation types than in previous studies. The generic tree diameter-height relationship depended linearly on a bioclimatic stress

variable E , which compounds indices of temperature variability, precipitation variability, and drought intensity. For cases in which total tree height is unavailable for aboveground biomass estimation, a pantropical model incorporating wood density, trunk diameter, and the variable E outperformed previously published models without height. However, to minimize bias, the development of locally derived diameter-height relationships is advised whenever possible. Both new allometric models should contribute to improve the accuracy of biomass assessment protocols in tropical vegetation types, and to advancing our understanding of architectural and evolutionary constraints on woody plant development.

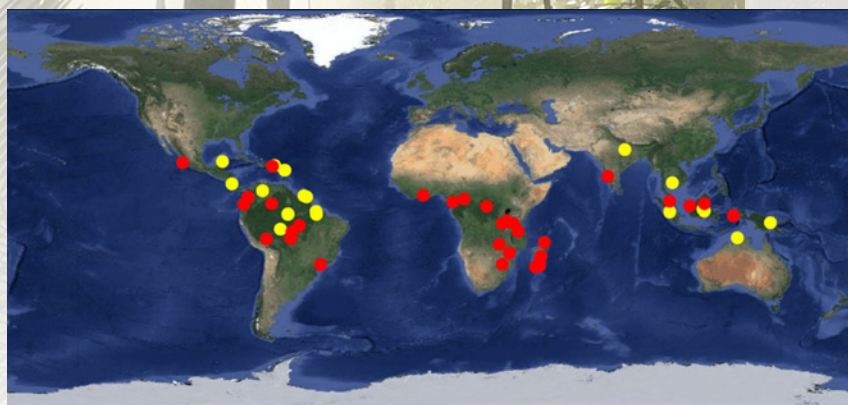


Fig.: Geographical locations of the study sites. Yellow circles indicate 20 studies included in Chave et al. (2005); red circles indicate 38 sites added to the present study.