European mountain plant population shows delayed response to climate change

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A modeling study from the European Alps suggests that population declines to be observed during the upcoming decades will probably underestimate the long-term effects of recent climate warming on mountain plants. A European team of ecologists around Stefan Dullinger from the Department of Conservation Biology, Vegetation and Landscape Ecology of the University of Vienna presents a new modeling tool to predict migration of mountain plants which explicitly takes population dynamic processes into account. Their results are published in *Nature Climate Change*.

Plant species are expected to respond to a warming climate by moving their ranges pole-wards or up-wards in mountains. Previous attempts to predict such range shifts have made several simplifying assumptions leading to large uncertainties about the impending loss of mountain plant populations.

In their study published in "*Nature Climate Change*" a European team of ecologists uses a new modeling approach which relaxes some of these assumptions. The authors apply this approach to simulate how 150 high mountain plant species will migrate from their current distribution in the Alps across this mountain range in response to 21st century climate trends. The results indicate that by the end of the 21st century the Alpine high mountain flora will lose on average 44 to 50% of its current distribution area, a fairly moderate forecast as compared to predictions achieved from more traditional modeling techniques.

However, the new approach also suggests that rapid climate trends foreseen for this century will likely outpace species' range shifts considerably. In particular, many of the plant populations predicted to persist in the near future will actually do so under local climate conditions that are already unsuitable for their long-term survival because long live spans and clonal reproduction strategies of many high mountain plants allow them to retard extinction.

"These results warn against drawing over-optimistic conclusions from the relatively modest loss of mountain plant populations likely to be observed during the coming decades", says Stefan Dullinger from the University of Vienna, "because the final consequences of climate warming on plant distribution in the Alps will only become realized with a delay of decades or even centuries."

In addition, the researchers found plants endemic to the European Alps, that is those which do not occur anywhere else, to be particularly sensitive to climate impacts. Up to 75% of these species might face a reduction of their ranges by more than 80% of their current distribution because they often have particularly low dispersal capacities and occur in lower marginal mountain chains, which might turn into climatic traps under warming. "This is particularly worrisome because endemic plants represent a natural heritage unique to a region and their loss is hence irreversible", added Karl Hülber from the Vienna Institute of Nature Conservation & Analyses (VINCA).

More information: *Nature Climate Change*: Extinction debt of high-mountain plants under twenty-first-century climate change: Stefan Dullinger, Andreas Gattringer, Wilfried Thuiller, Dietmar Moser, Niklaus E. Zimmermann, Antoine Guisan, Wolfgang Willner, Christoph Plutzar, Michael Leitner, Thomas Mang, Marco Caccianiga, Thomas Dirnböck, Siegrun Ertl, Anton Fischer, Jonathan Lenoir, Jens-Christian Svenning, Achilleas Psomas, Dirk R. Schmatz, Urban Silc, Pascal Vittoz,

& Karl Hülber. Available online on May 6, 2012. DOI: 10.1038/NCLIMATE1514