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Pollen-based quantitative land-cover reconstruction for northern Asia covering the last 40 ka

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We collected the available relative pollen productivity estimates (PPEs) for 27 major pollen taxa from Eurasia and applied them to estimate plant abundances during the last 40 cal. ka BP (calibrated thousand years before present) using pollen counts from 203 fossil pollen records in northern Asia (north of 40°N). These pollen records were organised into 42 site-groups, and regional mean plant abundances calculated using the REVEALS (Regional Estimates of Vegetation Abundance from Large Sites) model. Time-series clustering, constrained hierarchical clustering, and detrended canonical correspondence analysis were performed to investigate the regional pattern, time, and strength of vegetation changes, respectively. Reconstructed regional plant-functional type (PFT) components for each site-group are generally consistent with modern vegetation, in that vegetation changes within the regions are characterized by minor changes in the abundance of PFTs rather than by increase in new PFTs, particularly during the Holocene. We argue that pollen-based REVEALS estimates of plant abundances should be a more reliable reflection of the vegetation as pollen may overestimate the turnover, particularly when a high pollen producer invades areas dominated by low pollen producers. Comparisons with vegetation-independent climate records show that climate change is the primary factor driving land-cover changes at broad spatial and temporal scales. Vegetation changes in certain regions or periods, however, could not be explained by direct climate change, for example inland Siberia, where a sharp increase in evergreen conifer tree abundance occurred at ca. 7–8 cal. ka BP despite an unchanging climate, potentially reflecting their response to complex climate–permafrost–fire–vegetation interactions and thus a possible long-term-scale lagged climate response.