

PROJECT INFORMATION

Project title: Climate change induced mortality and growth trends as a basis for comparative nationwide assessments of tree species suitability in Germany (MultiRiskSuit)

Project ID: 299

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PROJECT DESCRIPTION

Project Consortium

The project consortium consists of all federal forest agencies in Germany: Bayerische Landesanstalt für Wald und Forstwirtschaft (Bavarian State Institute of Forestry), Forstliche Versuchs- und Forschungsanstalt Baden-Württemberg (Forestry Research Institute of Baden-Württemberg), Nordwestdeutsche Forstliche Versuchsanstalt (Northwest German Forest Research Institute), Forschungsanstalt für Waldökologie und Forstwirtschaft Rheinland-Pfalz (Research Institute for Forest Ecology and Forestry Rheinland-Pfalz), Landesforstanstalt Mecklenburg-Vorpommern, Landeskompetenzzentrum Forst Eberswalde, Forstliches Forschungs- & Kompetenzzentrum Gotha, Kompetenzzentrum Wald und Forstwirtschaft, Wald- und Holz Nordrhein-Westfalen, SaarForst Landesbetrieb.

The requested Level I and Level II data will be used by the Landesanstalt Mecklenburg-Vorpommern and the Bavarian State Institute of Forestry in cooperation with the department of Forest Economics and Sustainable Land-use Planning of the University of Göttingen.

Aims

The project aims at improving existing approaches for assessing tree suitability and at developing new multi-criteria suitability recommendations as a basis for the adaptation of forests to climate change for important tree species in Germany (spruce, pine, European larch, Douglas fir, fir, beech, sessile and pedunculate oak, birch, sycamore, hornbeam, red oak). Due to its federal structure, in Germany a variety of methods for the assessment of tree species suitability exist. Among these are for instance climate sensitive species distribution-, productivity- and mortality- models. A nationwide application and comparison of the various existing methods can give valuable insights in their strengths and weaknesses, increases the understanding of the predicted changes in tree species

suitability and allows to better capture the uncertainty in tree species suitability predictions based on soil, climatic and species specific factors. The lessons learned from this comparison will be used to evaluate and refine the underlying approaches. In a next step, multi criteria suitability recommendations which can be applied directly in forestry will be deduced incorporating the results of the different methods.

Methods in general

- Improvement of existing methods to assess tree species suitability under climate change (if necessary)
- Nationwide application of the methods of the respective federal states using the grid of the National Forest Inventory (BWI) and the Soil Condition Survey (BZE) as well as in “neighbourhood regions” i.e. in selected regions crossing the borders of the federal states
- Comparing the results of the different methods based on the predictions at the BWI and BZE grid as well as in the neighbourhood regions
- Analysing and quantifying the changes in distribution, production and mortality risk under climate change scenarios in Germany in the near (2021-2050) and in the far (2071-2100) future under the climate scenarios RCP 4.5 and 8.5
- Derive multi-criteria tree species suitability recommendations

Methods using ICP Forests data at the Bavarian State Institute of Forestry and the department of Forest Economics and Sustainable Land-use Planning of the University of Göttingen

- In Bavaria survival models that have been developed based on Level I and Level II data from 2012 to 2017 are used for predictions of mortality risk (ICP-project-list ID 98, Brandl et al. 2020). The current project aims at reparametrizing these models with longer time periods including the more recent and climatically more extreme years.
- Findings of the ongoing internal evaluation “Alterations in the lifetime of forest stands: Spatial patterns and robustness of survival models in forestry” (ICP-project-list ID 200) will be used for model reevaluation.
- Predictions of the improved survival models will be incorporated in the nationwide comparison of tree species suitability predictions and are part of multi-criteria tree species suitability recommendations for Germany.

Expected Results at the Bavarian State Institute of Forestry

- The knowledge of mortality dynamics of the most important German tree species will be broadened.
- Models that are based on longer time series and that include (more) hot and dry years should better captivate the effect of extremes like heat and drought on mortality. We expect a decrease in uncertainty in the model estimations and thus better predictions of mortality risk under climate change scenarios.
- The predicted mortality risk will improve tree species suitability assessment and can be incorporated in multi-criteria tree species suitability recommendations.

Methods using ICP Forests data at the Mecklenburg-Western Pomerania Forest Institute Dpt. Forest Planning / Forest Research / Information Systems Research Unit Silviculture and Forest Growth

- In order to estimate the distribution of mistletoe-infections (*Viscum album*) on pine-trees in Europe models will be developed based on Level I and Level II data and climate data (CHELSA). For accurate estimation of the distribution, long time periods are required including more recent years.
- Estimation of risk from infection by mistletoe to death of the pine-tree (Risk to mortality)
- Predictions of the mistletoe-at-pine-models will be incorporated in the nationwide comparison of tree species suitability predictions and are part of multi-criteria tree species suitability recommendations for Germany.

Expected Results at the Mecklenburg-Western Pomerania Forest Institute

- The distribution of infection of mistletoe at pine-trees in Europe depending on recent climate and future climate scenarios, crown and stand-characteristics
- The analysis of provided data should evidence which variables have a positive/negative effect on infection with mistletoe
- From level I/level II – Data we expect an effect of e.g. pure stands, age, stand density and density on infection with mistletoe
- The models should show the development of mistletoe-infection at pine tree in the future. We expect an increasing distribution
- The predicted infection risk will improve pine-tree suitability assessment and stand-development and can be incorporated in multi-criteria tree species suitability recommendations.

Data requirements

- Crown Condition (Level I and Level II) in order to derive mortality rates and infection rates
- Stand-information
- BioDiv and Growth and Yield data in order to check Crown Condition data (i.e. age estimation) and mortality rates for plausibility
- European climate data as explanatory variables in the models
- European soil data (BioSoil) as explanatory variables in the models
- Foliage data in order to test the effect of nutrient supply on tree survival
- Meteorological data of Level II plots in order to investigate more closely the cause and effect relationships between site variables and mortality (i.e. wind)

References

Brandl, S., Paul, C., Knoke, T., & Falk, W. 2020. The influence of climate and management on survival probability for Germany's most important tree species. *Forest Ecology and Management*, 458, 117652.