

Chapter VII: How fast can European forests adapt to a changing climate?

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The large diversity in abiotic and biotic circumstances in European forests makes it extremely difficult to predict what the impacts of climate change will be on the various tree species, and ecosystems at the various localities. This makes it even more difficult to analyse how forest management should adapt in order to take the changing circumstances into account at the right time and at the right pace. The case studies in MOTIVE provide a basis for upscaling to the European scale. For the first time we combine here species changes as predicted by a climate envelope model, with an incorporation of forest management responses in an empirical European forest resource model (EFISCEN).

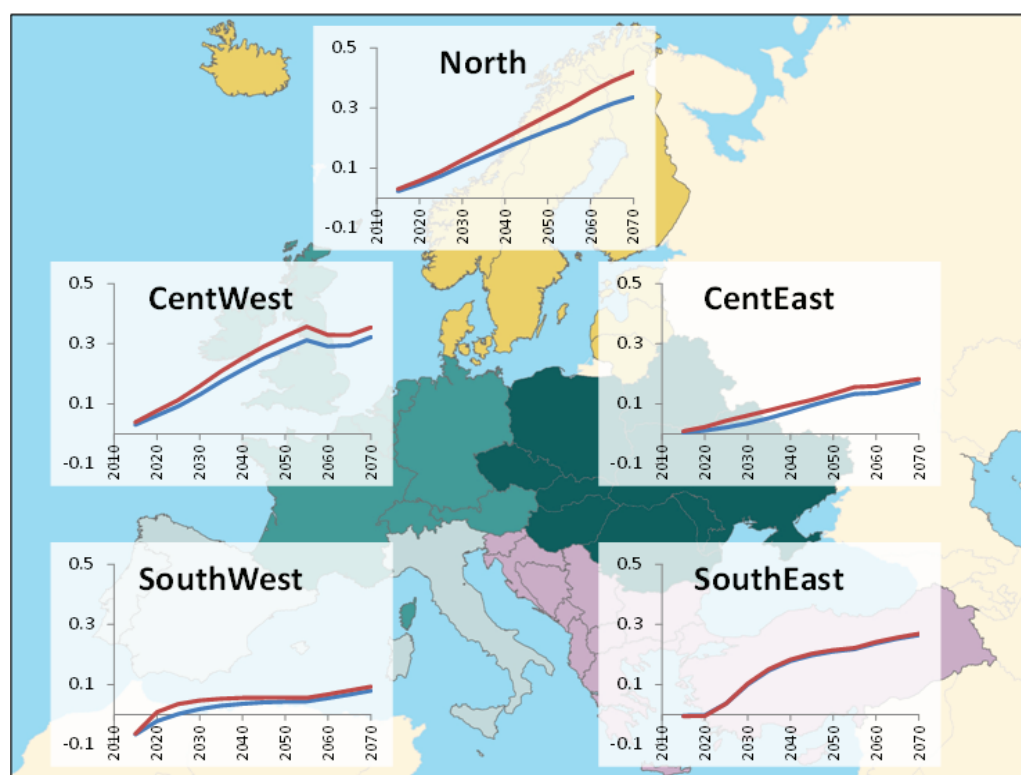


Figure 1. Realised area change for species with decreasing suitability as compared to Hanewinkel et al. 2013 maps (ie 0.5 means that 50% of the proposed area change by Hanewinkel has been realised.) blue is BAU management, red is adaptive management.

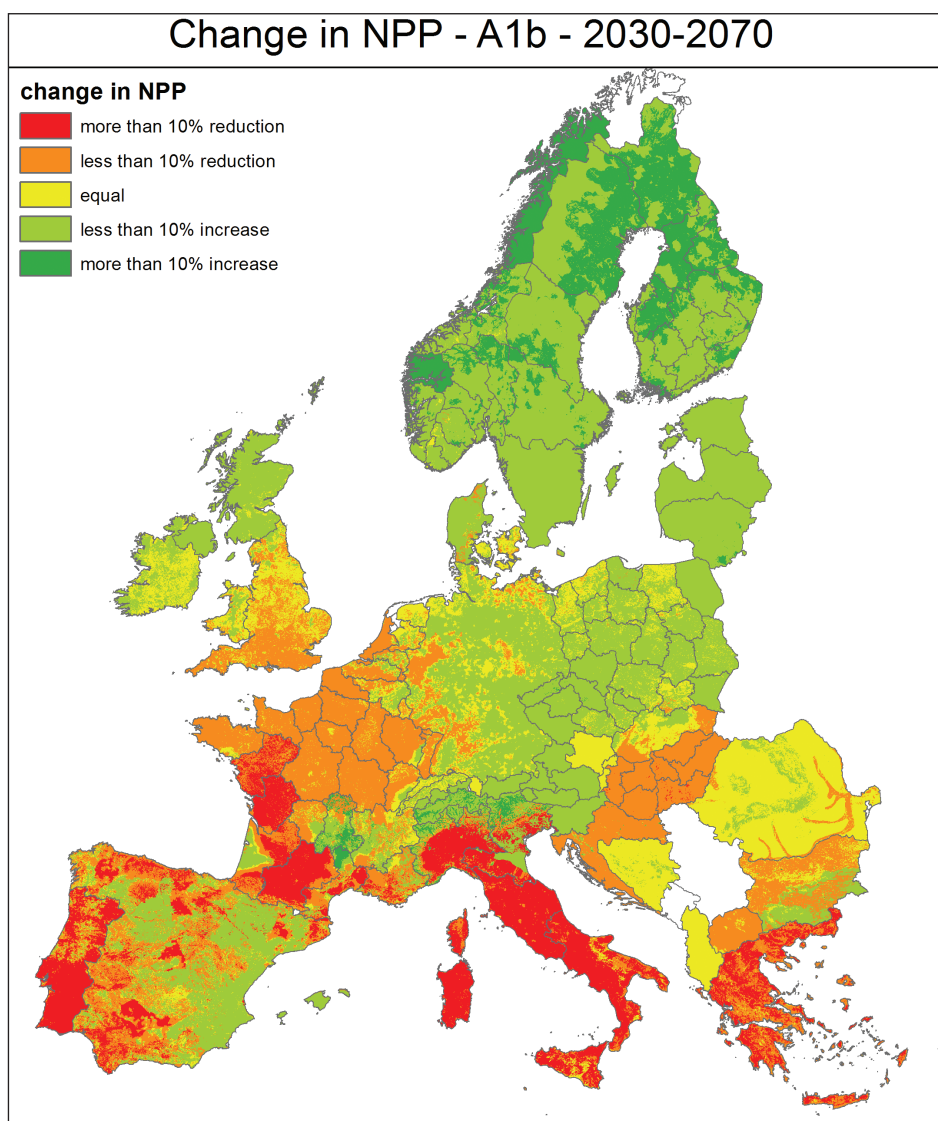


Figure 2. Expected average change in NPP in the period 2030–2070 per km², derived from Reyer et al. (2012).

This combination allows at the European scale to estimate how fast forest resources will change, under the assumption that existing trees on a site are plastic enough to survive the climate changes until the end of their normal rotation. It is assumed that only then a forest owner will decide to change tree species at that site towards one that is more preferred according to the climate envelope model. The owner will do this through shortening the rotation by approximately 10 years for susceptible species in order to speed up conversion towards more preferred species. This gives insight into fulfilment of raw material supply, forest resources, tree species, and increment under this adaptive management.

The results indicate that tree species composition will change only slowly at the European scale. By 2070, 10% of the total forest area will have changed species if species change at rotation end follows the climate envelope models. This can be increased to 12% by adaptive management, anticipating expected species shifts. This is respectively 20% and 23% of the area change that is indicated by the envelope models. Large differences occur in Europe, with Northern Europe and Central Western Europe showing a higher rate of adaptation and especially South Western Europe a slower rate.

Overall, growth increment increases under climate change as compared to current climate giving rise to positive production effects especially in Northern Europe. However, climate change effects are negative in South Western Europe. Adaptive management slightly reduces increment as compared to current management under climate change due to a higher share of temporarily slower growing forest (forest under regeneration). Raw material supply is not affected by climate change or adaptive management in this modelling study.