# Submitted Abstract

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## Abstract

Risks related to mass movements affect life, infrastructure and settlements in densely populated mountain regions such as the European Alps. Forests and other ecosystems provide a fundamental protective function that can strongly mitigate risks related to multiple hazards such as snow avalanches and rockfall. However, climate change and extreme climatic events, natural disturbances and management interventions may not only affect the immediate protection efficacy of the forest through stand density and stability reductions, but also regeneration dynamics and thus the long-term protection potential of forest ecosystems. The evaluation of forest dynamics under different climate, disturbance and management scenarios is thus vital to support climate-adaptive decision making in forest management.

In this contribution, we present the results of a forest landscape modelling approach (LandClim) used to simulate future forest and regeneration dynamics under a range of climate, forest management and disturbance scenarios until the end of the 21st century in the region of Davos, Switzerland. The model was initialized with forest structure data from stand maps and high-resolution remote sensing data, current climate, management practices and disturbance regimes. Four pathways of potential forest development were included: two climate/disturbance (moderate and strong change) and two stakeholders informed management scenarios (no adaptation and adaptation to increase resilience). The climate/disturbance scenarios accounted for changes in temperature, precipitation, windthrow and bark beetles, and considered interacting effects between windthrow and beetle disturbances and their effects on forest development and its protection function.

Understanding these processes is key to identifying priority areas for targeted management interventions. Changes in tree species composition are expected particularly under the more severe climate change scenarios with an increasing share of broadleaves also at higher elevations. Although management that reduces growing stock and promotes forest regeneration may support forest resilience, and thus the long-term protective effect against gravitational natural hazards, it may need to be balanced with short-term reductions in protection efficacy.

Our findings might help identify forest communities that are more resilient to climate change and can deliver a stronger protective function against multiple hazards. Thus, our work might inform forest managers, practitioners and decision-makers to ensure the protective role of mountain forests in the long term. The presented forest landscape modelling study is part of an interdisciplinary project that evaluates natural hazard processes, cascading processes and risks for the region of Davos under the effects of extreme events and climate change.