Initial Evidence of Climate-induced Change in the Republic of Tyva

Amber Soja (1) and the Tuvan Climate Change Team

(1) National Institute of Aerospace / NASA LaRC, Atmospheric Chemistry and Climate Dynamics, Hampton, United States (amber.j.soja@nasa.gov), (2) Nadezda Tchebakova, Sukachev Institute of Forestry, Krasnojarsk, Russia, (3) Elena Parfenova, Sukachev Institute of Forestry, Krasnojarsk, Russia, (4) Vladislav Konzai, Ubsunur Biosphere Reserve, Kyzyl, Russia, (5) David Westberg, SSAI, Hampton VA, USA, (6) Ludmilla Buryiak, Siberian State Technological University, Krasnojarsk, Russia, (7) Olga Kalenskaya, Siberian State Technological University, Krasnojarsk, Russia, (8) Elena Kukavskaya, Sukachev Institute of Forestry, Krasnojarsk, Russia, (9) Galina Ivanova, Sukachev Institute of Forestry, Krasnojarsk, Russia, (10) Paul Stackhouse Jr., NASA Langley Research Center

Atmosphere Ocean General Circulations Models (AOGCM) are in agreement that Siberia is expected to experience warming in excess of 40% above global mean temperatures by 2100. Moreover, it is predicted temperature increases will be evident in both the summer and winter. In association with changes in climate, the growing season length, the duration of the fire season, the amount of area burned and fire severity are predicted to increase. Increases in extreme fire seasons are already evident across the circumboreal. Fire will be a major catalyst for ecosystem change, which will force ecosystems to move more rapidly towards a new equilibrium with the climate. SiBCliM Bioclimatic model results predict expansive changes in ecosystems, from a landscape dominated by taiga to a landscape dominated by steppe and forest-steppe, and Tyva is predicted to be a "hot spot" for potential change.

The focus of this investigation is on south, central Siberia, specifically Tyva, where one would expect to find the initial signs of climate-induced change. The Sayan mountain range offers relatively abrupt change in ecosystems that are often defined by altitude, temperature and precipitation. Tyva is located at a vulnerable southern border, south of the Sayan, and contains 9 Biospheric Reserves, each representing distinct ecosystems. Tyva is home to several relic Pinus sylvestris forests.

January temperature increases have exceeded those predicted by the 2090 Hadley Centre scenario, but July temperatures are below predictions. The growing season length has already increased by ∼6 to 12 days. Predicted increases in rainfall are not apparent, and generally, precipitation change has been negative. Consequently, several of the relic pine forests have burned (some repeatedly), and natural regeneration is not visible at several sites, even one that had been re-planted on several occasions. Human influences are evident at the local scale (household use) and in some management zones, where forests are logged and planted regardless of their state of regeneration. We present a concentrated and complicated view of one region that is expected to change, and we believe Tyva is currently showing indications of climate-induced change.