

Successful restoration of plant communities

WHY POLLINATORS MATTER

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CHICAGO BOTANIC GARDEN

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Today's presentation

- **Area of study: the Great Basin**
 - Why restoration is needed
- **What Chicago Botanic Garden is doing, and why**
 - Research on wildflowers and their pollinators to help understand how to restore them once they have been lost from a site.

Areas of study



A great need for restoration

Over 1/3 of Great Basin habitat is in need of restoration



cattle grazing



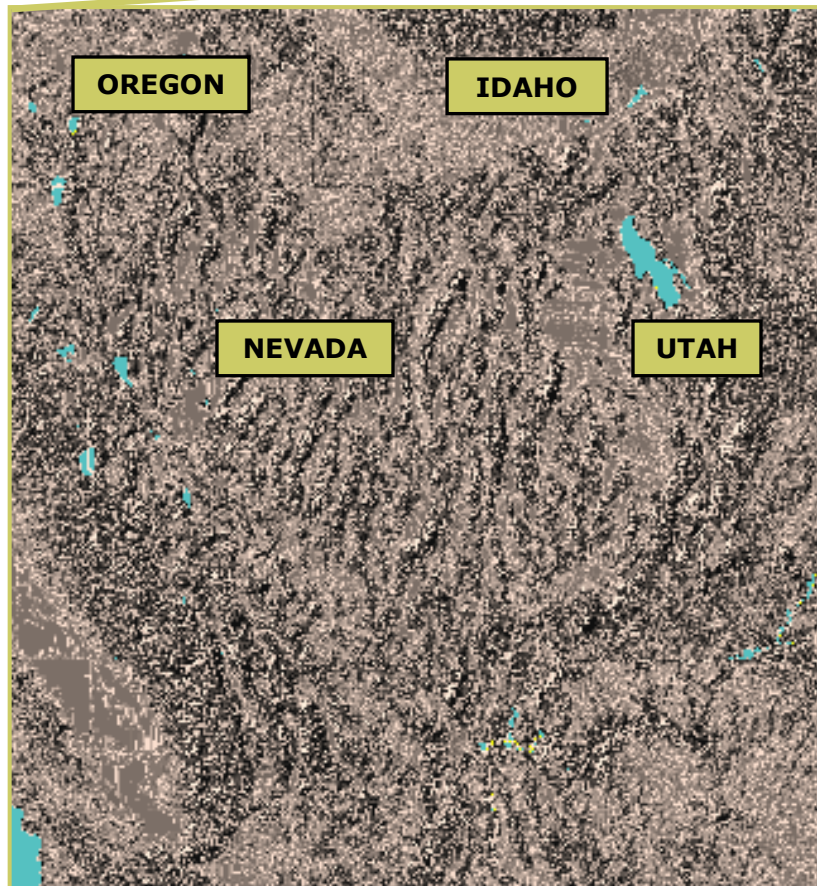
cheatgrass



Fire and loss of native plant communities

A need for *large-scale* restoration

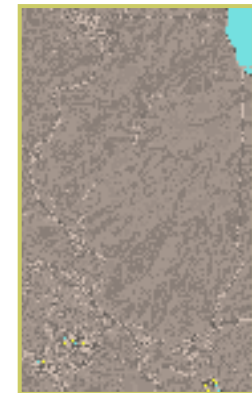
Great Basin: ~210,000 square miles



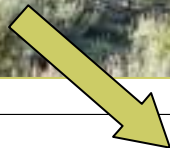
**Area in
need of
restoration**

~

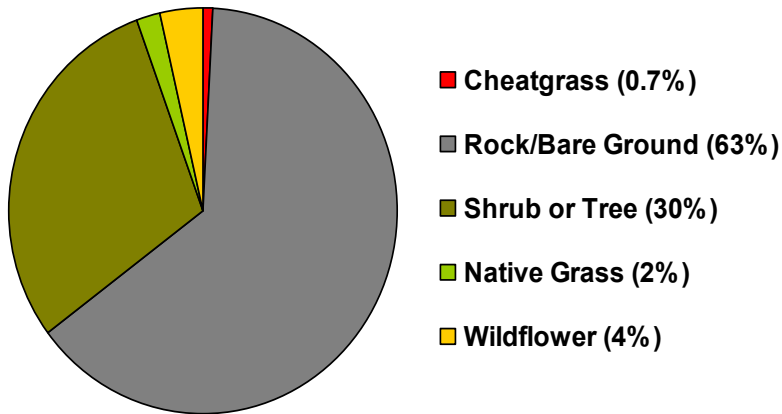
**state of
Illinois**



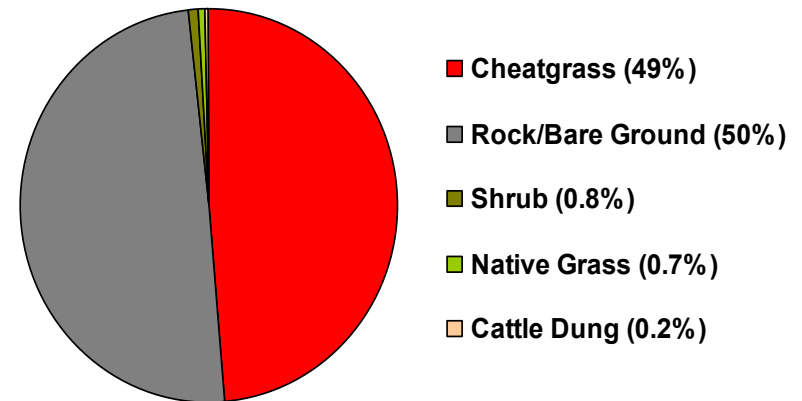
Plant-focused restoration efforts



Undisturbed Site



Disturbed Site



A need for research

- ❑ Grasses and sagebrush are relatively well studied (very common, high grazing value)
- ❑ Very little known about many wildflowers



Research to meet large-scale restoration needs

- **Restoration often means reseeding areas after wildfires (frequently with the use of helicopters)**
 - Goal: to slow the fire cycle by getting native species to establish and compete with cheatgrass



Requires large quantities of seeds!

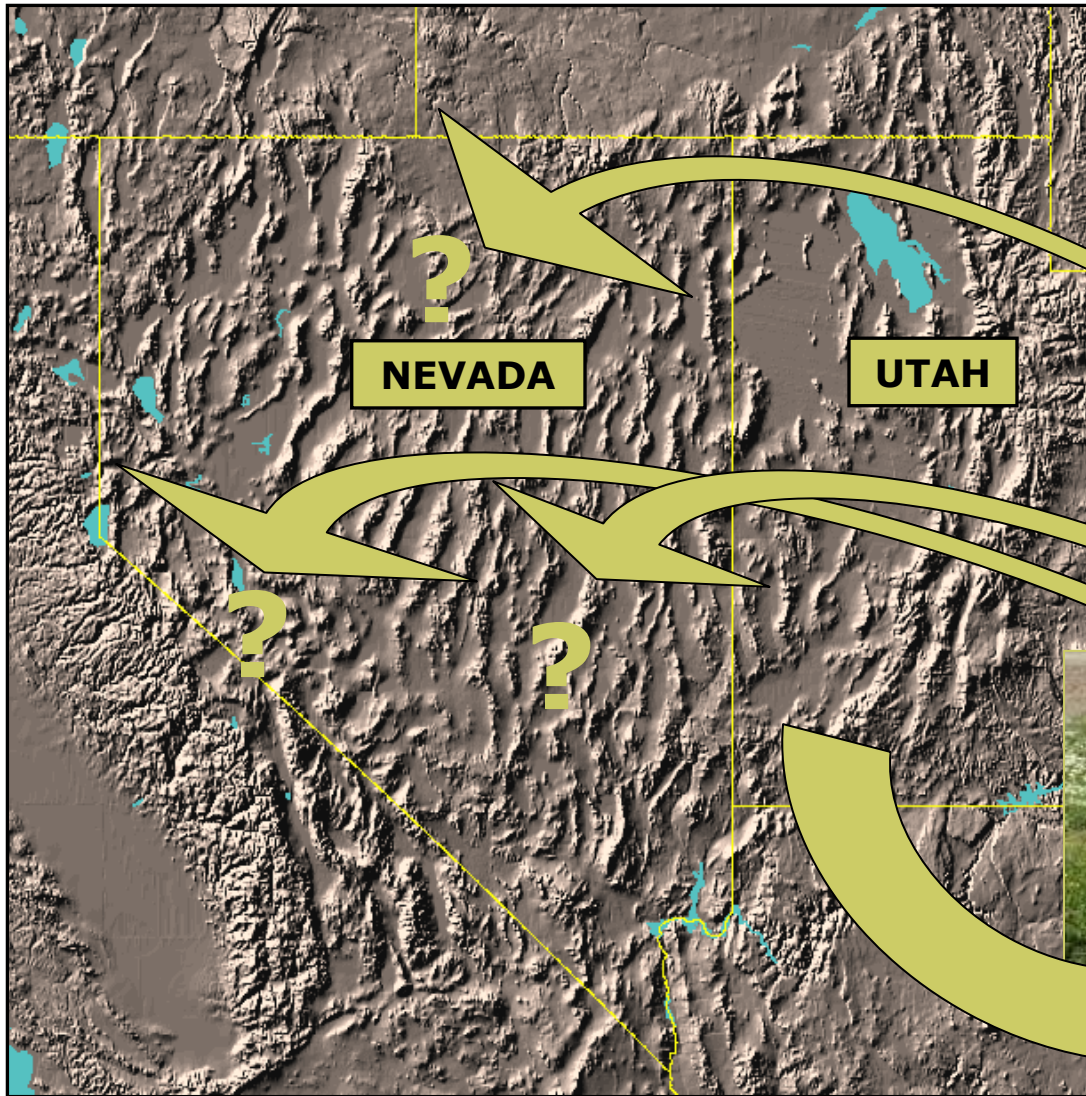
Research to meet large-scale restoration needs

- **Development of agricultural practices to produce large quantities of native seeds**
 - Federal government and private seed growers



**High cost of restoration failure:
*Where should seeds come from?***

Chicago Botanic Garden's Role



The seed sourcing question: Can seed from one source be used everywhere?



Answering the seed source question

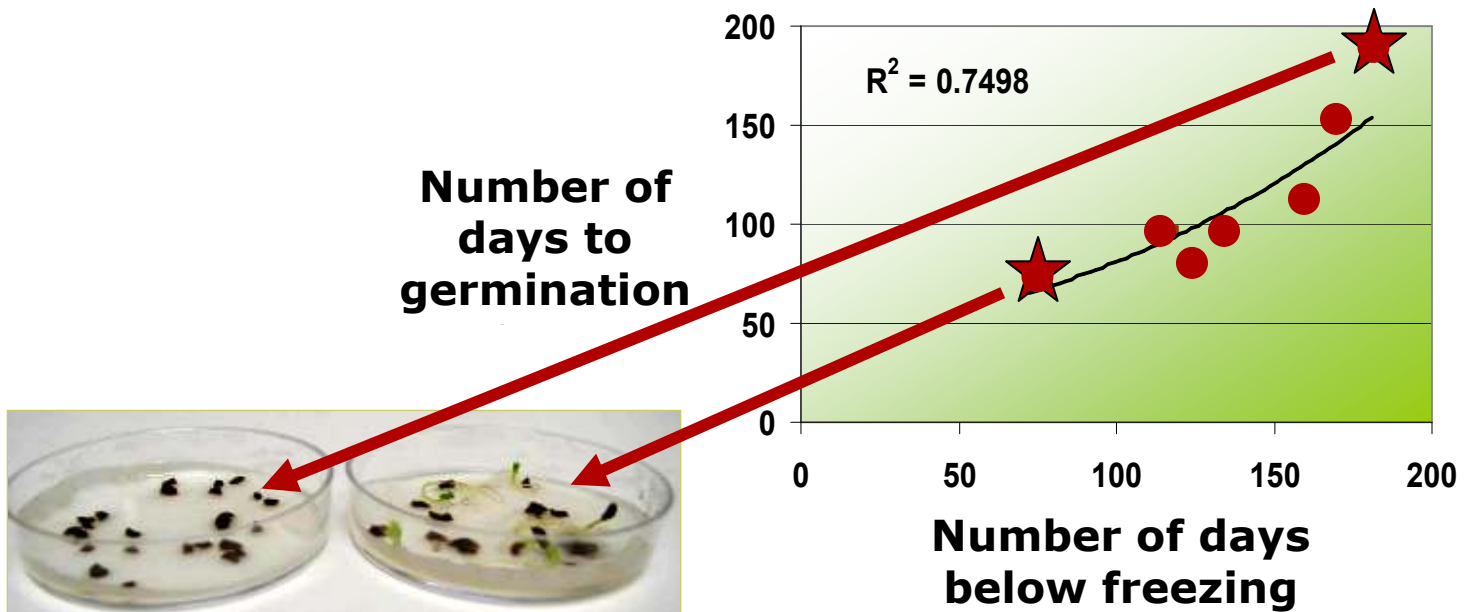
- Common garden studies
 - Incubators (CBG's seed lab) and CBG greenhouses
 - Field sites (Utah State University & Boise State University)



If genetic differences exist, moving seeds too far from their source may lead to poor restoration success

Common garden studies at CBG

- Adaptation to climatic conditions: seeds from sites with short winters germinate *faster* than seeds from sites with long winters



Increased risk of restoration failure if seed source is incorrect

Common garden studies in UT and ID



Adaptation to climatic conditions: plants from sites with short summers grow and flower *faster* than plants from sites with long summers

Increased risk of restoration failure if seed source is incorrect

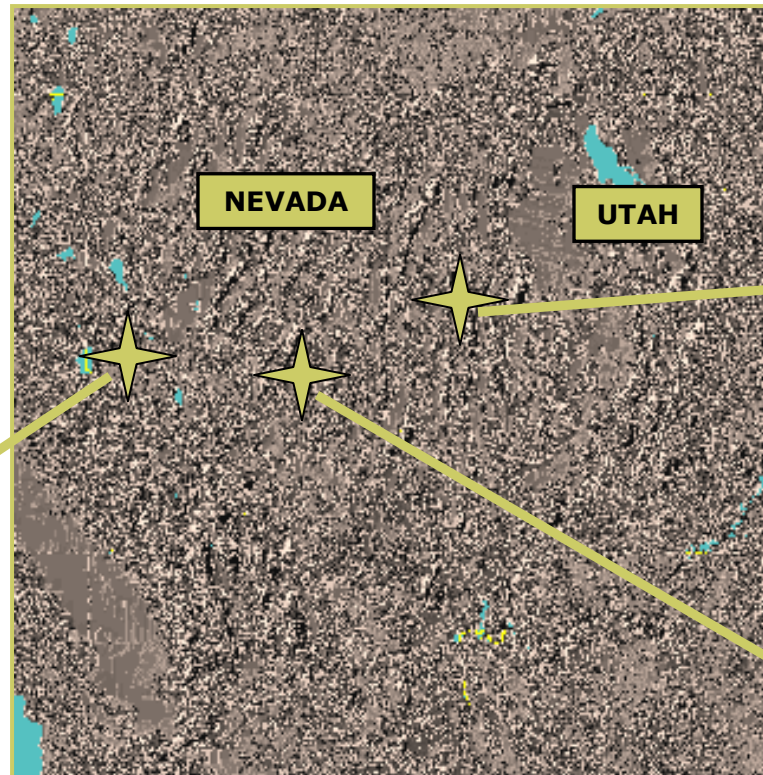
Unexpected results...



Penstemon deustus
(hot rock penstemon)

Hot rock Penstemon

Found in similar habitat throughout Great Basin

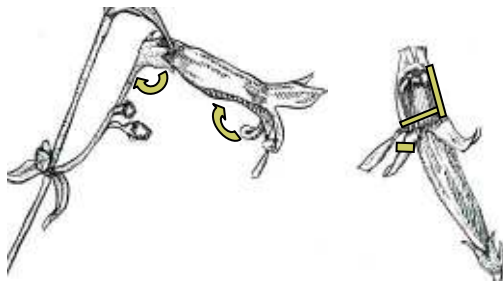


FIRST YEAR - few differences between sites: one source OK for restoration everywhere?

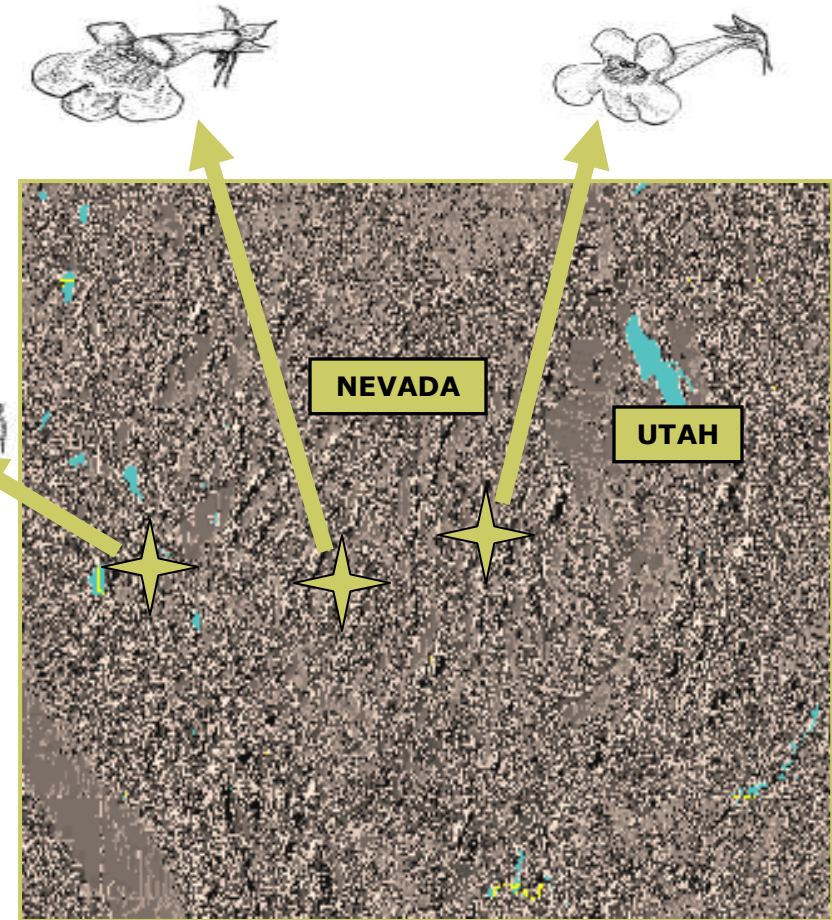
SECOND YEAR - flower shape and size VERY different between sites: one source NOT OK for restoration everywhere

Unexpected differences in flowers

Significantly different flower shapes and sizes found in different regions



Measurement	Significance
Floral angle	***
Lip angle	*
Corolla length	***
Central corolla width	***
Posterior corolla width	***
Mouth diameter	**
Central segment width	***
Anther exertion	***
Lower lip area	***



Flower differences due to pollinator differences?

- ❑ **Observe pollinators (bees) visiting plants at original collection sites**



Western Nevada: small flowers and small bee visitors



Central Nevada: medium flowers and medium bee visitors



Eastern Nevada: large flowers and bumblebee (large) visitors

- ❑ **Different regions contain distinct pollinators: flower shape and size appears to be linked to these differences**
- ❑ **Pollinators matter when choosing seed sources for restoration**

Knowledge gained

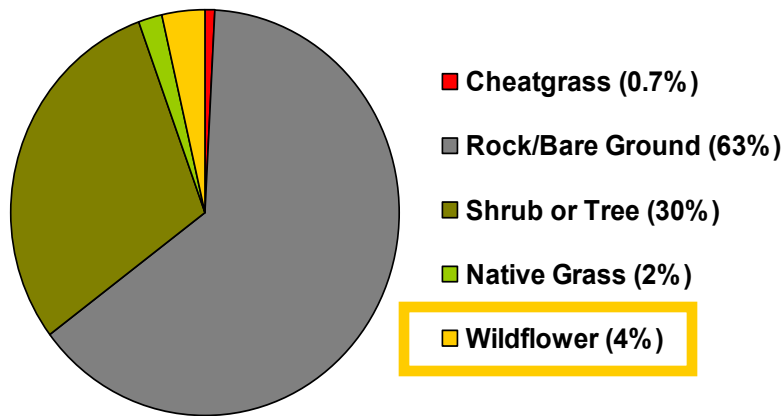
□ **Seed source matters**

- Wildflowers in the Great Basin adapted to both climatic *and* biological differences in the region, driving important genetic differences in many traits
 - Seed germination, growth rate, **pollinators**
- Using seeds from different sources indiscriminately may lead to the failure of a restoration
 - First generation (lack of germination)
 - Second generation (failure to produce seeds)

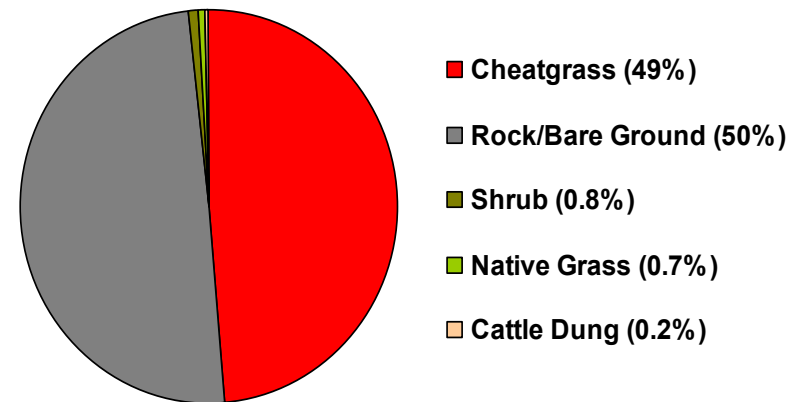
If wildflowers are restored, will pollinators follow?



Undisturbed Site



Disturbed Site



Sampling for pollinators

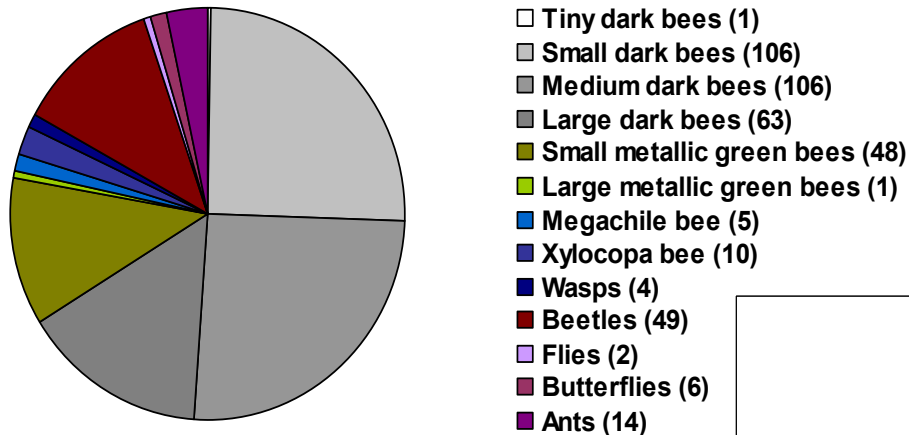
Introduced potted plants to disturbed and undisturbed sites

Observed pollinator visits



Significant differences between sites

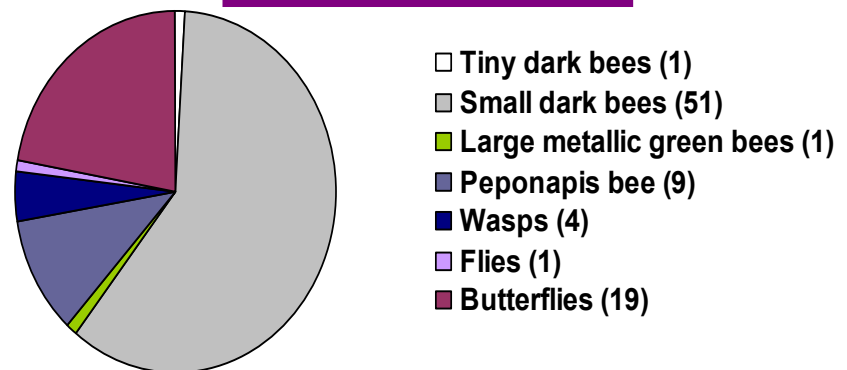
Undisturbed site (417 total visits)



□ Lower diversity of visitors at disturbed site

□ Over 4 times fewer visits to potted plants at disturbed site

Disturbed site (86 total visits)



Knowledge gained

- **Disturbed sites contain fewer potential pollinators**
 - Wildflowers restored to these sites may not receive enough pollinator visits to successfully reproduce
- **Restoration efforts should incorporate both wildflowers and pollinators**
- **Restoration research can benefit from a multidisciplinary and collaborative approach**

Goals going forward

□ **Share knowledge**

- Continue to present results at meetings and publish in peer-reviewed and popular journals to reach diverse audiences
 - Researchers (botanists, entomologists), federal land managers, policy makers, seed growers

□ **Directly inform policy**

- Continue collaboration with researchers at federal agencies, universities, and botanic gardens nationwide to draft recommendations for federal policies on seed transfer guidelines

Acknowledgements

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