

‘From research – for practice’: translating research findings for practical application

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Introduction: The prolonged drought in 2018 has emphasised again how changes in temperature and precipitation and the occurrence of extreme events directly affect agricultural systems such as grasslands. Thus, translating research findings for practical application is crucial, in particular to support resilient forage production systems that ensure productivity under future climate. Although drought effects on grasslands have been studied in numerous scientific experiments, findings have typically been published only in scientific literature unavailable for practice or policy-making. Thus, there is a lack of adequate translation and communication of research findings into the practical context.

Materials and methods: Using data from several multi-year summer drought experiments in Switzerland (e.g. Burri *et al.*, 2014; Gilgen and Buchmann, 2009; Hofer *et al.*, 2016), we (1) summarised observed responses of grassland vegetation and soils to experimental drought and (2) translated them for practice to support grassland management decisions in the future.

Results: Grassland responses to drought varied considerably among individual studies. Thus, simple generalisations based on single studies are impossible and recommendations for practice need to be based on a comprehensive evaluation of multiple studies taking into account environmental and management aspects (Table 1). We rely on established channels and networks to disseminate these results to different stakeholder groups. Examples are low threshold activities like hands-on activities at fairs for the general public, information leaflets and field days for practitioners, and scientific discourse with governmental actors.

Table 1. Responses from drought experiments in Swiss grasslands and their applicability.

| Variable | Response | Universal applicability |
|-------------------------------------|---|--|
| Short-term yield | Mostly negative but positive responses also occur | Restricted to regions as response is site-dependent; species or functional group composition is relevant |
| Annual yield | Moderate to no response | High resilience of grasslands to drought can be generalised |
| Photosynthesis/stomatal conductance | Mostly species-dependent decrease | Not directly relevant for practice |
| Weed pressure | Increase possible | Generalisation difficult as weeds are often not considered explicitly; sward diversity is relevant |

Conclusion: Only when appropriately translated for practical application and distributed through tailored channels such as the Swiss Grassland Society (AGFF), regional extension services and other established farmers’ networks, research findings on drought effects can contribute directly to achieving resilient forage production systems in Switzerland.

Burri S., Sturm P., Prechsl U.E., Knohl A. and Buchmann N. (2014) The impact of extreme summer drought on the short-term carbon coupling of photosynthesis to soil CO₂ efflux in a temperate grassland. *Biogeosciences* 11, 961-975.

Gilgen A.K. and Buchmann N. (2009) Response of temperate grasslands at different altitudes to simulated summer drought differed but scaled with annual precipitation. *Biogeosciences* 6, 2525-2539.

Hofer D., Suter M., Haughey E., Finn J.A., Hoekstra N.J., Buchmann N. and Lüscher A. (2016). Yield of temperate forage grassland species is either largely resistant or resilient to experimental summer drought. *Journal of Applied Ecology* 53, 1023-1034.