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Effects of recurrent drought on the water balance and biomass production of irrigated mountain grassland

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Besides rising temperatures, climate change is also expected to change precipitation patterns, especially increasing the probability of extreme events like droughts and thunderstorms. In the North Italian region of Trentino/South Tirol, a reduction of rainfalls in spring has been observed in the last decades. A joint project by the European Academy Bozen/Bolzano and the University of Innsbruck analyzed the effects of repeated spring and summer droughts on the water balance, carbon flux and productivity of an irrigated mountain grassland site at 1500 m a.s.l. in the inner-alpine dry area of the Matsch Valley/Vinschgau during the years 2012 and 2013. We anticipated a decrease of soil moisture, evapotranspiration, carbon uptake, and plant growth during drought periods. Soil memory effects, delayed plant development, and changes of vegetation composition were expected long-term effects of periodic water shortage. Water balance was measured continuously with weighing lysimeters (diameter and depth 0.3 m) which were installed in 2011; in addition to lysimeter weight, soil moisture and water potential in 2 depths and the volume of seepage was recorded every ten minutes for each lysimeter. Carbon flux was measured regularly with a canopy chamber eduring the growing season, above-ground biomass and vegetation composition were analyzed after cutting the vegetation twice per year in accordance to local management. To simulate severe droughts, a group of three lysimeters was sheltered from any rainfall and irrigation with a foil tunnel for four to six weeks during the early growth period in spring and again during the regrowth period after the first cut in summer in 2012 and 2013. A control group of three lysimeters remained unsheltered and exposed to rainfall and irrigation. Preliminary results show a clear reduction of soil moisture, evapotranspiration, carbon uptake and biomass in sheltered lysimeters during the drought periods, but a quick recovery afterwards. However, during the two year measuring period vegetation on sheltered lysimeters changed significantly from forb- to graminoid-dominated communities.