Priority effects in plant community assembly in different dry grassland habitats over time

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Background

- Fukami et al. (2005) found high species turnover and increasing dissimilarity of species **but**
  a convergence of mainly morphological traits over time in grassland developing on ex-arable land.
- In a dry grassland sown in December 2007 we are testing whether this effect is generally found in early successional grassland systems and whether it holds true if physiological traits are also considered.
- Using a grassland assembly experiment (Habitat Garden) with different starting diversities
  - we are following changes in plant cover, diversity, and biomass over time
  - comparing traditional with high-tech census methods (FieldScreen: a Mobile Field Positioning System for field phenotyping)
  - and measuring phenotypic traits of select species in the field and in microcosms

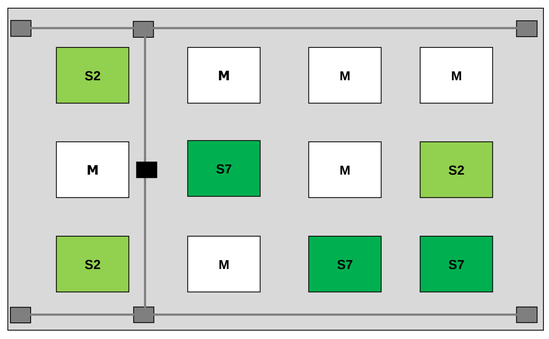
How does starting diversity affect assembly of dry grassland habitats over time?

Design of the Habitat Garden Experiment

Sand plots were sown in December 2007 with either

- 2 grass species and 27 forb species (**2 grass**)
- 7 grass species and 39 forb species (**7 grass**)
- One quarter of every plot was not sown (**control**)
- Neighbouring plots of ex-arable land were sown with mesic grassland species (data not shown here)
- Species can therefore establish either
  - From the sown seeds
  - From the seedbank in soil
  - From neighbouring plots (mesic or sand) or from outside experiment

Habitat Garden
- 6 dry grasslands on sand
  - 3 plots with 2 grass species, (**S2**)
  - 3 plots with 7 grass species, (**S7**)
  - 6 mesic plots on ex-arable land (**M**)
    - non sown control, (**C**)
    - (plot size 2 x 2m)



First results

Species diversity and cover

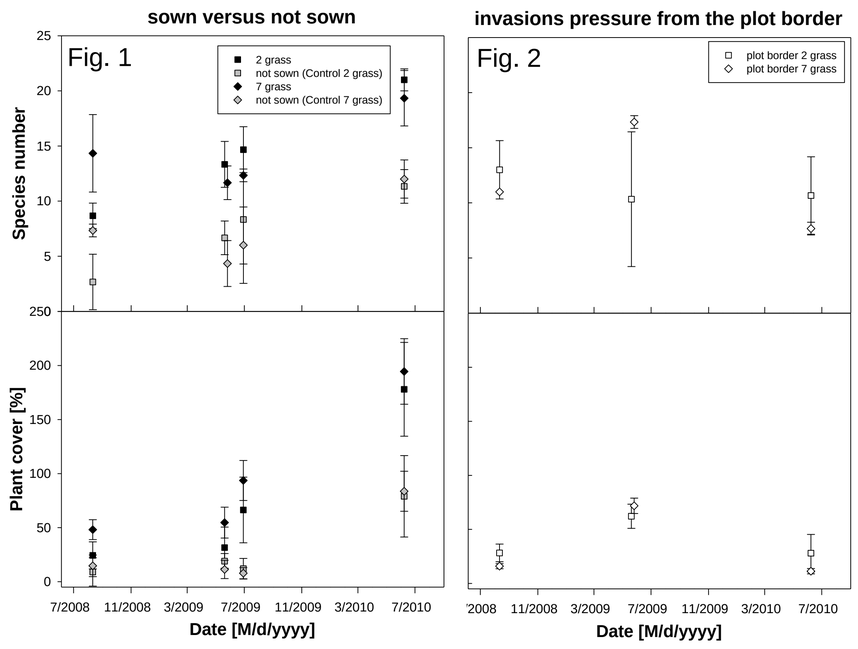


Fig.1 and 2: Species number and plant cover in percent in the plots and plot borders (mean +/- 1 standard deviation, n= 3)

biomass and establishment success

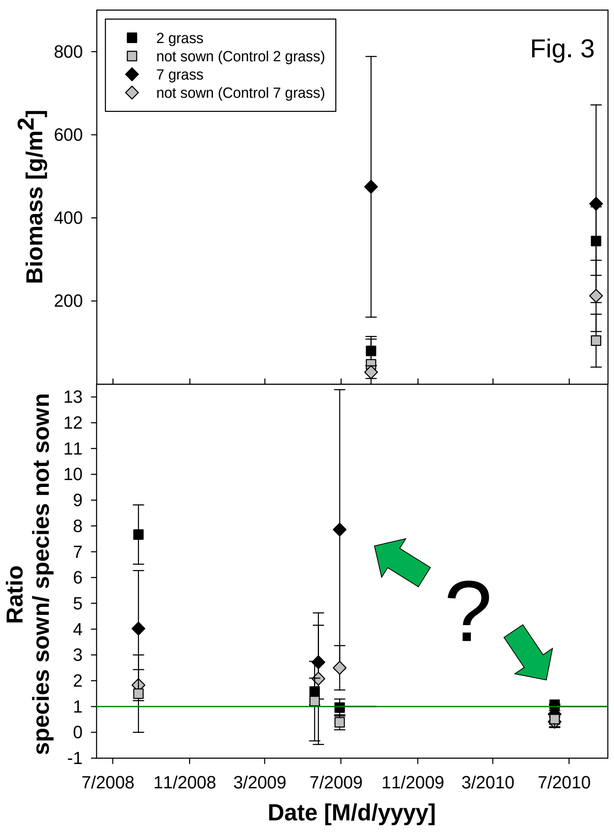


Fig.3: Biomass and ratio of species sown/ species not sown over time. Values are mean +/- 1 SD, n= 3.
The green line indicates the ratio of sown species /non-sown species.

- Between 2008 and 2010 plant cover, species number and biomass increased over time.
- The 2 grass-species plots have more species **but** lower overall cover and biomass than the 7 grass-species plots.
- Invasion pressure from the plot border was higher in the 7 grass-species plots in 2009 **but** the ratio of sown species/not sown was high. → Invasion resistance in 7 grass plots 2009
- The 2 grass species plots showed a continuous decrease of the sown/not sown species ratio, whereas in the 7 species plots this ratio varied strongly from year to year.
- In 2010 the number of species growing in the plots reached an equilibrium of sown and not sown species.

Further Work

Analysis of FieldScreen Photos

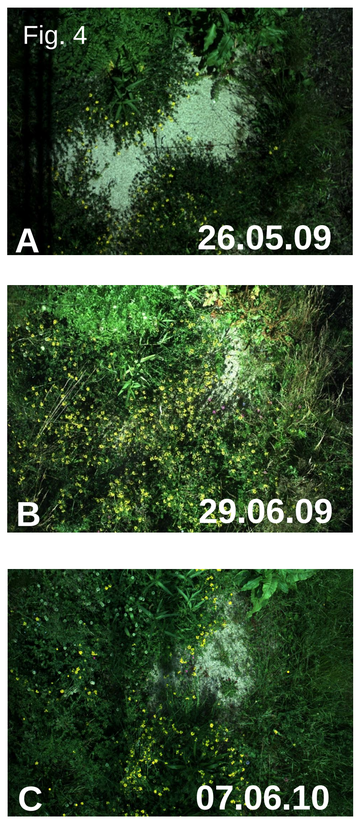


Fig.4: Photos from a example plot (7 grass), taken with the FieldScreen, focus more on spatial and temporal changes in species turnover over time. In future we will link these data with conventional diversity data .

Conclusions

- **Priority effects are occurring in this dry grassland**, with the initial diversity sown affecting the trajectory of the community (so far).
- Overall development is vary variable from year to year (the persistence of the priority effect will become clear with further data).
- The 7 grass species plots seem to have a higher invasion resistance than the 2-grass plots: species richness but also species turnover in 2 grass-plots is much higher than in 7 grass-plots. Despite higher invasion pressure from plot borders, the 7 grass-plots have a higher ratio of sown species/non sown than 2 grass-plots
- **Next steps**: To test whether trait convergence and increasingly dissimilarity of plots also occurs at the same time as high species turnover;
- Trait data of select species growing across a soil nutrient gradient in microcosms will be used to help explain species turnover in the field plots

Literature: Fukami, T. et al. (2005). "Species divergence and trait convergence in experimental plant community assembly." Ecology Letters 8(12): 1283-1290.