POEM: a grassland field experiment to shed light on the belowground mechanisms of priority effects

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Introduction and Objectives

- Both the **order and timing of arrival** of plant species during community assembly can have long lasting impacts on the structure and functioning of plant communities, notably via the creation of ***priority effects***[1].
- *Priority effects* occur when early arriving species affect the establishment, growth, or reproduction of species arriving later[2].
- Although such *priority effects* frequently occur during assembly of natural plant communities, we still know very little about the mechanisms responsible for these effects (e.g., resource pre-emption, plant-soil feedbacks, niche complementarity, etc.)[3] (Figure 1).
- POEM (PriOrity Effect Mechanisms) is a grassland field experiment manipulating plant functional group order of arrival to explore the relative roles of state of the art theories of species coexistence in the creation and persistence of priority effects in dry grasslands.
- **We hypothesize that differences in plant order of arrival will lead to communities differing in structure and functioning aboveground and belowground.**

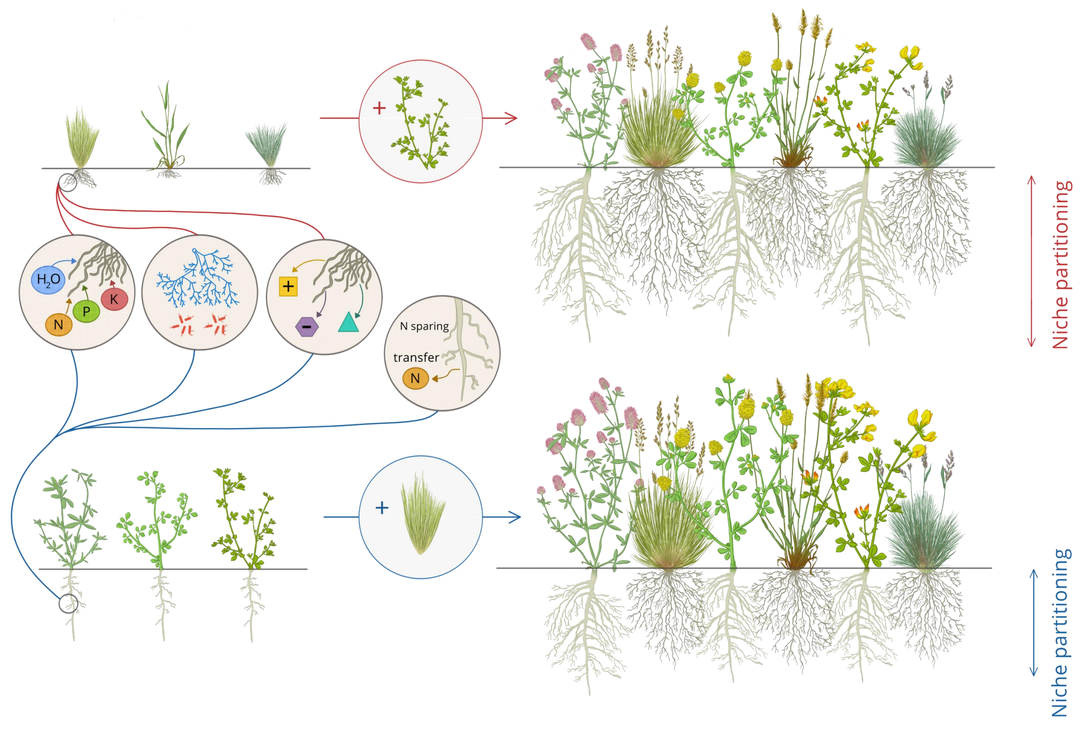


Figure 1. Manipulating plant order of arrival during assembly can create priority effects impacting on the structure and functioning of plant communities. Because different species will have potentially different effects on the biotic and abiotic components of the local environment, it is very likely that late-arriving species will not experience the same conditions depending on which species arrived first, thus leading to the creation of priority effects.

Experimental design and Research methods

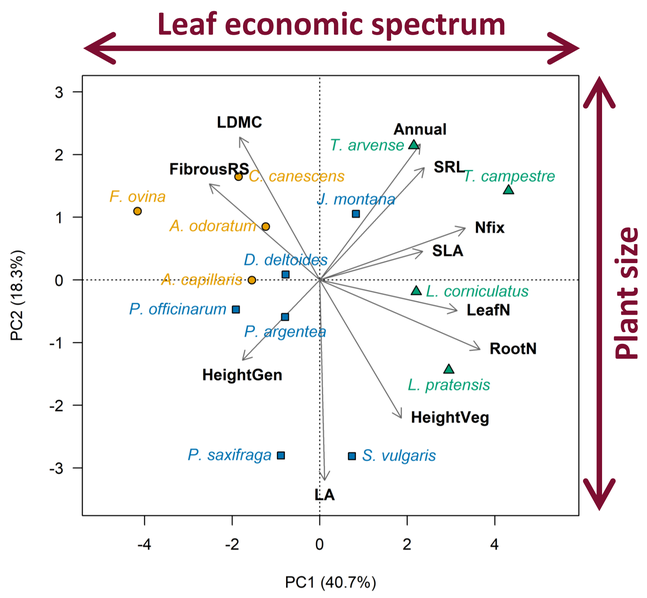
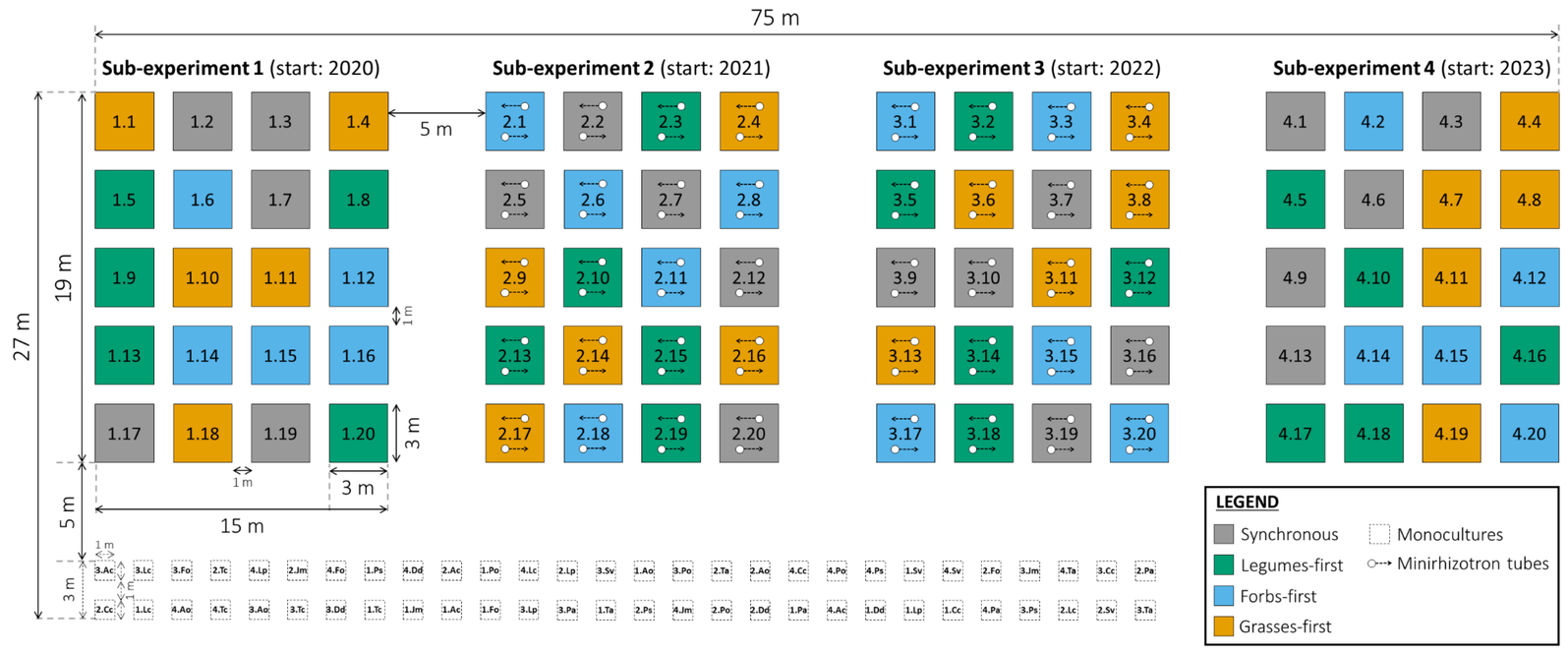
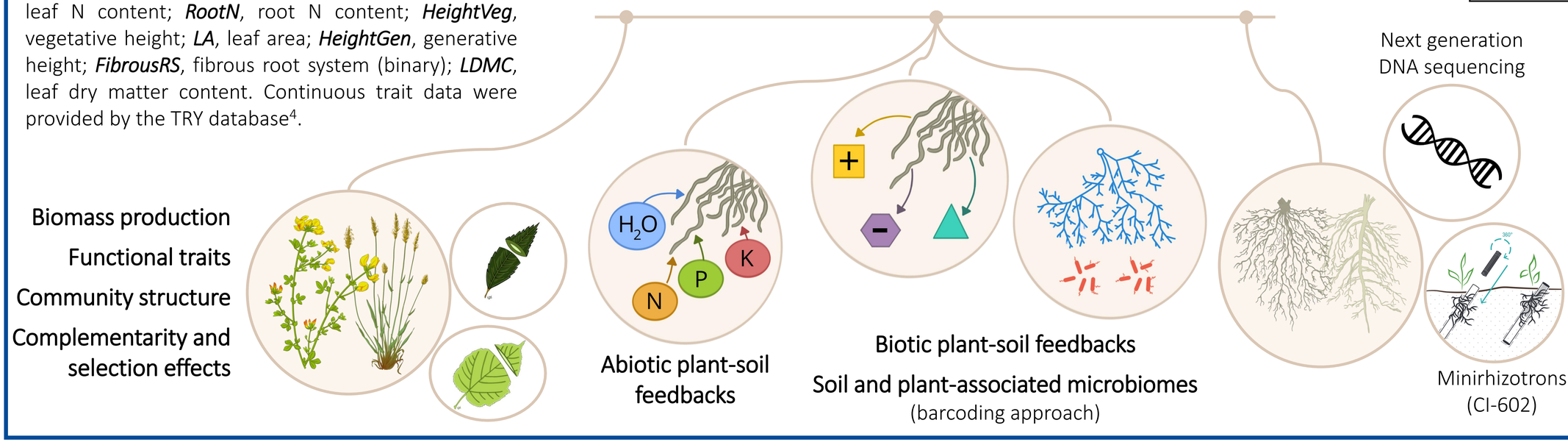


Figure 2. Species pool used for the experiment. Our species pool consists of 14 species divided in 3 functional groups: forbs (6), grasses (4), and legumes (4). ***Annual***, annual (binary); ***SRL***, specific root length; ***Nfix***, N fixation (binary); ***SLA***, specific leaf area; ***LeafN***, leaf N content; ***RootN***, root N content; ***HeightVeg***, vegetative height; ***LA***, leaf area; ***HeightGen***, generative height; ***FibrousRS***, fibrous root system (binary); ***LDMC***, leaf dry matter content. Continuous trait data were provided by the TRY database[4].

Figure 3. Experimental design of the field experiment. This experiment consists of four independent sub-experiments. One experiment will be initiated each year for four consecutive years, starting in 2020. This set up will allow us to evaluate to what extent weather conditions during plant establishment affect the strength and persistence of priority effects. All sub-experiments will test the same priority effect treatments: grasses sown first, forbs sown first, legumes sown first, and all PFGs sown at the same time (Synchronous).





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References

[1] Weidlich et al (2018). *Journal of Ecology*, 106, 774-780.
[2] Weidlich et al (2017). *Frontiers in Plant Science*, 2008, 1-12.
[3] Fukami (2015). *Annual Review of Ecology Evolution and Systematics*, 46, 1-23.
[4] Kattge et al (2011). *Global Change Biology*, 17, 2905-2935.

Acknowledgements

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https://carolinalevicek.com/