THE RESPONSE OF THE WATER FLOWS OF THE BOREAL FOREST REGION AT THE VOLGA’S SOURCE AREA TO CLIMATIC AND LAND-USE CHANGES

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The “Volgaforest” project (IC15-CT98-0120) was focused on a long-term study of the water budget of the boreal forest area at the Upper Volga catchment in Russia, on an evaluation of possible impacts of its changes on forest conditions, and on an estimation of a possible feedback of the changes in land-use and forest composition on the water regime of the Upper Volga’s area. The selected Upper Volga’s catchment (about 3412km2 between 56°20’-57°20’N, 32°00’-33°20’E) is located at very sensitive boundary of boreal and nemoral forest communities and, at the same time, at the continental divide for the watersheds of the Caspian, the Baltic and the Black Seas close to sources of other large European rivers: Dnepr, Daugava and Neva. Past and present atmosphere, water and forest conditions of the selected watershed area were investigated using different experimental, mo delling and statistical approaches to predict their possible future changes using available climatic scenarios and developed and validated SVAT and hydrological schemes compatible with General Circulation and regional atmospheric models. Analysis of past and present climatological, hydrological and land-use data showed a significant impact of climatic and land-use changes on the water regime of the Upper Volga area. During the last 50-60 years the mean annual temperature increased by 1.2°C, and annual precipitation increased by 140 mm. At the same time, Volga’s annual runoff at the Selishy dam decreased by 8% during the last 20 years. Air temperature and precipitation changes are more obvious during the winter and spring and cannot be seen in summer. Frequent snow melting in winter due to high probability of thaws despite increased precipitation leads to a gradual reduction of the soil water storage in spring and in deficit of available soil water for tree growth in summer. Summer droughts accompanied by strong sinking of the ground water level, forest fires and pest attacks can result in weakening the stability of coniferous forests, their degradation and replacement by deciduous tree species. Since, broadleaf trees transpire about 10-20% more then coniferous trees during summer months, it can be expected that possible forest changes can result in increase of transpiration rate and in decrease of ground water discharge and of water levels in the Upper Volga lakes. Results of hydrological simulations using future climatic scenarios showed that expected climatic changes may produce significant changes of the evapotranspiration and runoff regimes of the Upper Volga area. Reduced snow accumulation, earlier melting season, increased runoff reaction on precipitation in autumn and winter, increased evapotranspiration and drier soils in summer are the principal impacts of climatic changes on water resources of the Upper Volga’s catchment.