Palaeoecological assessment of prehistoric and historic human impact in the high elevation areas of the Northern Carpathians, Romania

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The Carpathian Mountains of northern Romania are classed as outstanding ecosystems for their species endemism and habitat diversity (UNEP, 2007). However, despite their protected status, these mountains are presently threatened by both direct human impacts and climate warming affecting medium to long-term ecosystem stability and the resilience of natural habitats (Pauli et al., 2012). Such threats are likely to result in a dramatic loss of biodiversity and habitat change (Knorn et al., 2012).

This paper presents a high resolution, multi-proxy palaeoenvironmental reconstruction (pollen, dung fungal spores, micro and macro-charcoal, mineral magnetic properties and geochemistry) in three sedimentary sequences located at different elevations across the Northern Carpathians (Romania) over the Late Holocene (i.e. the last 4000 years). We aim to: i) determine what aspects of prehistoric and historic human activity (e.g. burning, clearing, grazing) have shaped the landscapes of today, and ii) use this information to facilitate their environmental management and conservation strategies to maintain the ecological and economic sustainability of extant habitats in the currently changing environment.

Our preliminary results suggest that the most impacted landscapes were located above 1600 m a.s.l. As such, vegetation above the timberline (the limit of the closed forest) appears to have undergone the most marked structural and compositional changes, characterised by: i) increases in landscape openness after ca. 3000 cal yr BP, and particularly over the last two centuries; ii) increasing human disturbance after 3000 cal yr BP, with two significant episodes between 2100 and 1000 cal yr BP, and over the last two centuries. Conversely, the conifer belt underwent prominent disturbances only during the last 1200 years. Our results further suggest that humans have actively contributed to the lowering of the timberline and treeline. On the other hand, low-intensity land-use practices on mountain pastures appear to be beneficial for mountain grasslands resulting in the formation of rich mountain grassland communities.

Fire was identified as a significant driver of vegetation change particularly above timberline, mainly due to its use as a tool to enlarge and maintain subalpine grassland areas used for grazing. Increased anthropogenic pressure is reflected in a series of erosion increases around ca. 1400-900 cal yr BP and over the last two centuries.

Our reconstruction offers a greater understanding of the legacy of land use management for vegetation and habitat change and helps to improve our predictive capacity of future environmental changes in the Carpathian Mountains. We found that fire activity was connected with landscape openness and grassland extent, and possibly contributed to the formation of rich subalpine grasslands in these sensitive, marginal environments. Based on our findings, we suggest that an effective strategy to maintain grassland openness and likely diversity is to promote moderate intensity grazing and burning.

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References

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