



Comparison of carbon and biomass estimation methods for European forests

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National and international reporting systems as well as research, enterprises and political stakeholders require information on carbon stocks of forests. Terrestrial assessment systems like forest inventory data in combination with carbon calculation methods are often used for this purpose. To assess the effect of the calculation method used, a comparative analysis was done using the carbon calculation methods from 13 European countries and the research plots from ICP Forests (International Co-operative Programme on Assessment and Monitoring of Air Pollution Effects on Forests). These methods are applied for five European tree species (*Fagus sylvatica* L., *Quercus robur* L., *Betula pendula* Roth, *Picea abies* (L.) Karst. and *Pinus sylvestris* L.) using a standardized theoretical tree dataset to avoid biases due to data collection and sample design. The carbon calculation methods use allometric biomass and volume functions, carbon and biomass expansion factors or a combination thereof. The results of the analysis show a high variation in the results for total tree carbon as well as for carbon in the single tree compartments. The same pattern is found when comparing the respective volume estimates. This is consistent for all five tree species and the variation remains when the results are grouped according to the European forest regions. Possible explanations are differences in the sample material used for the biomass models, the model variables or differences in the definition of tree compartments. The analysed carbon calculation methods have a strong effect on the results both for single trees and forest stands. To avoid misinterpretation the calculation method has to be chosen carefully along with quality checks and the calculation method needs consideration especially in comparative studies to avoid biased and misleading conclusions.