EGU21-12821
https://doi.org/10.5194/egusphere-egu21-12821
EGU General Assembly 2021

Disentangling human-fire-climate linkages at mid-elevations in the Šumava Mountains of central Europe

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To distinguish human-caused from naturally-caused fire regimes, palaeoecological records must demonstrate that observed changes in vegetation and fire are in response to changes in human activity rather than driven by natural climate-fire relationships. Here, we use a high-resolution multi-proxy approach (testate amoebae derived depth to water table (DWT), macro- and micro-charcoal, charcoal morphologies, pollen, non-pollen palynomorphs, plant macrofossils, and XRF) from Pékna, a mid-elevation peat bog situated near Lipno Reservoir - an area rich in human land use - to investigate human-driven vs. naturally-driven fire regimes in the Šumava Mountains. Our results span the entire Holocene and illustrate that humans have been consistently modifying the landscape since 5,500 cal yr BP. Specifically, during the mid-Holocene (7,000 – 4,000 cal yr BP) when water table was at its highest at Pékna, relatively frequent, low-severity fires occurred and was accompanied by the prolonged presence of coprophilous fungi, secondary human indicators and an opening of the forest, suggesting human activities. Human land use intensified ~1,500 cal yr BP as indicated by increases in primary human indicator species, an increase in early successional tree species (Pinus and Betula) indicating an opening of the forest canopy, and the development of regional mining is suggested by a marked increase in the concentration of lead (Pb). While water table depths decreased indicating drier conditions ~1,500 cal yr BP, local fires persisted, burning at low severities as indicated by the continued presence of charred herb macrofossils. The most intensive land use occurred in the last 500 years with the highest abundance of primary and secondary human indicator species, and coprophilious fungi. Locally, marked increases in the concentration of both redox-sensitive elements such as iron (Fe), calcium (Ca), sulphur (S), and chlorine (Cl), and detrital elements such as potassium (K), aluminum (Al) and

Titanium (Ti) indicate major changes in the depositional environment over the last 500 years, possibly due to peat draining. However, this time period witnessed decreased biomass burning as a result of a more open landscape and less fuels to burn. These results contribute to a growing body of literature illustrating the importance of prehistoric impact in the mid-mountains of Central Europe.