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Assessing Impacts of Climate Change on Biomass and Species Composition across Russia using a Dynamic Vegetation Model and IPCC Climate Output

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The Northern Hemisphere's boreal forests and, in particular, the Siberian boreal forest zone, may have a particularly strong effect on the Earth's climate through mechanisms involving changes in the regional surface albedo. Warmer climate has been implicated in the conversion of Russia's Siberian Larch forests to Dark-Conifer Forests of Spruce and Fir implying a potential positive feedback cycle: a warmer climate can accelerate the natural succession from Larch to Dark-Conifer forest; the resultant albedo change then can promote additional climate warming. This climate/cover feedback motivates development of dynamic models simulating the composition of Russian forest. Utilization of the individual based forest growth model, FAREAST, with climate station data provided by the National Climate Data Center (NCDC) for 2083 Russian stations allowed us to generate baseline biomass values (tCha-1) from year zero to mature forest. The model biomass (tCha-1) was previously validated using independent forest inventory data from across the Russian region. The FAREAST model output represents the average of 200 simulated plots per location for climatic conditions reported for the corresponding station. IPCC climate output data from NCAR's Community Climate System Model 3.0 (CCSM) SRES climate change scenarios, A1B and B1, were used to evaluate detailed changes in biomass (tCha-1) and species composition of forests across Russia in response to warming for stands of various ages. These results are used to identify the location, age and species composition of forests which are vulnerable to climate change. Assessing the forest vulnerability in congruence with the age and species distribution is a powerful tool in understanding forest response to climate change in addition to the forests role in climate/cover feedback associated with albedo change.