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Fire Impact on Phytomass and Carbon Emissions in the Forests of Siberia

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Siberian boreal forests contribute considerably to the global carbon budget, since they take up vast areas, accumulate large amount of carbon, and are sensitive to climatic changes. Fire is the main forest disturbance factor, covering up to millions of hectares of boreal forests annually, of which the majority is in Siberia. Carbon emissions released from phytomass burning influence atmospheric chemistry and global carbon cycling. Changing climate and land use influence the number and intensity of wildfires, forest state, and productivity, as well as global carbon balance. Fire effects on forest overstory, subcanopy woody layer, and ground vegetation phytomass were estimated on sites in light-conifer forests of the Central Siberia as a part of the project "The Influence of Changing Forestry Practices on the Effects of Wildfire and on Interactions Between Fire and Changing Climate in Central Siberia" supported by NASA (NEESPI). This study focuses on collecting quantitative data and modeling the influence of fires of varying intensity on fire emissions, carbon budget, and ecosystem processes in coniferous stands. Fires have a profound impact on forest-atmospheric carbon exchange and transform forests from carbon sinks to carbon sources lasting long after the time of burning. Our long-term experiments allowed us to identify vegetation succession patterns in taiga Scots pine stands after fires of known behavior. Estimating fire contributions to the carbon budget requires consideration of many factors, including vegetation type and fire type and intensity. Carbon emissions were found to depend on fire intensity and weather. In the first several years after fire, the above-ground phytomass appeared to be strongly controlled by fire intensity. However, the influence of burning intensity on organic matter accumulation was found to decrease with time.