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Erosion regime controls sediment eDNA-based community reconstruction

Marina A. Morlock[1], Saúl Rodriguez-Martinez[1], Doreen Yu-Tuan Huang[1,2], and Jonatan Klaminder[1]
[1]Department of Ecology and Environmental Sciences, Umeå University, Umeå, Sweden
[2]School of Geography, Politics, and Sociology, Newcastle University, NE1 7RU Newcastle upon Tyne, UK

Environmental DNA (eDNA) analysis from lake sediments shows promise to become a great paleoecological technique. Nevertheless, our knowledge regarding catchment processes that influence the eDNA signal preserved in sediments creates uncertainties when interpreting temporal changes in reconstructed biodiversity. Are changes in species composition the result of 'real' changes in species abundances or simply the result of altered DNA transport processes in the catchment?

In this presentation, we investigate the role of erosion for sediment eDNA-based reconstructions. We utilize sediment records from the Central Alps and compare the plant and mammal DNA pools in lake sediments of similar age but deposited under different erosion regimes: detrital event layers formed during heavy precipitation events vs. hemi-pelagic background sedimentation.

We find strong differences in the reconstructed plant and mammal communities both across space and time. Temporal changes across the Holocene were the main drivers of change for reconstructed plant communities, but sediment type -and thus erosion regime- was the second most important factor of variance. Around 30% of all plant and mammal taxa were uniquely detected in event layers. Our results highlight that the two sediment types preserved their unique assembly of plant and animal DNA, suggesting that post-depositional mobility of terrestrial DNA is insignificant on Holocene timescales. However, our results also highlight the challenge when attributing changes in erosion regimes to the appearance of new species in an eDNA-based paleo-record because increased erosion will also increase the representation of taxa already present in the lake's catchment. In our case, this mechanism was an important factor for DNA-inferred species composition and taxonomic richness recorded in the sediments.