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Last 1000 years of environmental history in Southern Bucovina, Romania; a high resolution multi-proxy lacustrine archive

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Introduction
Research has shown that, particularly for the last millennium, local and regional climatic and environmental variations are complex and rarely follow wider spatial patterns. Detailed knowledge of local scale past landscape dynamics and their drivers is therefore directly relevant for ecosystems and humans as both are dependent on local environmental changes. However, the paucity of high resolution palaeoenvironmental information in Eastern Europe is critical for mountain regions where dramatic changes in slope and sediment dynamics can lead to habitat degradation and socio-economic impacts for local communities.

Aim
We present a high-resolution, multi-proxy analysis of a dated lacustrine sequence from the Bucovina Mountains (north-eastern Romanian Carpathians, Eastern Europe), providing the first palaeoenvironmental history of the area over the last ca. 950 years. Our aim is to determine the timing, magnitude and impacts of the main drivers of change (climate variability, human impact and fire activity) at both catchment-scale and regionally; we further identify environmental components which underwent the most critical variation (i.e. type and intensity of slope processes, changes in sediment sources, flood frequency, lake silting and tree-cover dynamics); and finally, based on our findings, we determine the most probable response of this lake - catchment system to ongoing and future environmental changes.

Methods
We used the mineral magnetic properties of sediments, their elemental geochemistry, organic matter content and particle size variations to trace the sources of sediments and the type/intensity of the processes resulting in their deposition. Pollen analysis, stomata and tree macrofossils were used to assess the dynamics of catchment and regional vegetation. Charcoal analysis was employed to reconstruct fire activity and fire-related disturbances.

Results and Discussion
The sedimentary record reveals high intensity slope responses to longer and short-term changes in hydrological conditions and the extension of forest cover. The landscape underwent major disturbances at the onset of the millennium and during the last 200 years. We found the enhanced catchment instability (i.e. landsliding, intense channel and gully erosion, increased number of flood events) from the onset of sedimentation to AD 1450 to be related mainly to natural factors. Conversely, the recent accelerated topsoil removal and rill development, coupled with maximum sediment accumulation rates, were mostly a consequence of direct human interventions such as deforestation, grazing, biomass burning, with climate-related hydrological conditions playing a subordinate role.

Conclusions
Through a multi-proxy palaeoenvironmental approach and reflecting its exceptionally high temporal resolution (2-3 years/cm on average), this study significantly contributes to enhancing our understanding of landscape dynamics and their drivers in smaller mountain catchments.