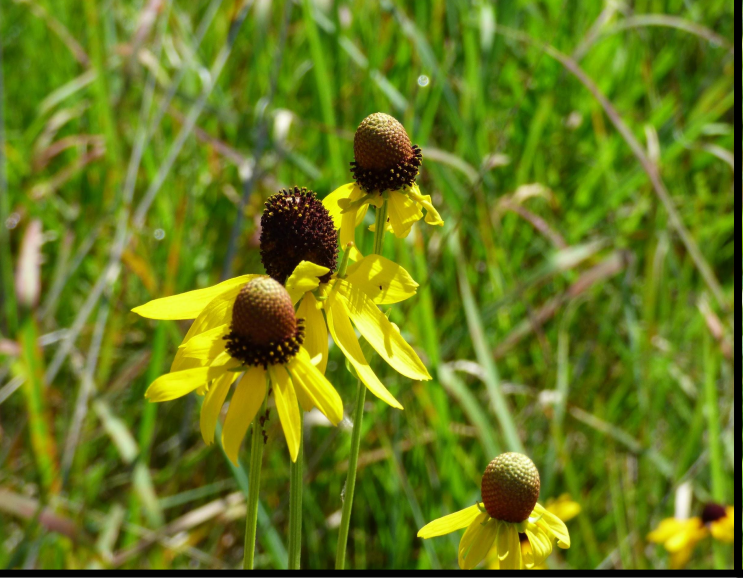
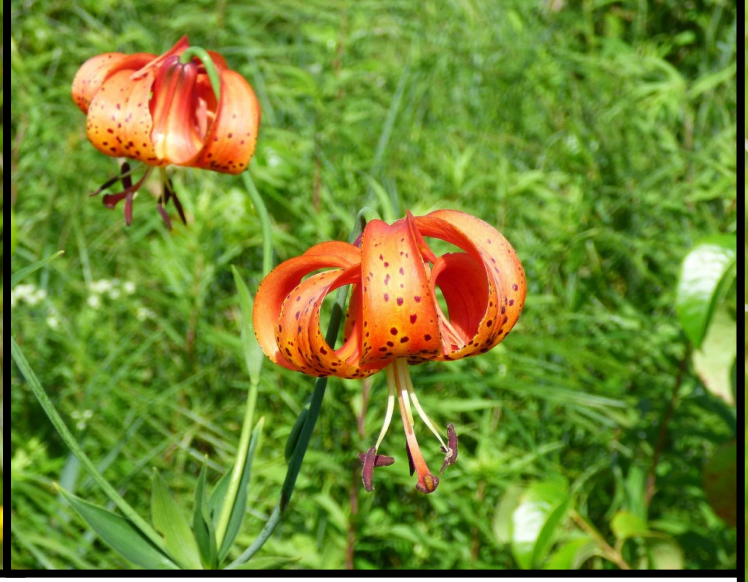


Functional Trait Composition and Restoration Seed Mixes: Invasion Resistance in Prairie Plant Communities

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Plant Biology and Conservation
Chicago Botanic Garden and Northwestern University

Background

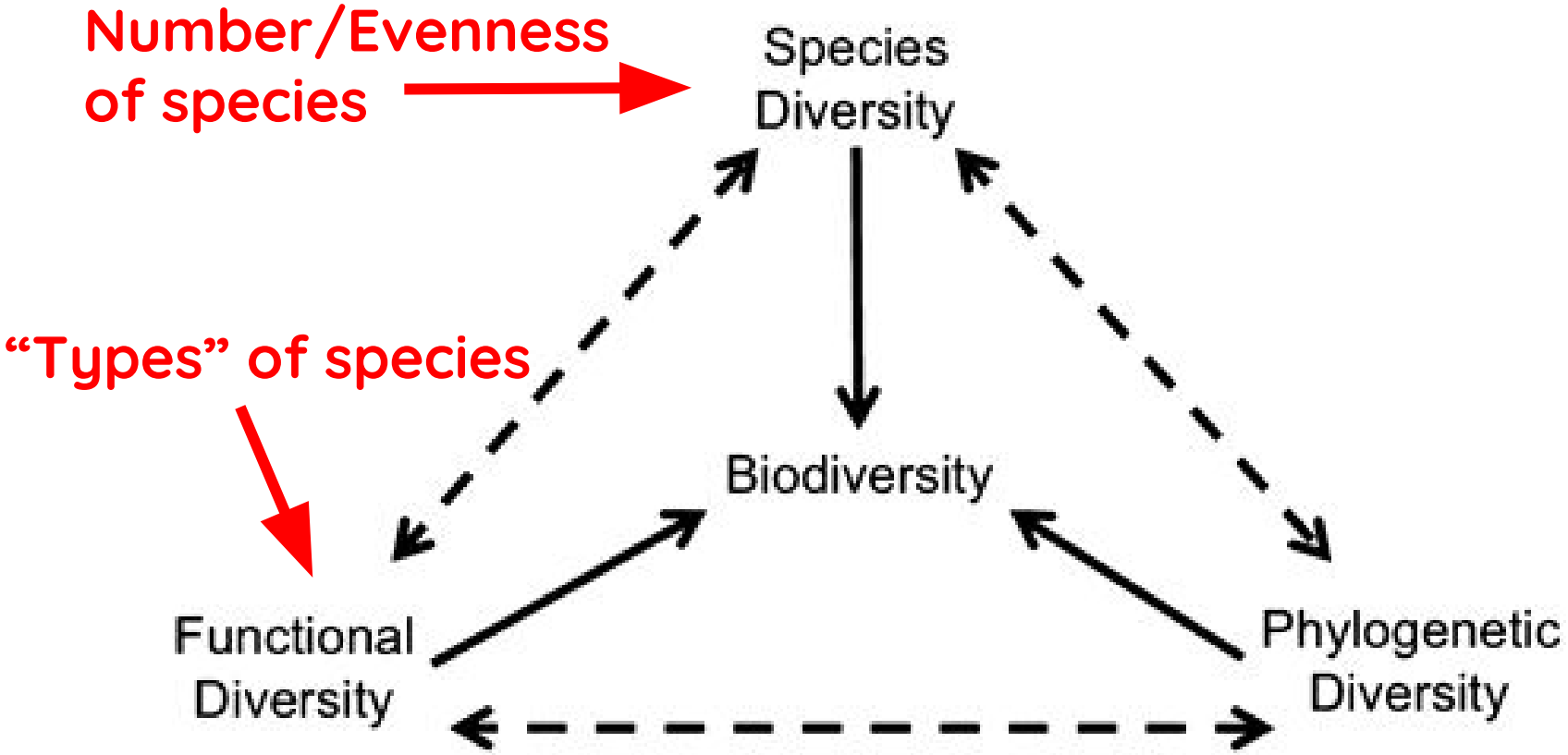
Invasive Plant Species are a major driver of global change and substantially affect recipient communities.

Resisting invasion is a key restoration goal.

Community Diversity is a characteristic thought to increase invasion resistance.

Maximizing Diversity in seed mixes could reduce invasion in resulting restorations.

Components of Biodiversity



Modified from Swenson, 2011

A Note on Functional Traits

Leaf Traits

Specific Leaf Area
- growth rate, resource aquistion, competetive ability

Leaf Thickness
- leaf longevity, stress tolerance

Leaf Dry Matter Content
- leaf longevity, stress tolerance

Petiole Length
- light interception

Circularity
- light interception

Whole Plant Traits

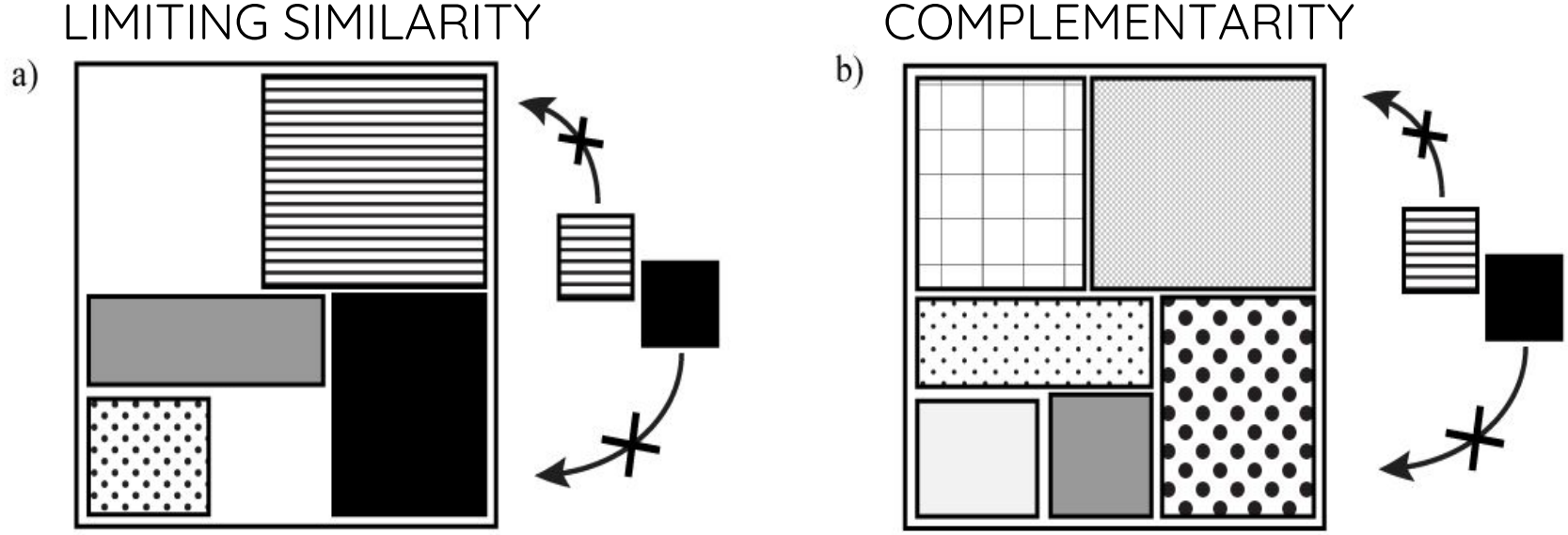
Plant Height
- light interception, competetive ability

Stem Dry Matter Content
- structural support, stress tolerance

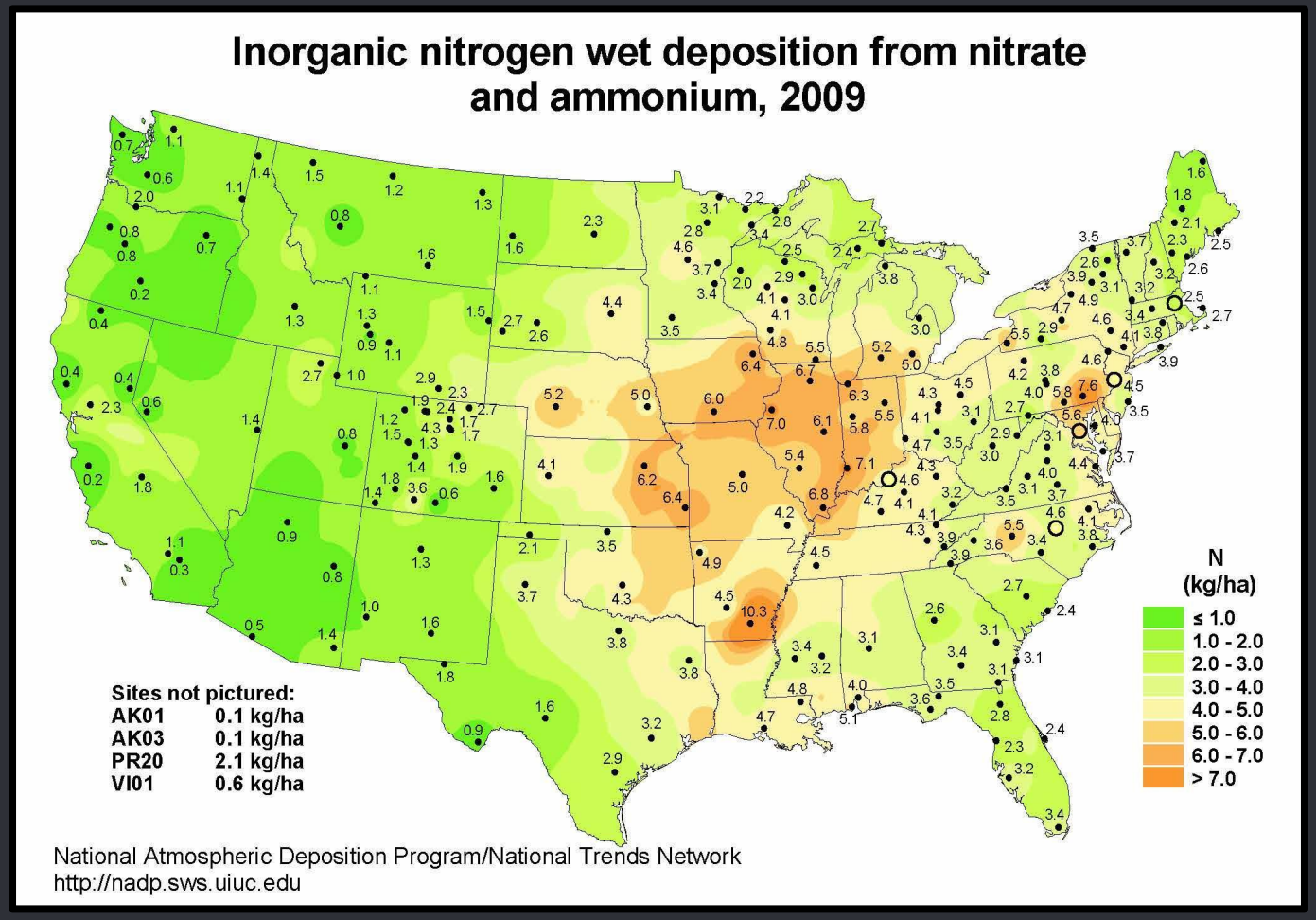
Root Traits! Certainly important but difficult to measure

- water budget, resource aquistion, competetive ability, mycorrhizal associations

Functional diversity operates to resist invasion through Resource Pre-emption

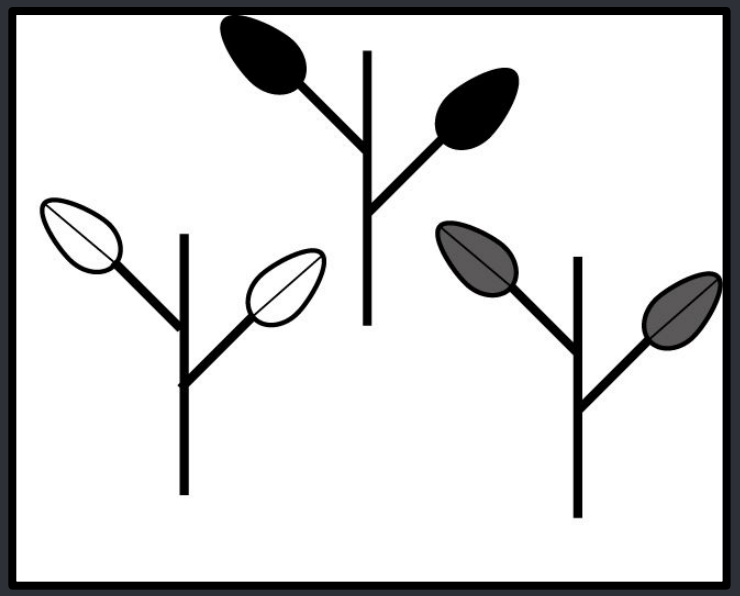


Invasion resistance may decrease with increased availability of limiting nutrients

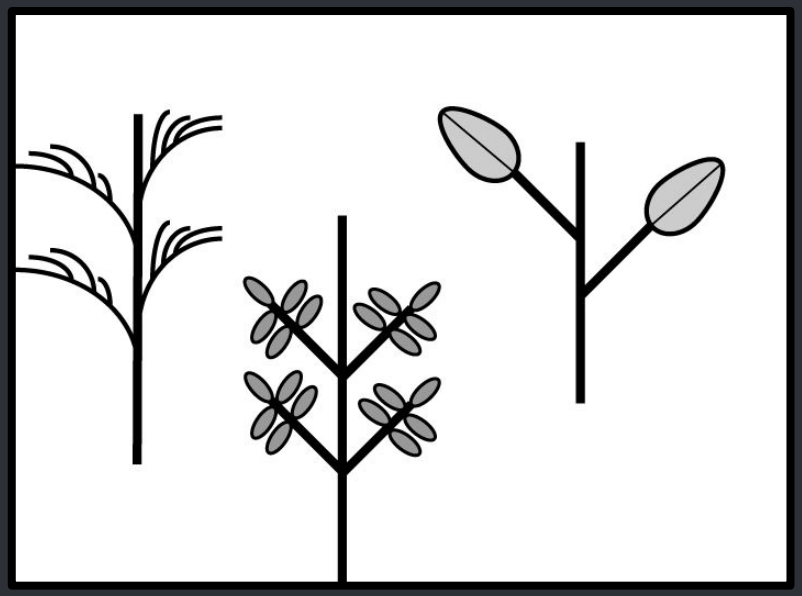


Application: Restoration Seed Mixes

When addressing invasion suppression as a restoration goal, should seed mixes:



Only maximize species richness and diversity?



Also consider functional diversity and composition?

Hypotheses

1) Biomass of invaders will be lower in communities with high functional diversity (Complementarity).

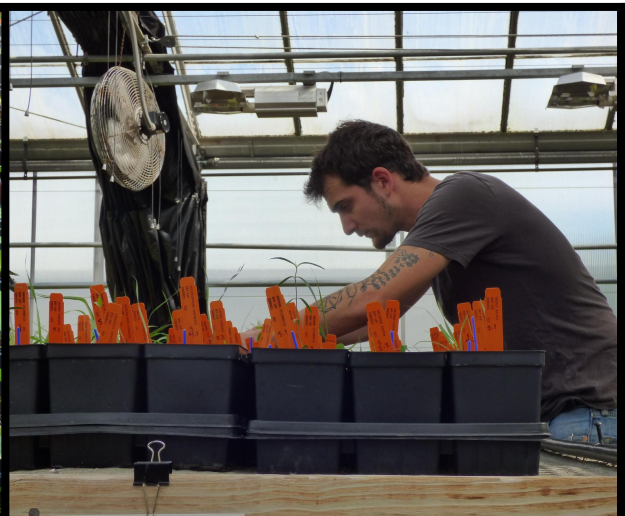
2) Biomass of invaders will be lower in communities with mean functional traits similar to those of invaders (Limiting Similarity).

3) Effects of complementarity and limiting similarity on resistance to invasion is less pronounced or absent in nitrogen addition treatments.

Methods

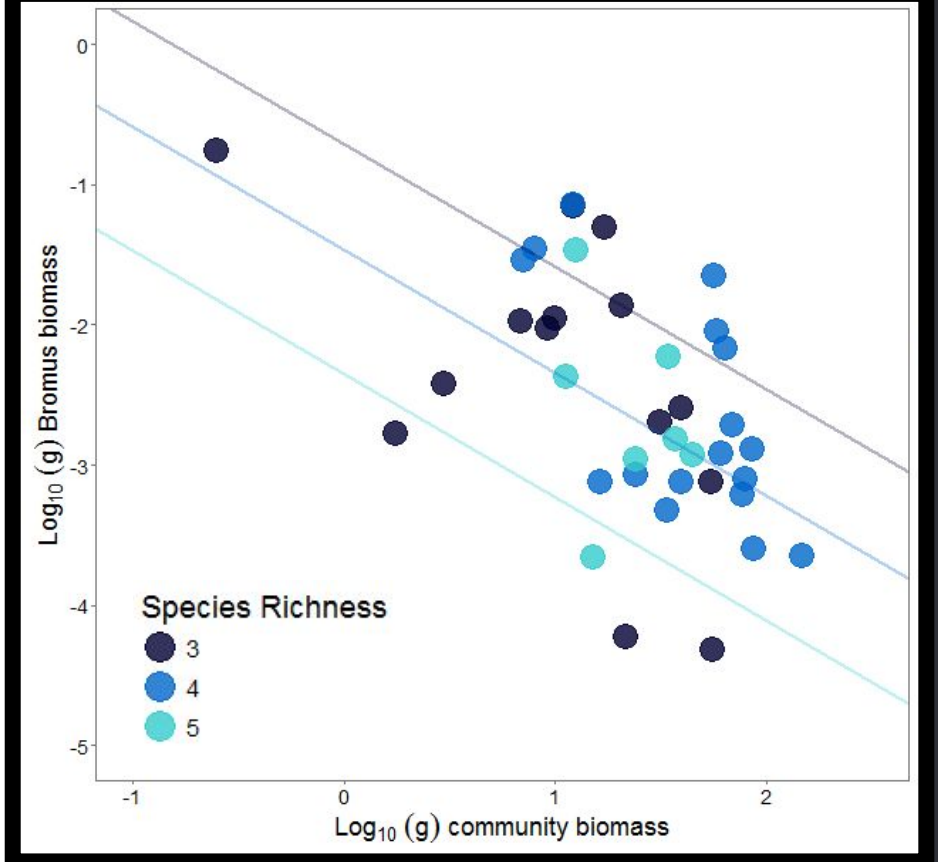
1) Stratification/Germination
2) Planting Communities
3) Invading with *Bromus inermis* & *Melilotus officinalis*
4) Bi-weekly N additions
5) 9 Weeks of Growth
6) Harvest Biomass (Dry and Weigh)

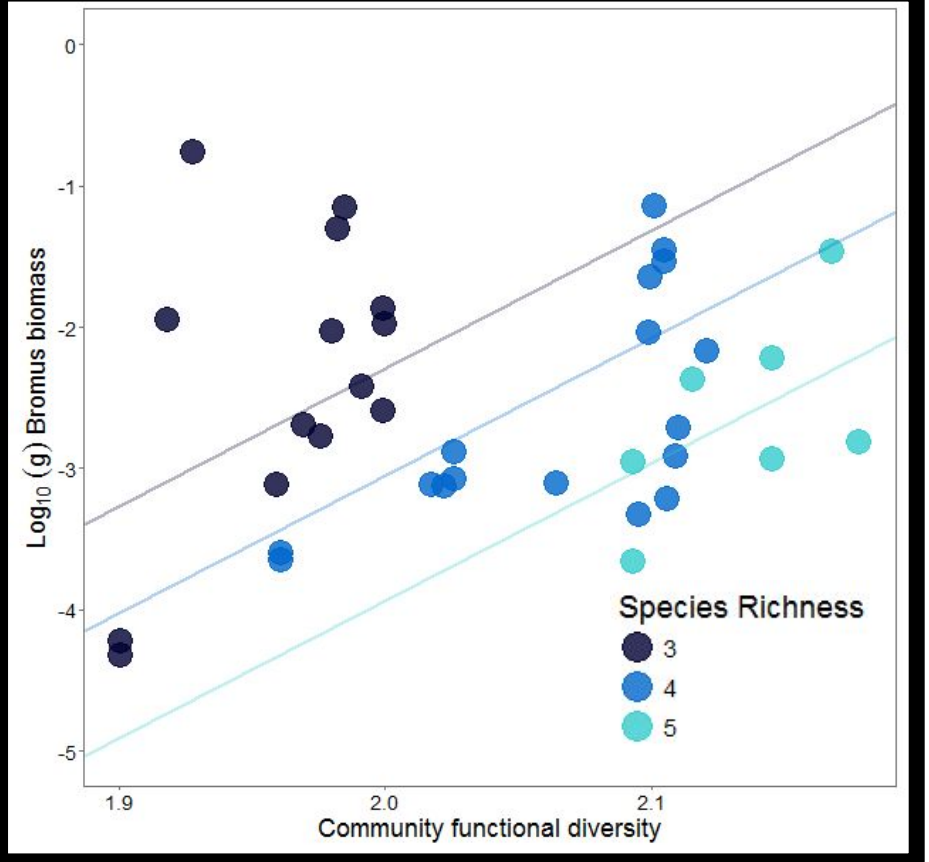
24 Communities
X
2 Invasion Treatments
X
2 Nitrogen Treatments
=
96 Replicates



Bromus – Complimentarity Model

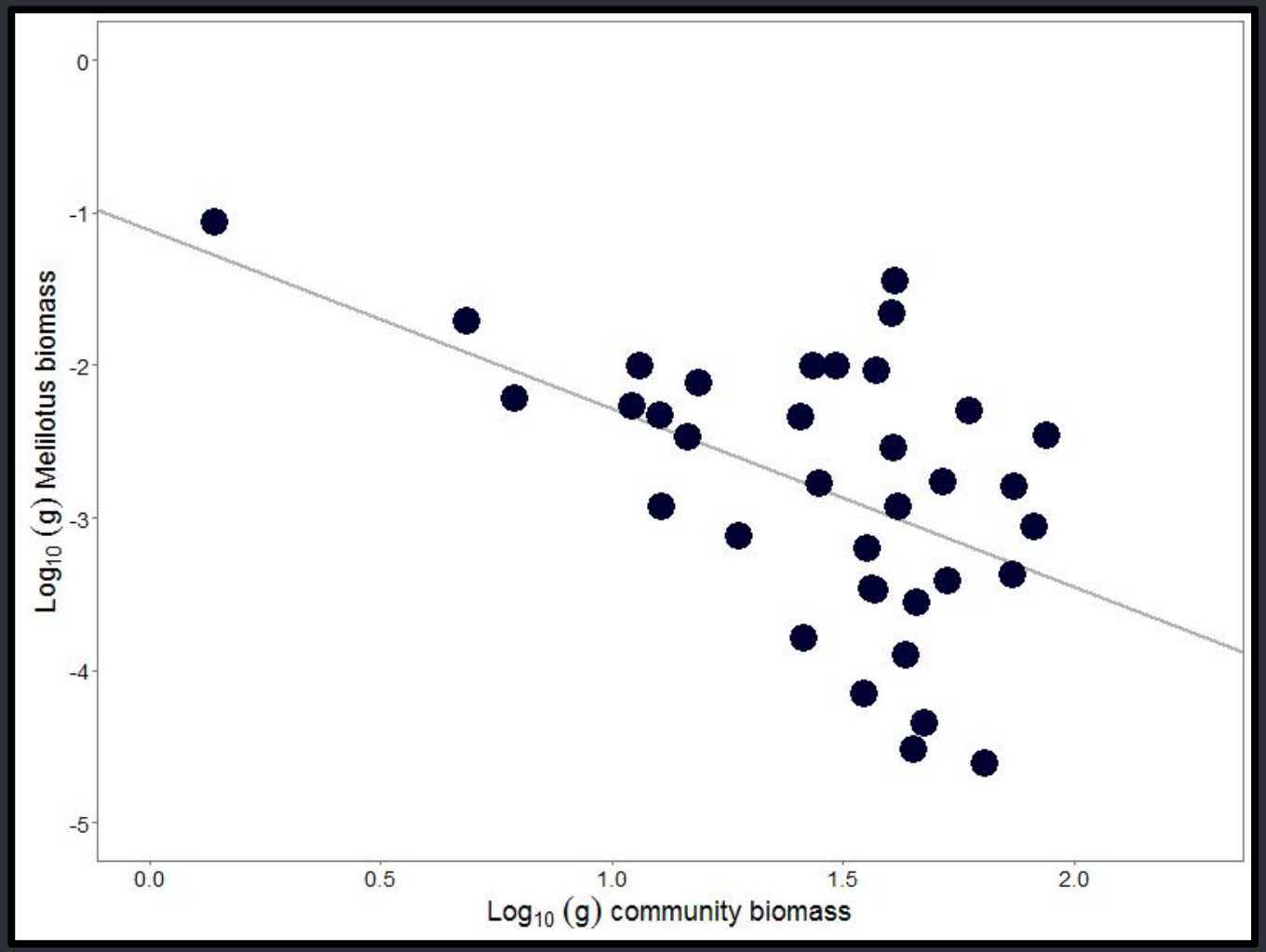
Functional diversity, community biomass, and species richness significantly affect *Bromus* biomass ($F = 9.91$ on 4 and 33 d.f, $p < 0.001$)





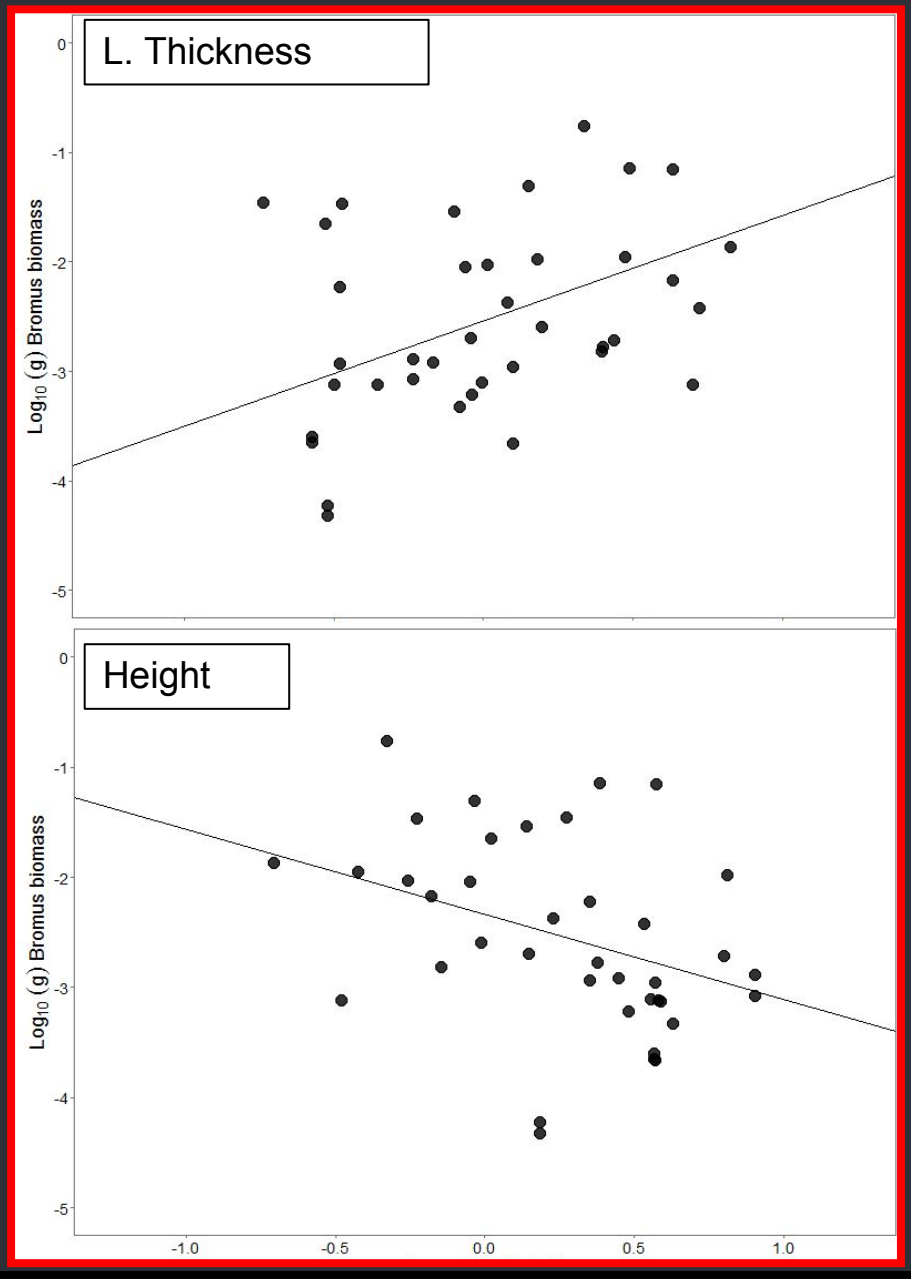
Melilotus – Complimentarity Model

Only community biomass predicted *Melilotus* biomass

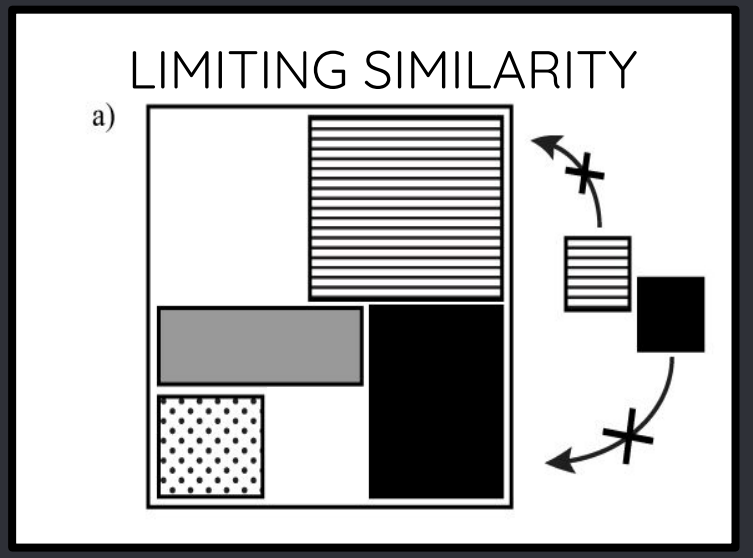


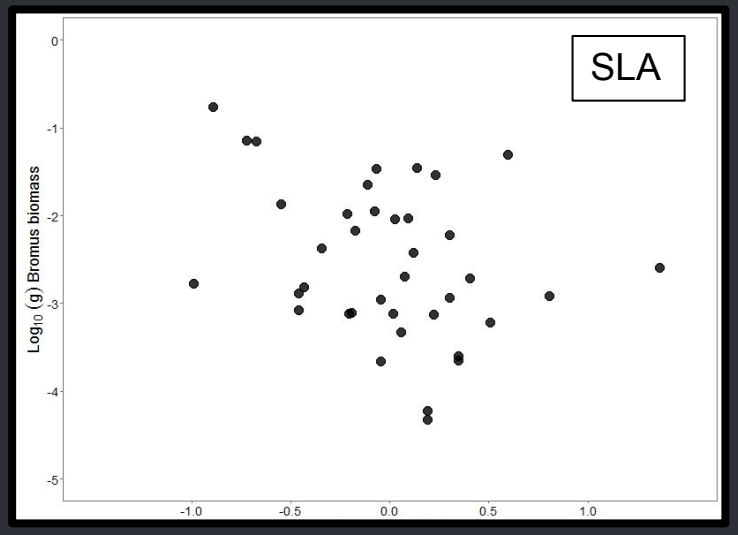
F = 12.6 on 1 and 34 d.f, $p < 0.005$

Bromus -Trait Models

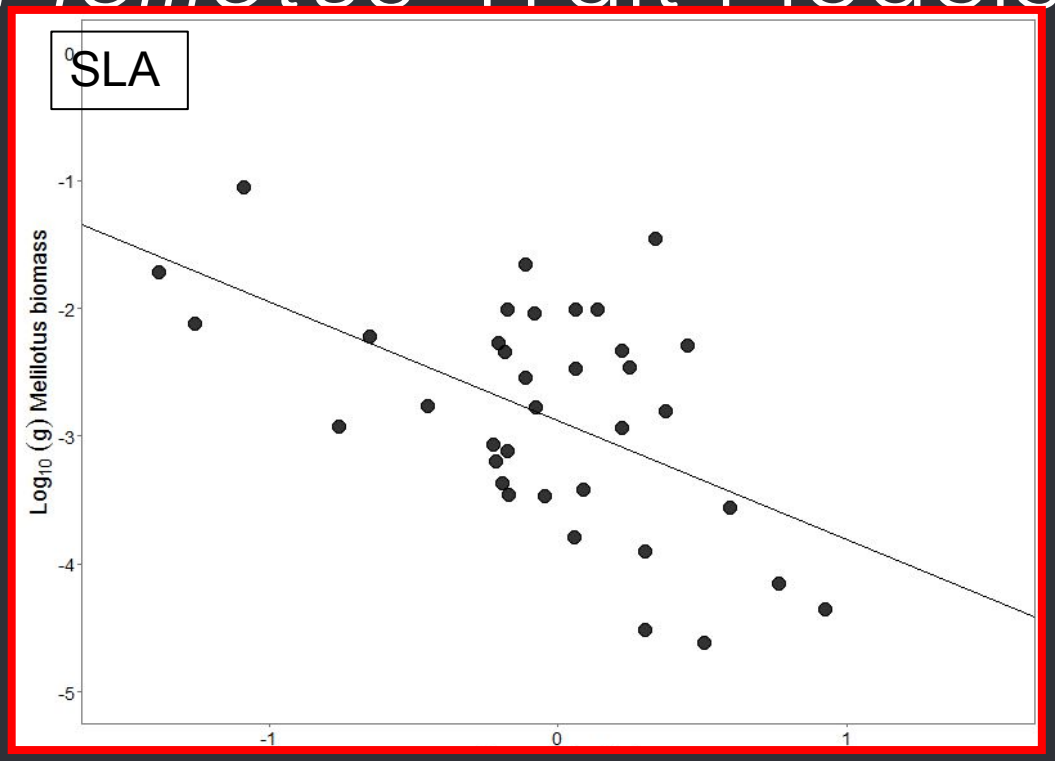


F = 5.49 on 2 and 35 d.f, $p < 0.05$

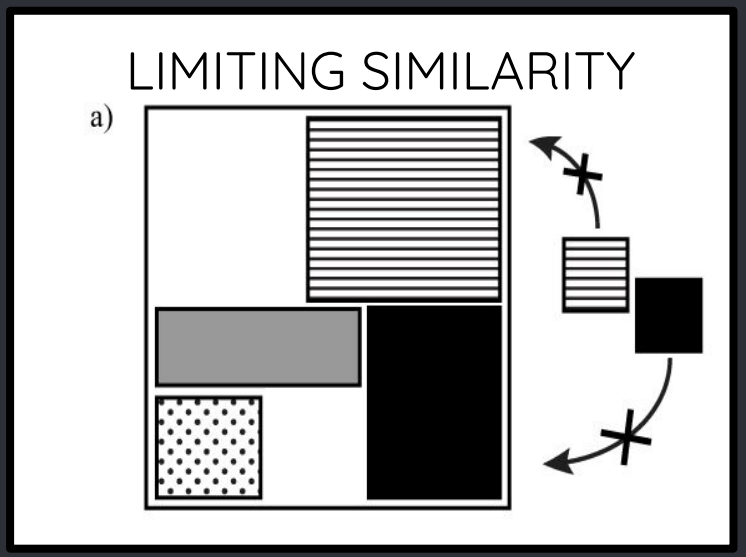


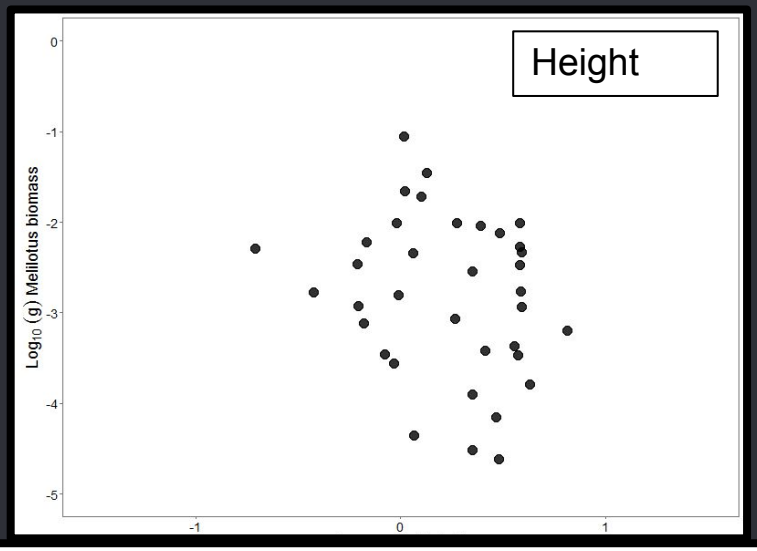


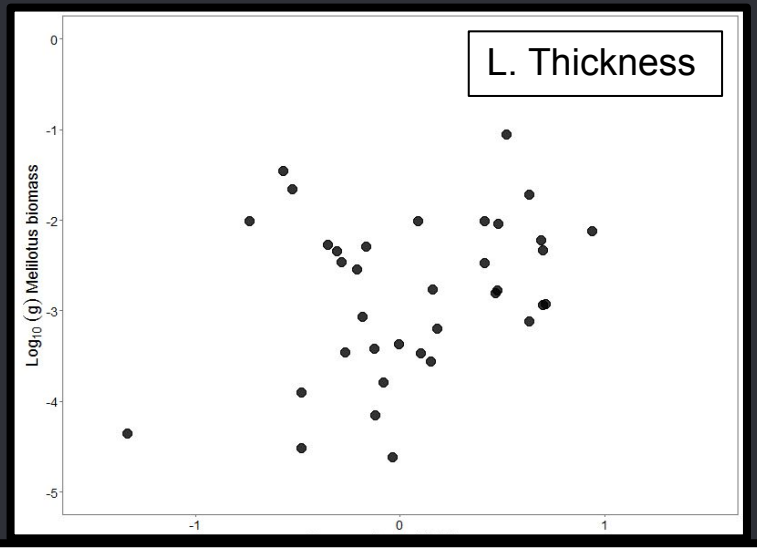
Melilotus-Trait Models



F = 14.1 on 1 and 34 d.f p < 0.001







Hypotheses

1) Biomass of invaders will be lower in communities with high functional diversity (Complementarity).
No, but evidence of an opposite trend in *Bromus* invaded treatments.

2) Biomass of invaders will be lower in communities with mean functional traits similar to those of invaders (Limiting Similarity).
Yes, there is evidence for limiting similarity.

3) Effects of complementarity and limiting similarity on resistance to invasion is less pronounced or absent in nitrogen addition treatments.
No. There was not enough evidence to suggest an effect of

Conclusions

- In this experiment, FD had a positive (*Bromus*) or no effect (*Melilotus*) on invader biomass. Complementarity may not be driving invasion resistance.
- This could be explained by low species richness.
- Relationships could change in later life stages and at higher plant densities
- Future studies should test similar hypotheses at larger scales in the field and should manipulate species richness and density.

Conclusions

- My results suggest that limiting similarity may be constraining invader success.
- Early restoration efforts may benefit from seed mixes containing species with traits similar to those of potential invaders.
- Future studies should investigate the tradeoffs of increased invasion resistance and the saturation of potentially dominant native species.
- Nitrogen addition may require longer time-spans or more intense resource competition to impact invasion.

Acknowledgments

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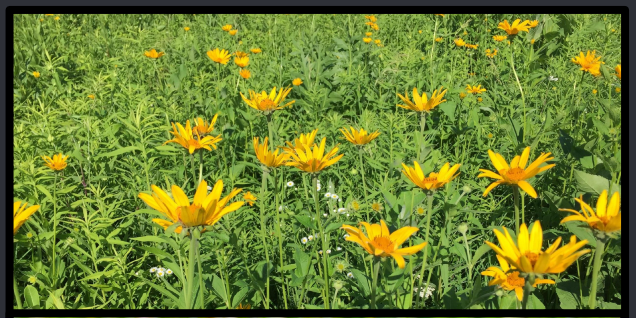
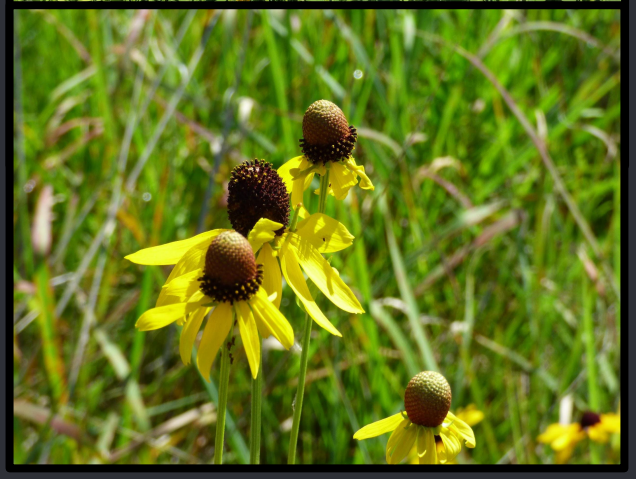
Questions?





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