Changes of land use and land cover, biogeochemistry, and their feedbacks to climate in northern Eurasia

Qianlai Zhuang (1), Jerry Melillo (2), David Kicklighter (2), John Reilly (3), Sergey Paltsev (3), Andrei Sokolov (3), Yongxia Cai (3), Anatoly Shvidenko (4), Nadejda Tchebakova (5), Andrey Sirin (6), and the Anna Peregon and Guangsheng Zhou Team

(1) Purdue University, Earth & Atmospheric Sciences and Agronomy, West Lafayette, United States (qzhuang@purdue.edu), (2) Marine Biological Laboratory, Woods Hole, MA, (3) Massachusetts Institute of Technology, Cambridge, MA, (4) International Institute of Applied Systems Analysis, Laxenburg, Austria, (5) Institute of Forest, Siberian Branch of the Russian Academy of Sciences, Krasnoyarsk, Russia, (6) Institute of Forest Science, Russian Academy of Sciences, (7) Institute of Soil Science and Agrochemistry SB RAS, Novosibirsk, Russia, (8) Institute of Botany, Chinese Academy of Sciences

In recent decades, the largest increase of surface air temperature and related climate extremes have occurred in northern Eurasia. This temperature increase and extreme climate are projected to continue during the 21st century according to climate models. The changing climate could affect land cover and the biogeochemical cycles in the region. These changes in biogeography and biogeochemistry, in turn, will affect how land use evolves in the future as humans attempt to mitigate and adapt to future climate change. Regional land-use changes, however, also depend on pressures imposed by the global economy. Feedbacks from future land-use change will further modify regional biogeochemistry and climate. Using a suite of linked biogeography, biogeochemical, economic, and climate models, we explore how six future climate projections may influence vegetation distributions, carbon stocks and fluxes, and economic activity in northern Eurasia during the 21st century. Preliminary results indicate a northern shift of biomes such that, in the absence of land use, tundra areas in the region will decrease by 48 to 96% whereas steppe areas will increase by 22 to 82% and areas of temperate forests will increase by 66 to 86% in response to climate change. These biome shifts lead to new economic opportunities that have different land-use change consequences on terrestrial carbon dynamics in the region than would be predicted in the absence of biome shifts. In the presentation, we will also present the progress on how radiative forcing will change due to changes of albedo, evapotranspiration, and biogeochemistry resulting from changes of land use and land cover in the region.