A 9000 year perspective on carbon accumulation rates under changing hydro-climate and vegetation conditions in a mountain peatland, northern Carpathians, Romania

Angelica Feurdean (1,2), Andrei Panait (2), Mariusz Gałka (3), Andrei Diaconu (2), Simon Hutchinson (4), Andreas Mulch (1,5), Ioan Tantau (2), Thomas Hickler (1,6)

(1) Senckenberg Biodiversity and Climate Research Centre, Frankfurt am Main, Germany (angelica.feurdean@senckenberg.de), (2) Department of Geology, Faculty of Biology and Geology, Babeș-Bolyai University, Romania, (3) Department of Biogeography and Palaeoecology, Faculty of Geographical and Geological Sciences, Adam Mickiewicz University, Poznan, Poland, (4) School of Environment & Life Sciences, University of Salford, Salford, UK, (5) Institute of Geosciences, Goethe University, Frankfurt am Main, Germany, (6) Department of Physical Geography, Goethe University, Frankfurt am Main, Germany

Peatlands, in particular ombrogenous bogs, which entirely depend on water from precipitation, are sensitive to changes in the balance between precipitation and evapotranspiration; and therefore highly suitable for hydro-climatological reconstruction. Peatlands also represent a large carbon pool in the terrestrial biosphere. However, little is known about the C sequestration processes in mountain peatlands under various competing drivers of change (climate, vegetation, fire). We applied a multi-proxy approach (bulk density, loss on ignition, total organic carbon, testate amoebae, $\delta^{13}C$ in *Sphagnum*, plant macrofossils, pollen and charcoal) to a peat sequence from a mountain ombrogenous bog (Tâul Muced) to explore how changes in hydro-climate conditions, peat plant composition and fire have affected long-term physical peat properties and the rate of carbon accumulation over the last 9000 years. Carbon accumulation at this site ranged from 7 to 105 g C cm$^{-2}$ yr$^{-1}$ (mean 23 ± 14 g C cm$^{-2}$ yr$^{-1}$). We found that high moisture availability (P-E) as inferred from testate amoebae and $\delta^{13}C$ values in *Sphagnum* increased the carbon sink capacity of peatland. The strength of the relationship between the rate of carbon accumulation and climate appears particularly evident over the last millennium when high C accumulation rates correlated with the warm and wet conditions of the Medieval Climate Anomaly and lower C accumulation rates with the dry conditions of the Little Ice Age. We also found a significant positive correlation between the rate of C accumulation and changes in vegetation; rates were lowest (17 g C cm$^{-2}$ yr$^{-1}$), during periods of mixed *Sphagnum* (primarily *S. magellanicum* and *S. angustifolium*) and vascular plant (Cyperaceae, *Eriophorum vaginatum*) growth and increased (31 g C cm$^{-2}$ yr$^{-1}$) during the accumulation of *Sphagnum* peat, regardless the dominant *Sphagnum* species. We did not find indication of peatland fire during the investigated interval. Our study represents one of the first investigating the carbon-sink capacity of mountain peatlands in the Carpathians and consolidates the geographical coverage of proxy reconstructions of hydro-climate variability in a poorly studied region.