Submitted Abstract

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Abstract

Forests in mountain regions play a crucial role in protecting settlements and infrastructure against natural hazards. At the same time, more frequent and severe disturbances due to climate change may lead to a temporary reduction in the provision of the protection service of forests. In this study, we analysed the long-term dynamic of the protective effect of forests against rockfall after severe disturbance events for different rockfall and site characteristics. We therefore modelled stand growth of the three dominating tree species F. sylvatica, P. abies and A. alba using long-term data of the Swiss National Forest Inventory (SNFI). We then quantified the potential energy dissipation capacity of forests as a function of stand growth based on a rapid rockfall assessment tool. Finally, we analysed the evolution of the protective effect for varying rockfall dispositions. The results show that the potential energy dissipation capacity of the stands mainly depends on the altitude, slope and the species. While a high protective effect against small blocks (0.1-0.5 m3) is regained already in the first 20-30 years after a disturbance, the recovery of the protective effect takes substantially longer for larger blocks (> 1m3). After ~200 years of stand growth, the protective effect decreases again for small blocks because of a limited number of tree stems for sufficient impacts. The study allows for the quantification of the long-term dynamics of the protective effect of forest against rockfall for a wide range of site and rockfall dispositions. This is of particular importance in the face of increasing disturbance frequency and severity due to climate change.