



A comparison of European forest sector carbon budgets - strengths and weaknesses of alternative methodological approaches

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Several methods exist to quantify terrestrial carbon sources and sinks. Forest inventory based carbon budgeting, eddy flux measurements (EC), biogeochemical modelling, remote sensing (RS), and atmospheric inversion methods each have specific strengths and weaknesses. As part of the concerted action CarboEurope GHG, forest carbon sink assessments based on different approaches have been reviewed at the European level, including experiences also from the regional and national levels.

When comparing carbon sink estimates resulting from different methods, one should take into account the differences in reference time periods between methods. Also differences in the geographic reference areas and in the separation between land use classes complicate a direct quantitative comparison of the results. More useful is a comparison in qualitative terms: Forest inventory based budgets are reliable, they can be compiled with rather low and to large extend quantifiable uncertainty; flux measurements are the only integrated assessments including forest vegetation and soils and can be used to calibrate the other approaches; RS and combined RS-modelling approaches are particularly strong in monitoring the inter-annual variability of carbon fluxes; terrestrial ecosystem models are evolving as the best tools for estimating and projecting spatially explicit inventories. Inverse modeling offers an independent integrated assessment across all land use sectors, but separation of forests is not possible without many uncertain assumptions.

A lot of research has been directed recently towards consolidated carbon budgets derived from inventory data. Particularly the conversion from measured volume estimates to carbon has improved and assessments of uncertainties were made. New results from RS and EC studies progressed our understanding of the variability in

time and space (e.g. management and age class effects). An intelligent combination of strengths of different approaches could further improve European carbon budget estimates.