EGU22-499
https://doi.org/10.5194/egusphere-egu22-499
EGU General Assembly 2022

Fires and forests: A reconstruction of Holocene fire-vegetation relationships in Central Yakutia, Siberia

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The year 2021 set new records for wildfire extent in the Republic of Sakha (Yakutia) in eastern Siberia, Russia. Wildfire seasons in this unique region, characterized by its deciduous boreal forest and permafrost landforms, are becoming more intense. Some fires are threatening local communities, while their smoke covers vast stretches of land every summer, posing health risks to people even in the distance. At the same time, the larch trees of the eastern Siberian boreal forest stabilize the permafrost soils below as guardians of a continental-scale storage of terrestrial carbon. It is still largely unknown how the current trend of wildfire intensification will develop in the future, and how it will modify the structure of the boreal forests within the next decades to centuries. However, even though needed for a well-founded evaluation of long-term impacts of changing fire regimes, data on past trends of wildfire activity still remains scarce in eastern Siberia.

Here, we present a new reconstruction of boreal fire and vegetation dynamics, spanning the last ca. 10.8 ka. Continuously analyzed macroscopic charcoal particles and a REVEALS-transformed pollen record from a sediment core from Lake Satagay (N 63.078, E 117.998) give insight into long-term trends and relationships between changes in fire regime and vegetation composition and coverage. The data indicates that modern larch-dominated forests co-exist with a lower severity fire regime, whereas early Holocene open larch-birch woodlands enabled increased charcoal accumulation and thus supported a higher severity fire regime. Considering the expected increase in tree mortality caused by wildfires and insect damage, likely to thin out currently denser tree stands, this fire-vegetation relationship suggests a potential upcoming positive feedback on intensifying fire regimes.