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Ecosystem services of arable land in response to cropping systems and drought

Yujie Liu (1), Gicele S. Duarte (1), Valentin Klaus (1), Anna K. Gilgen (1), Emily O. Hagen (2), Raphaël Wittwer (2), and Nina Buchmann (1)

(1) Institute of Agricultural Sciences, Department of Envionmental Systems Science, ETH Zürich, Universitätstrasse 2, CH-8006 Zürich, (2) Ecological Farming Group, Agroscope Reckenholz Tänikon, Reckenholzstrasse 191, CH-8046 Zürich

Agroecosystems are nowadays often confronted with ecosystem degradation due to unsustainable intensification and climate change. One reason for intensification is that the projected demand for food and feed is increasing due to global population growth and dietary changes. Additionally, drought events, which are projected to increase in both frequency and severity in the future, will potentially have strong effects on the ecosystem services provided by agroecosystems.

Organic farming has been proposed to better cope with current agricultural challenges in climate change and increasing needs for food. However, whether organic farming can solve the trade-off between production and non-production services even under drought conditions remains unclear. Likewise, conservation tillage might provide considerable ecological benefits compared to conventional tillage, but the contribution of different tillage methods to the resilience of agroecosystems towards drought needs further investigation.

The objective of this study is to assess the response of ecosystems services in organic and conventional cropping systems with conventional and conservation tillage to simulated drought. Several provisioning, supporting and regulating ecosystem services are being measured. We collect data on provisioning, supporting and regulating services.

First results of treatment effects on litter decomposition, a supporting ecosystems service that was assessed via the Tea Bag method, will be shown. The method involves two types of Lipton tea with different C:N ratios: Rooibos tea, characterized by a slow decomposition rate (wide C:N); and green tea, characterized by a faster decomposition rate (narrow C:N). The experiment was conducted in a pea and barley mixture and a maize field to test for the effects of drought and cropping systems on litter decomposition rate. Tea bags were installed in the uppermost 5 cm of the topsoil. Decomposition was assessed during three periods: 1) Tdrought: during the drought treatment; 2) Tpostdrought: during the post-drought (recovery) phase (after drought until harvest); 3) Ttotal: during both drought and recovery phases. The results show that except for the wide C:N litter during the post-drought phase only, drought decreased decomposition. The type of tillage affected decomposition during the post-drought phase only. Significant differences between organic farming and conventional farming were only found in Ttotal with higher decomposition rate under organic farming. Generally, drought affected decomposition similarly in both crops and for both types of litter. This indicated that in the future more frequent phases of drought will significantly impact on nutrient cycling in arable systems.