Abstract template for the conference "A century of national forest inventories – informing past, present and future decisions"

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On page two, you are asked to fill in your abstract in the format and font size indicated. Please remember to include authors affiliation information in the footer section of page two. The length of the abstract may not be more than one page including references.

Abstract title:		Predicting tree growth from a wide range of variables including climate and species mixing effects
Take-home message:		*Repeated measurements from Swiss NFI plots served as ideal basis to predict tree growth not only as a function of stand, site and management characteristics but also of climate and species mixture effects. Results represent Switzerland's large environmental variability, thus (1) providing a deeper understanding of the main drivers modulating tree growth in Central European forests, and (2) supporting their inclusion in forest scenario models.*
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General topic, see website: (please double click on the check box and activate the relevant one)	☐	Improving future NFIs by learning from the past
	☒	NFIs today and in the future
	☐	Cutting edge and futuristic inventory techniques and technologies
Preferred presentation form:	☒	Oral presentation
	☐	Poster
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Predicting tree growth from a wide range of variables including climate and species mixture effects

Brigitte Rohner, Marco Mina, Esther Thürig

Introduction: Identifying factors that affect tree growth is crucial for ecological and economic evaluations influencing ecosystem management decisions. Thus, it has implications for management scenario analyses. Empirical forest scenario models have traditionally been prepared to estimate future forest development based on statistical inferences combined with management strategies. Such models have often been developed based on NFI data in order to be representative for large spatial extents. In the past, growth functions therein have mostly considered drivers related to site, stand, and management under the assumption of constant environmental conditions. Recent effects of climate change and nutrient deposition on forests, however, render such an assumption questionable. Additionally, mixed species forests have been identified to be often more productive than monocultures. However, such complementarity effects are difficult to generalize because they can vary among species and along gradients of environmental conditions. Our objective was to (1) simultaneously quantify the effects of many different drivers (stand, management, site, climate, and N-deposition) on tree growth (Rohner et al. 2018), and (2) investigate how species complementarity on tree growth varies with these drivers (Mina et al. 2018).

Materials and methods: The analyses were conducted separately for the nine main tree species growing in Central Europe. Nonlinear mixed models were fitted to individual-tree basal area increments (BAI) from the Swiss NFI. We initially considered 23 potential explanatory variables specifying stand, management, site, climate, and N-deposition, and selected the most influential for each species. Tree-level complementarity for each species was calculated using categorical variables indicating the species composition of the NFI plot. To investigate whether complementarity effects were modulated along gradients, we included interactions between variables expressing stand and environmental conditions and the mixture variable.

Results: In general, BAI was positively related to DBH and temperature and negatively related to basal area of larger trees, stand density, mean DBH of the 100 thickest trees per ha, slope, and soil pH. Harvesting had a positive effect on BAI for most species. In general, nitrogen deposition was positively related to BAI, except for spruce and fir. Increasing drought mostly reduced BAI, except for pine and oak. The magnitude – positive or negative – of complementarity increased with increasing stand density and stand development. Complementarity for many but not all species increased with drought and temperature. While soil conditions, nitrogen and topography influenced complementarity for many species, a general pattern could not be detected (increases and decreases were observed).

Conclusion: The identified BAI functions include many growth drivers while representing large spatial extents, making them useful for both nationwide scenario analyses and deepening the understanding of the main drivers modulating tree growth throughout Central Europe. Incorporating the functions into forest scenario models may pave the way for a better understanding of forest responses to the suite of potential influencing factors as well as for analyses of scenarios that assume changing conditions with respect to climate, nitrogen deposition and species mixture.

References:

Mina et al., 2018, J Ecol, 106, 1106 – 1119

Rohner et al., 2018, Eu J For Res, 137, 29 – 44

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