Drought impacts on leaf functional and hydraulic community traits in grasslands: A matter of timing

Amarante Vitra*†[1,2]

[1]Institut Fédéral de Recherches sur la Forêt, la Neige et le Paysage (WSL) – Institut fédéral de recherches WSL -Site Lausanne EPFL-ECOS Batiment GR - Station 2 CH-1015 Lausanne (Switzerland), Switzerland

[2]Ecole polytechnique fédérale de Lausanne (EPFL) – EPFL-ENAC-ECOS Bâtiment GR, Station 2 CH-1015 Lausanne, Suisse, Switzerland

Abstract

Drought events can occur at different periods during the vegetation growing season, likely having contrasting effects when happening early or later in the season. However, knowledge about the interacting effects of the timing of drought and the stage of the vegetation along the growing season is still scarce, thus limiting our ability to accurately predict forage quantity losses.
To investigate plant community responses to drought seasonality (during or after the peak of biomass production), we established a drought experiment in two semi-natural grasslands of the Swiss Jura Mountains. We measured three plant functional traits including two leaf traits reflecting drought tolerance (SLA, LDMC) and one hydraulic trait (predicted percentage loss of hydraulic conductance, PLCp) and plant aboveground biomass. Plant species composition was also determined to calculate community weighted mean traits.

First we observed that community weighted mean trait values strongly varied along the growing season. Second we found that the effects of drought occurring during the peak of growing season had lower intensity than when occurring after this peak. We also found that the plant hydraulic trait was more plastic than the leaf traits.

Using a structural equation model (SEM), we also showed that reduction in soil moisture had no direct impacts on aboveground biomass production. Instead, we observed that the diminution in aboveground biomass production was partially due to a lower PLCp under drought, which directly and indirectly affected changes in SLA. Change in SLA in response to drought was the best predictor of community aboveground biomass production.
The stochasticity of extreme drought events is likely to increase in the future and knowledge on the effects of different drought timing together with the choice of plant traits used to assess community response to drought are thus important for improving mechanistic model predictions of climate change impacts.

*Speaker
†Corresponding author: amarante.vitra@epfl.ch