

Appendix R

R 1 - 4.4. Implications for forest management.

This new paragraph will be added as “4.4. Implications for forest management” at page 13 line 4:

Our findings might be relevant for future management strategies of temperate forests. Specifically, the analysis, which species benefit most from rising temperatures (Fig 6), suggests replacing spruce monocultures with mixtures of deciduous trees.

Further, based on the analysis of which forest structure benefits most from rising temperatures (Fig. 4, Fig 5, Fig 6), we would suggest that early stage even-aged forests include only pioneer species. In the mature stage, we predict a positive effect of temperatures on wood production for a mixture of climax species including different tree sizes. These climax species could be planted below the canopy of the pioneer species in young forests. In our approach, we do not simulate the establishment and initial growth of very young trees. This can be analyzed in future studies with our approach. However, during the conversion between these two forest types one big challenge might be the removal of the pioneer trees without damaging the young trees, which will build the mature forest.

R2 - 4.5 implications for global vegetation modelling.

This new paragraph will be added as “4.5 implications for global vegetation modelling” at page 13 line 4:

Most global vegetation models (DGVM) represent vegetation as fractional cover of different plant functional types within a grid cell (e.g. LPJ Sitch et al 2003). Only a few global vegetation models include a more detailed representation of vegetation structure and functional diversity (Sato et al. 2007, Scheiter et al. 2013, Sakschewsky et al. 2016). It would be interesting to perform the here presented analysis also with global vegetation models which include structure, to better understand the mechanisms driving the sensitivity of forest systems against climate change.

Beside the global vegetation models, forest gap models, which have been restricted to local stands in the past are now able to simulate regions or even entire continents (Seidl et al. 2013, Roedig et al. 2017). Many studies using DGVMs or large scale forest gap models simulate natural succession. Our analysis indicates that natural and managed or disturbed forest systems (which differ in forest structure) might react differently on climate change. Hence, we suggest considering forest structure in future analysis on forest systems. Such forest structure information might be derived for instance from remote sensing.

R3 - enlarged conclusion:

The new conclusion will replace the text on page 13 line 6-9:

The temperature sensitivity of wood production in temperate forests is driven by forest structure and species diversity as our study showed. The species distribution index (Ω_{AWP}) and forest height seems to be the most important forest properties influencing temperature sensitivity.

Temperate forests that benefit most under temperature rise are (a) young forests including deciduous pioneer species with an even-aged structure and (b) old-growth forests with high tree height heterogeneity including different deciduous climax species.

This study tries also to give an explanation why forests suffer from rising temperatures in some cases and in others not. Finally, this work motivates the inclusion of forest structure and spatial distribution of species into future studies regarding wood production.

Additional References:

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Scheiter, Simon, Liam Langan, and Steven I. Higgins. "Next-generation dynamic global vegetation models: learning from community ecology." *New Phytologist* 198.3 (2013): 957-969.

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