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The Late Holocene forest fire history in continuous permafrost zone of Central Siberia

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Understanding the long-term fire history of larch forests in the permafrost zone of Central Siberia is essential for an assessment of the possible responses and feedbacks of forest ecosystems to climate change. The multi-proxy record from the area of the Evenkian field station of the Sukachev Institute of Forest SB RAS, located in the middle part of the Lower Tunguska river basin provides important new data on the fire frequency, vegetation changes and paludification dynamics in the Central Evenkia over the last 3.5 ka BP. The new results of radiocarbon dating, loss on ignition, plant macrofossil and macro charcoal analyses from a sediment core taken in the waterlogged larch forest (N 64°09'56.1" E 100°31'43.9") are presented.

The obtained data have shown that fires were an important factor in the evolution of forest ecosystems in this continuous permafrost regions and acted as a trigger for the paludification process in the study area. The reconstruction of fire frequency demonstrated that the fire return period in the warm epochs of the late Holocene (3.6-2.7 ka BP, 1.5-0.7 ka BP, including the Medieval Climate Anomaly) varied from 115 to 150 years, and increased to 275-300 years during the periods of cooling (2.7-1.5 ka BP; the Little Ice Age, 0.7-0.15 ka BP). We suggested that the shorter and possibly colder summers during the cold epochs led to a decreased evaporation and a rise of ground moisture in many habitats, which was unfavorable for the occurrence and extension of forest fires. During the last 200 years the frequency of forest fires in the study area increased significantly, the fire return period reduced to a minimum value for the entire period under consideration (i.e. the last 3.5 ka BP) and reached 80 years. The fire free interval revealed from the macro charcoal analyses for the last 200 years is close to the average fire free interval reconstructed by dendrochronological data from the study area for the same period. The low human impact on forest ecosystems due to remote location of study area from settlements and mining regions suggests the natural causes of these fires.

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