



Human-induced fire regime shifts during 19th century industrialization

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Climate and natural vegetation composition determine the biome-specific fire regimes, but shifts in regional to global fire regimes can also be strongly affected by human land management. Among the last 250 years, fire occurrence increased globally during the mid-19th century, which was explained mainly by natural changes, but also related to increased human population growth. Yet, it is poorly known how exactly humans have influenced fire regimes prior to active wildfire suppression, which led to a global decrease in fire occurrence since the onset of the 20th century. To improve predictions of current and future fire risk, the human dimension of fire regime shifts requires more interdisciplinary research.

Here, we investigate the influence of climate, land cover change, and human activity on fire regimes in northern Poland using multiple highly resolved lake-sedimentary fire proxies (i.e. charcoal and the fire biomarkers levoglucosan and its isomers). Supported by a review of historical documents, we robustly classify source area- and temperature-specific fire regimes (biomass burnt, fire episodes). We find two prominent fire regime shifts during the 19th and 20th centuries, driven by an adaptive socio-ecological cycle in human forest management. Although individual fire episodes were triggered mainly by arson during dry summers, the biomass burnt increased unintentionally during the mid-19th century due to the plantation of flammable, fast-growing pine tree monocultures needed for industrialization. State forest management reacted with active fire management and suppression during the 20th century. Similar scenarios are likely also in other industrializing regions worldwide, where not only pine but also flammable Eucalyptus monocultures have been planted. In the light of climate projections that predict increasingly dry conditions, a renewed need for adaptations to increasing fire risks becomes necessary.