Measuring the impact of drought and soil management on soil biodiversity and multifunctionality

SOILGUARD

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Background

The capacity of sustainable soil management to buffer detrimental impacts of climate change on soil biodiversity remains elusive. We are studying the effects of field-simulated droughts and soil management on soil biodiversity and multifunctionality at seven sites across Europe, covering five major bioclimatic zones.(Fig.1).

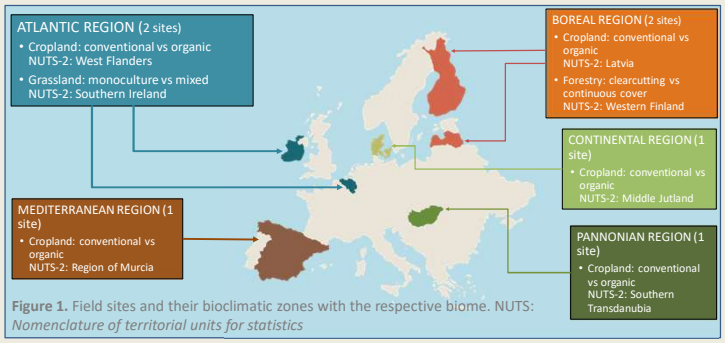

Figure 1. Field sites and their bioclimatic zones with the respective biome. NUTS: *Nomenclature of territorial units for statistics*

Methods

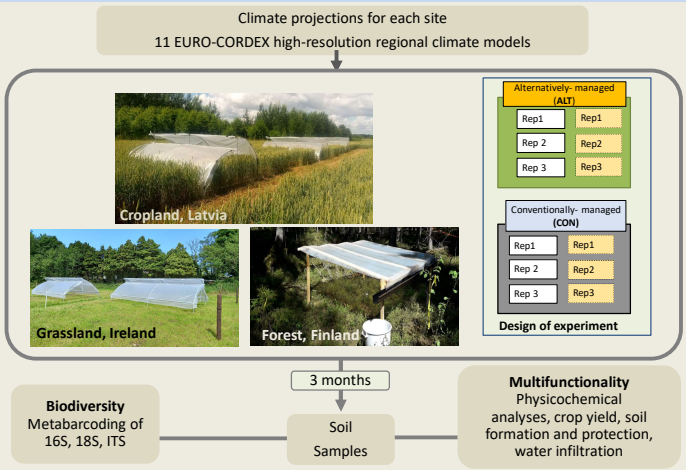

Figure 2. Field simulations performed using precipitation indexes generated from climatic projections using reference data from 1981-2010. 3x5 m² rainout shelters were used to control water input.

Results

1. Alpha diversity

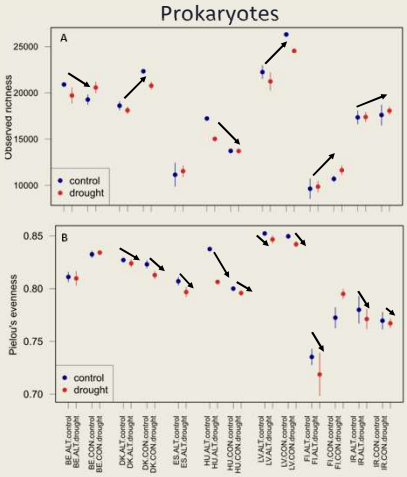

Figure 4. Values are averages of three replicates per site. **A:** Observed number of ASV (amplicon sequence variance). **B:** Pielou's evenness index, with higher values indicating similar abundances, and lower values indicating dominance of some groups.

2. Beta diversity

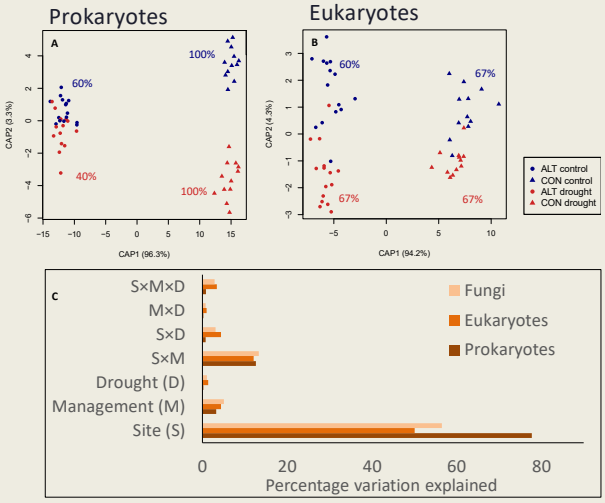

Figure 5. A,B: Canonical analysis of principal coordinates of Bray-Curtis distances of the pooled **cropland** samples. No separation of samples by M or D found for grassland and forest (not shown). Percentages successful classification into each treatment combination are shown. **C:** Percentages are calculated from R^2 of PERMANOVAS, only significant values (P<0.5) are shown.

3. Modeling soil biodiversity and soil multifunctionality

Figure 6. Significant predictors of either soil multifunctionality (**A**) or alpha biodiversity (**B**). t-values are shown for those predictors selected in the most parsimonious models for each variable (according to their Akaike information criterion, AIC).

Conclusions

1. Site was the dominant driver of alpha (16-91% of the variance) and beta (50-78% of the variance) diversity.
2. Site dependency of alpha diversity decreased in the order of Prokaryotes > Eukaryotes > Fungi, and of beta diversity in the order Prokaryotes >Eucaryotes.
3. Management effects (organic vs. conventional) were site dependent for alpha (6-7%) and beta (12-13%) diversity.
4. Drought effects were sometimes detectable but remained small.
5. Aridity, rather than experimental drought was a better predictor of soil biodiversity and multifunctionality.

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