

Publication

A greener Greenland? Climatic potential and long-term constraints on the future expansion of trees and shrubs across a large Arctic region

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Warming-induced expansion of trees and shrubs into tundra vegetation will strongly impact Arctic ecosystems. Today, a small subset of the boreal woody flora found during certain Plio-Pleistocene warm periods inhabits Greenland. Whether the twenty-first century warming will induce a re-colonization of a rich woody flora depends on the roles of climate and migration limitations in shaping species ranges. Using potential treeline and climatic niche modelling, we project shifts in areas climatically suitable for tree growth and 56 Greenlandic, North American and European tree and shrub species from the Last Glacial Maximum through the present and into the future. In combination with observed tree plantings, our modelling highlights that a majority of the non-native species find climatically suitable conditions in certain parts of Greenland today, even in areas harbouring no native trees. Analyses of analogous climates indicate that these conditions are widespread outside Greenland, thus increasing the likelihood of woody invasions. Nonetheless, we find a substantial migration lag for Greenland's current and future woody flora. In conclusion, the projected climatic scope for future expansions is strongly limited by dispersal, soil development and other disequilibrium dynamics, with plantings and unintentional seed dispersal by humans having potentially large impacts on spread rates.

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