Analysis of cumulative climate risks and associated impact cascades in Switzerland

Raphael Neukom (1,2), Veruska Mucchione (2), Nadine Salzmann (1), Christian Huggel (2), Vincent Roth (3), and Roland Hohmann (3)
(1) University of Fribourg, Department of Geosciences, Switzerland (nadine.salzmann@unifr.ch), (2) University of Zurich, Department of Geography, Switzerland, (3) Federal Office for the Environment (FOEN)
contact: *raphael.neukom@unifr.ch*

University of Zurich[UZH]

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Background and motivation

In its recent study on 'climate-related risks and opportunities', the Swiss Federal Office for the Environment (FOEN) identified knowledge gaps and related missing planning tools for risks with low probability of occurrence but potentially very severe impacts for society and/or the environment (1). Such risks refer in particular to risks triggered by cumulating meteorological / climatic extremes events, which exacerbate through process cascades or return within shorter time intervals than expected.
To respond to these knowledge gaps and 'blind spots' in climate risks, a collaborative effort including academic and government institutions at different administrative levels is undertaken in order to explore and analyse the potential of such large cumulative, complex risks and to suggest actions needed to manage them in Switzerland. The project is based on two case studies, which are developed in consultation with stakeholders from science, policy and practice at the national and sub-national level.
The case studies analyse risks triggered by meteorological events based on projected and recently published Swiss Climate Scenarios CH2018 (2), considering rare but plausible scenarios where such triggering events cumulate and/or occur in combination. One case study is conducted in the alpine region of southern Grisons, the second one in the urban Area of Basel.
Here we present the results from the alpine case study conducted in the Val Mesolcina (GR).

Case Study 1: Protective forest, Val Mesolcina, GR

Study Area: Vulnerable areas of protective forest in Soazza / Mesocco
Trigger-event: Two consecutive very dry and warm seasons (winter to summer), following a stormy autumn.
Impact cascades: comined impacts on the protective forest by drought, bark beetle infestation, fire risk and windthrow.
Analysis method: Identification of storylines together with stakeholders, followed by an expert survey. In the survey, 29 participants from administration and practice estimated the likelihood of a loss of protective function in a „top-down" and a „bottom-up" concept.

Can a combined meteorological event lead to a loss of protective function in the forest und a worst-case scenario of cascading impacts?

Fig. 1: Protective forest in the Val Mesolcina. The three vulnerable forest areas studied in the survey are highlighted with coloured shading.

Impact of individual and combined hazards

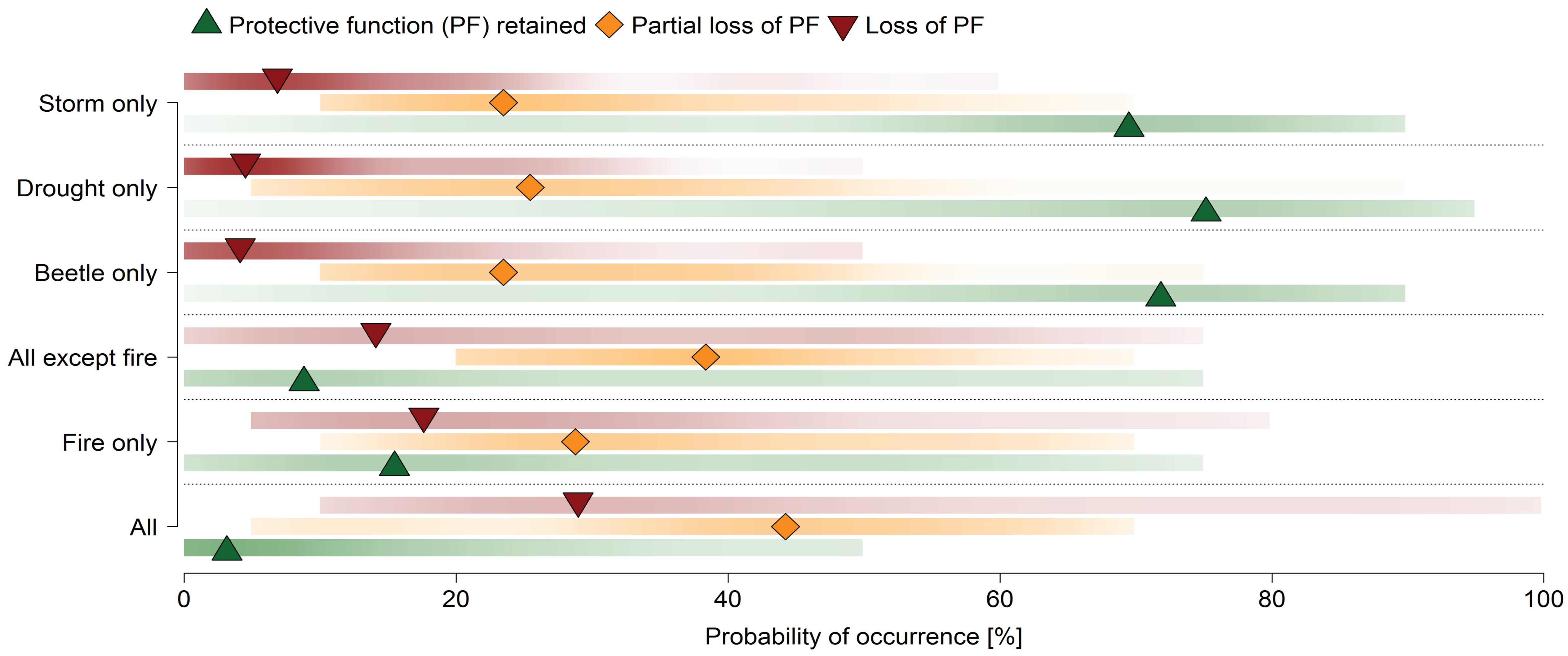


Fig. 2: Synthesis from the „top-down" part of the experts survey.
Likelihood of occurrence of the scenarios "protective function retained", "partial loss of protective function" and "complete loss of protective function" for various hazards that can be caused by the trigger-event. The values were estimated by 29 experts for all three scenarios. The symbols show the most likely value expected by the experts (modal value). The shaded areas span all given answers.

Individually, the hazards strorm, drought and bark beetle are unlikely to harm the protective function.

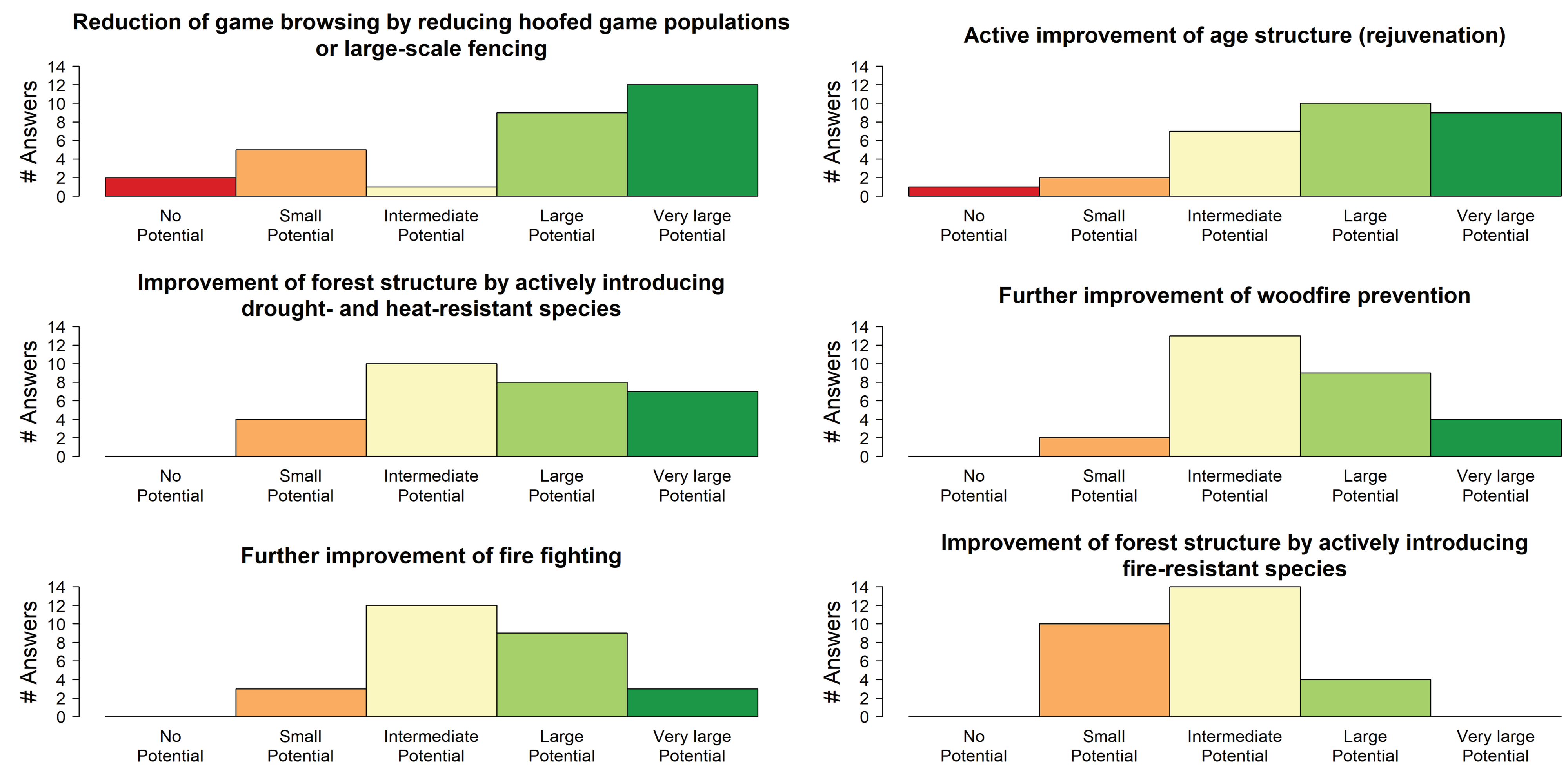
If all hazards occur combined, all experts expect at least a partial loss of the protective function. The probability that the protective function is retained, drops below 10%.

Potential of adaptation options

Fig. 3: Suitability of different adaptation measures to minimize the risk for the loss of protective function caused by the trigger-event.

Bars show the number of answers for the options „no potential" (dark red) to „very large potential" (dark green) for six different adaptation options.

In summary, a general improvement of the age structure is estimated to have the largest potential to increase the resilience of the forests (top panels). Many experts think that this can be achieved by reducing game browsing, which has been identified as the key obstacle for rejuvenation and replacement of spruce and birch by more resilient species.



References:
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2 NCCS 2018: CH2018 - Climate Scenarios for Switzerland. National Centre for Climate Services, Zurich. 24 pp.ISBN 978-3-9525031-3-3