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Assessing management effects on Oak forests in Austria

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Historic land use as well as silvicultural management practices have changed the structures and species composition of central European forests. Such changes have effects on the growth of forests and contribute to global warming. As insufficient information on historic forest management is available it is hard to explain the effect of management on forests growth and its possible consequences to the environment. In this situation, the BIOME-BGC model, which integrates the main physical, biological and physiological processes based on current understanding of ecophysiology is an option for assessing the management effects through tracking the cycling of energy, water, carbon and nutrients within a given ecosystems. Such models are increasingly employed to simulate current and future forest dynamics. This study first compares observed standing tree volume, carbon and nitrogen content in soil in the high forests and coppice with standards stands of Oak forests in Austria. Biome BGC is then used to assess the effects of management on forest growth and to explain the differences with measured parameters. Close positive correlations and unbiased results and statistically insignificant differences between predicted and observed volumes indicates the application of the model as a diagnostic tool to assess management effects in oak forests. The observed data in 2006 and 2009 was further compared with the results of respective model runs. Further analysis on simulated data shows that thinning leads to an increase in growth efficiency (GE), nitrogen use efficiency (NUE) and water use efficiency (WUE), and to a decrease in the radiation use efficiency (RUE) in both forests. Among all studied growth parameters, only the difference in the NUE was statistically significant. This indicates that the difference in the yield of forests is mainly governed by the NUE difference in stands due to thinning. The coppice with standards system produces an equal amount of net primary production while consuming significantly less nitrogen compared to the high forests.