Flowering phenology in alpine grassland strongly responds to shifts in snowmelt but weakly to summer drought

ID 4618964
Author(s) Vorkauf, Maria; Kahmen, Ansgar; Körner, Christian; Hiltbrunner, Erika
Author(s) at UniBasel Hiltbrunner, Erika ; Vorkauf, Eva Maria Nora ; Körner, Christian ; Kahmen, Ansgar ;
Year 2021
Title Flowering phenology in alpine grassland strongly responds to shifts in snowmelt but weakly to summer drought
Journal Alpine Botany
Volume 131
Number 1
Pages / **Article-Number** 73-88
Alpine plants complete their seasonal phenological cycle during two to three snow-free months. Under climate change, snowmelt advances and the risk of summer droughts increases. Yet, photoperiodism may prevent alpine plants from benefiting from an earlier start of the growing season. To identify the drivers of flowering phenology in the seven main species of an alpine grassland, we experimentally shifted the snowmelt date through snow manipulations, and excluded precipitation during summer. With ”time-to-event” models, we analysed the beginning of main flowering with respect to temperature sums, time after snowmelt, and calendar day (photoperiod). We identified two phenology types: four species tracking snowmelt dates directly or with a certain lag set by temperature sums, including the dominant sedge Carex curvula , Anthoxanthum alpinum Helictotrichon versicolor , and Trifolium alpinum , and three species tracking photoperiod: Geum montanum , Leontodon helveticus and Potentilla aurea . Photoperiodism did not act as daylength threshold but rather modulated the thermal sums at flowering. Hence, photoperiod delayed flowering after earlier snowmelt. The grass A. alpinum was the only one of seven species that clearly responded to drought by earlier and longer flowering. The remarkably high importance of snowmelt dates for both phenology types suggests an earlier onset of flowering in a warmer climate, particularly for non-photoperiod-sensitive species, with an increasing risk for freezing damages and potential disruptions of biotic interactions in the most frequent type of alpine grassland across the Alps. Consequentially, the distinct microclimate and species-specific responses to photoperiod challenge temperature-only based projections of climate warming effects on alpine plant species.
Publisher Springer
ISSN/ISBN 1664-2201 ; 1664-221X
edoc-URL https://edoc.unibas.ch/83387/
Full Text on edoc No;
Digital Object Identifier DOI 10.1007/s00035-021-00252-z
ISI-Number WOS:000636975300001
Document type (ISI) Article