BOOK OF
ABSTRACTS

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Accounting for phenotypic plasticity and local adaptation in species distribution models to support prescriptions on assisted migration

S3.1 Assisted migration for adapting forests to climate change

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Abstract: The most common tool to predict future changes in species range are occurrence-based species distribution models. However, these models often underestimate the potential future habitat, as they do not account for phenotypic plasticity and local adaptation. These highly important processes in the response of tree populations to climate change are considered in trait-based models combining reaction norms of quantitative trait variation as a function of past climate experienced at seed source origin to which populations are genetically adapted, and simultaneously as a function of current climate experienced at the planting site to which they show plastic responses.
We make use of extensive provenance trial series of Norway spruce and European beech to model future height growth potential and compare these predictions with classic species distribution models. For Norway spruce, both the occurrence-based and the growth-based model show a significant retreat towards northern latitudes and higher elevations (-55 % and -43 % by 2080). However, thanks to the species particularly high phenotypic plasticity, the decline is delayed. Increasing summer heat coupled with decreasing water availability limits performance, while a prolonged frost-free period enables an increase within the remaining area. Signals of local adaptation along climatic gradients are low, as they are masked by a strong influence of latitude. The latter reflects population differentiation for the Baltics, but does not capture the high phenotypic variation associated with heterogeneity in Central European mountain ranges and postglacial migration history. The model is used to provide recommendations for optimal provenance selection under future climate. In essence, seed transfer cannot mitigate the projected range decline of Norway spruce, but it can help to exploit potential opportunities for better growth associated with warmer climate conditions. A comparable model for European beech is currently under development and results will be presented.