



Fuel Consumption and Fire Emissions Estimates in Siberia: Impact of Vegetation Types, Meteorological Conditions, Forestry Practices and Fire Regimes

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Boreal forests play a crucial role in carbon budgets with Siberian carbon fluxes and pools making a major contribution to the regional and global carbon cycle. Wildfire is the main ecological disturbance in Siberia that leads to changes in forest species composition and structure and in carbon storage, as well as direct emissions of greenhouse gases and aerosols to the atmosphere. At present, the global scientific community is highly interested in quantitative and accurate estimates of fire emissions. Little research on wildland fuel consumption and carbon emission estimates has been carried out in Russia until recently. From 2000 to 2007 we conducted a series of experimental fires of varying fireline intensity in light-coniferous forest of central Siberia to obtain quantitative and qualitative data on fire behavior and carbon emissions due to fires of known behavior. From 2009 to 2013 we examined a number of burned logged areas to assess the potential impact of forest practices on fire emissions. In 2013-2014 burned areas in dark-coniferous and deciduous forests were examined to determine fuel consumption and carbon emissions. We have combined and analyzed the scarce data available in the literature with data obtained in the course of our long-term research to determine the impact of various factors on fuel consumption and to develop models of carbon emissions for different ecosystems of Siberia. Carbon emissions varied drastically (from 0.5 to 40.9 tC/ha) as a function of vegetation type, weather conditions, anthropogenic effects and fire behavior characteristics and periodicity. Our study provides a basis for better understanding of the feedbacks between wildland fire emissions and changing anthropogenic disturbance patterns and climate. The data obtained could be used by air quality agencies to calculate local emissions and by managers to develop strategies to mitigate negative smoke impacts on the environment and human health.