Late Holocene ecosystem change and disturbance dynamics in the High Tatra Mountains, western Carpathians

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Temperate mountain spruce forests have seen more frequent and severe disturbances such as windthrows and insect outbreaks during recent decades. Furthermore, the warming climate is predicted to increase the risk of forest fires in these mountain forests in the future. Alongside natural disturbances and changing climate conditions, increasing anthropogenic activity has affected mountain forests along the Carpathian mountain range. As this increasing impact on anthropogenic land use is coupled with changing climate, it is difficult to predict the future changes in mountain forests. Therefore, it is crucial to understand the long-term forest dynamics and disturbance history in the mountain forests ecosystems.

To assess the late Holocene forest dynamics and disturbance history in mountain spruce forests, we sampled four small forest hollows from the High Tatra Mountains in Slovakia. We analysed fire history from macroscopic charcoal records and fossil pollen records was used to reconstruct changes in forest composition over the last 1200 years. As disturbances are key factors shaping mountain forest dynamics, we used pollen records to produce overall disturbance index based on plant ecological indices attributed to pollen taxa (Kuneš et al. 2019). We apply variation partitioning to assess the relative importance of temperature, human impact and forest density (*Picea:Pinus* ratio) as potential drivers on the past fire history. Temperature variable for the past 1000 years is derived from temperature reconstruction based on dendrochronological records from the region. We use human indicator pollen taxa as the variable for human impact on ecosystem dynamics, and to indicate human activity in the region. In addition, we utilized non-pollen-palynomorphs as indicators of grazing.

These multiproxy records demonstrate increase in fire activity and change in overall disturbance regime around 1200–1300 AD connected to the change in forest composition and opening of the landscape. Our results suggest that human impact is the main driver behind this change in this fire regime. Concurrently pollen records indicate change in forest composition and in landscape openness in connection to increasing human activity. It is plausible that increased human impact has initiated period of more frequent fires and change in forest composition, which in turn may have affected the overall disturbance regime in the study area.

References

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