

Spring 5-18-2020

A Review of Plant-Soil Feedbacks and Their Importance For Palouse Prairie Restoration and Management

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Recommended Citation

Pentico, Rachael SV, "A Review of Plant-Soil Feedbacks and Their Importance For Palouse Prairie Restoration and Management" (2020). *2020 Symposium Posters*. 23.
https://dc.ewu.edu/srcw_2020_posters/23

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Background

- The Palouse Prairie is one of the most endangered ecosystems in the United States with only a little more than 1% still in tact (Noss et al 1995).
- Restoration and management is important to bring back the biodiversity that it once had.

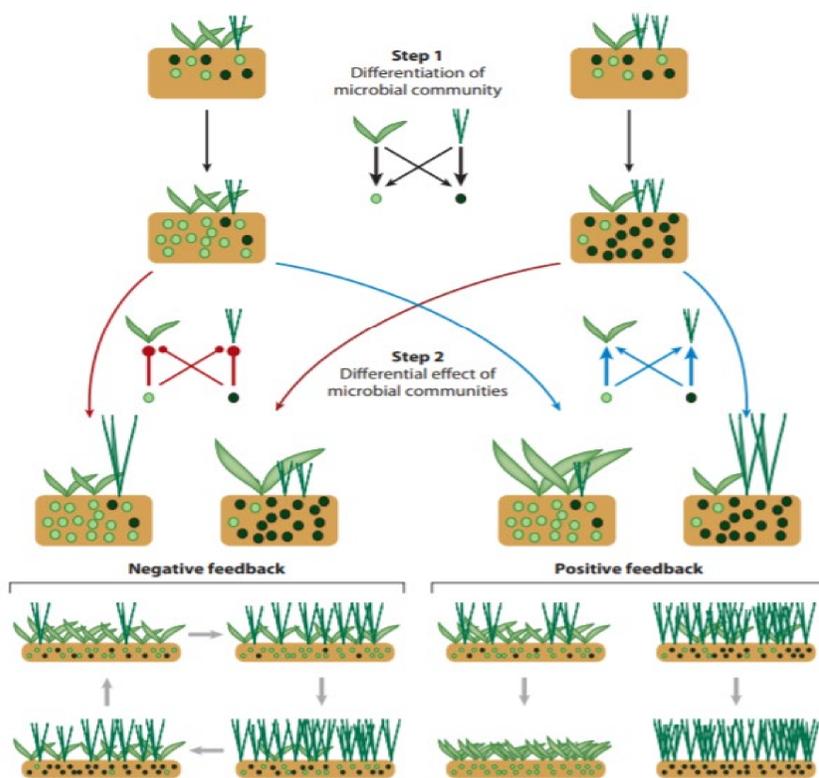


Figure 1: Steps involved in soil microbial feedback (Bever, Platt, and Morton 2012).

- Plants alter both the biotic and abiotic characteristics of the soil they grow in.
- These changes alter the ability for some plants to grow in this soil in the future.
- Negative PSF leads to increases in biodiversity.
- Positive PSF leads to decreases in biodiversity.
- PSFs play a role in plant community structure, invasion, competition, and successional turnover.

Research Objectives

- Gain a deeper understanding of how PSFs affect plant community structure, succession, and invasion.
- Apply the knowledge to the restoration and management of the Palouse Prairie.

Methods

- Read and synthesized the information provided in over 15 published research papers on PSFs.
- Common research methods for PSF studies include using whole-soil or AMF-only inoculation.
- Comparisons are made using plants as phytometers in sterilized soil vs. inoculated soils.

Results

- Inoculation, whether AMF-only or whole-soil, leads to negative PSFs in tallgrass prairie species, which helps to maintain biodiversity within this ecosystem (Fitzsimons and Miller 2010).
- The negative PSFs, however, can aid invasive plants and allow them to dominate the landscape (Bever 2002).
- Early-successional plants are less responsive and dependent on AMF mutualists than late-successional plants, and therefore can colonize highly disturbed lands (Koziol and Bever 2012), like the Palouse Prairie.
- Prairie restoration increases soil communities and chemical properties overtime and eventually repair themselves to pre-disturbance quality (Jangid et al. 2010).
- Highly abundant plant species feel more negative effects from PSFs than rare species in a landscape (Maron et al. 2016).

- Most PSFs are negative in conspecific soils, but the effects aren't as significant when the plants are also facing competition. Competition and PSF effects are mostly additive, but can be synergistic when the species are grown together in one of the species conspecific soil. (Lekberg et al. 2018).

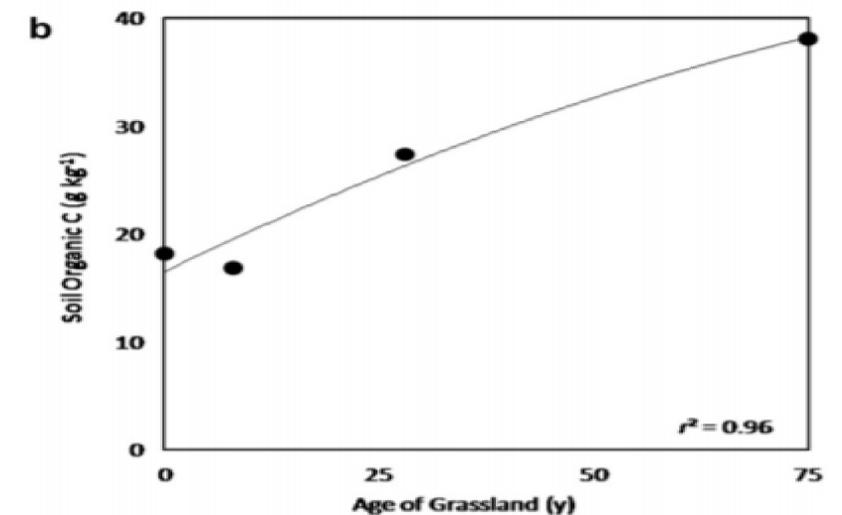


Figure 2: Carbon in the soil increases after Prairie restoration (Jangid et al. 2010).

Acknowledgments

The author would like to thank Rebecca Brown for her assistance on this project.

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