Snowbeds are particularly affected by climate change in the Swiss Alps

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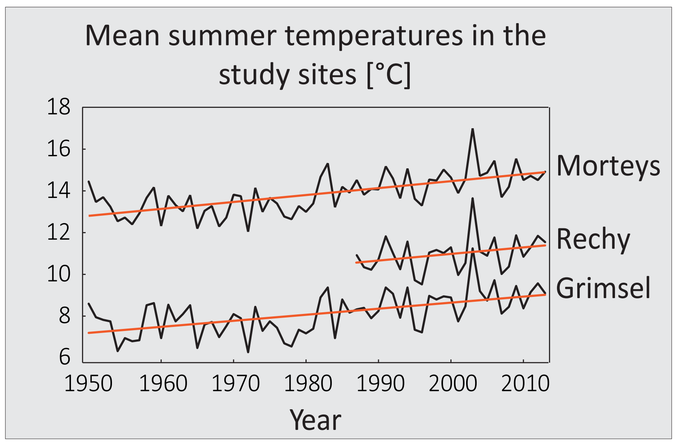
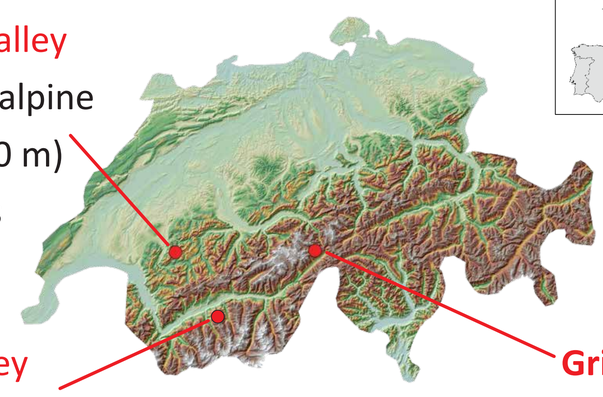
Context

Mountain regions are warming rapidly and the upward shift of plant species has been observed on many alpine and nival summits[1]. On the other hand, the reaction of the subalpine and lower alpine plant communities to the current climate changes has been little investigated so far[2,3]. The increasing temperatures, combined with lower snow precipitations, lead to an earlier snowmelt and therefore longer growing seasons[4].



Study area

Morteys Valley
Subalpine-alpine
(1700-2230 m)
Calcareous



Rechy Valley
Subalpine-alpine (2328-2740 m)
Siliceous + Calcareous

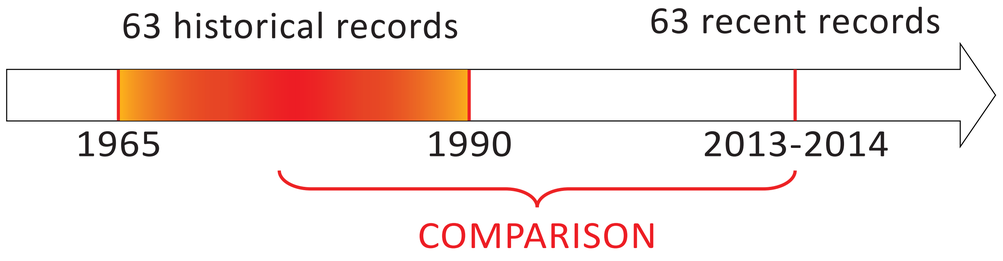
Grimsel Oberaar
Alpine (2300-2650 m)
Siliceous

Methods

Re-survey study...



63 historical records — 63 recent records



We determined the changes in diversity and species composition and, with the help of ecological indicator values[5], we identified the environmental factors potentially responsible of the observed changes.

... on 6 plant communities

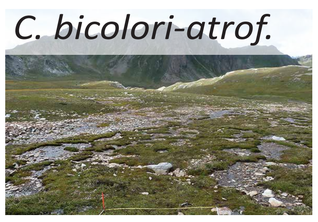
Calcareous subalpine grasslands

Subalpine siliceous grasslands

Alpine ridges Both calcareous and siliceous

Alpine siliceous grasslands

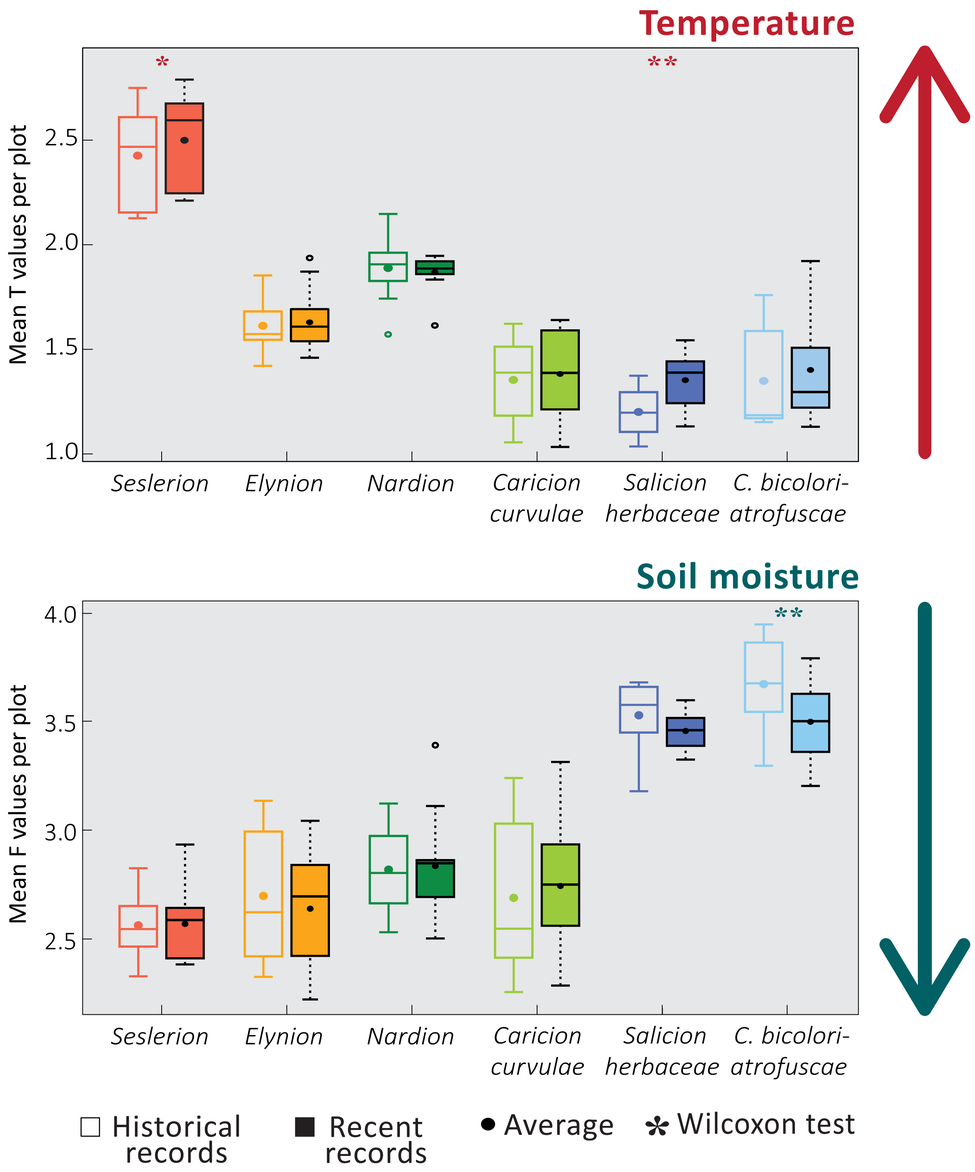
Wet snowbeds close to river, lakes, firns



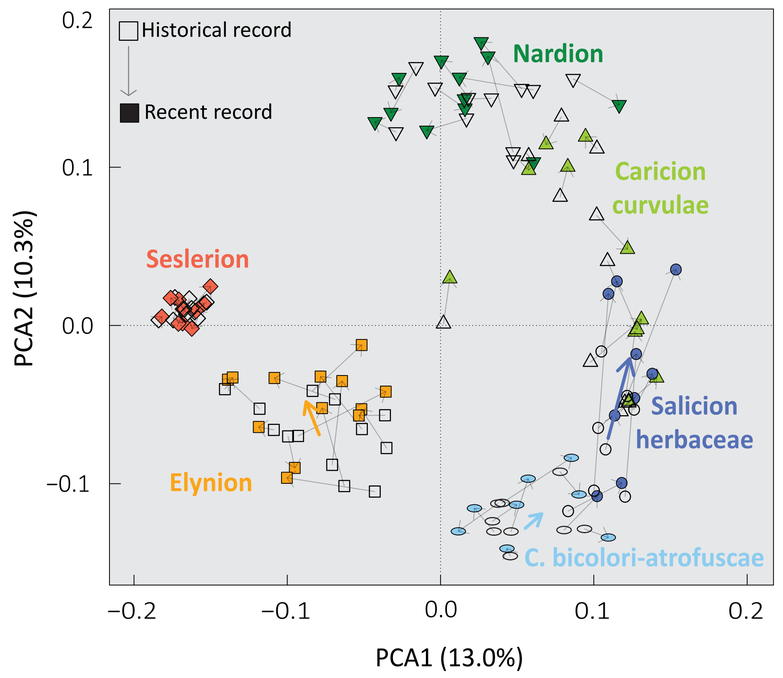
Snowbeds: more than 8 months of sow cover per year

Results

Ecological indicator values[5]



Shifts of plant communities



> Snowbeds:
earlier snowmelt and longer growing season allow the colonisation by grassland species.

> Grasslands:
Steep terrains = physical barriers, high aboveground and belowground competition, high longevity and clonality of certain species prevent the arrival of species from lower elevations.

Conclusions

1. Climate change affects subalpine-alpine plant communities **differently**.
2. Plant communities linked to **long snow cover** are the most endangered.
3. Will **persistence** of grasslands induce a large local extinction debt[6] ?

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References: (1) Pauli, H. et al. 2012. Science 336; (2) Britton, A. J. et al. 2009. Biol. Conserv. 142; (3) Ross, L. C. et al. 2012. J. Veg. Sci., 23; (4) Serquet, G., et al. 2013, Theor. Appl. Climatol., 114; (5) Landolt, E. et al. 2010. Ecological Indicator Values and Biological Attributes of the Flora of Switzerland and the Alps. (6) Dullinger, S. et al. 2012. Nat. Clim. Chang., 2.

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