Geophysical Research Abstracts
Vol. 12, EGU2010-11046, 2010
EGU General Assembly 2010

Productivity of Northern Eurasian forests: Analysis of uncertainties

Anatoly Shvidenko (1), Dmitry Schepaschenko (1,2), and Ian McCallum (1)

(1) International Institute for Applied Systems Analysis, Laxenburg, A-2361 Austria (shvidenk@iiasa.ac.at), (2) Moscow State Forest University, Mytischi-5, 141005, Moscow reg., Russia

Indicators of biological productivity of forests (live and dead biomass, net primary production, net and gross growth) are crucial for both assessment of the impacts of terrestrial ecosystems on major biogeochemical cycles and practice of sustainable forest management. However, different information and the diversity of methods used in the assessments of forests productivity cause substantial variation in reported estimates. The paper contains a systems analysis of the existing methods, their uncertainties, and a description of available information. With respect to Northern Eurasian forests, the major reasons for uncertainties could be categorized as following: (1) significant biases that are inherent in a number of important sources of available information (e.g., forest inventory data, results of measurements of some indicators *in situ*); (2) inadequacy and oversimplification of models of different types (empirical aggregations, process-based models); (3) lack of data for some regions; and (4) upscaling procedure of "point" observations.

Based on as comprehensive as possible adherence to the principles of systems analysis, we made an attempt to provide a reanalysis of indicators of forests productivity of Russia aiming at obtaining the results for which uncertainties could be estimated in a reliable and transparent way. Within a landscape-ecosystem approach it has required (1) development of an expert system for refinement of initial data including elimination of recognized biases; (2) delineation of ecological regions based on gradients of major indicators of productivity; (3) transition to multidimensional models (e.g., for calculation of spatially distributed biomass expansion factors); (4) use of process-based elements in empirical models; and (5) development of some approaches which presumably do not have recognized biases. However, taking into account the fuzzy character of the problem, the above approach (as well as any other individually used method) is not able to recognize structural uncertainties. In order to assess those, a special statistical procedure for harmonizing the multiple constraints of the estimates obtained by independent methods (landscape-ecosystem approach; flux measurements; process-based vegetation models; inverse modeling) was used to estimate uncertainty of the final results. Application of the above methodology resulted in a reliable assessment of major indicators of productivity. For instance, live biomass at the country's level is estimated with uncertainty of 4-6%, net primary production – 7-10% (confidential interval 0.9). It was recognized the tendency of increasing productivity of Russian forests during the last four decades at level of $0.5\pm0.2\%$ year^{-1}. However, all the above procedures includes expert estimates and judgements, and some problems still require additional considerations (e.g., elimination of biases of remote sensing data; assessment of uncertainties of process-based models; formal procedures of multiple constraints of the results were obtained by different methods).