

Building Research
Capacity in Biology:
Local adaptation to
microbial
communities in
widely translocated
big sagebrush
(*Artemisia
tridentata*)

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Species interactions generate selection pressure...

But patterns of “biotic” local adaptation are variable

Where and WHY are populations adapted to their local species interactions?

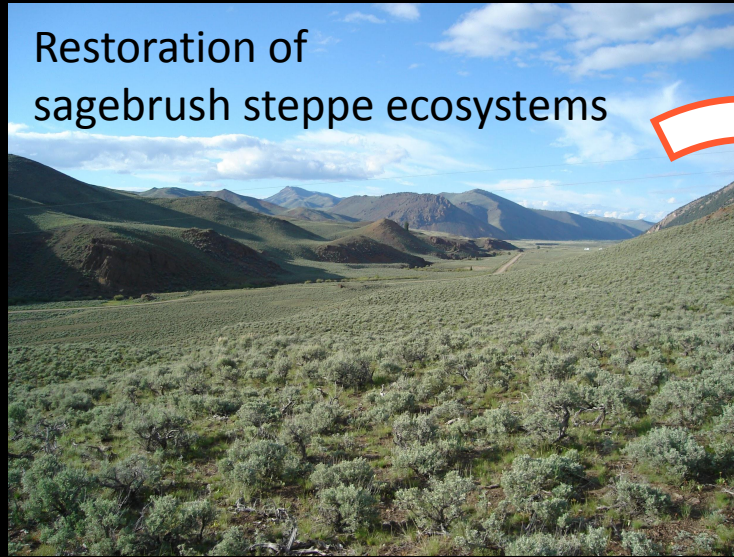
- Seed grant research accomplishments
- Next steps via NSF Broadening Research Capacity in Biology award

Implications of
plant-microbe feedbacks
for translocation
outcomes?

Widespread
translocations via
post-fire
seedings...

...but patterns of
establishment
variable.

Restoration of
sagebrush steppe ecosystems



Bromus tectorum, cheatgrass



Reduced fire return interval





**Allison
Simler-Williamson (BSU)**



**Marie-Anne deGraaff
(BSU)**



**Leonora Bittleston
(BSU)**



**Trevor Caughlin
(BSU)**



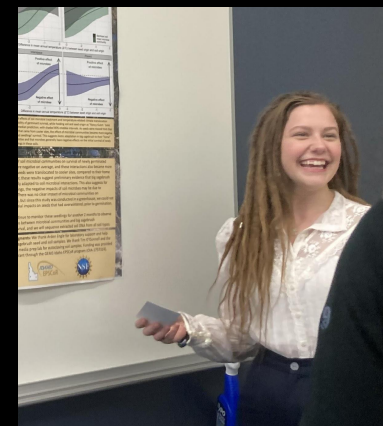
**Matt Germino
(BSU)**



Seed grant
team!



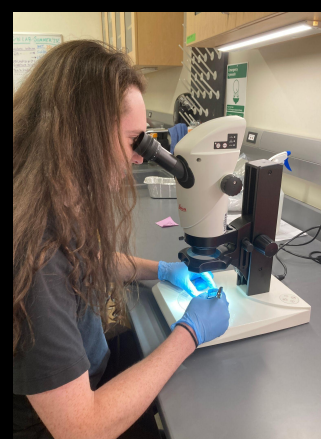
**Arden Engel
BSU MS Student**



**Grace-Ann Myers
BSU Undergrad –
SARE/VIP**



**Kaitlyn Opland
BSU Undergrad –
SARE**



**Aden O'Brien
CWI Undergrad –
SARE**

Thank you!

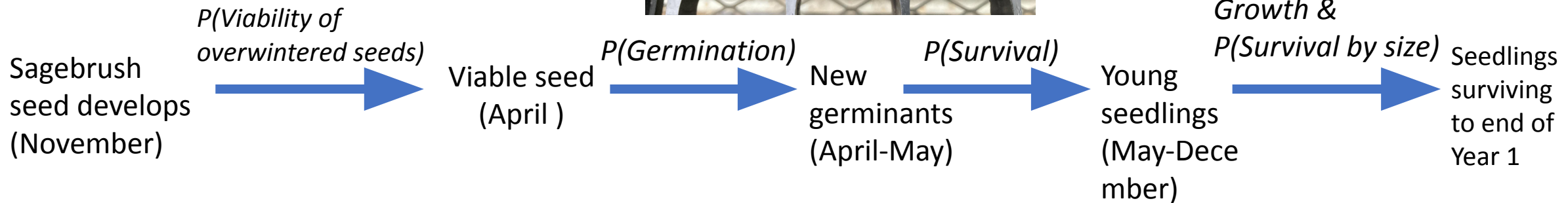
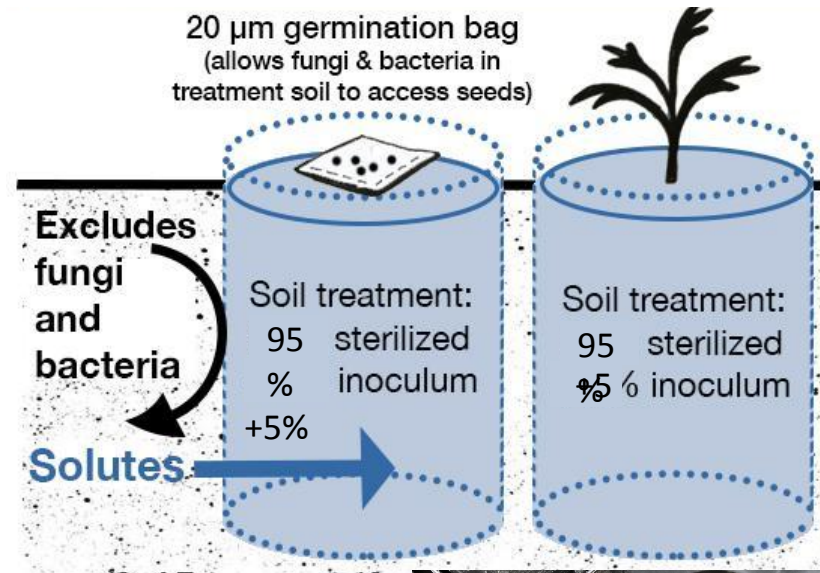
- Andrii Zaiits
- Ryan Wickersham
- Toby Maxwell
- Sabrina Schuler
- Aden O'Brien

- Luci Wilson
- Ashley Leavitt
- Leslie Nichols
- Ace Pedraza
- Sami Kennel

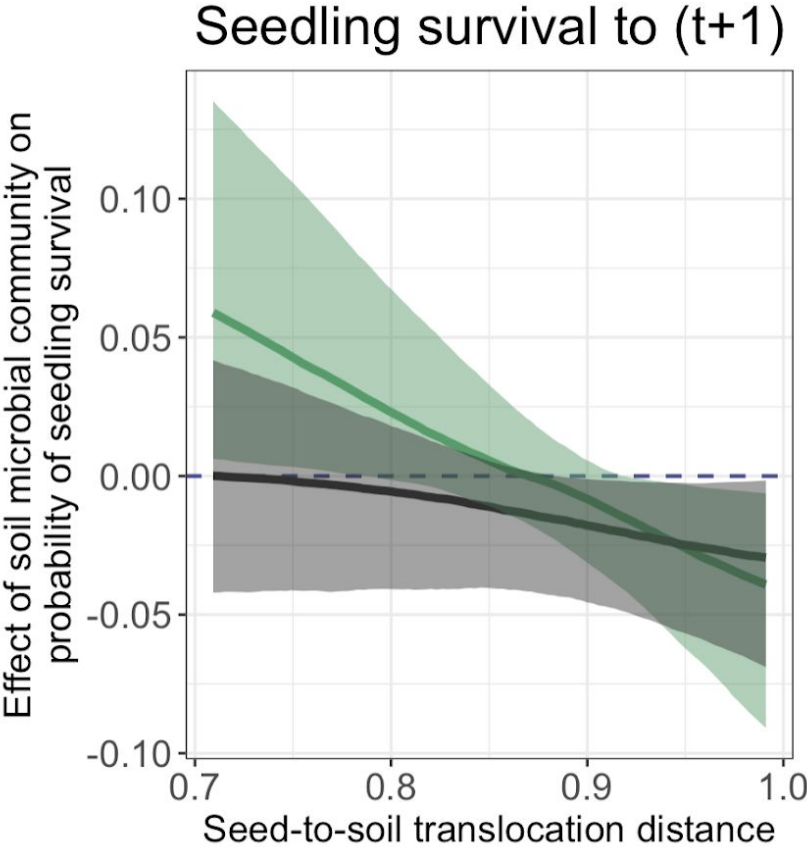
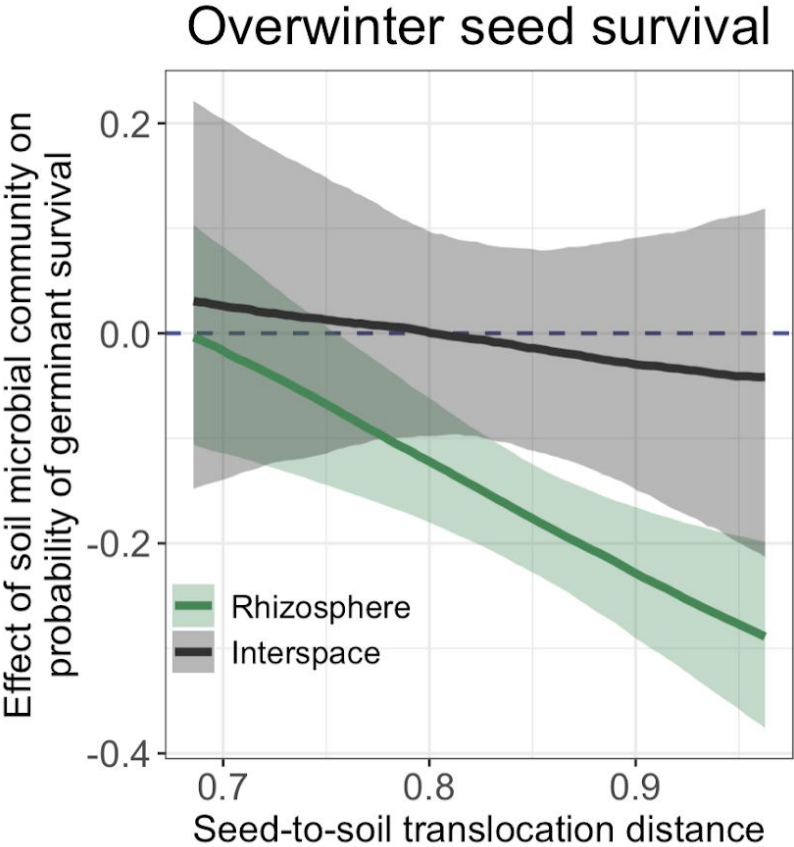
- Zane Cram, USDA ARS
- Ann Marie Raymondi, Snake River Birds of Prey NCA
- Boise National Forest
- Tim O'Donnell

Integrating microbial mechanisms into sagebrush population models

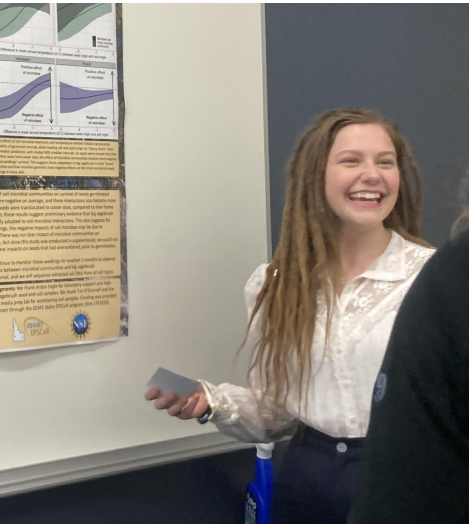
- 6 "microbe" common garden designs established
- >8000 observations of the impacts of soil microbes on sagebrush vital rates over 2 years.



Patterns consistent with “biotic” local adaptation to soil microbes, across several plant life history stages.



Seed data:
Kaitlyn Opland
Boise State
Undergrad –
SARE

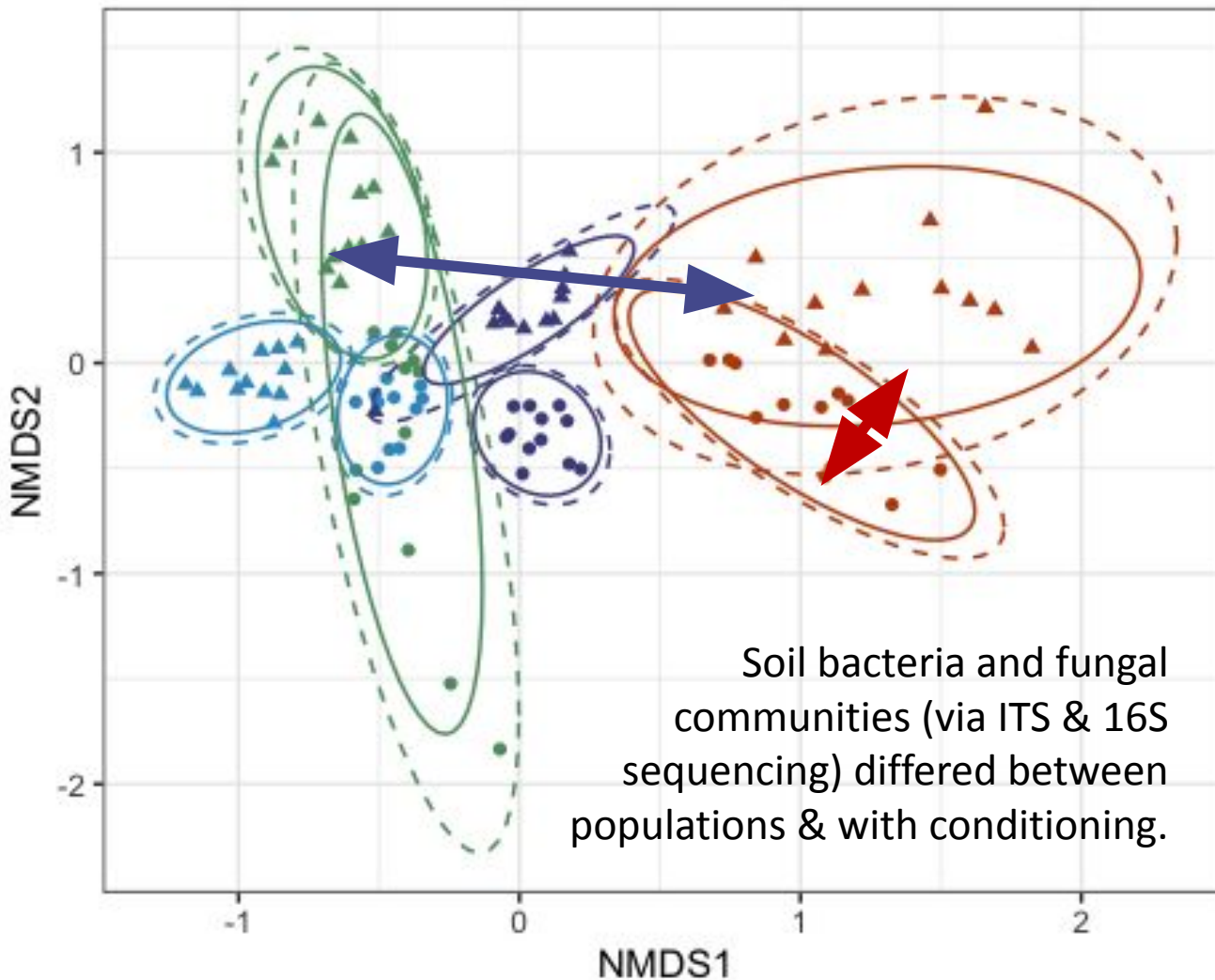


Seedling data:
Grace-Ann
Myers
Boise State
Undergrad –
SARE-VIP

Variation in direction of microbial impacts across vital rates, consistent with pathogenic and mutualistic interactions

Metagenomic data quantifying translocation of plant populations and soil microbes

Fungal community composition



Site Elevation

- 1523
- 1413
- 1191
- 939

- Rhizosphere
- ▲ Interspace

“Seed-to-soil” translocation distances established using microbial community composition

>300 soil bacterial and fungal community samples from sagebrush steppe



Kaitlyn Opland
BSU Undergrad –
SARE

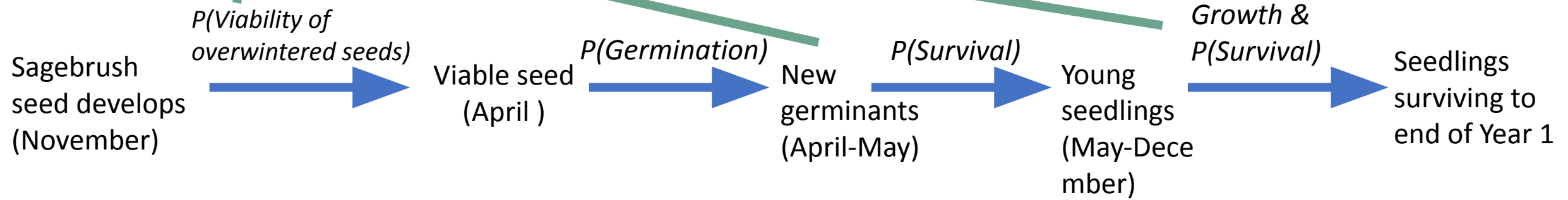
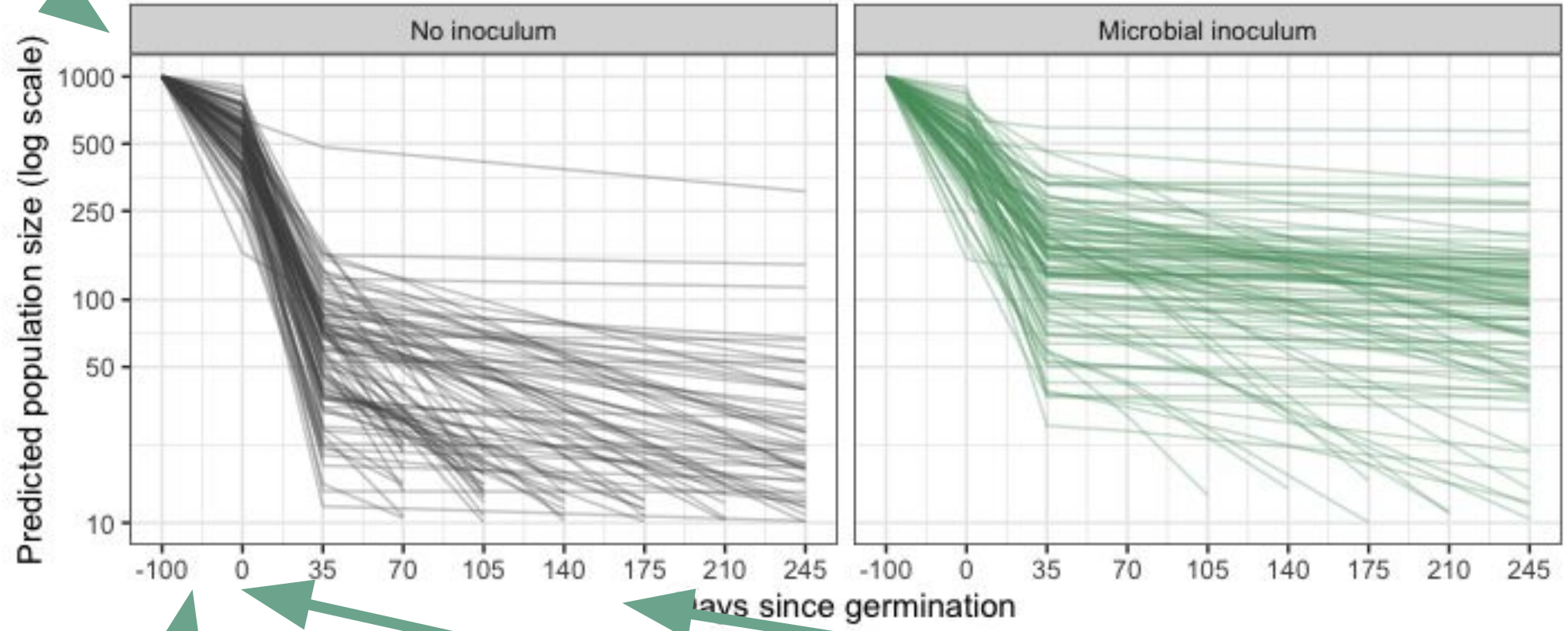


Aden O'Brien
CWI Undergrad –
SARE

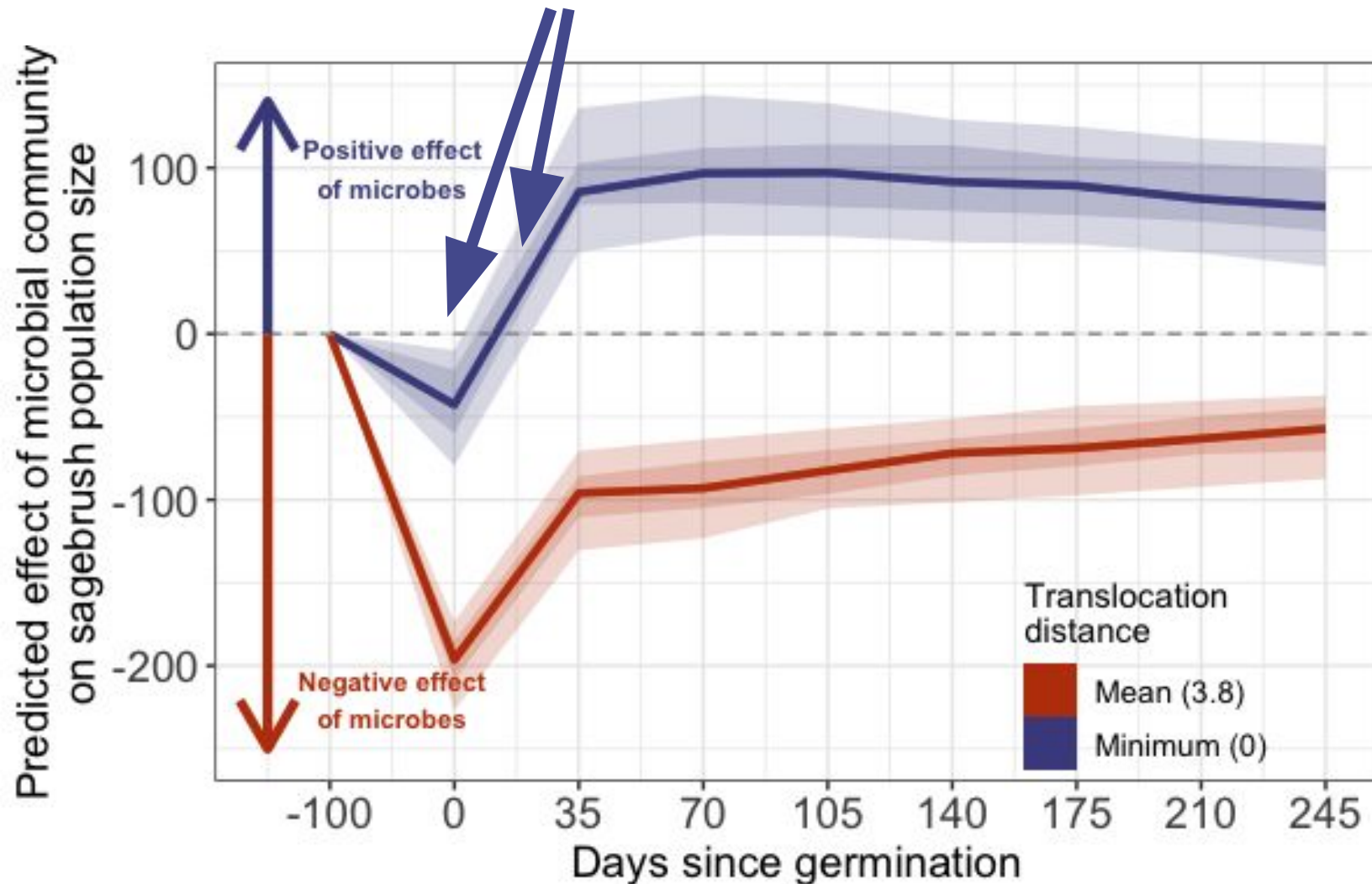
Integral Projection Models of *Artemisia tridentata* populations incorporate empirical data

Simulate seeding (n=1000)

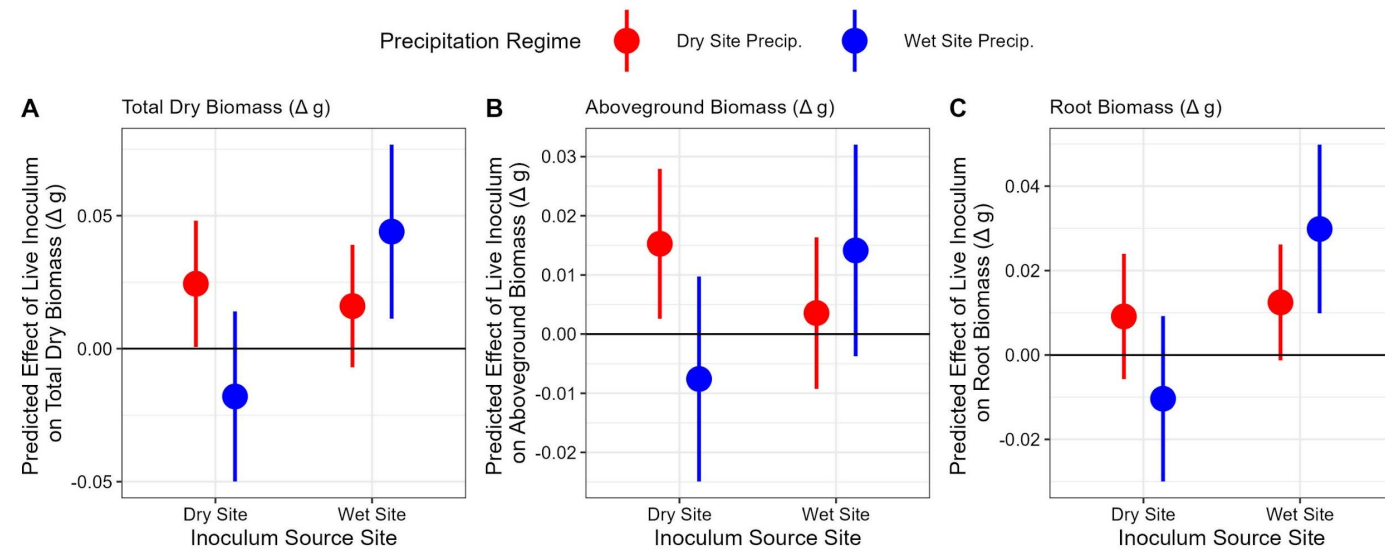
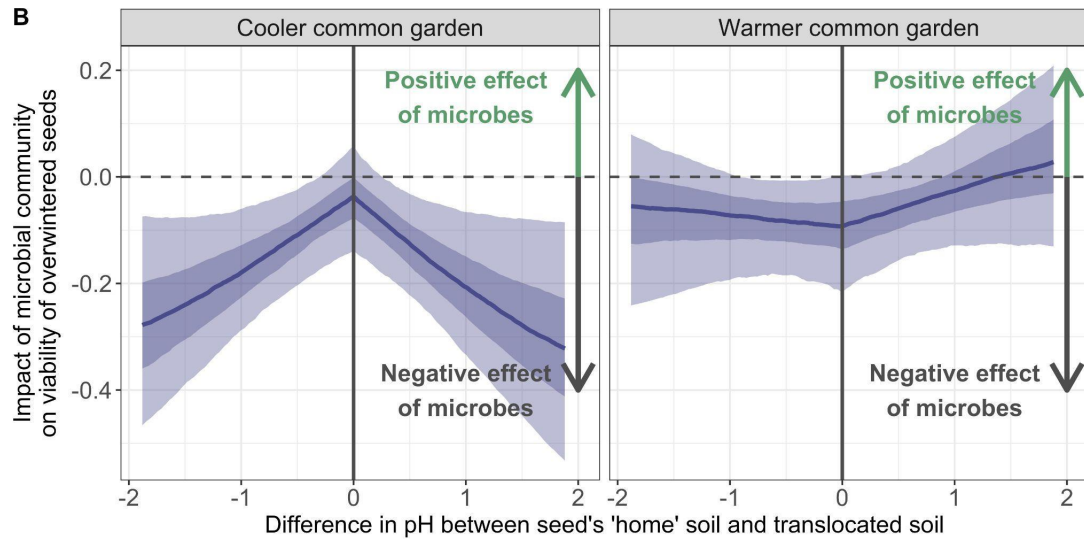
Translocation distance = 0



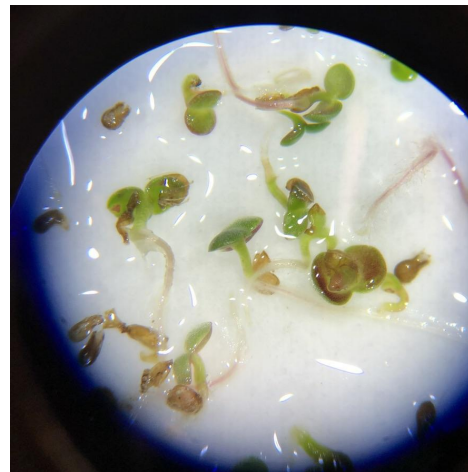
Population size most sensitive to microbial impacts on survival of new seedlings in first weeks after germination



Outcomes of plant-microbe interactions + biotic adaptation contingent on environmental conditions?



Patterns of local adaptation vary with precipitation regime & between warm v. cool common gardens



Arden Engel
BSU MS Student dissertation



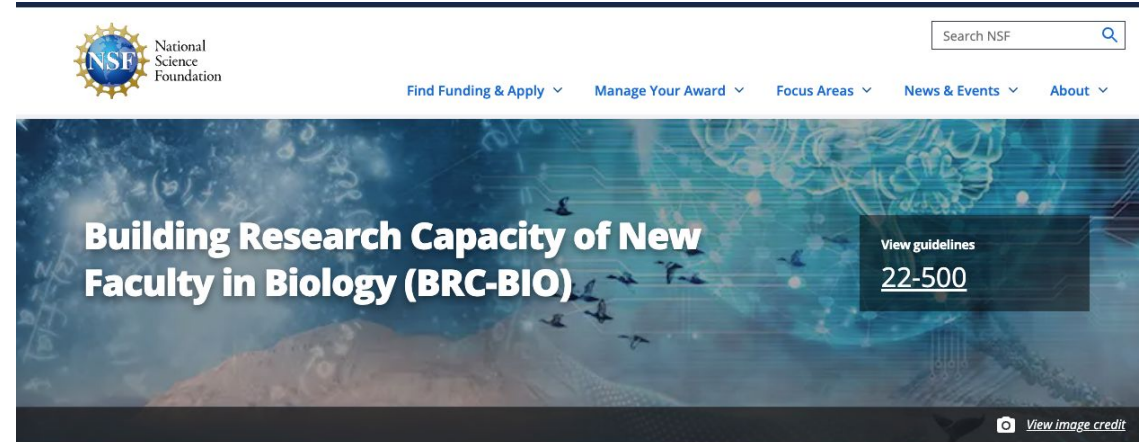
Next steps via

NSF's Broadening Research Capacity in Biology Award (Award #2312572!)

Environmental variation and the disruption of biotic local adaptation: Predicting consequences of changing microbial interactions for plant populations

Funding in 2024-2027 for:

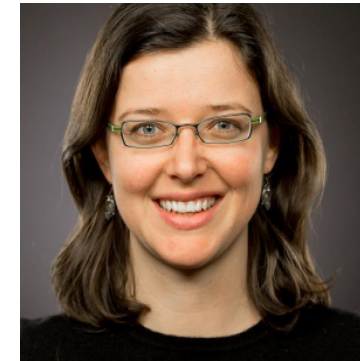
- 2 BSU graduate students
- 6-10 undergraduate researchers
- Programs to expand diverse participation in biology
- BSU Biology Equipment & early career Simler-W lab



Allison
Simler-Williamson
(BSU)



Marie-Anne deGraaff
(BSU)

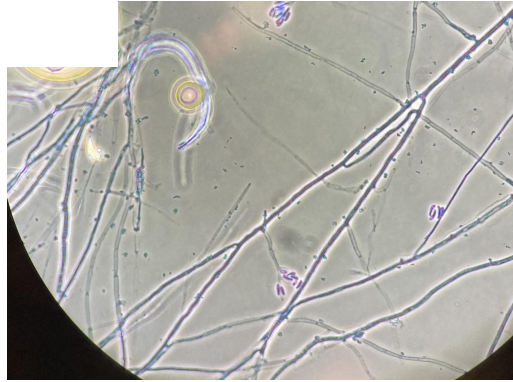
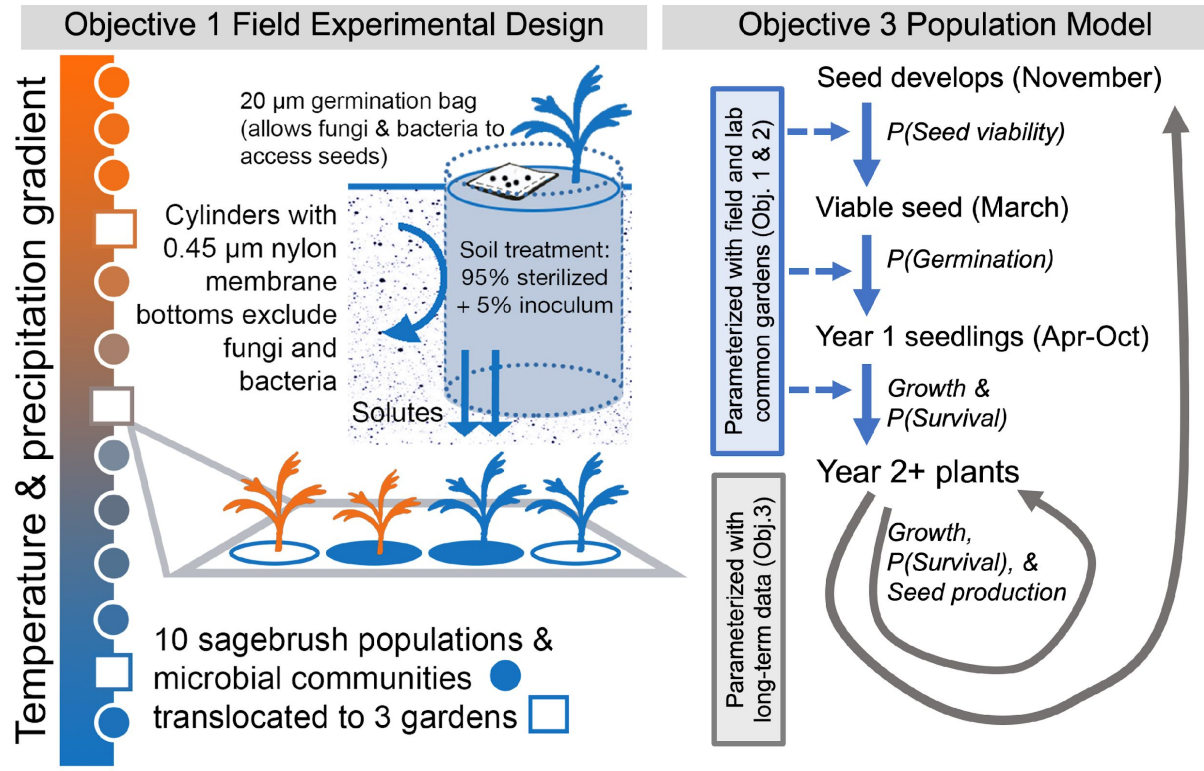


Leonora Bittleston
(BSU)



Trevor Caughlin
(BSU)

Next steps via NSF's Broadening Research Capacity in Biology Award (Award #2312572!)



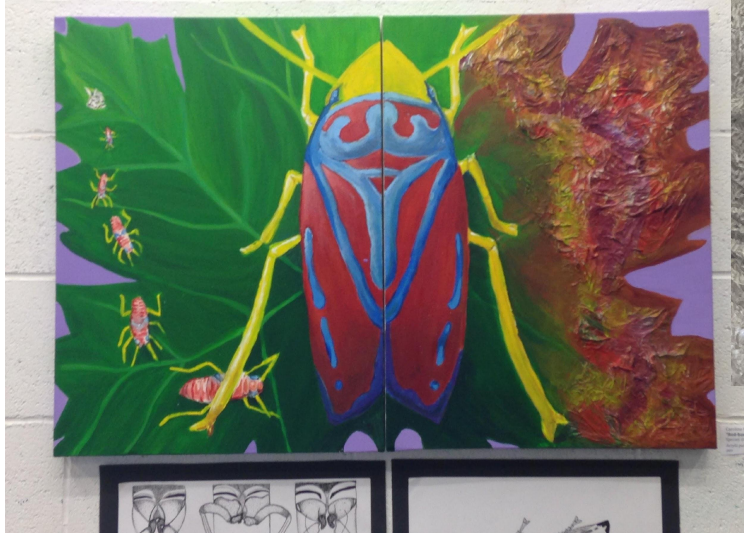
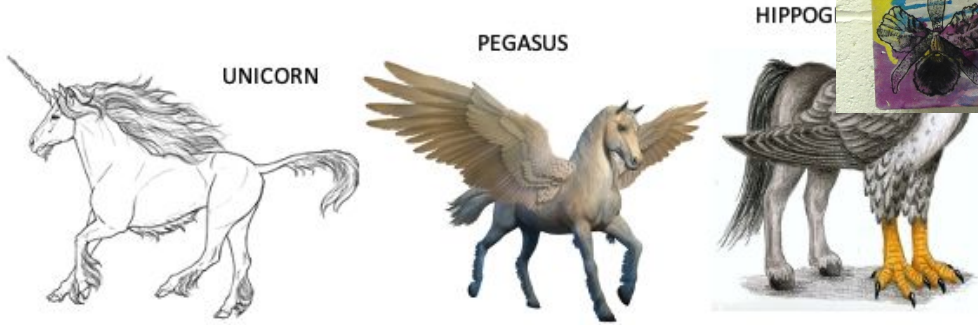
- How do abiotic gradients shape the strength of biotic adaptation?
- Will populations from contrasting abiotic environments differ in susceptibility to disruption of biotic adaptation with climate change?
- Climate impacts on sagebrush vulnerability to pathogens in the seed bank?

Selecting collection sites right now!

Next steps via NSF's Broadening Research Capacity in Biology Award (Award #2312572!)

Research-Inspired Active Learning Resources for Biology 192 at BSU: Sagebrush, Bacteria, Fungi & Protists!

1. Which species is an outgroup in the phylogeny?
2. Give one example of an ancestral trait for a clade in your phylogeny.
3. Give one example of a derived trait for a clade in your phylogeny. List a few different ones on your tree.
4. Are any of these traits likely to have evolved more than once in your phylogeny?
5. Which creature is most closely related to Pegasus?



	HOOVES	MAGICAL POWERS	WINGS	SINGLE HORN	BIRD-LIKE TALONS
Horse					
Hippogriff					
Pegasus					

Art-Science Integration VIP Funding

Co-Leads: Stephanie Galla, Megan Cattau, Sarah Dalrymple

