The Importance of Multimodel Projections to Assess Uncertainty in Simulation Models: A Case Study using the Forest Dynamics Model SYMFOR

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Simulation models have been increasingly used to gain insights regarding the effect of both direct and indirect anthropogenic impacts on natural resources and to devise policies that minimize these effects. If the uncertainty associated with projections from these simulation models is not adequately quantified and reported, modeling results might be misleading, with potentially disastrous consequences. We describe a method that allows the partitioning of the overall uncertainty in model projections into a number of different sources: model stochasticity, starting conditions effect, parameter uncertainty, and uncertainty due to model assumptions. Then, using multimodel projections from the forest dynamics model SYMFOR, we show that a source of uncertainty seldom reported – the uncertainty due to modeling assumptions – can be the greatest source of uncertainty. This implicitly reveals the importance of these multimodel projections, even when multiple independent models are not available. Finally, we suggest that a weighted multimodel average (where the weights are estimated from the data) might be substantially more precise than a simple multimodel average (equivalent to equal weights for all models), as models that strongly conflict with the data are given greatly reduced, or even zero weights. These results, derived from our case study, are likely to hold for a variety of simulation models. Furthermore, the method of partitioning modeling uncertainty is likely to be useful for other simulation models, allowing for a better estimate of the uncertainty associated with model projections and allowing researchers to identify which data need to be collected to reduce this uncertainty.

Key words: forest dynamics, simulation model, multimodel projections, uncertainty, modeling assumptions, partitioning of the variance

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