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Impacts of climatic changes on carbon and water balance components of boreal forest ecosystems in central part of European Russia

A. Olchev (1), E. Novenko (2), O. Desherevskaya (3), and J. Kurbatova (1)

(1) A.N. Severtsov Institute of Ecology and Evolution of RAS, Moscow, Russian Federation (aoltche@gmail.com), (2) Institute of Geography of RAS, Moscow, Russian Federation, (3) Faculty of Geography, M.V. Lomonosov Moscow State University, Moscow, Russian Federation

Within the framework of the study the possible impacts of climatic changes on carbon and water balances of boreal forest ecosystems of the central part of European Russia for period up to 2100 was estimated using results of model simulations and field measurements. The boreal forests of the Central Forest State Natural Biosphere Reserve (CFSNBR) were selected for the study. They are located at the southern boundary of south taiga zone in the European part of Russia (Tver region) and it can be expected that they will be very sensitive to modern climate warming.

Expected future pattern of climatic parameters in the study area was derived using the global climatic model ECHAM5 (MPI Hamburg, Germany) and climatic scenarios B1, A1B and A2 (IPCC 2007). The possible scenarios of species composition changes of the boreal forests were developed using reconstructions of Holocene vegetation cover and climatic conditions on the base of pollen and plant macrofossil analysis of peat profiles in CFSNBR.

The annual future pattern of CO2 and H2O fluxes of the forests were simulated using a process-based Mixfor-SVAT model (Olchev et al. 2002, 2008). The main advantage of Mixfor-SVAT is that it allows us to describe CO2 and H2O fluxes both in mono-specific and mixed forest stands. It is able to quantify both total ecosystem fluxes and flux partitioning among different tree species and canopy layers. It is obvious that it can be very helpful to describe accurately effects of species composition changes on structure of dynamics of carbon and water balance of forest ecosystems.

Results of modeling experiments show that expected climatic and vegetation changes can have significant impact on evapotranspiration, transpiration, Net Ecosystem Exchange (NEE), Gross (GPP) and Net (NPP) Primary Productivities of boreal forest ecosystems. These changes have a clear seasonal trend and they are depended on species composition of a forest stand.

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