# Carbon stocks in tropical forests: disentangling the response of forest structural components to environmental drivers across spatial scales

T5.33 Temporal, spatial and big data - Challenges for modelling climate change impacts on forest tree and stand growth

**Pauline Depoortere**[1] , *David Bauman*[2], *Adeline Fayolle*[1], *Jean-François Bastin*[1]

[1] TERRA Teaching and Research Centre, Gembloux Agro Bio-Tech, Université de Liège

[2] French National Research Institute for Sustainable Development (IRD)

**Abstract**

The critical role of tropical forests in the global carbon cycle is well-known. Yet, there remain uncertainties regarding the spatial distribution of forest aboveground carbon stocks (AGC) substantially limiting our potential to develop relevant conservation and restoration strategies for these ecosystems. In particular, the lack of convincing relationships between forest AGC and its environmental drivers represents an unstated and major source of uncertainty. In this study, we hypothesize that this lack of consensus results from the omission of a key concept in forest ecology: the AGC of a forest community is not a single entity but the product of distinct forest structural components (e.g. basal area, mean quadratic diameter, stem density and wood density weighted by basal area) each responding differently, and sometimes antagonistically, to environmental drivers (e.g. climate, soil properties and topography). Gathering forest inventories from 606 plots across three tropical regions (i.e. South America, Asia and Africa), we studied the influence of environmental drivers on several forest structural components and AGC, using linear regressions and controlling for spatial autocorrelation in model residuals. In addition, we tested the influence of the climate data sources by testing the sensitivity of the results to different climate datasets (e.g.WorldClim, ERA5, CHIRPS and TRMM). Preliminary results unveil significant and strong relationships between environmental drivers and each forest structural component (with an average RMSE of 18%), whereas no or weak environmental influence was identified on AGC (with an average RMSE of 34%). It confirms the hypothesis that the link between environmental drivers and forest AGC is indirect through specific and antagonistic relationships between environment and each forest structural component. Interestingly, we identified a strong influence (with an average RMSE of 8,2%) of soil properties (i.e. clay content and pH) and topography (i.e. elevation and slope) on the wood density weighted by basal area. These results highlight the necessity to study the drivers of forest structural components across tropical regions to understand the spatial distribution of tropical forest AGC. This research provides key insights for future studies on forest AGC drivers as well as conservation-restauration strategies.