

Evaluating management options in protection forests using a comprehensive simulation model

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The cost-effective management of protection forests requires integrating biological, technical and economic knowledge which has only been partly achieved to date (Brang et al. 2006). It is therefore difficult to comparatively evaluate different management strategies, i.e. combinations of preventive operations (thinning, planting) and reactive treatments after disturbances (salvage harvesting, fill planting or re-planting, construction of defensive structures). In this paper, we describe a protection forest model that enables such evaluations, and provide examples of applications in case studies.

The model depicts relevant traits of protection forests at a regional level. It is based on a modified Markov chain approach and contains six modules (Fig. 1). In the stand dynamics module, the development of 16 stand types (e.g., multi-storied stand) is modeled. In the disturbances module, the areas affected by storm and insect damage can be given for each stand type. In the silvicultural operations module, silvicultural strategies can be defined. In the risk module, the hazard potential, the damage potential and probable damage from natural hazards are estimated. The costs module summarizes management costs, and the last module enables a cost-benefit analysis of the strategy chosen. The model runs over a 150 year period in 10 year steps.

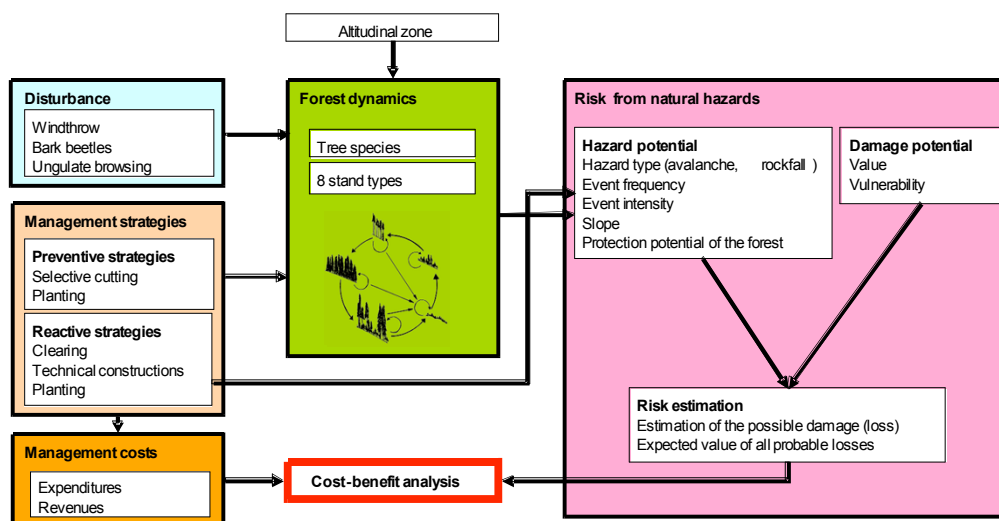


Fig. 1. Modules of the protection forest model, and most important influences between and within modules.

The PFM has not been validated so far, and some improvements of the model structure have been described. These shortcomings prevent the user from comparing management strategies, which was the reason for building the model. Nevertheless,

first tests of the PFM show plausible model behavior, which suggests that the approach is promising. Moreover, the existing PFM seems suitable for screening the relative relevance of different parameters for risk reduction, and for identifying factors which are clearly relevant and clearly irrelevant. Furthermore, the model can be applied to evaluate the chances of reducing uncertainty in judging management strategies by investing research in different areas.

The particular merit of the PFM is that it is the first model to describe, in a simplified way, the long-term development of protection forests, integrating ecological, economic and technical aspects.

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