



Impact of wildfires in dark-coniferous primary forests of Siberia

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Primary forests of Siberia are mainly represented by dark-coniferous (Siberian pine, fir, spruce) and larch stands located either in plain northern and central taiga zones or in mountains of southern Siberia. Observed climate changes impact on the sustainability of forest ecosystems resulting in shifting of the boundaries of vegetation zones. Dark-coniferous primary forests are among the most vulnerable ecosystems where higher fire frequency would result in drastic consequences. The prediction of fire effects is necessary for maintaining the primary boreal forests and developing of appropriate fire management strategies.

We investigated fire impact in mixed dark-coniferous forests dominated by Siberian pine, fir, and spruce with some participation of larch and deciduous species. Fires in dark-coniferous forests occurred mainly in summer due to the later drying out of the ground cover. Crown fires dominated in mountain dark-coniferous forests located on steep slopes; while in plain central taiga dark-coniferous forests, steady surface fires often occur. Tree mortality following steady surface fires even of low severity exceeded 40%. Crown fires resulted in total tree death. After high-severity fires the majority of trees died in the year of fire event, while the highest tree mortality after fires of low-to moderate severities was observed 4-5 years post-fire. The proportion of larch trees in species composition increased due to their greater fire resistance. In the future, the disturbed mixed dark-coniferous stands are represented by larch stands with the participation of Siberian pine and other dark-coniferous species, by open forests, or by burned sites with deciduous regeneration.

In the dark-coniferous forests disturbed by fires, reforestation mainly occurs through a change of dominant tree species. Birch often prevails post-fire. The maximum number of deciduous seedlings was observed in the mountain regions of southern Siberia where it exceeded 900 thousand per hectare. Dark-coniferous forests are forming faster (30-40 years post-fire) in central taiga under the canopy of birch trees, while in southern forests it takes 80 years and more for ecosystem to return to its prefire state. The fire-induced changes of tree composition (from dark-coniferous to deciduous species) and living ground cover (from moss to grasses) make it possible to grow productive dark-coniferous forests on the same areas for centuries and ensures the sustainability of forest ecosystems. Higher fire frequency caused by climate change or anthropogenic impact may significantly alter the succession patterns especially in the southern primary boreal forests of Siberia.