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Ancient DNA from northern Eurasian lakes reveals community dynamics of vascular plants over the past 25,000 years

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Ancient DNA (aDNA) recovered from sediments in the Arctic and Subarctic has proved a useful new tool for studying change in terrestrial ecosystems over time. The cold and relatively dry conditions of the Arctic and Subarctic appear to be ideal for the preservation of extra-cellular (i.e. “environmental”) DNA, particularly within permafrost and/or lake sediments. While the focus of work to date that uses aDNA retrieved from sediments has been vascular plants, information on bryophyte, invertebrate and vertebrate taxa has also been retrieved from sites in northern regions. We evaluate the potential of sedimentary ancient DNA (sedaDNA) to detect plant diversity and community dynamics over the past 25,000 years from lakes in the Eurasian Arctic. How DNA is recruited into lake sediments remains poorly understood, yet DNA retrieval may be related to features such as sediment quality, catchment size and inflowing streams. Here, we present sedaDNA records from lakes in northern Norway and the Polar Urals, which differ greatly in terms of their catchment size, sedimentary characteristics and glacial histories. The glacial finger lake (Bolshoye Shuchye) in the Polar Urals has a large and topographically catchment and clay-rich sediments, both of which may contribute to the rich DNA flora obtained. We obtained nearly 12 million sequence reads of 167 plant taxa from 153 lake-sediment samples, providing a level of ecological detail rarely obtained. Although displaying similar trends, the DNA record shows several features that the pollen stratigraphy failed to detect, including a turnover in grass genera over the Late Pleistocene to Holocene transition, the persistence of a diverse arctic-alpine forb flora into the Holocene and a diverse and variable bryophyte flora through time.