Submitted Abstract

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Abstract

The protection of infrastructure against the impacts of natural hazards is one of the most important ecosystem services in many mountain forests. Forest management can decisively influence their current protective quality and its future development. Due to the management history and the resulting forest dynamics of many mountain forests, regular interventions are often necessary to counteract the tendency of a development towards uniform and dense stands that lack the key element of resilience: sustainable regeneration.

In practical forest management, decisions on when and how to intervene in a protection forest are usually taken on a stand-level, based on an assessment of its current state, the expected development, and the descriptions of minimal and ideal forest states according to the site type and natural hazard. However, it is not known how often interventions need to be scheduled to sustainably warrant the protective function of mountain forests. Thus, to support practical management planning, knowledge about effective long-term management strategies, i.e., the types and timing of interventions, to improve or maintain the protective function is needed.

We developed a new, spatially explicit yet simple forest stand simulation model based on empirical data with a specific focus on regeneration that includes trees as small as 10 cm in height. The model is able to depict the spatial stand structure and detailed management scenarios. This allows us to assess the protective quality of the simulated stands, including the quantity and composition of regeneration. We present the model and its validation, and apply it for deriving management strategies for typical forest types and stand structures of Swiss protection forests that increase and/or maintain the protective function against different natural hazards. We also discuss how these findings can be transferred to decision makers on different levels of forest management and planning.