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Contrasting patterns of vegetation compositing and species diversity over 22 000 years in two adjacent arctic-alpine catchments

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Throughout the late Quaternary, the vegetation of Polar Urals (Russia) endured dramatic changes in climate, but still seems to have maintained a high, yet compositionally dynamic species richness. A recent study of Lake Bolshoe Schuchye (187 m a.s.l., Clarke et al. 2019 Sci. Rep.) suggests that this region was an important refugium for arctic-alpine plant taxa during the Early Holocene forest expansion. Whether the survival of taxa and the turnover of species and functional groups was consistent throughout the region or dependent on local conditions remains unknown. Here, we present reconstructed plant assemblage dynamics spanning the past 22,000 years based on metabarcoding of sedimentary ancient DNA (sedaDNA) cored from Maloe Schuchye (287 m a.s.l.). The record is compared to the neighboring lake Bolshoe Schuchye in terms of how taxonomic richness and composition of functional groups developed through time. Throughout the study period, several large-scale vegetation changes occur in both cores, however, identified at slightly delayed time intervals for the higher altitude site Maloe Schuchye, based on the CONISS clustering. The total richness was higher in Maloe Schuchye (274 taxa) compared to Bolshoe Schuchye (191 taxa), and the average richness was higher in Maloe Schuchye throughout the period. The largest difference in taxonomic richness between the two lakes was during the Last Glacial Maximum (LGM) and Late Glacial periods, when Maloe Schuchye had considerable higher richness of forbs and graminoids than Bolshoe Schuchye. Despite these contrasting diversity patterns, the time of arrival of taxa highly align in the two records. Thermophilic plant taxa occur slightly earlier in the lower altitude Bolshoe Schuchye lake record, as expected. Further, the survival and persistence of arctic-alpine taxa is similar in the two catchments, confirming the importance of this region for long-term survival or arctic-alpine species.