

PROJECT INFORMATION

Project title: Specification of biogeochemical thresholds for the cultivation of important forest tree species in the face of climate change

Project ID: 88

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PROJECT DESCRIPTION

Project partners & Funding

The SW-KW project is conducted by the Technical University of Munich (TUM), Professorship Forest Nutrition and Water Resources in cooperation with the Thünen Institute for Forest Ecosystems, Eberswalde. The project is funded by the German Waldklimafonds (www.waldklimafonds.de), which is promoted by the Federal Ministry of Food and Agriculture as well as the Federal Ministry of the Environment, Nature Conservation, Building and Nuclear Safety.

Background & Aims

Facing climate warming, forestry in Germany needs decision support for forest conversion, which is necessary at many sites (e.g. Falk & Mellert 2011), so far, this often requires the introduction of broad leaf species. However, a change of the tree species raises the question, whether the nutrient supply at a site is also sufficient for alternative climate-adopted species. However, there are significant knowledge gaps about the interaction between climate and nutrition (e.g. Mellert & Ewald 2014), in particular at the environmental limits of tree species.

The specification of biogeochemical thresholds (substrate, soil chemistry) based on plant-response-related critical nutrient values is a central aim of the study. On this basis we examine the species suitability for the cultivation of the most important forest tree species in Germany. The resulting thresholds, which characterize specific site ranges (range of species exclusion; range of strong and weak nutrient limitation, as well as no limitation) should assist forestry planting decisions and should be integrated in forestry handbooks on site classification.

Methods

The project relies on cross-sectional data about forest site characteristics, nutrition and growth. For investigating interactions between nutrient availability and climate, the primary data set of the Nationwide Forest Soil Survey 2 (BZE 2) needs to be expanded into regions providing a climate analogue to the future climate of Germany. Especially for warmer regions of Germany whose future climate analogue regions are not found on the territory of the Federal Republic today, European data should be used, most preferably from the ICP Forests monitoring program on Level I and Level II.

For the detection of biogeochemical threshold values modern statistical techniques for data mining, e.g. boosting based approaches, kernel density estimation techniques and modern regression methods (e.g. Generalised Additive Models, Quantile Regression) will be applied. Such techniques are suitable to identify nutrition-growth-relationship even under a poor signal-to-noise ratio (e.g. Mellert & Göttlein 2013).

References

Falk W, Mellert KH (2011) Species distribution models as a tool for forest management planning under climate change: risk evaluation of *Abies alba* in Bavaria. *Journal of Vegetation Science* 22. doi: 10.1111/j.1654-1103.2011.01294.x

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Mellert KH, Göttlein A (2014) Identification and validation of thresholds and limiting nutrient factors of Norway spruce by using new nutritional levels and modern regression. *German J Forest Res* 184 9/10: 197-203