Submitted Abstract

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First Author First Name Last Name	 Christian (1) Rixen
Submitting Author First Name Last Name	 Christian Rixen
Correspondence	rixen@slf.ch
Co-Authors **>> E-Mails will be not listed**	Wipf, Sonja (2); Rumpf, Sabine (3); Giejsztowt, Justyna (4); Millen, Jules (4); Morgan, John (5); Nicotra, Adrienne (6); Venn, Susanna (7); Zong, Shengwei (8); Dickinson, Katherine (9); Freschet, Gregoire (10); Kurzböck, Claudia (1); Ji, Lin (11); Pan, Hongli (12); Pfund, Beat (1); Quaglia, Elena (13); Su, Xu (14); Wang, Wei (15); Wang, Xiangtao (15); Yin, Hang (16); Deslippe, Julie (4)
Organisations **>> for readability limited to 9** **>> full list can be found online**	1: SLF, Switzerland 2: Swiss National Park 3: University of Basel 4: Victoria University of Wellington 5: LaTrobe University 6: Australian National University 7: Deakin University 8: Northeast Normal University 9: University of Otago
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Abstract

Climate warming is shifting the distributions of mountain plant species to higher elevations. Cold-adapted plant species are under increasing pressure from novel competitors that are encroaching from lower elevations. Plant capacity to adjust to these pressures may be measurable as variation in trait values within a species. In particular, the strength and patterns of intraspecific trait variation along abiotic and biotic gradients can inform us whether and how species can adjust their anatomy and morphology to persist in a changing environment.

Here, we tested whether species specialized to high elevations or with narrow elevational ranges show more conservative (i.e. less variable) trait responses across their elevational distribution, or in response to neighbours, than species from lower elevations or with wider elevational ranges. We did so by studying intraspecific trait variation of 66 species along 40 elevational gradients in four countries in both hemispheres. As an indication of potential neighbour interactions that could drive trait variation, we also analysed plant species' height ratio, its height relative to its nearest neighbour.

Variation in alpine plant trait values over elevation differed depending on a species' median elevation and the breadth of its elevational range, with species with lower median elevations and larger elevational range sizes showing greater trait variation, i.e. a steeper slope in trait values, over their elevational distributions. These effects were evidenced by significant interactions between species' elevation and their elevational preference or range for several traits: vegetative height, generative height, specific leaf area and patch area. The height ratio of focal alpine species and their neighbours decreased in the lower part of their distribution because neighbours became relatively taller at lower elevations. In contrast, species with lower elevational optima maintained a similar height ratio with neighbours throughout their range.

We provide evidence that species from lower elevations and those with larger range sizes show greater intraspecific trait variation, which may indicate a greater ability to respond to environmental changes. Also, larger trait variation of species from lower elevations may indicate stronger competitive ability of upslope shifting species, posing one further threat to species from higher ranges.