



## Millennial-scale lag times in vegetation response to glacial climate in Siberia

Ulrike Herzschuh (1,2), John H. Birks (3,4), Andrei Andreev (5,6), Martin Melles (5), and Julie Brigham-Grette (7)

(1) Alfred Wegener Institute, Research Unit Potsdam, Potsdam, Germany (ulrike.herzschuh@awi.de), (2) Institute of Earth and Environmental Sciences, University Potsdam, Potsdam, Germany, (3) 3 Department of Biology, University of Bergen, and Bjerknes Centre for Climate Research, Bergen, Norway, (4) Environmental Change Research Centre, University College London, London, UK, (5) Institute of Geology and Mineralogy, University of Cologne, Cologne, Germany, (6) 6 Institute of Geology and Petroleum Technologies, Kazan Federal University, Kazan, Russia, (7) Department of Geosciences, University of Massachusetts-Amherst, USA

Vegetation change on all relevant temporal scales is assumed to be primarily driven by contemporary climate change, which would imply that vegetation-climate feedbacks become effective without long-term delay. However, our results from multivariate analyses of pollen assemblages from Lake El'gygytyn (NE Siberia) and other data covering the Mid-Pliocene-Warm-Period and the Plio-Pleistocene-Transition challenge this concept of broad-scale vegetation-climate equilibrium. Our results indicate that interglacial vegetation during the Plio-Pleistocene transition mainly reflects the condition of the preceding glacial instead of contemporary interglacial climate. We assume that the observed vegetation-climate disequilibrium, in particular the absence of pine and spruce in interglacials following strong glacial stages, originates from the combined effects of permafrost persistence, distant glacial refugia, and fire plus possible interactions. Our results imply that today's widespread larch ecosystem on permafrost is not in climate-equilibrium but rather represents a transient vegetation type which is still responding to the extreme glacial condition of the last glacial. This also implies that feedback between vegetation and climate and between permafrost and climate in northern mid- and high latitudes becomes active with long-term delay, which is of relevance for global climate change.