

Competitive intensity among and between seedlings

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Plant interactions

- Objective 2.3 of the National Native seed strategy that calls for research on plant establishment, species interactions, and ecological interactions
 - Explore interactions among native and between native and non-native plants



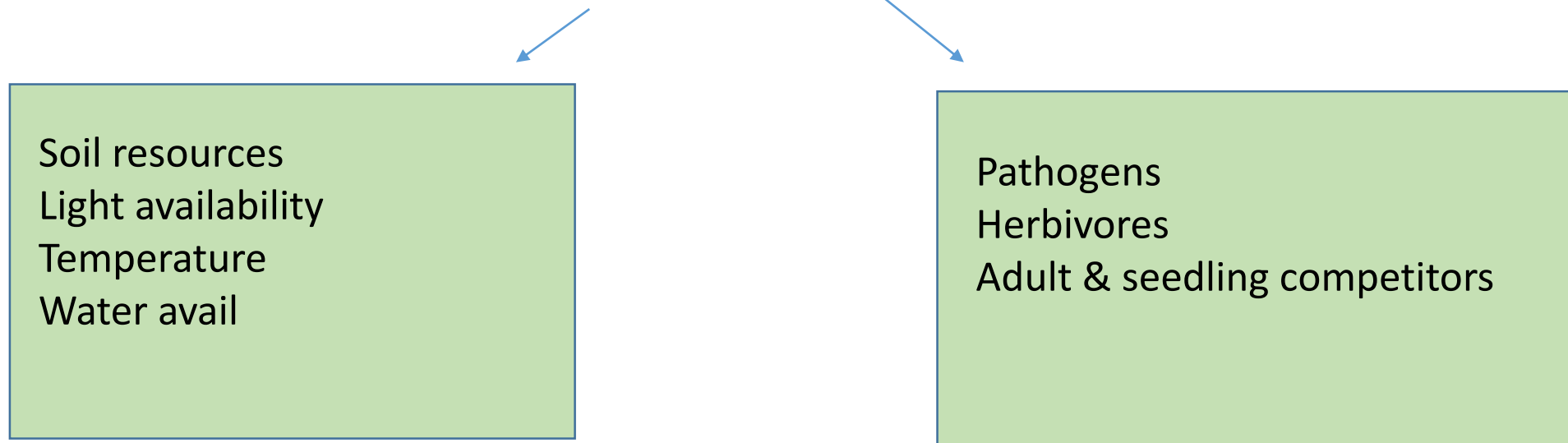
Restoration in the arid west

- Restoration efforts are plagued by substantial seedling failure due to environmental factors and competition from aggressive species
 - Dry, disturbed, fire prone
 - Low productivity, high competition
- Hinders creating diverse plant assemblages
 - Diversity benefits, ecosystem services, & wildlife support



Plant seedlings

- Vulnerable life stage to abiotic and biotic stressors (Moles & Westoby 2003)



- Competition imposed on seedlings is more detrimental than among adults (Weigelt et al. 2002, Spasojevic et al. 2014)
- Population dynamics may govern whether competition between individuals of the same species differ from those of different species

Negative density dependence

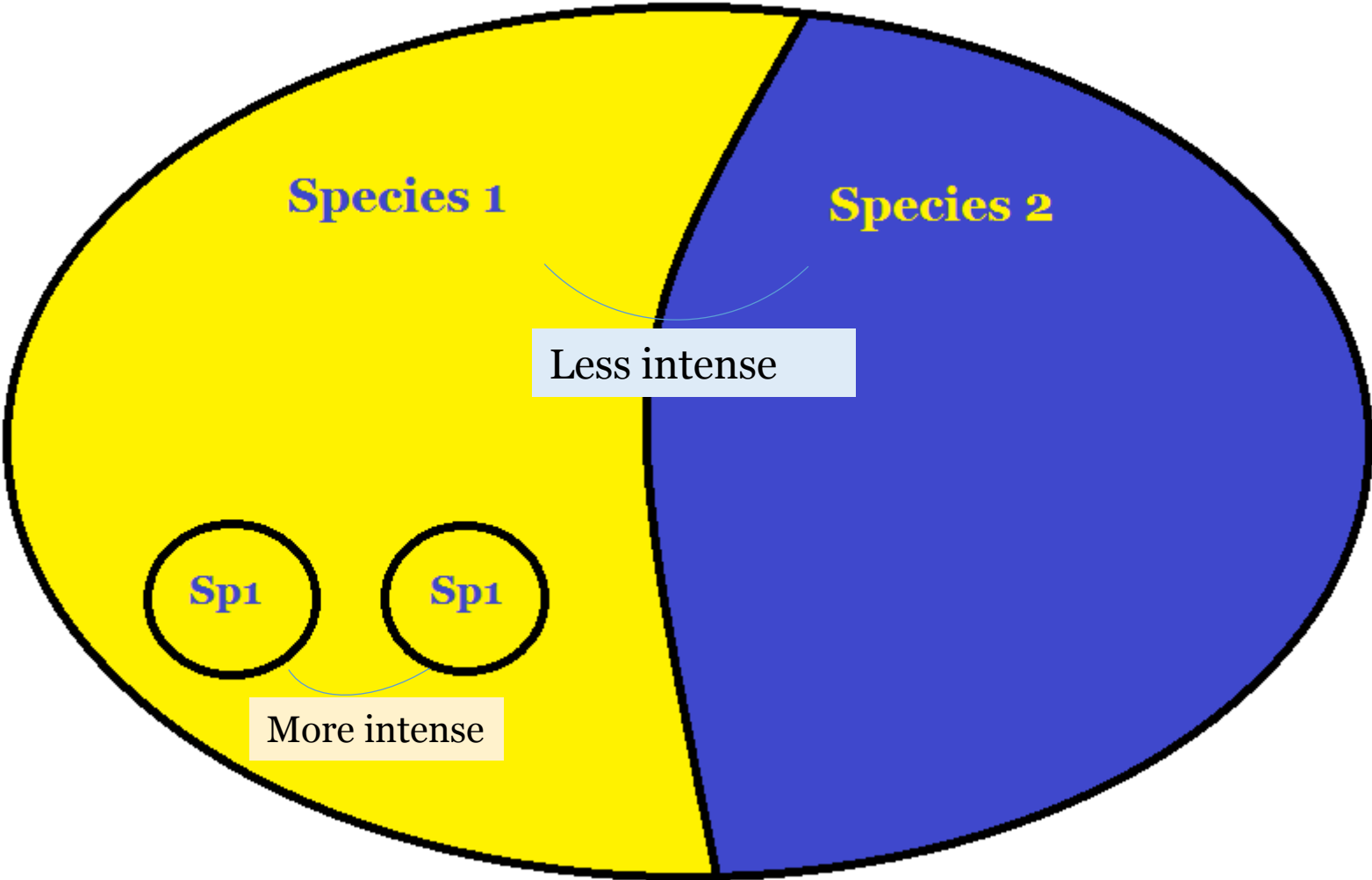
- Individuals of the same species share more similar resource needs [etc.] than individuals of differing species
- Expected to cause competition among individuals of the same species to be more intense than between individuals of different species
- This sounds bad, but...

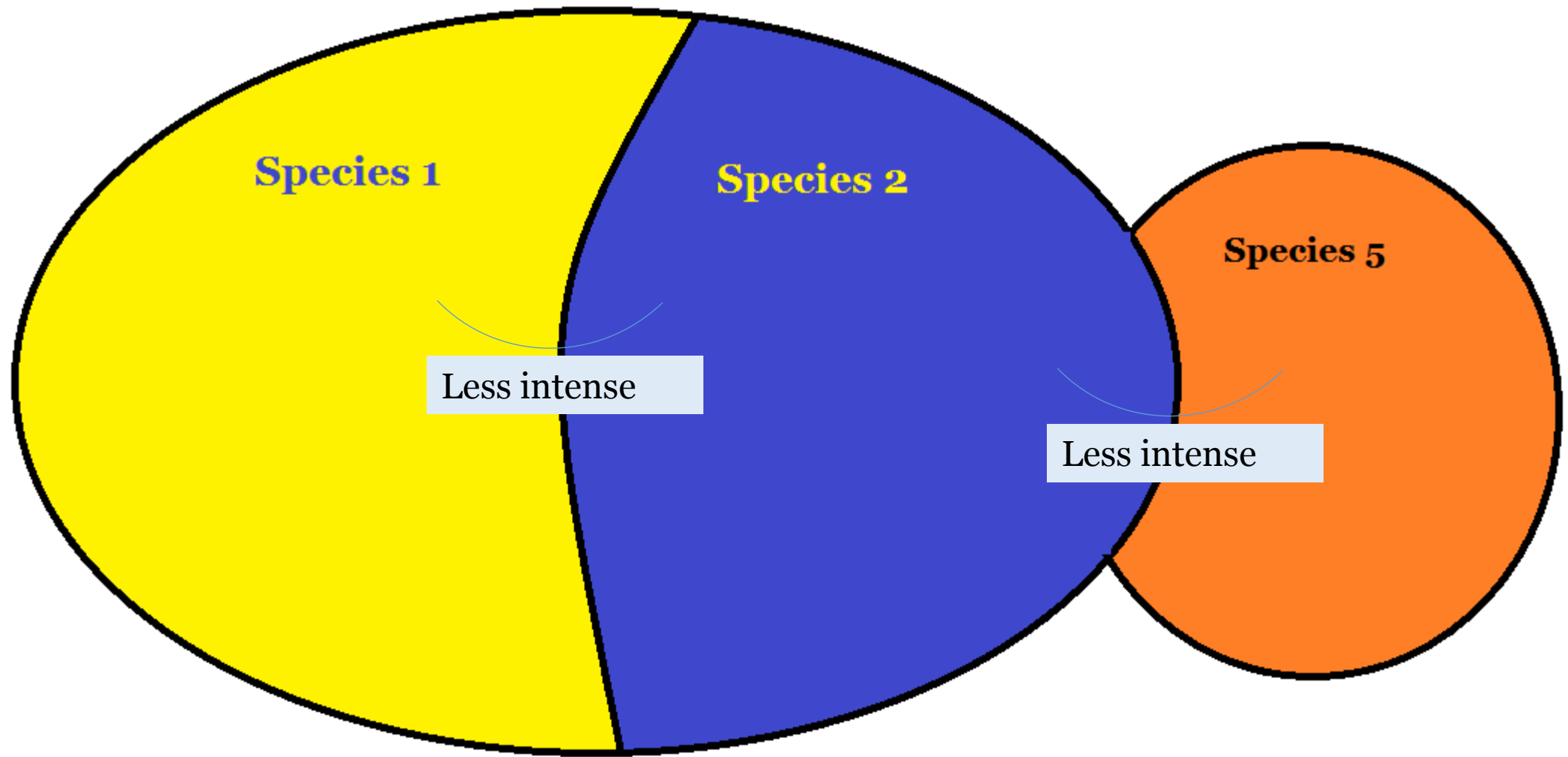


Stabilizing niche mechanisms

- Promotes diversity (Chesson 2000, 2008)
- Reduce overabundance
- Help buffer small populations from extinction
 - intense within species competition is alleviated due to low numbers



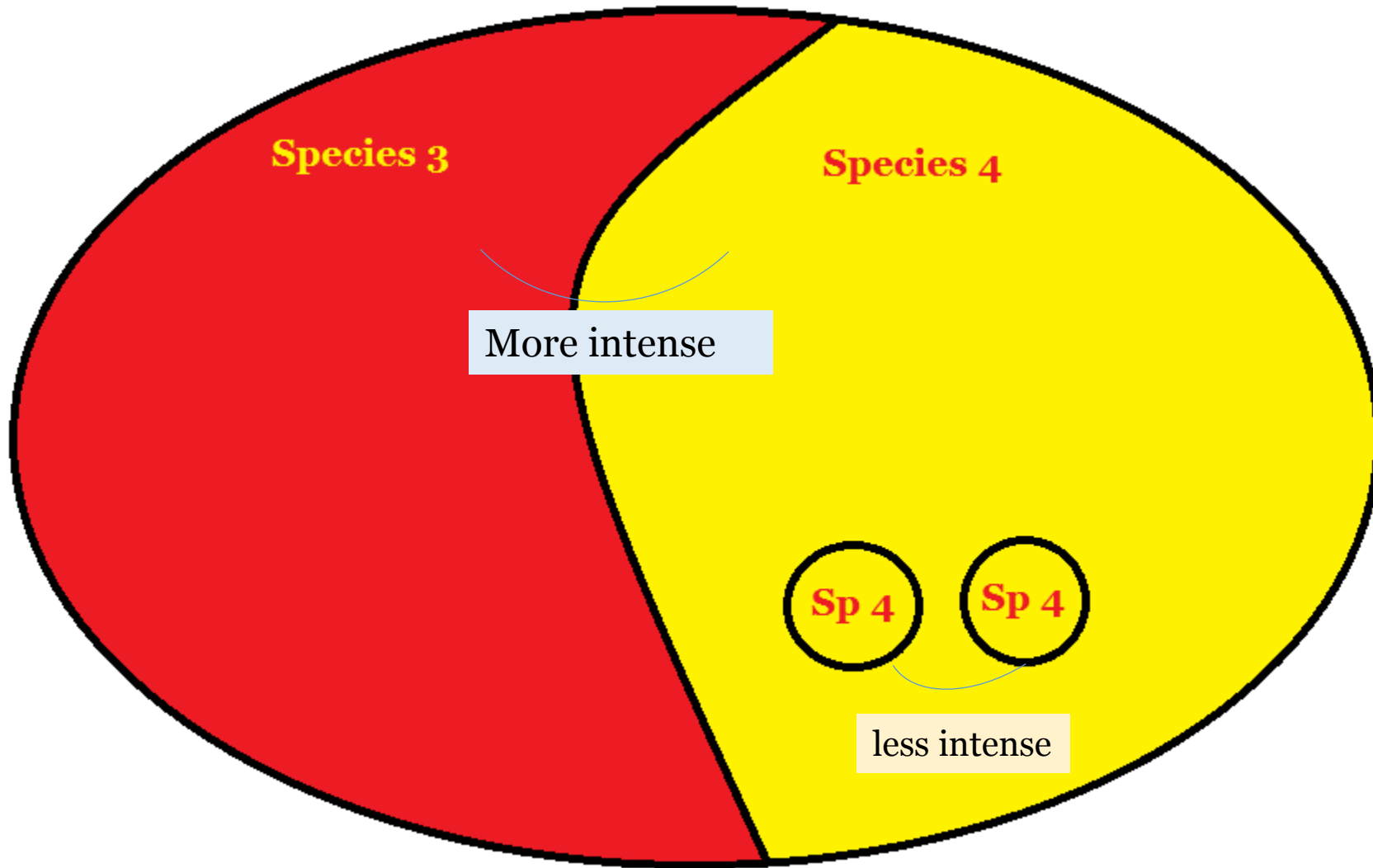




Negative density dependence

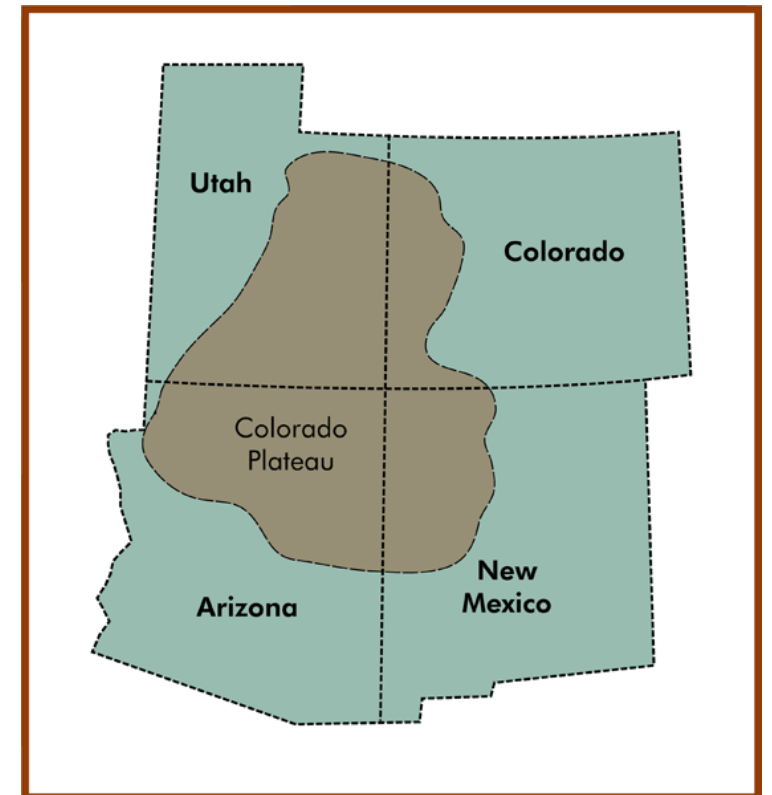
- Negative density dependences
- More facilitation between individuals of the same species
- Contributes to overabundance and dominances
- Detrimental to diversity





Restoration & plant interactions

- High diversity in restoration is often a goal
 - Plant-plant interactions can play a major role in the establishment of species & maintaining diversity
- We need to know more about the within- and between species interaction dynamics to inform seed mix design



Das Study (German for “the Study”):

- Objective

- Determine if the interaction strength differs among individuals of the same species compared to competition between species



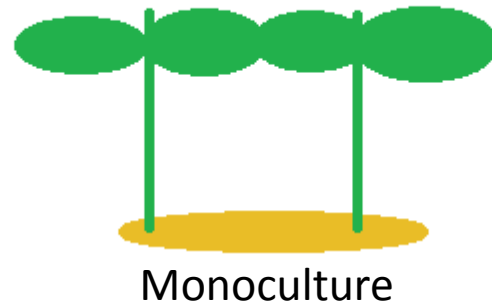
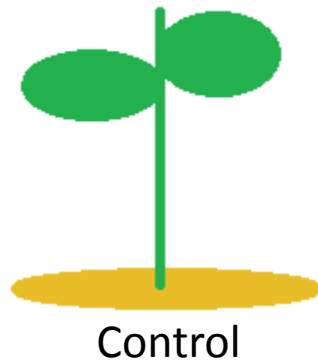
Das Study

- Species used:
 - Considered as high priority species for restoration in the Colorado Plateau
 - Species
 - *Helianthus annuus* (common sunflower) \$
 - *Linum lewisii* (native blue flax) \$
 - *Linum perenne* (blue) \$
 - *Pascopyrum smithii* (western wheatgrass) w
 - Accessions purchased or wild collected
 - Stored in the Dixon National Tallgrass Prairie Seed Bank



Das Study

- Sand in containers
- Growth chamber
- Seven weeks
- Three treatment groups



Interaction dynamics

- Data

- above- and belowground mass

- root mass fraction (RMF) $\frac{\textit{Root mass}}{\textit{Total mass}}$

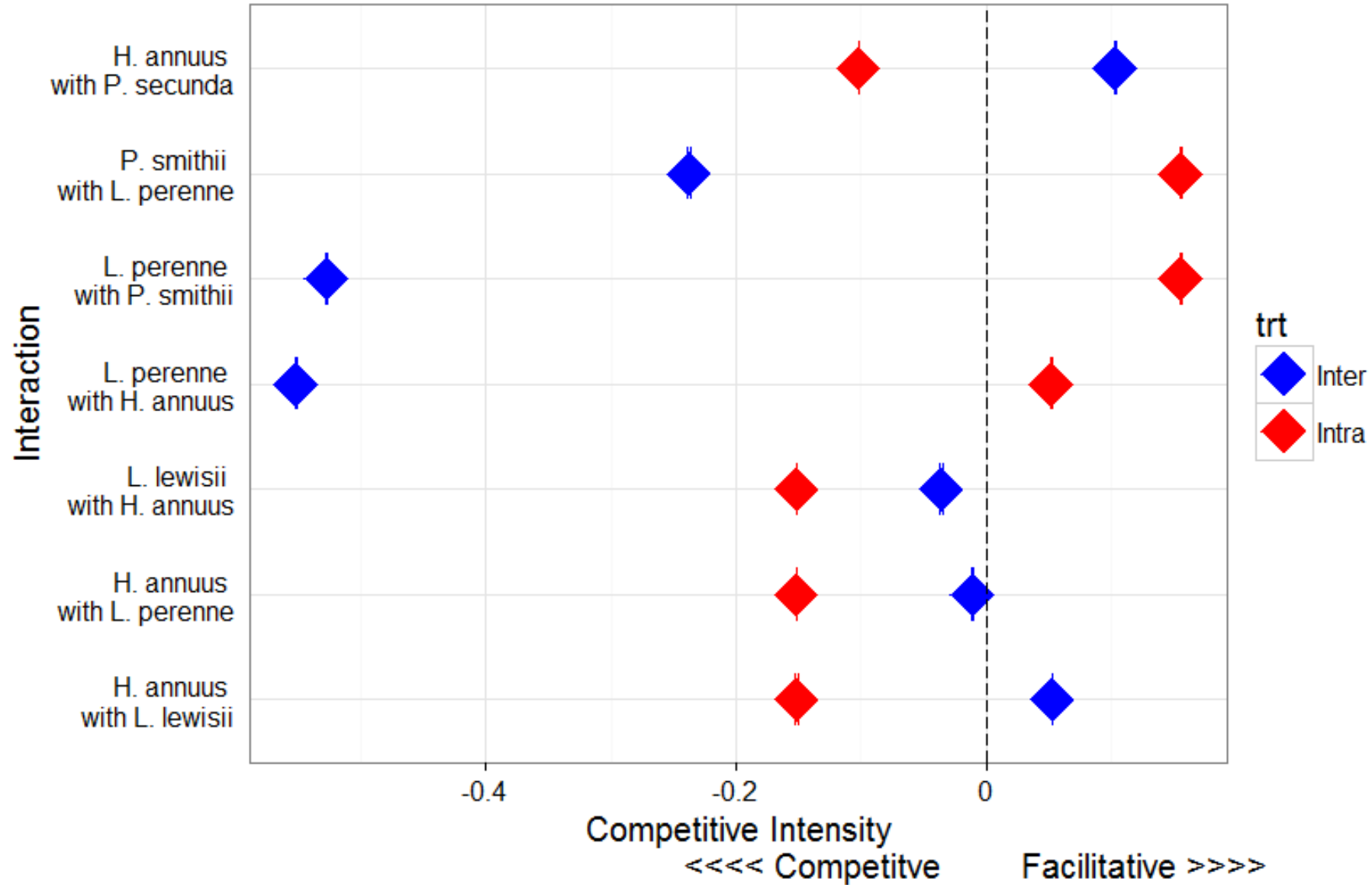
- Effect size calculation $\ln\left(\frac{\textit{RMF of experimental group}}{\textit{RMF of control group}}\right)$

Roots & Interactions

- Roots
 - Important for resource acquisition
 - Soil biota associations
 - Non-resource based communications.
 - Important interface for interactions (e.g. Acciaressi & Guiamet 2010, Foxx & Kramer in prep)
 - Most intense interactions occur between roots (Kiær et al. 2013)



Interaction dynamics



Effect size comparison
 $p = 0.037$

Interaction dynamics

- Four of seven combinations competed more intensely with individuals of the same species than of other species
 - *Helianthus annuus* & *Linum lewisii*
- Two species competed more intensely with individuals of different species
 - *Pascopyrum smithii* & *Linum perenne*
 - *P. smithii* can become dominant where introduced and *L. perenne* can also become abundant
 - *L. perenne* is non-native, used in restoration, and can become abundant
 - Varies by population?
 - These dynamics may limit diversity via competitive exclusion of different species
 - Seed mix design consideration

Future Work

- Elucidate how intraspecific variation and plastic responses can change the competitive relationships between individuals of the same and different species using native and invasive species
 - Mechanistic understanding of how dominant and invasive species negatively impact plant establishment and coexistence



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Thank you!

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This and additional presentations available at <http://nativeseed.info>

