Illés, Gábor, Norbert Móricz (2022): Climate envelope analyses suggests significant rearrangements in the distribution ranges of Central European tree species. Annals of Forest Science 79:35

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Abstract

Key message: Climate envelope analysis of nine tree species shows that Fagus sylvatica L. and Picea abies H. Karst could lose 58% and 40% of their current distribution range. Quercus pubescens Willd and Quercus cerris L. may win areas equal with 47% and 43% of their current ranges. The ratio of poorly predictable areas increases by 105% in southern and south-eastern Europe.
Context: Climate change requires adaptive forest management implementations. To achieve climate neutrality, we have to maintain and expand forest areas. Impact assessments have great importance.
Aims: The study estimates the potential climate envelopes of nine European tree species for a past period (1961–1990) and for three future periods (2011–2040, 2041–2070, 2071–2100) under two emission scenarios (RCP4.5 and RCP8.5) based on the current species distribution.
Methods: Climate envelopes were estimated simultaneously using the random forest method. Multi-resolution segmentation was used to determine the climatic characteristics of each species and their combinations. Models were limited to the geographical area within which the climatic conditions correspond to the climatic range of the training areas.
Results: Results showed remarkable changes in the extent of geographic areas of all the investigated species' climate envelopes. Many of the tree species of Central Europe could lose significant portions of their distribution range. Adhering to the shift in climate, these tree species shift further north as well as towards higher altitudes.

Conclusion: European forests face remarkable changes, and the results support climate envelope modelling as an important tool that provides guidelines for climate adaptation to identify threatened areas or to select source and destination areas for reproductive material.

forest ecology
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climate: climate change
environmental impact assessment

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