

Investigating fire history in Poland over the last 2000 years using annually laminated lake sediments

Extreme climate events such as heat-waves and drought episodes have become more frequent across Europe since the 1950s, making forests more vulnerable to disturbances such as fire. Climate models predict extreme climate events will become more severe throughout Europe as a result of increasing global temperatures. Although the Mediterranean region remains the most affected area, unusually dry summers have led to large wildfires in countries such as Sweden, Germany and Poland in recent years. This is alarming because currently the role of fire as a disturbance agent is deemed negligible in central European temperate forests. Thus, future climate change may potentially threaten the resiliency of Polish forests.

Fire is a natural process integral to the order and function of our planet. Studying the influence of fire in the Earth's ancient ecosystems helps to understand the flammability of the vegetation and the environmental responses and hence, predict future changes. To be successful, we need to better understand drivers because fire is not only driven by temperature but also by the flammability of vegetation (i.e. fuel) and ignition, both driven and triggered by either natural or human action.

Fires have been an important disturbance factor for thousands of years in central Europe. However, long-term information on past fire regimes is currently lacking to reliably assess the vulnerability of temperate zone forests to climate change and increasing fire risk. Due to climate change, Poland is projected to experience an increase in both heat stress and wildfire activity over the next century which has the potential to turn fire-resistant forests into fire-prone forests. Therefore, understanding how wildfire activity may change with future climate change is critical.

This project aims at examining the long-term interactions among fire, climate, vegetation and human activity to determine the drivers of fire regimes and their changes over the last 2000 years as this time period is essential for the understanding of the modern climate system, biodiversity, social organization, and economic structure. To achieve this goal a range of analysis will be held including developing accurate, reliable and comparable chronologies for sediments of three Polish lakes, analysis of macrocharcoal from these sediments, assessing minimal charring temperature of macrocharcoal particles and statistical analysis. These steps are necessary to discuss spatio-temporal changes of fire activity, fully understand past fires behavior and assess potential future changes.

Three lakes with annually laminated (varved) sediments will be used in this project. These sediments are considered as one of the best natural archives that allow reconstructing past climatic and environmental conditions because they provide high-resolution time scale in calendar years. The accurate time scale and detailed macrocharcoal analysis will allow determining what was the role of climate and humans as drivers of fire events in Poland over the last 2000 years.