Drought impact on ecosystem functions on different management practices

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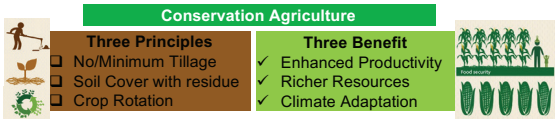
1 Introduction

- Arable and grassland ecosystems are increasingly valued for their ecological functions and services. Drought is one of the most common and costly disasters, which are projected to increase in both severity and frequency, with negative effects on ecosystem productivity and functioning.
- Various management practices have been developed to produce enough high quality food while reducing environmental impacts.

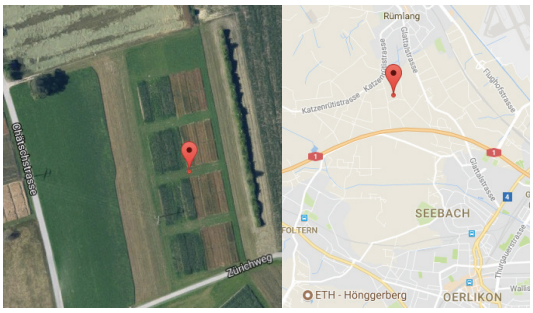


- Trade-off between private and public ecosystem functions are assumed to more balanced in organic farming.
- However, very little is known on how these different farming practice may interact in affecting the functioning and resilience of ecosystems to extreme drought.

2 Research Objectives

The FAST trial, including organic and conventional farming regimes and tillage/no tillage experiments will be used to assess the response of different ecosystem functions within arable crops and temporary grasslands to different nitrogen fertilizer levels and drought treatments.

3 Study Sites



The field site is located at the Swiss federal agricultural research station Agroscope, Reckenholz near Zurich (latitude 47°26′ N, longitude 8°31′ E).

4 Materials and Methods

FAST trail: FAST is composed of two field experiments established on the same field beside each other, comprising the following factors: production system treatment (conventional intensive tillage (C-IT), conventional no tillage (C-NT), organic intensive tillage(O-IT) and organic reduced tillage (O-RT)).A total of 16 treatments each replicate four times. Each replicated four times result in 64 plots in total. The size of the main plots and subplot is 6 m × 30 m and 3 m × 15 m. All assessments were performed within the inner 2 m × 10 m of each subplot to avoid border effects. We will stimulate drought with portable roofs.

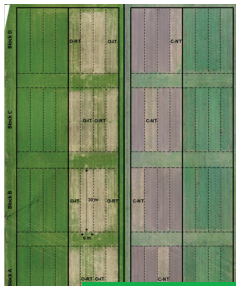


Fig 1. Field design (Wittwer et al.,2016)


Fig 2. Portable roof (shoot in 7/9/2017)

Ecosystem functioning assessment: We will assess ecosystem function in different arable systems based on REFA method (Meyer et al., 2015). Repid Ecosystem Function Assessment comprises a set of important functions and enables standardized and comparable measurements, which can also help to close the identified ecosytem functioning data gap.

Table 1. Ecosystem functioning indicators and sample based on REFA (Meyer et al,2015)

Ecosystem functions	Field sample
Plant and element cycles	
Above ground productivity	Aboveground biomass of herbaceous vegetation is harvested; only current year growth from woody plants
Belowground primary productivity	Collection of soil sample
Soil fertility	Collection of soil sample
Saprophagous food-web	
Decomposition	Decomposition of standardized small wooden sticks as proxy; sticks are exposed within surface soil and collected after month
Consumer-plant interactions	
Plant infection	Plant biomass sample(see above)

Litter decomposition will be assessed by applying the Tea Bag Index method (TBI) and **the nitrogen leaching risk** will be estimated by resin bags, which capture nitrate in soil below the main rooting zone.

Fig 3. Tetrahedron-shaped synthetic tea bags used for Tea Bag Index (TBI) expeiments; Resin bags for nitrogen leaching risk measurement; Installation of resin bags.

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