Current and past climate co-shape community-level plant species richness in the Western Siberian Arctic

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Abstract

Aim The Arctic ecosystems are exposed to amplified climate warming and, in some regions, to rapidly developing economic activities. This study assesses, models and maps the geographic patterns of community-level plant species richness in the Western Siberian Arctic and estimates the relative impact of environmental and anthropogenic factors driving these patterns. With our study, we aim at contributing towards conservation efforts for Arctic plant diversity. Location Western Siberian Arctic, Russia. Methods We investigated the relative importance of environmental and anthropogenic predictors of community-level plant species richness in the Western Siberian Arctic using macroecological models trained with an extensive geobotanical dataset. We included vascular plants, mosses and lichens in our analysis, as non-vascular plants substantially contribute to species richness in the Arctic. Results We found that the mean community-level plant species richness in this vast Arctic region does not decrease with increasing latitude. Instead, we identified an increase in species richness from South-West to North-East, which can be explained by environmental factors. We found that paleoclimatic factors exhibit higher explained deviance compared to contemporary climate, potentially indicating a lasting impact of ancient climate on tundra species richness. We also show that the existing protected areas cover only a small fraction of the regions with highest species richness. Conclusions Our results reveal complex spatial patterns of community-level species richness in the Western Siberian Arctic. We show that climatic factors such as temperature (including paleotemperature) and precipitation are the main drivers of plant species richness in this area, and the role of relief is secondary. We suggest that while plant species richness is mostly driven by environmental factors, an improved spatial sampling is needed to robustly assess anthropogenic impact on species richness. Our approach can be used to design conservation strategies and to investigate drivers of plant species richness in other arctic regions.

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