Relating sagebrush genome size to resource co-limitation and competition

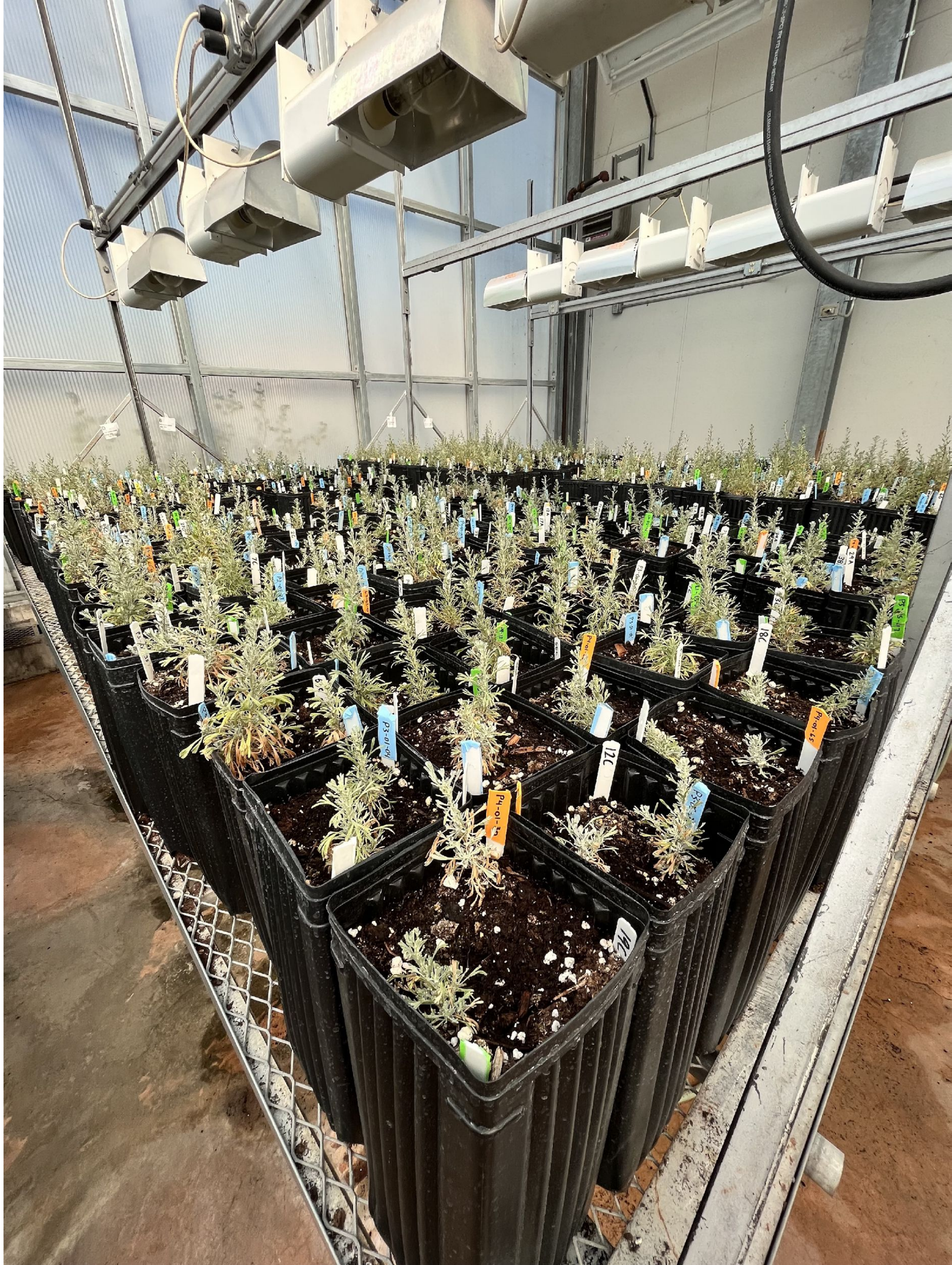
Dr. Josh Grinath

Assistant Professor

Community & Global Change Ecology Lab

Department of Biological Sciences

Idaho State University



Our Collaborative Team

Co-PI's:

- Kathryn Turner (ISU)
- Donna Delparte (ISU)
- Kathleen Lohse (ISU)
- Sven Buerki (BSU)

Graduate Students:

- Trey Harris (ISU)
- Lukas Grossfurthner (UI)

Post-MS Scholars:

- Carlos Dumaguit (BSU)
- Patricia Kerner (ISU)

SARE Students (ISU):

- Delaney Hyer
- Saige Jeffs
- Diana Lugo Cordero

Undergraduate Assistants (ISU):

- Holly Forster
- Krissy Wuthrich
- Makayla Leonard
- Dominic Gentry
- Kayla Hobbs
- Hannah Clawson
- Chris Forshee
- Elizabeth Mandala
- Audrey Jorgensen

Many volunteers too!

Ecological Consequences of Genome Size Variation

Genetic material is rich in nitrogen (N) and phosphorus (P)

- Nucleic acids ~39% N and 9% P

Genome size = total amount of DNA contained in a single genome

- Measured as mass (picograms, pg)
- Varies widely among species
- Can vary within species

Expect nutrient requirements increase along with genome size

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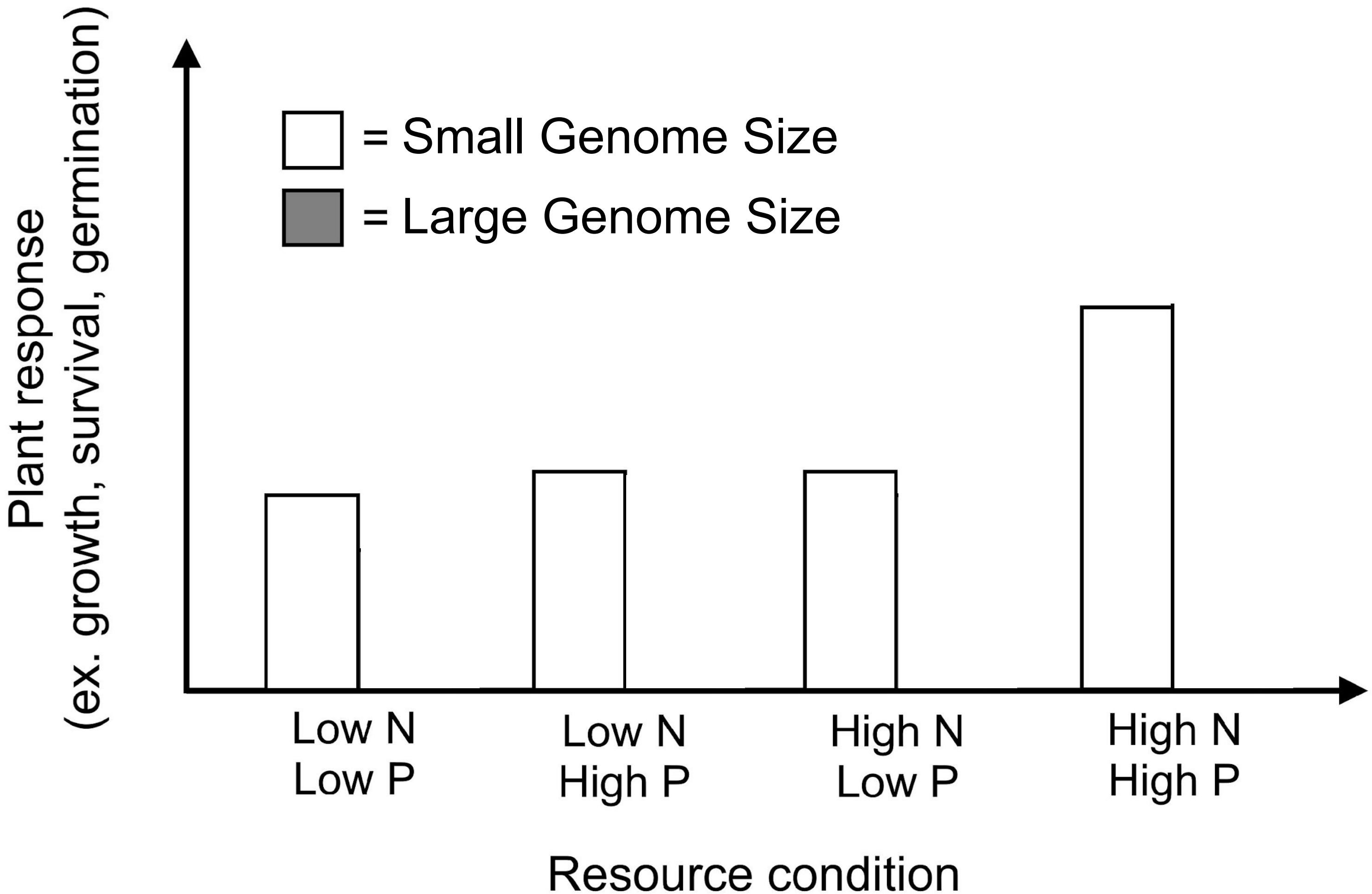
Consequences may include:

- **N and P more limiting**
- **Stronger resource co-limitation**
- **Differing competitive abilities**

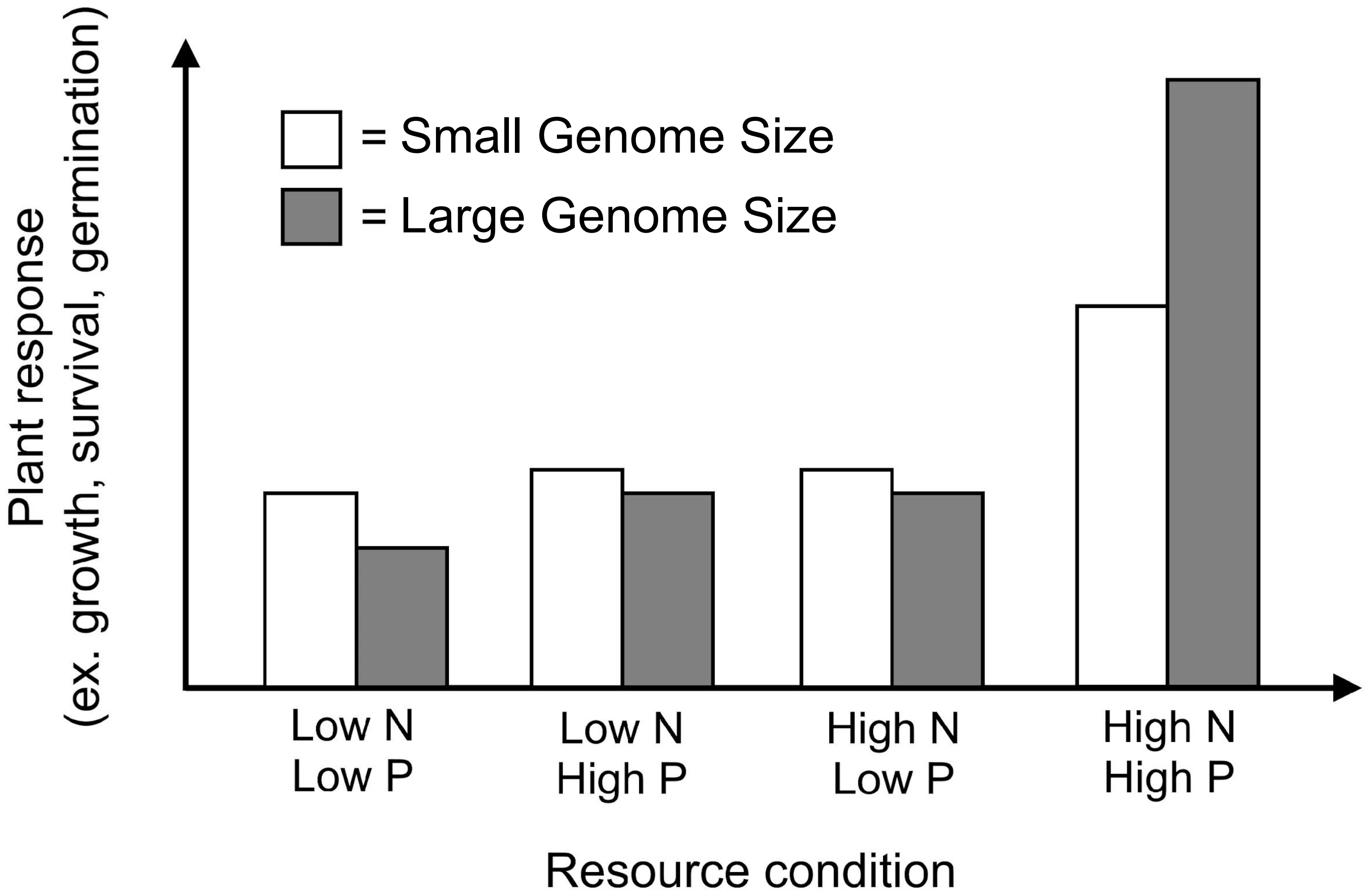
Co-limitation and Genome Size

Plants are commonly co-limited by N & P



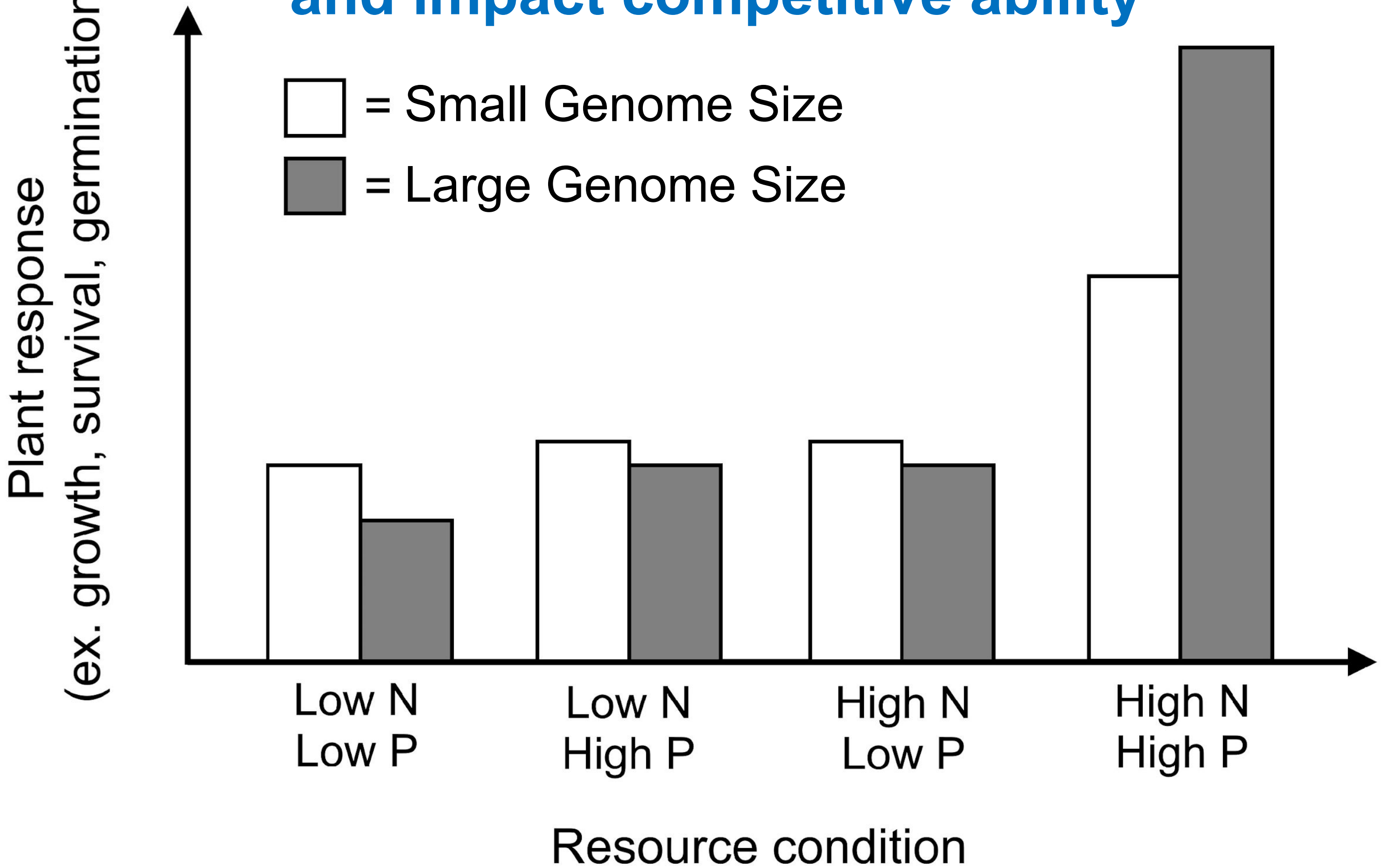
Co-limitation and Genome Size

Which may be stronger for plants with large genome sizes



Co-limitation and Genome Size

Which may be stronger for plants with large genome sizes and impact competitive ability

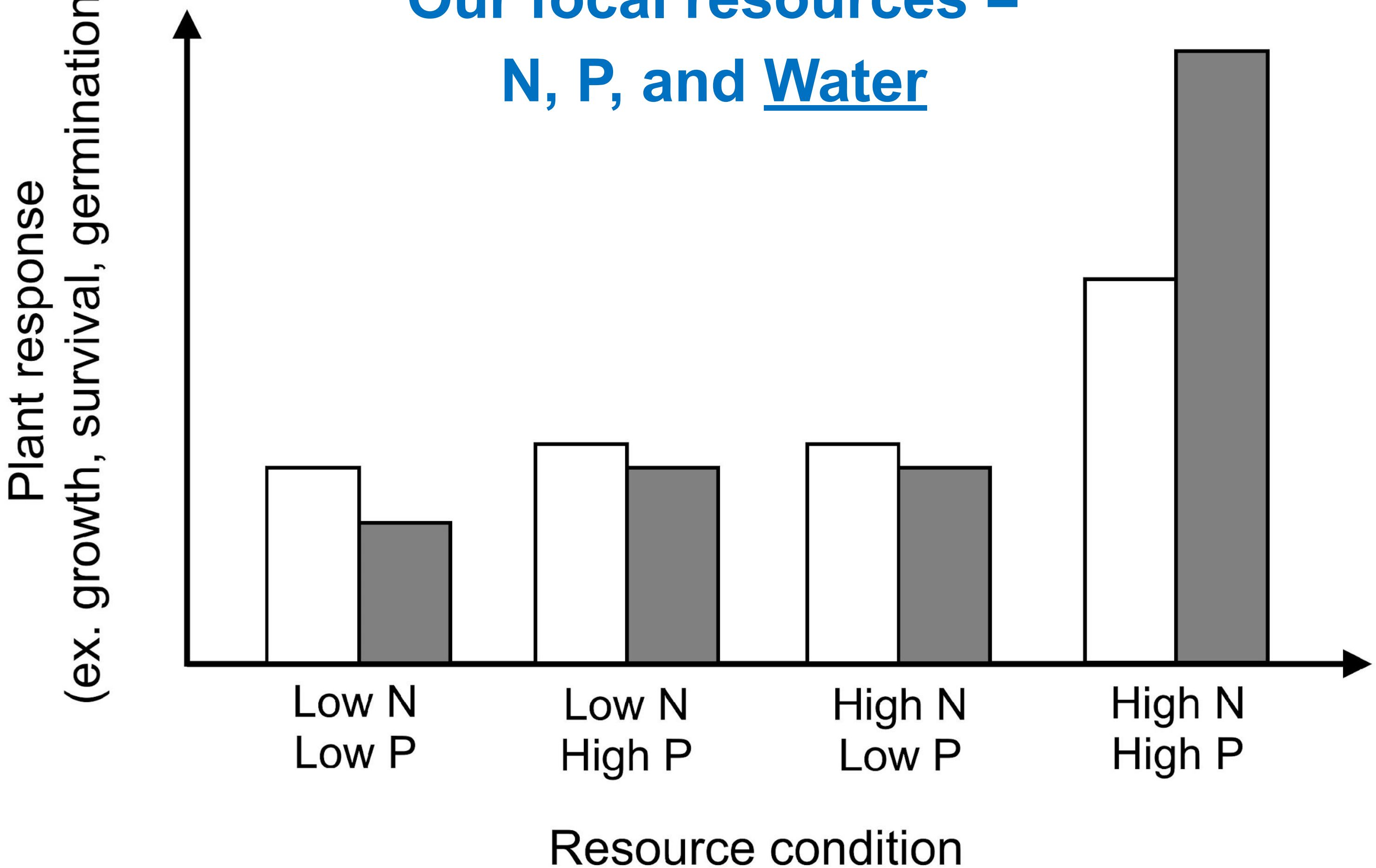


Co-limitation and Genome Size

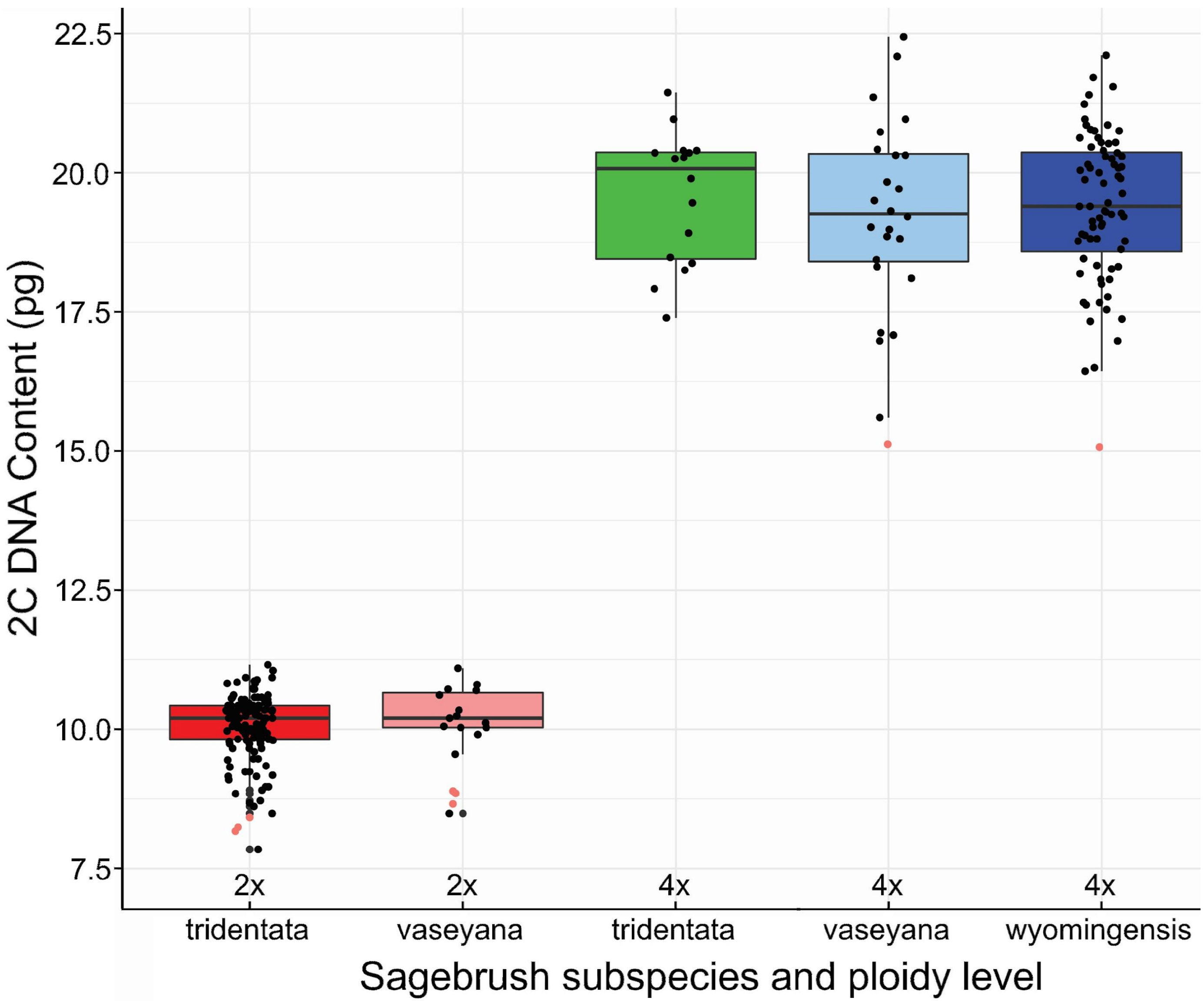
We used sagebrush to test these ideas

Our focal resources =

N, P, and <u>Water</u>



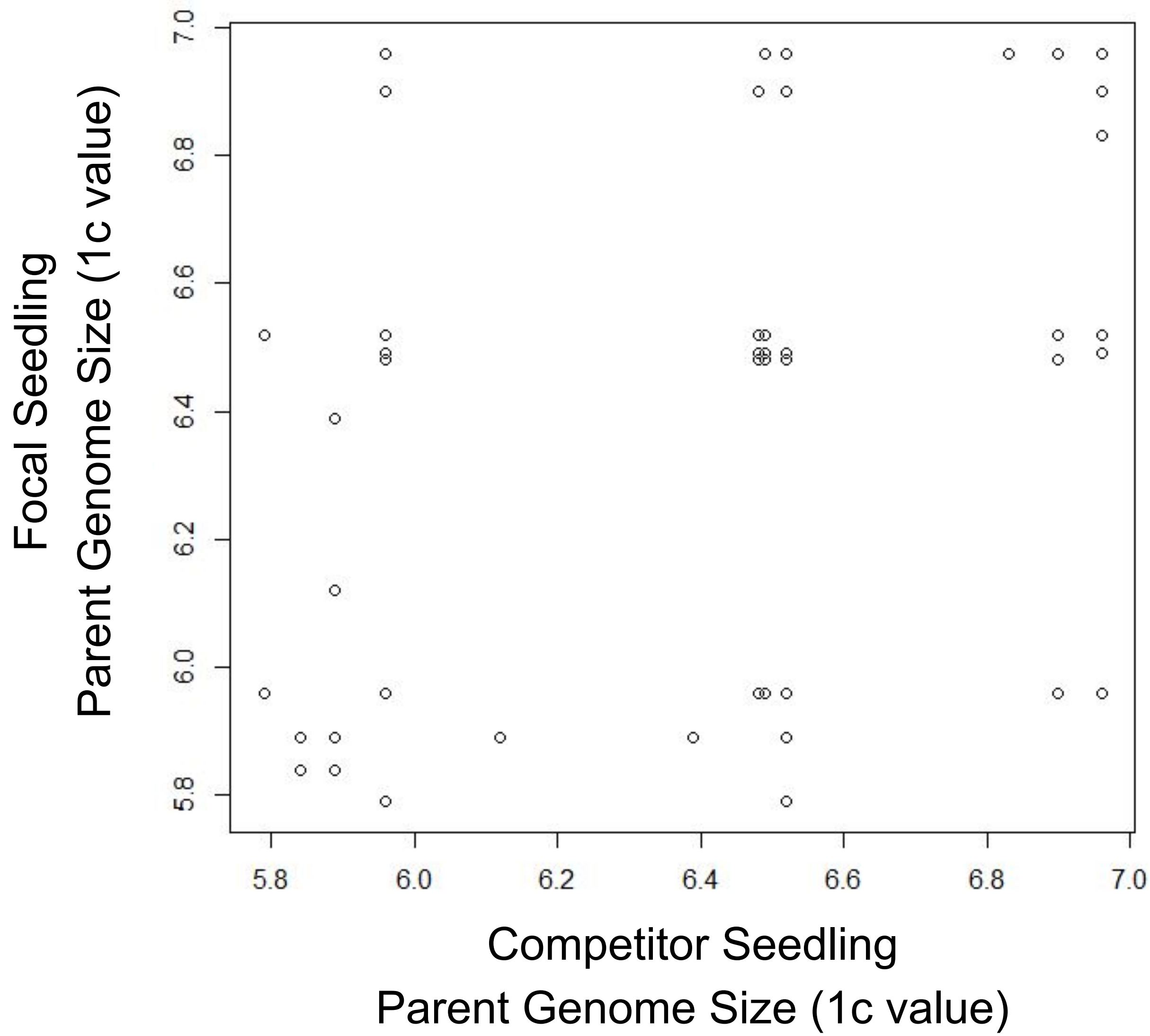
Genome Size Variation in *Artemisia tridentata*



(Courtesy of Bryce Richardson)

Greenhouse Experiment
with *Artemisia tridentata wyomingensis*

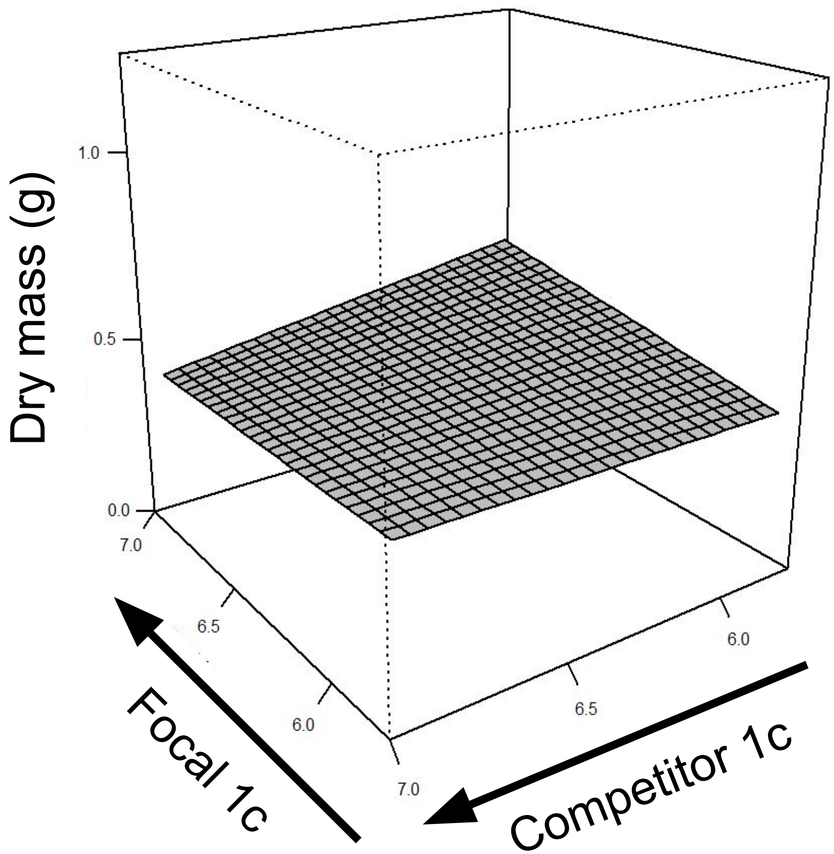
Response Surface applied to low vs high N, P, & Water (factorially crossed)



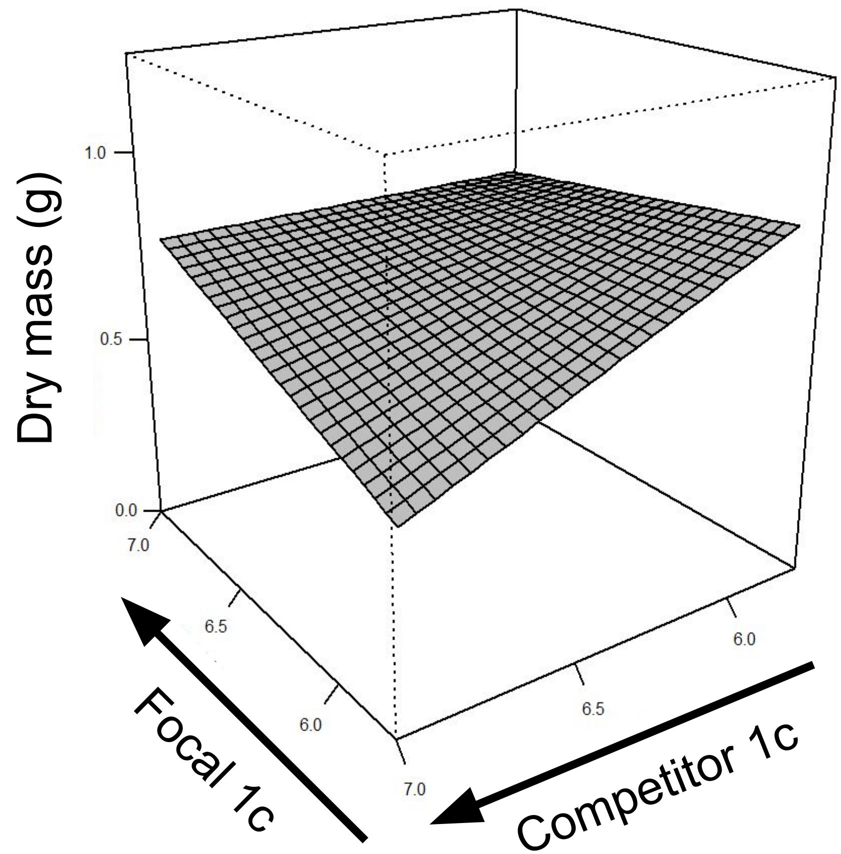
Sagebrush Seedling Biomass:
Water x Focal GS x Competitor GS

New results!

Low Water



High Water



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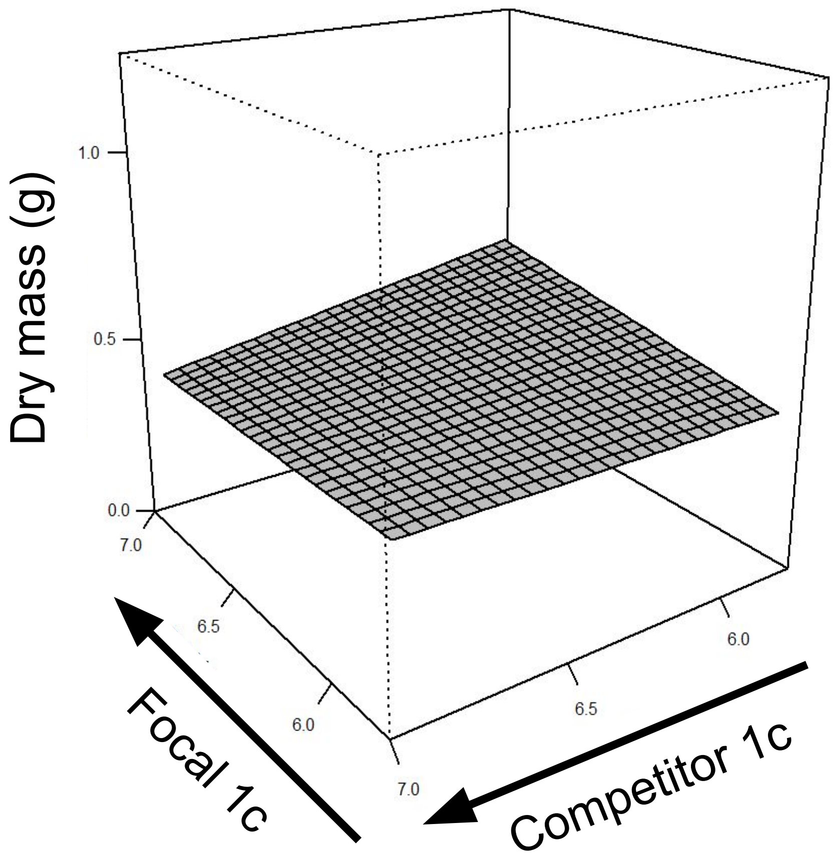
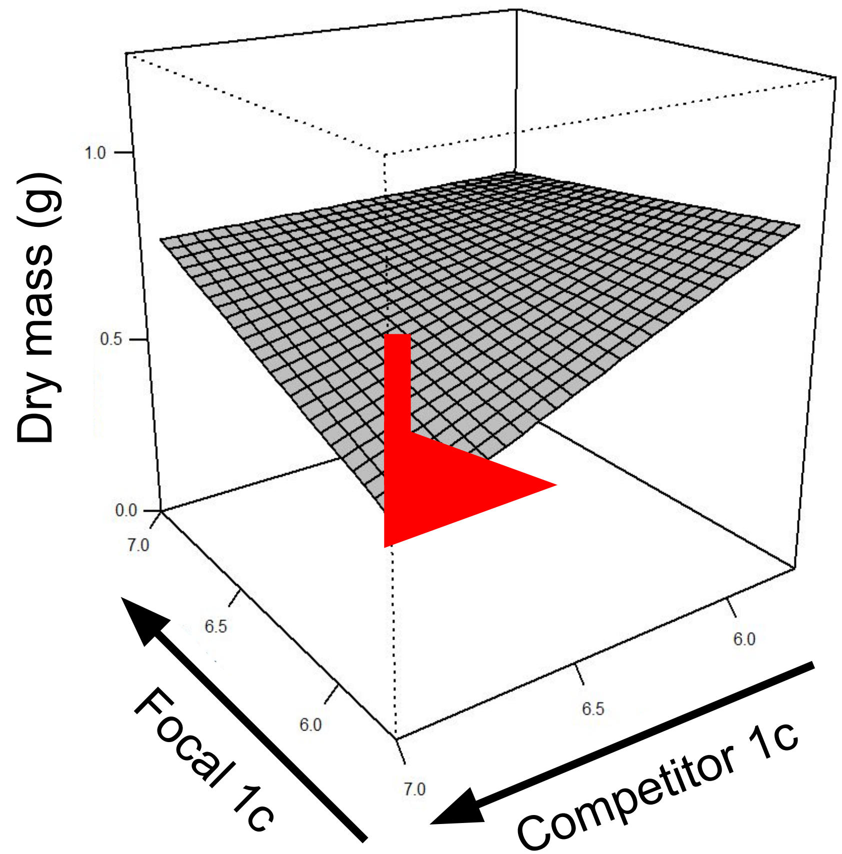
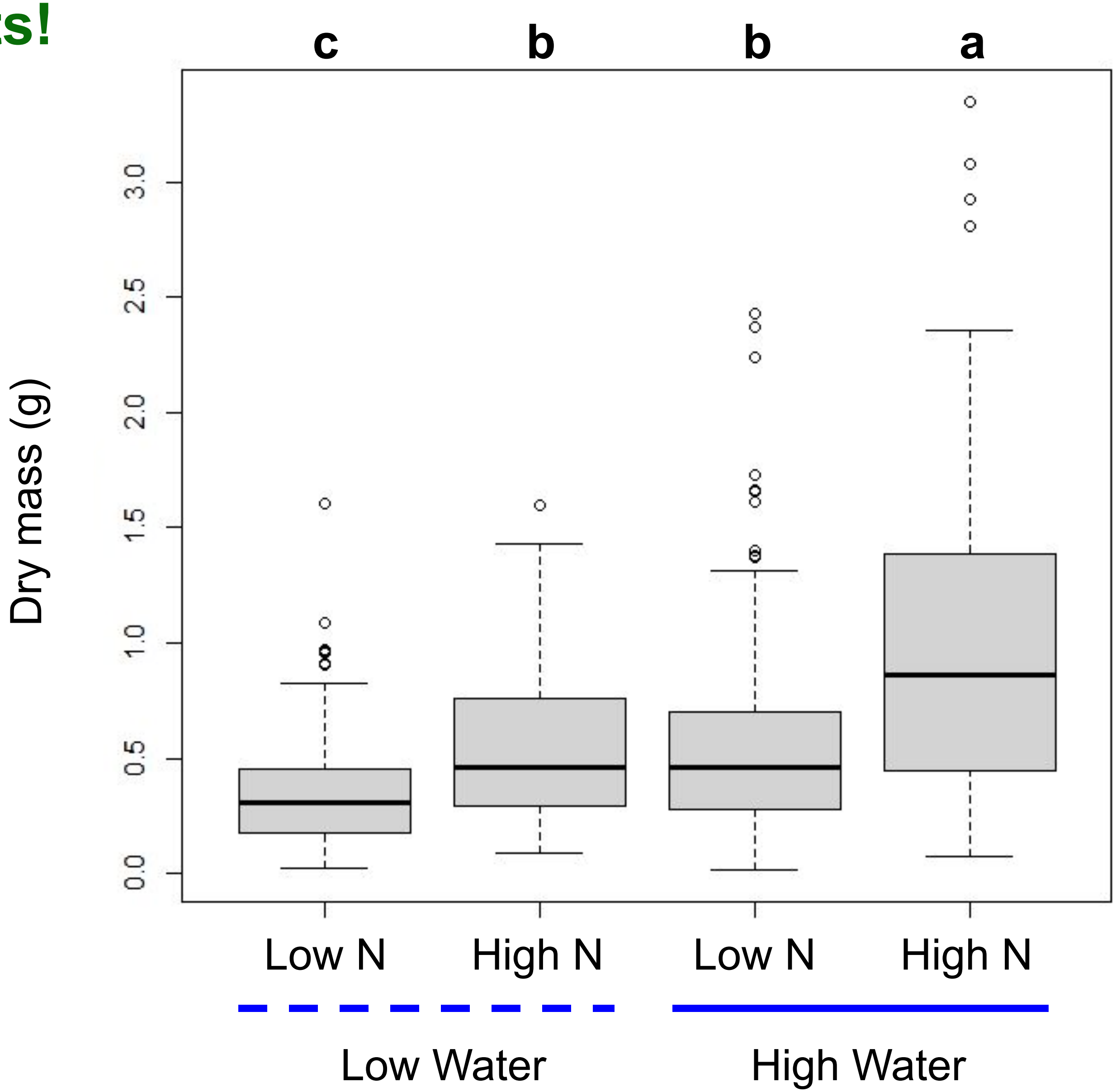


High Water



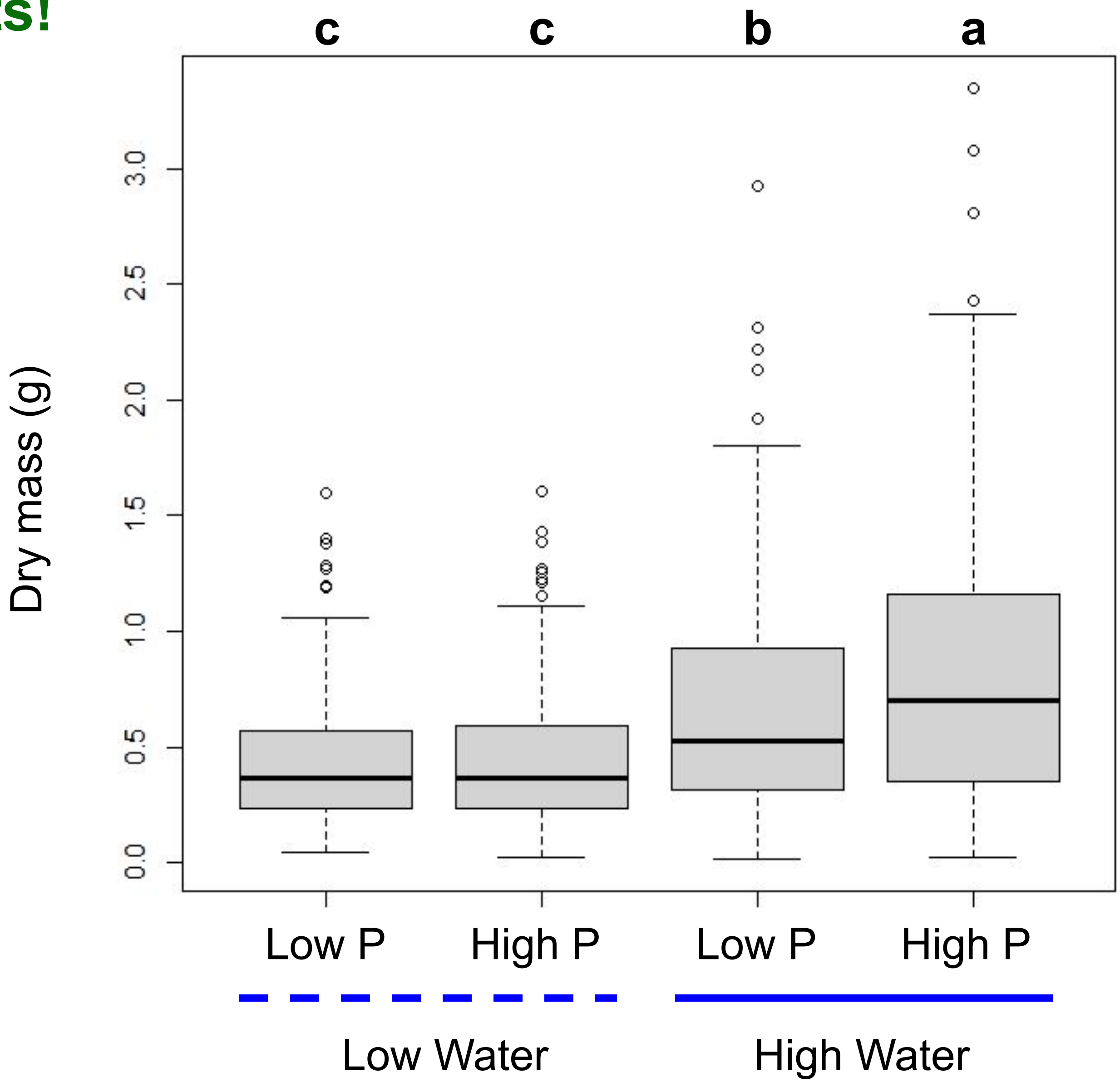
Sagebrush Seedling Biomass: Nitrogen x Water

New results!



Sagebrush Seedling Biomass: Phosphorus x Water

New results!



Now taking this to the field

Seeding sagebrush with small and large genome sizes into field conditions varying in N, P, and water availability, among other factors:

1) Elevational Gradient Experiment, where at each of 6 elevations:

- Burned vs. Unburned areas (fires in 2020)
- Shrub ‘fertile islands’ vs. Inter-shrub areas

Now taking this to the field

Seeding sagebrush with small and large genome sizes into field conditions varying in N, P, and water availability, among other factors:

2) Nitrogen Deposition Legacy Experiment:

- Legacies of simulated N deposition (0, 6, or 12 kg N/ha/yr)
- Shrub ‘fertile islands’ vs. Inter-shrub areas

Now taking this to the field

Seeding sagebrush with small and large genome sizes into field conditions varying in N, P, and water availability, among other factors:

3) Shrub Removal Legacy Experiment:

- Legacy treatment of clipping shrubs, mostly *A. tridentata*
- Shrub ‘fertile islands’ vs. Inter-shrub areas

Thanks, and stay tuned!

Questions?