

Rare Plant Propagation Research, Phase II

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and

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Blue Diamond cholla
Cylindropuntia multigeniculata



White-margined beardtongue
Penstemon albomarginatus



Sticky buckwheat
Eriogonum viscidulum



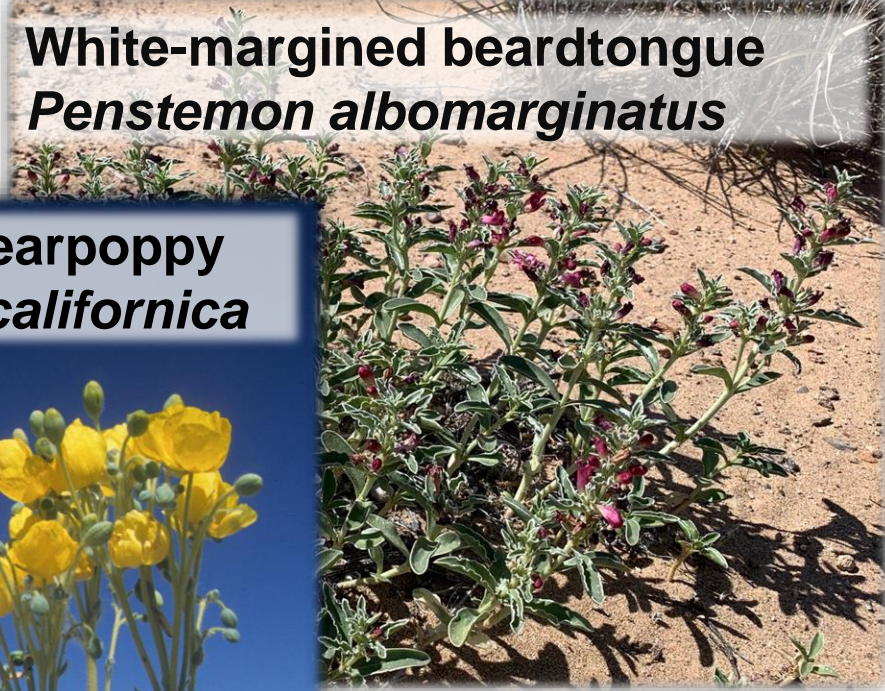
Three-corner milkvetch
Astragalus geyeri var. *triquetrus*



Blue Diamond cholla
Cylindropuntia multigeniculata



White-margined beardtongue
Penstemon albomarginatus



Las Vegas bearpoppy
Arctomecon californica



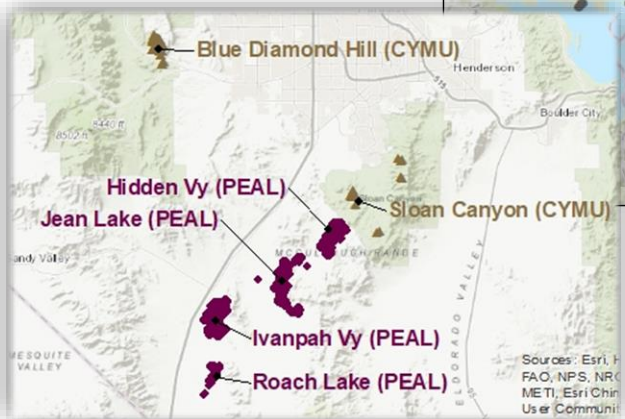
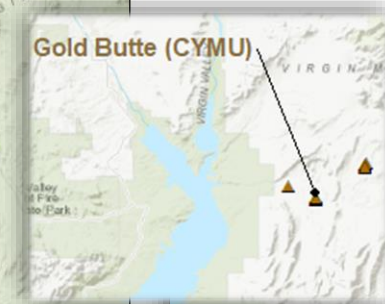
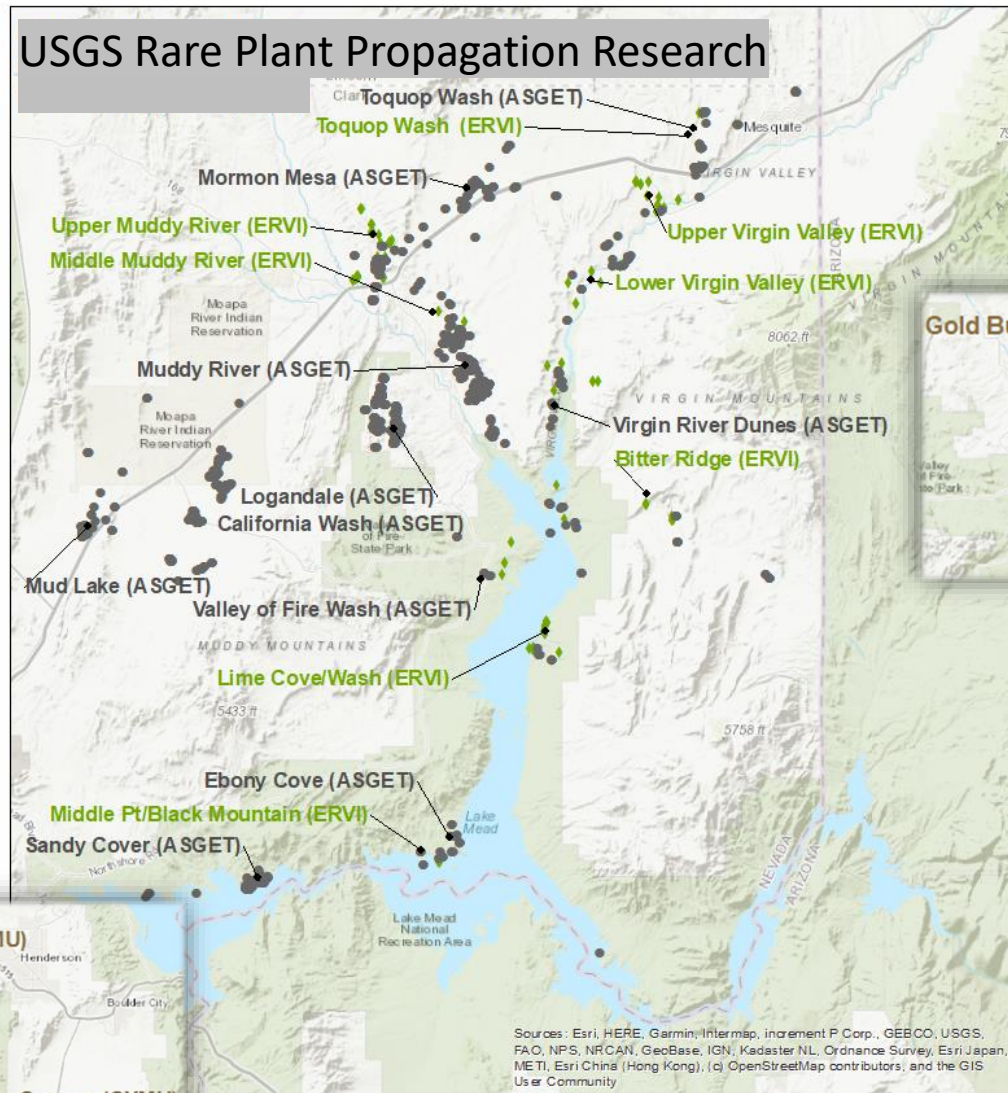
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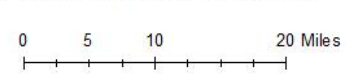


USGS Rare Plant Propagation Research



Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

Population unit names follow The Nature Conservancy (2007)



Rare Plant Propagation Research, **Phase I**

2019-USGS-1990A

Las Vegas bearpoppy: Stosich *et al.* 2022. *Monogr of West Nor Amer Nat* 14:1-22

- Status-of-knowledge review on propagation and reintroduction potential (Phase II, propagation from seed and seed bank)

Blue Diamond cholla: Scoles-Sciulla *et al.* 2023. *Native Plants* 24:4-17

- Stem (joint) cuttings as a method for nursery production (50:50 soil mix and frequent watering treatments, (Phase II, re-introduction)

Three-corner milkvetch

- Failure of field collections and seed bank to produce seed emphasizes the urgency for alternative approaches (Phase II, supplemental watering).



Rare Plant Propagation Research, **Phase I**

2019-USGS-1990A

White-margined beardtongue

- Primary dormancy in seeds (soil seed bank)
- Secondary dormancy (seed burial experiment)
- Mating system (field experiment)

Sticky buckwheat

- Primary dormancy in seeds (soil seed bank)
- *Secondary dormancy (seed burial experiment) – in progress*
- Mating system (greenhouse experiment)



Rare Plant Propagation Research, Phase I

2019-USGS-1990A

White-margined beardtongue

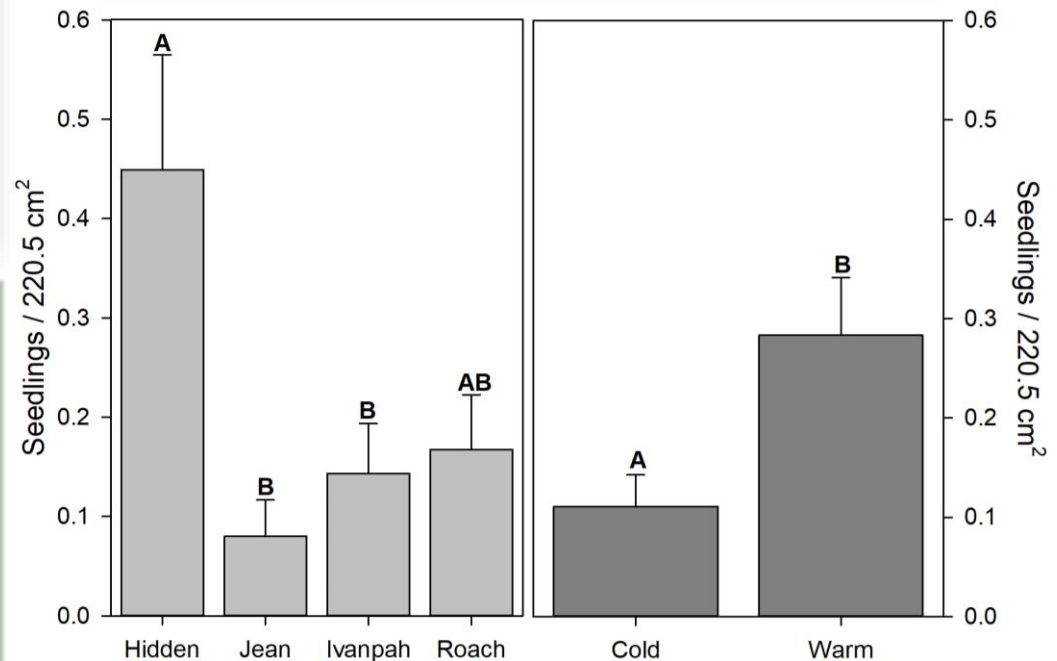
Primary dormancy = inability to germinate following dispersal from parent plant



Method

- Soils collected after seed dispersal and kept under warm/dry or cold/dry storage
- Incubated under wetting-drying cycles to simulate conditions that promote germination

- Seed densities differ among subpopulations
- Warm, dry conditions promote seedling emergence
- **After-ripening reduces primary dormancy**



Preliminary data not yet under USGS internal review

Rare Plant Propagation Research, Phase I

2019-USGS-1990A

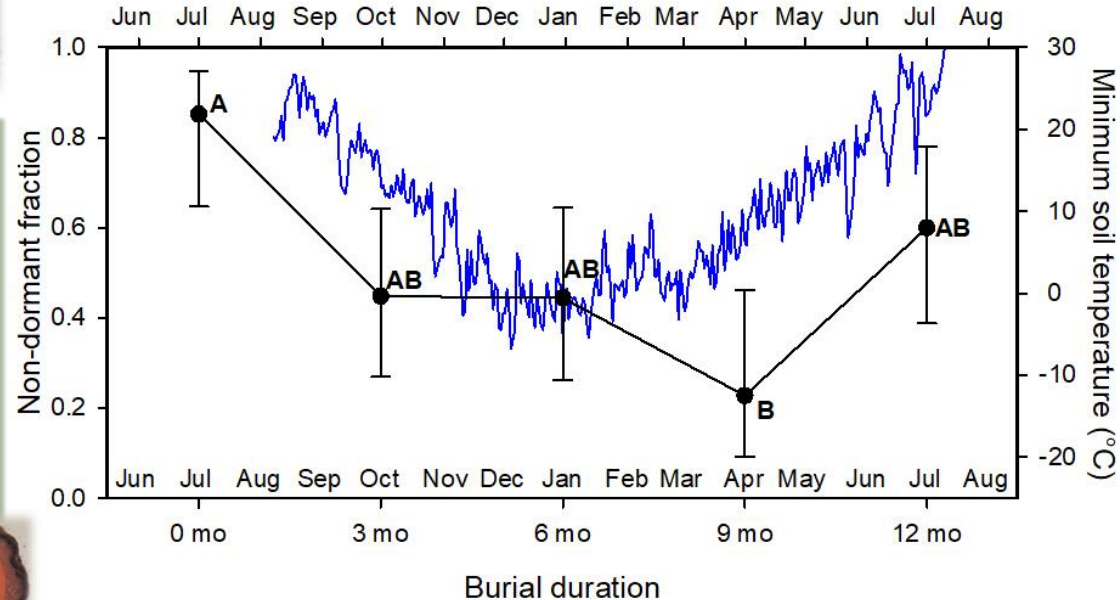
White-margined beardtongue

Secondary dormancy = inability to germinate following environmental cue



- Seeds are non-dormant after dispersal and after-ripening (June/July)
- Seeds enter secondary dormancy during cold months
- Seeds non-dormant again by next summer

➤ Dormancy cycling



Preliminary data not yet under USGS internal review

Method

- Seeds from Ivanpah Valley subpopulation
- Seeds buried in mesh bags and placed in habitat in July
- Seed retrieved every 3 months for 1 year and tested for germinability/viability



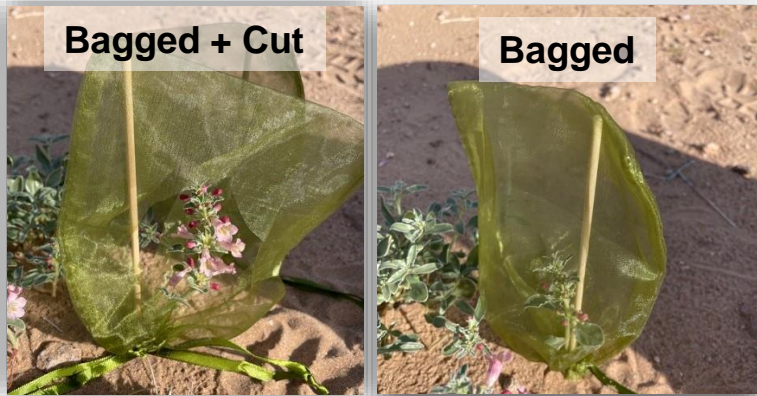
Rare Plant Propagation Research, Phase I

2019-USGS-1990A

White-margined beardtongue

Field test of mating system

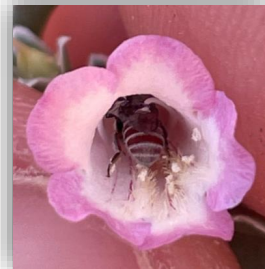
- Outcrossing vs. self-fertilization



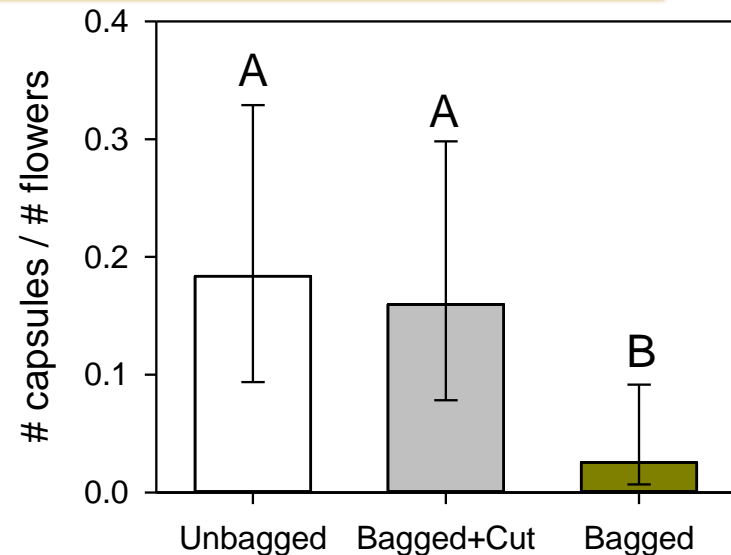
Method

- Ivanpah Valley subpopulation
- Bud-bearing shoots prepared for pollinator exclusion
- Capsules counted (prop of flowers)

- Fruit (capsule) formation low in 2022 due to prolonged drought conditions
 - Plants without access to pollinators had significantly fewer capsules
- **Outcrossing mating system**



Ashmeadiella
bee



Photos: A. Stosich

Preliminary data not yet under USGS internal review

Rare Plant Propagation Research, Phase I

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Sticky buckwheat:

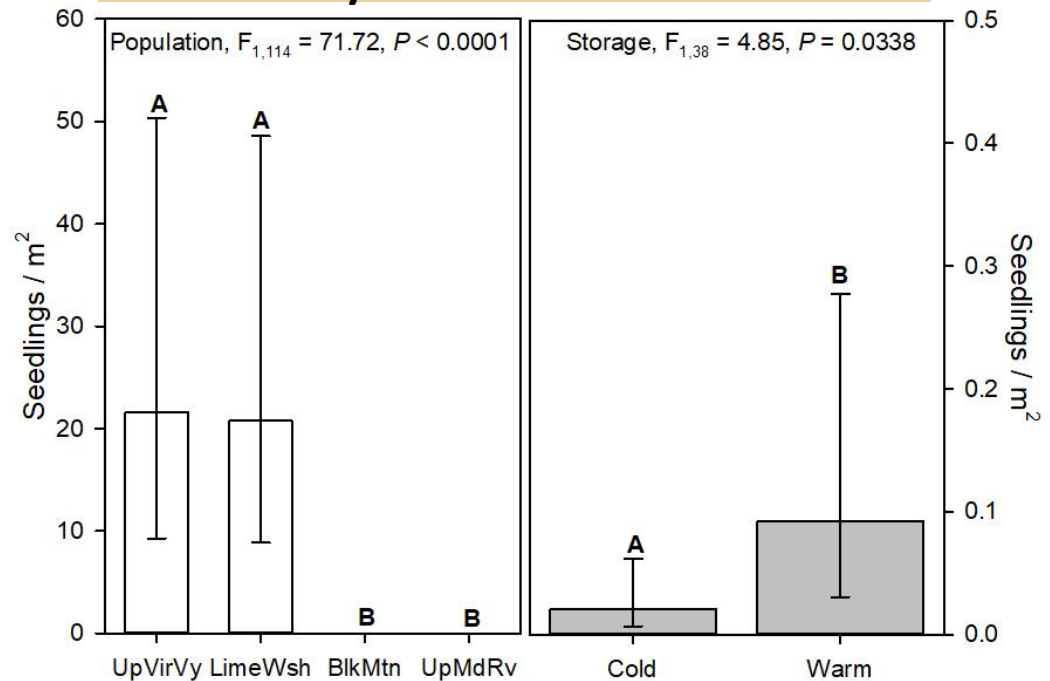
- Primary dormancy



Method:

- Soils collected after seed dispersal and kept under warm/dry or cold/dry storage
- Incubated under wetting-drying cycles to simulate conditions that promote germination

- Seed densities differ among subpopulations
- Warm, dry conditions promote seedling emergence
- **After-ripening reduces primary dormancy**



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Rare Plant Propagation Research, Phase I

2019-USGS-1990A

Sticky buckwheat

- Nursery test of mating system



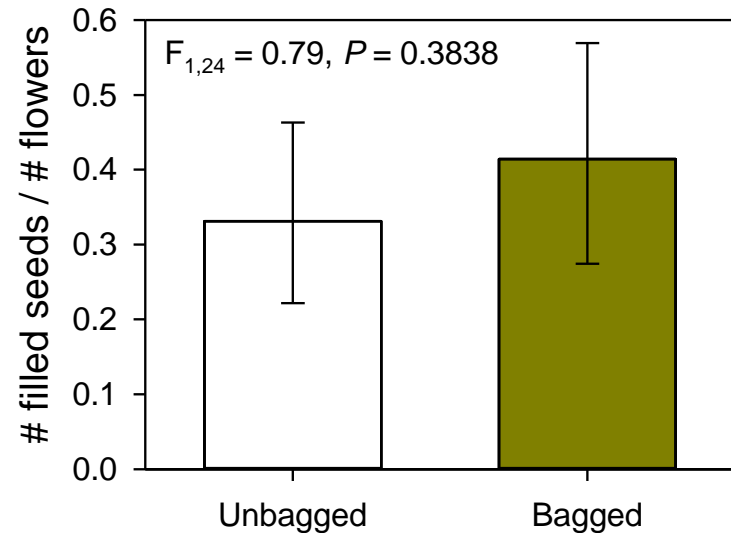
Method

- Plants produced from seed bank grow-out used for trial
- Whole plants unbagged/bagged
- Seeds counted (prop of flowers)

- ~35% seed fill in experimental trial
 - Plants without access to pollinators had the same seed fill rate as those with pollinators
- **Self-fertilization mating system**



Flies visited open flowers



Preliminary data not yet under USGS internal review

Rare Plant Propagation Research, **Phase I**

2019-USGS-1990A

White-margined beardtongue

- Seeds have physiological dormancy (seasonal cycling); mating system is out-crossing
- Reproductive failure led to unreliable seed production across populations during study
- Alternative propagation approaches may be needed (**Phase II, stem/root cuttings**).



Sticky buckwheat

- Seeds have physiological dormancy (seasonal cycling); mating system is self-fertilization (**Phase II, seed collections**).
- Seedlings produced from seed bank were difficult to transplant and develop; however, once established, plants were prolific seed producers with high seed viability (**Phase II, seed bank collections**).



Rare Plant Propagation Research, Phase II

2021-USGS-2075A

(Jan 2023 – Dec 2026)

Sticky buckwheat: Conservation seed collections

- Directly, from plants in habitat
- Indirectly, from seed bank propagated plants

Three-cornered milkvetch: Conservation seed collections

- Supplement watering on habitat plots and collect directly from plants
- Seed collections from seedlings in seed bank (watered plots)

Las Vegas bearpoppy: Nursery propagation from seed for outplanting

- Test propagation approaches using seeds provided by USDA/ARS
- Seedlings from soil seed bank using greenhouse emergence method

Blue Diamond cholla: Re-introduction into habitat

- Test reintroduction practices (season, nurse plant, herbivore protection, supplemental watering)

White-margined beardtongue: Cutting propagation and re-introduction

- Test nursery growth conditions for producing robust stock
- Test re-introduction treatments for maximizing survival

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Rare Plant Propagation Research, Phase II

2021-USGS-2075A

Sticky buckwheat: Conservation seed collections

- Direct collections from adult plants in habitat: up to 50 plants/population, 3,000 seeds per population (2023 – 2026), Center for Plant Conservation
- Indirect collections from seed bank grow-out (start Nov 2023)
- Germination testing on all collections (5 °C incubation)



Population	# Matrilines	Total # Seeds
Toquop Wash	18	8,550
Upper Virgin Valley	42	3,204
<i>Upper Muddy River</i>	33	1,385

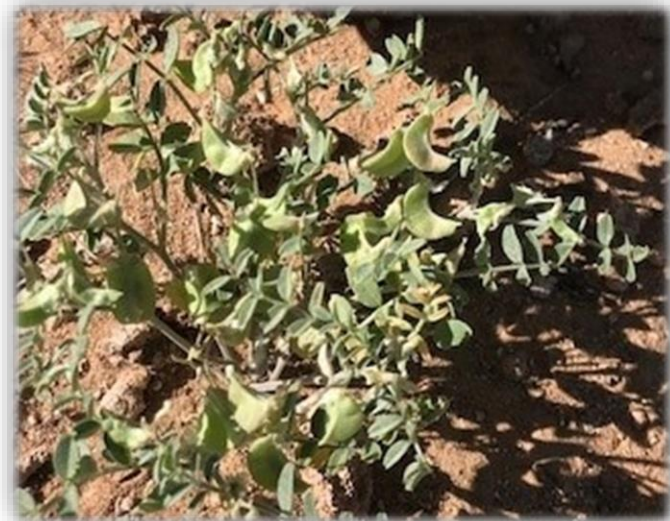


Rare Plant Propagation Research, Phase II

2021-USGS-2075A

Three-cornered milkvetch: Conservation seed collections

- Select habitat plots for supplemental watering (Fall 2023, 2024)
- Water by overhead spray
- Monitor and remove Sahara mustard (BLM request)
- Direct seed collections from adult plants in habitat (Spring 2024, 2025)
- Indirect collections from seed bank grow-out (start Nov 2024)
- Germination testing on all collections

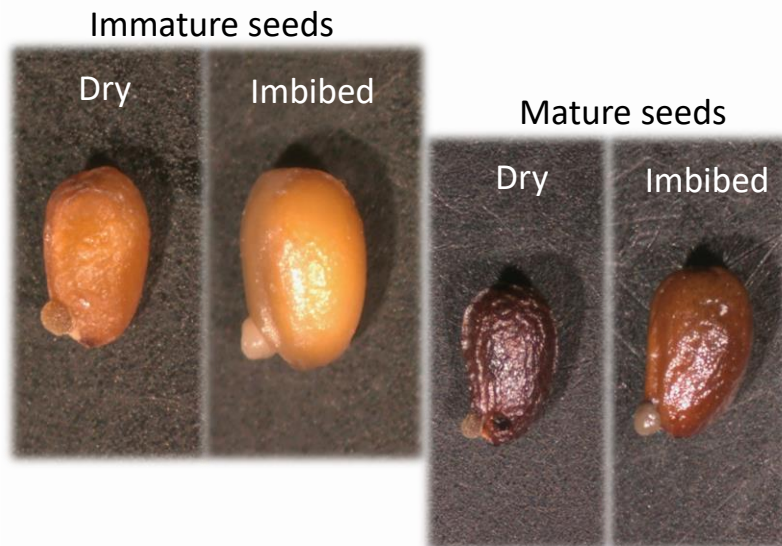


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Las Vegas bear poppy

- Seed permeability trial

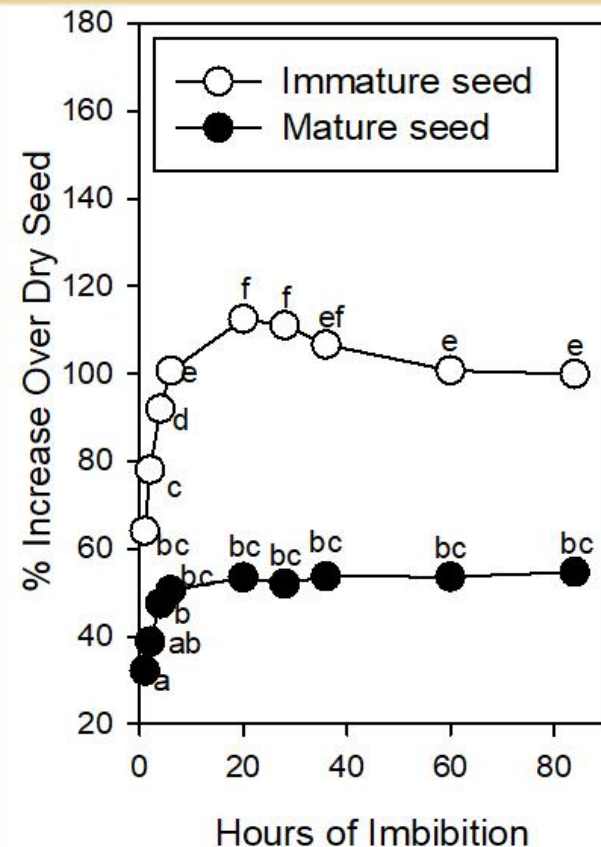


Photos: Mikaela Gaskill, USGS

Methods

- Seeds from Gold Butte (USDA/ARS)
- Pre-weighed, soaked in water, and re-weighed until fully imbibed

- Immature and mature seeds have different seed coat permeabilities
- **Permeable seed consistent with MPD or MD**



Preliminary data not yet under USGS internal review

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Las Vegas bearpoppy

- Seed viability through tetrazolium testing (in progress)

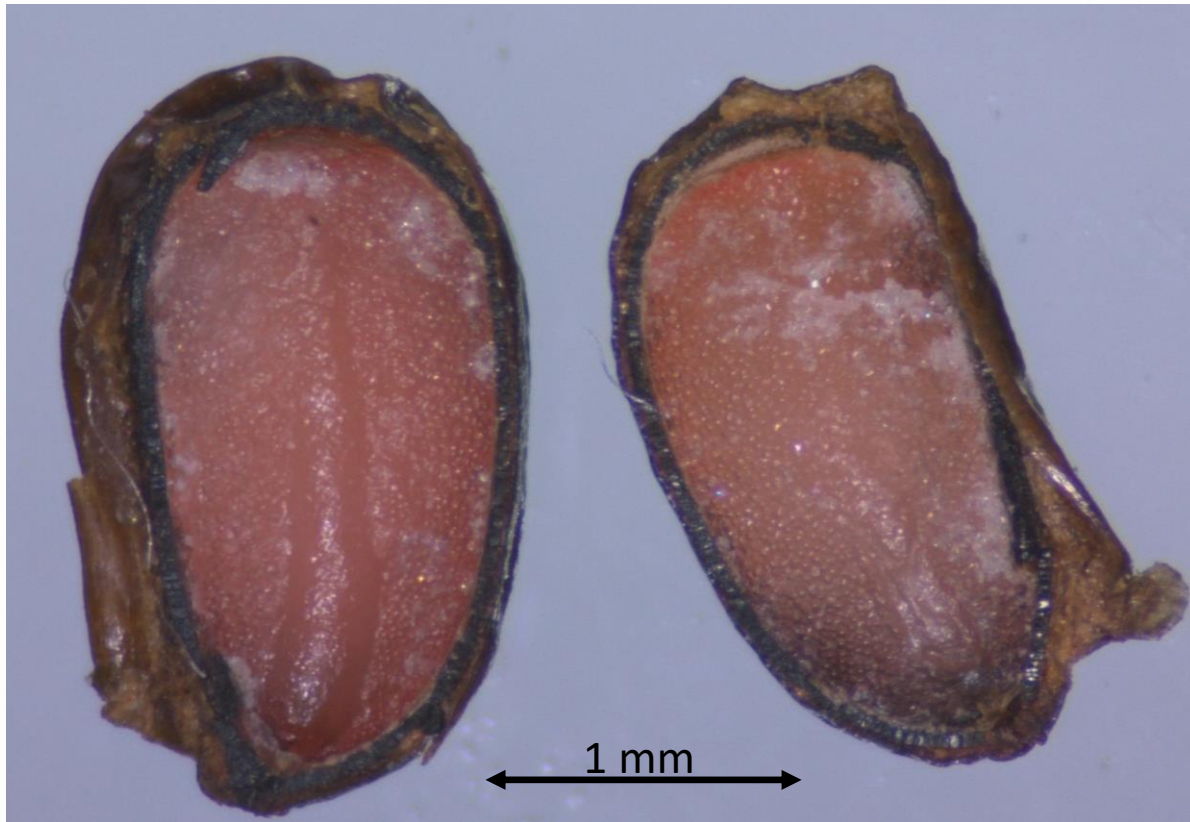


Photo: Mikaela Gaskill, USGS

Rare Plant Propagation Research, Phase II

2021-USGS-2075A

Blue Diamond cholla: Test practices for reintroduction into habitat

- Use best propagation methods from Phase I; Blue Diamond plants + new Gold Butte joint collection)
- Collected in Spring 2023 for Spring 2024 outplanting (Fall collection in Oct 2023)



Gold Butte population



April 2023 collection



Shadehouse growth

Rare Plant Propagation Research, Phase II

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White-margined beardtongue: Test nursery growth conditions for producing robust stock

- Initial test of four hormone treatments (IBA, NAA, IBA+NAA, Control)
- 53% rooted and no significant or immediate die-off



Alex Stosich, MS student
Utah State University



Rare Plant Propagation Research, Phase II

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White-margined beardtongue: Test nursery growth conditions for producing robust stock

- Two-stage propagation:
 - Preparation of basal and terminal shoot cuttings (38% rooted)



Photos: A. Stosich

Rare Plant Propagation Research, Phase II

2021-USGS-2075A

White-margined beardtongue: Test nursery growth conditions for producing robust stock

- Two-stage propagation:
 - Preparation of basal and terminal shoot cuttings
 - Transplantation to pots with varied dimensions (soil volume constant)



Observations:

- Terminal cuttings rooted at higher percentage than basal cuttings
- Population differences in root length and root number

Ivanpah and Jean > Hidden

Photos: A. Stosich

Rare Plant Propagation Research, Phase II

2021-USGS-2075A

2023 Summary

- **Sticky buckwheat:** Conservation seed collections
Seed from plants in habitat (two collections completed, viability testing in progress; continue in 2024-2026)
 - Seed from plants propagated from seed bank (start Oct 2023, 2024)
- **Three-cornered milkvetch:** Conservation seed collections
 - Water habitat plots (Nov 2023, 2024) and collect from plants (spring 2024, 2025)
 - Seed plants propagated from seed bank, watered plots (start Oct 2024, 2025)
- **Las Vegas bearpoppy:** Nursery propagation for outplanting
Test propagation practices from Gold Butte seeds (permeability completed, germination in progress)
 - Evaluate growing seedlings from soil seed bank using greenhouse emergence method (start Oct 2024)
- **Blue Diamond cholla:** Re-introduction into habitat
Test reintroduction practices (season, nurse plant, herbivore protection, supplemental watering) – spring collections completed and growing in shadehouse
- **White-margined beardtongue:** Cutting propagation and reintroduction into habitat
Test nursery growth conditions for producing robust stock (in progress in greenhouse)
 - Test re-introduction treatments for maximizing survival (spring 2025)

Questions?

We gratefully acknowledge everyone for their support, assistance and insights...

- Stefanie Ferrazzano
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- Lillian Setters



- Mikaela Gaskill
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