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RESEARCH ARTICLE

Above- and below-ground responses to experimental climate forcing in two forb species from montane wooded pastures in Switzerland

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Abstract

1. Mountain ecosystems are particularly threatened by ongoing climate change and the species composition of high elevation grasslands is already changing. An open research question is how these ecosystems will adapt to changes in their key environmental constraints.
2. The responses of wooded pastures to experimental climate forcing were analysed in a transplantation experiment conducted downslope, along an elevational temperature and precipitation gradient on the lee side of Jura Mountains, Switzerland (up to +4.17°C and −35% precipitation). To improve mechanistic understanding of biodiversity and biomass decreases in response to transplantation, changes in functional traits within foliage and roots of one ubiquitous (*Taraxacum officinale*) and one montane (*Alchemilla monticola*) perennial forb species were investigated.
3. In consequence of transplantation, the two studied species raised their temperature optimum for CO_2 assimilation and net photosynthesis yield from 20 to 30°C. During cool periods, the highest rates of leaf gas exchanges were measured at the lower recipient sites. However, an opposite trend was observed during a spring drought and summer warm spell. Regarding the more integrative morpho-anatomical traits, *Alchemilla* primarily acclimated to warmer temperatures at the recipient sites with increased leaf and foliage rosette size. Missing xeromorphic and/or hydraulic adjustments in foliage and roots, its susceptibility to higher vapour pressure deficits and lower soil moisture availability was thus enhanced. *Taraxacum* showed adjustments to both warmer temperature and lower moisture availability, including reduced leaf size, lower hydraulic diameter of xylem vessels and theoretical specific hydraulic conductivity.
4. The anticipated shift in the environmental conditions at high elevation, with reduced coldness limitation but increasingly constraining water economy, could thus become particularly demanding for montane species of wooded pastures. It may