

GC33F-03 Carbon account of forest ecosystems as a fuzzy system: a case study for Northern Eurasia

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We consider practicality of a *verified* account of Net Ecosystem Carbon Budget for forest ecosystems (FCA) that supposes reliable assessment of uncertainties, i.e. understanding “uncertainty of uncertainties”. The FCA is a fuzzy (underspecified) system, of which membership function is inherently stochastic. Thus, any individually used method of FCA is not able to estimate structural uncertainties and usually reported “within method” uncertainties are inevitably partial. Attempting at estimation of “full uncertainties” of the studied system we follow the requirements of applied systems analysis integrating the major methods of terrestrial ecosystems carbon account, assessing the uncertainties “within method” for intermediate and final indicators of FCA with their following mutual constrains. Landscape-ecosystem approach (LEA) 1) serves for strict systems designing the account, 2) contains all relevant spatially distributed empirical and semi-empirical data and models, and 3) is presented in form of an Integrated Land Information System (ILIS). By-pixel parametrization of forest cover is provided by utilizing multi-sensor remote sensing data (12 RS products used) within GEO-wiki platform and other relevant information based on special optimization algorithms. Major carbon fluxes within the LEA (NPP, HR, disturbances etc.) are estimated based on fusion of empirical data with process-based elements by sets of regionally distributed models. Uncertainties within LEA are assessed for each module and at each step of the account. “Within method” results and uncertainties (including LEA, process-based models, eddy covariance, and inverse modelling) are harmonized based on the Bayesian approach. The above methodology have been applied to carbon account of Russian forests for 2000-2010; uncertainties of the FCA for individual years were estimated in limits of 25%. We discussed strengths and weaknesses of the approach, system requirements to different methods of FCA, information and research needs, obtained and potential levels of uncertainties.