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Resilience of belowground carbon allocation dynamics after drought in a mountain grassland

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Drought periods, which have been projected to become more frequent in many European regions, can severely affect plant and microbial carbon (C) turnover. Drought has been shown to decrease plant C uptake, affect plant belowground C allocation, and may alter the accessibility of recent plant derived C for soil microbes, thus shifting the active microbial community composition in soils. It is however still not clear how plant belowground allocation dynamics and the transfer of recent C from plants to microbial communities recover after an extreme drought.
To address this question we conducted a $13CO_2$-pulse labelling experiment on a mountain meadow that had been exposed to 10 weeks of rain-exclusion, had been mown at the end of the drought treatment and, after rewetting, had returned to similar soil moisture conditions as in control plots. We traced the 13C label from plant shoots to fine roots and fine root respiration, as well as to the extractable soil organic carbon pool, and into the soil microbial biomass (by phospholipid fatty acids analysis, PLFA).
Although plant biomass and plant C during regrowth were not affected by the precedent drought treatment, plant 13C uptake and belowground 13C allocation were decreased compared to control plots that had not experienced drought. Microbial biomass and community composition, which had changed during drought, differed no longer between drought and control plots 2 weeks after rewetting. Nonetheless, 13C uptake of plant derived C into microbial groups was slower in plots that had been exposed to drought.
We conclude that effects of drought on plant C allocation dynamics and its consequences for microbial uptake of plant-derived C may persist even after a drought has ceased, while the microbial community is highly resilient to an extreme drought in mountain grassland.