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Phenology is plastic: the response of alpine shrub Salix herbacea to earlier snowmelt

Julia Wheeler (1,2), Janosch Sedlacek (3), Mark van Kleunen (3), Oliver Bossdorf (4), Guenter Hoch (2), Sonja Wipf (1), Sophie Karrenberg (5), Christian Lexer (6), Andres Cortés (5), and Christian Rixen (1)

(1) WSL Institute for Snow and Avalanche Research SLF, Davos, Switzerland (julia.wheeler@slf.ch, wipf@slf.ch, rixen@slf.ch), (2) Institute of Botany, University of Basel, Basel, Switzerland (guenter.hoch@unibas.ch), (5) Department of Plant Ecology and Evolution, Uppsala University, Uppsala, Sweden (sophie.karrenberg@ebc.uu.se, andres.cortes@ebc.uu.se), (3) Department of Biology University of Konstanz, Konstanz, Germany (mark.vankleunen@uni-konstanz.de, janosch.sedlacek@uni-konstanz.de), (4) Institute of Plant Sciences, University of Bern, Bern, Switzerland (bossdorf@ips.unibe.ch), (6) Department of Biology, University of Fribourg, Fribourg, Switzerland (christian.lexer@unifr.ch)

Climate change has been demonstrated to accelerate snowmelt in alpine systems, which can represent a critical ecosystem change for alpine plant communities. Understanding how snowmelt timing affects phenology and the development of alpine plants, and the capacity of these plants to respond, is thus necessary for predicting alpine community response to climate change. We examined the effects of snowmelt timing on the phenological development of the common clonal alpine shrub Salix herbacea over three growing seasons using both a space-for-time substitution along a natural snowmelt gradient and a reciprocal transplant experiment of clonal fragments between early and late snowmelt microhabitats.

Leaf, flower and fruit development time was significantly influenced by snowmelt timing along both the natural snow gradient and in the reciprocal transplant, with less time required to develop to each phenophase in shrubs growing naturally in late-lying snowbeds and in S. herbacea clonal fragments transplanted from early-exposure sites into late snowbed microhabitats. This suggests that snowmelt timing, likely through the regulation of seasonal temperature accumulation, controls phenological development. In addition, the transplant experiment indicated that S. herbacea demonstrates a highly plastic phenological response to snowmelt timing, because there was no significant difference in phenology between clones originating either from snowbeds or early exposure sites when exposed to the same climatic conditions. Thus, S. herbacea may be able to profit from accelerated snowmelt due to climate change by developing soon after snowmelt. However, freezing damage during vulnerable early development stages may increase, as phenological development is slowed and the probability of lethal freezing events is increased under early snowmelt conditions.