

Submitted Abstract

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Title	Ecosystem Responses Of Alpine Grasslands To Drought Depend On Timing: Results From A Mesocosm Study Investigating Plant Performance And Co2 Flux Thresholds.
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Abstract

As a result of climate change, increased frequency of drought events are predicted globally. In this scenario, the timing of dry events represents a crucial aspect in determining the degree to which limited water supply impacts ecosystem functions. Research on drought-timing effects on high-elevation grasslands, however, is still scarce. In particular, a study investigating moisture thresholds of ecosystem functions under different drought timings has yet to be carried out.

To fill this knowledge gap, a mesocosm experiment was implemented using monoliths from a *Carex curvula* grassland. The effects of different drought timings during the growing season was assessed on plant performance - i.e. aboveground net primary production (ANPP) and plant survival. Soil moisture and temporal thresholds (days without precipitation) of ecosystem respiration (ER) and gross ecosystem production (GEP) were also identified to assess whether these vary in different drought conditions - i.e. a dry event starting immediately after snowmelt (EARLY) vs one starting ca. 1 month later (MID). Three drought treatments were employed: early-season drought (ED) and mid-season drought (MD), both of which lasted 1 month; and full-season drought (FD) lasting 2 months, which was carried out to identify the thresholds triggering different ER and GEP rates. Full-rainfall exclusion was imposed and monoliths watered during the whole experimental period were used as controls (C).

The plant community was diversely affected by drought depending on its timing, with the greatest ANPP reduction in ED compared to C; plant survival, on the other hand, was lower in MD, while plants in ED exhibited similar C values. Threshold analysis revealed that soil moisture and temporal thresholds for ER and GEP were different according to drought timing, with thresholds under MID drought being reached at higher moisture values, and after a shorter dry period, compared to those under EARLY drought.

Overall, the impact of drought on ecosystem functions in alpine grasslands appears to be strongly dependent on the timing of dry spells during the growing season. In particular, the thresholds of key ecosystem processes differ according to when the extreme event is experienced - a result confirmed by the data on plant survival. Timing should, therefore, be factored in when ecological thresholds in response to water scarcity are investigated.