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Understanding Propagation Potential for Conserving Rare Plant Species in Clark County

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Project #2019-USGS-1990A

August 15, 2022

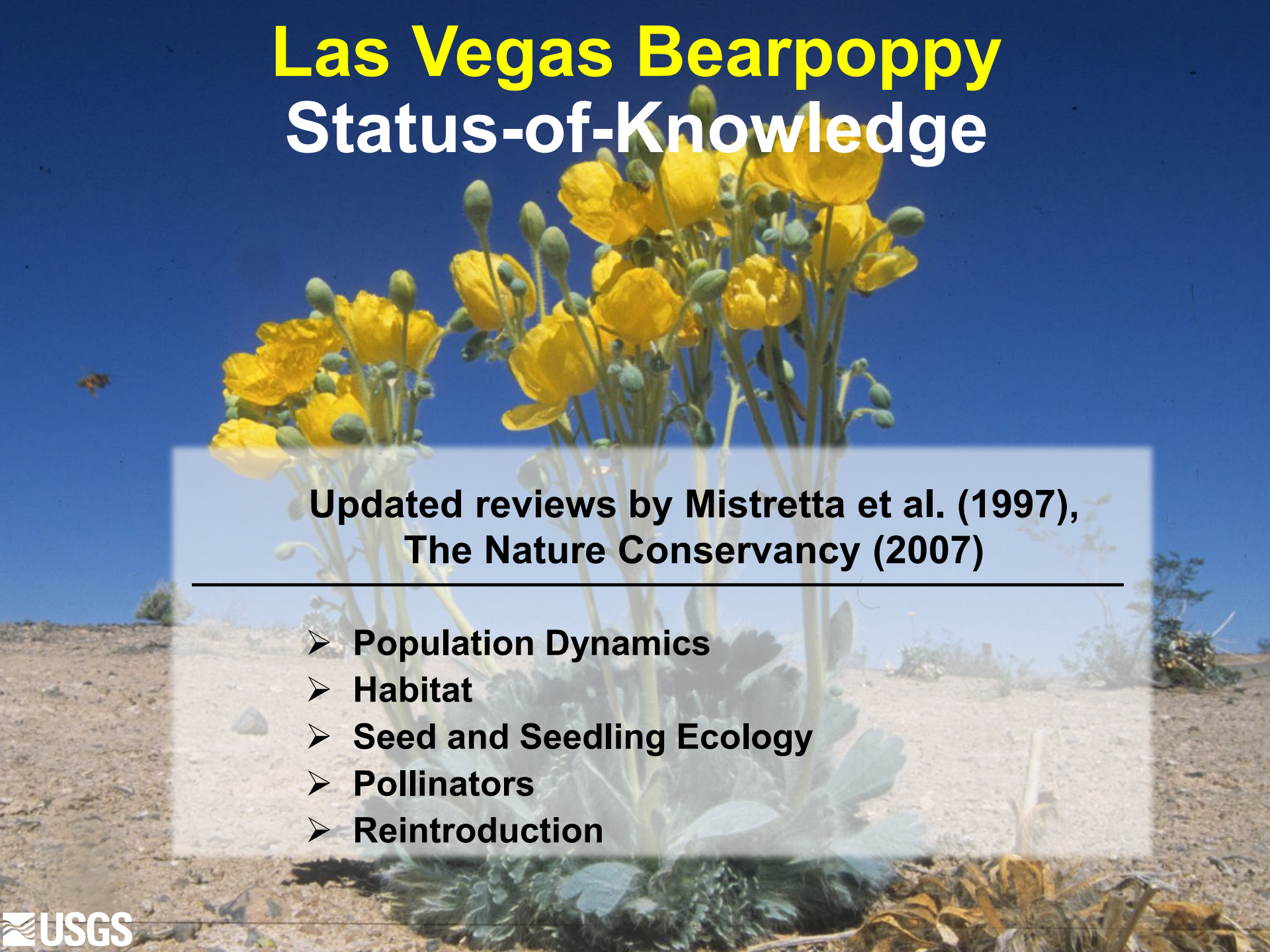
Blue Diamond cholla
Cylindropuntia multigeniculata

White-margined beardtongue
Penstemon albomarginatus

Sticky buckwheat
Eriogonum viscidulum

Three-corner milkvetch
Astragalus geyeri var. *triquetrus*

Las Vegas Bearpoppy
Status-of-Knowledge



Updated reviews by Mistretta et al. (1997), The Nature Conservancy (2007)

- **Population Dynamics**
- **Habitat**
- **Seed and Seedling Ecology**
- **Pollinators**
- **Reintroduction**

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Las Vegas Bearpoppy
Conservation and Restoration

"Further Research For Species Conservation"

- **Preserve Germplasm for the Future**
- **Understand Edaphic Endemism**
- **Promote *A. californica* – Pollinator Relationships**
- **Protect Soil Seed Reserves**
- **Predict Responses to Climate Change and Land Use**

Stosich, A., L.A. DeFalco, and S.J. Scoles-Sciulla. *In Press*. Review of *Arctomecon californica* (Papaveraceae) with a focus on the species' potential for propagation and reintroduction and conservation needs. *Western North American Naturalist* (2022 Vol. 82(3))

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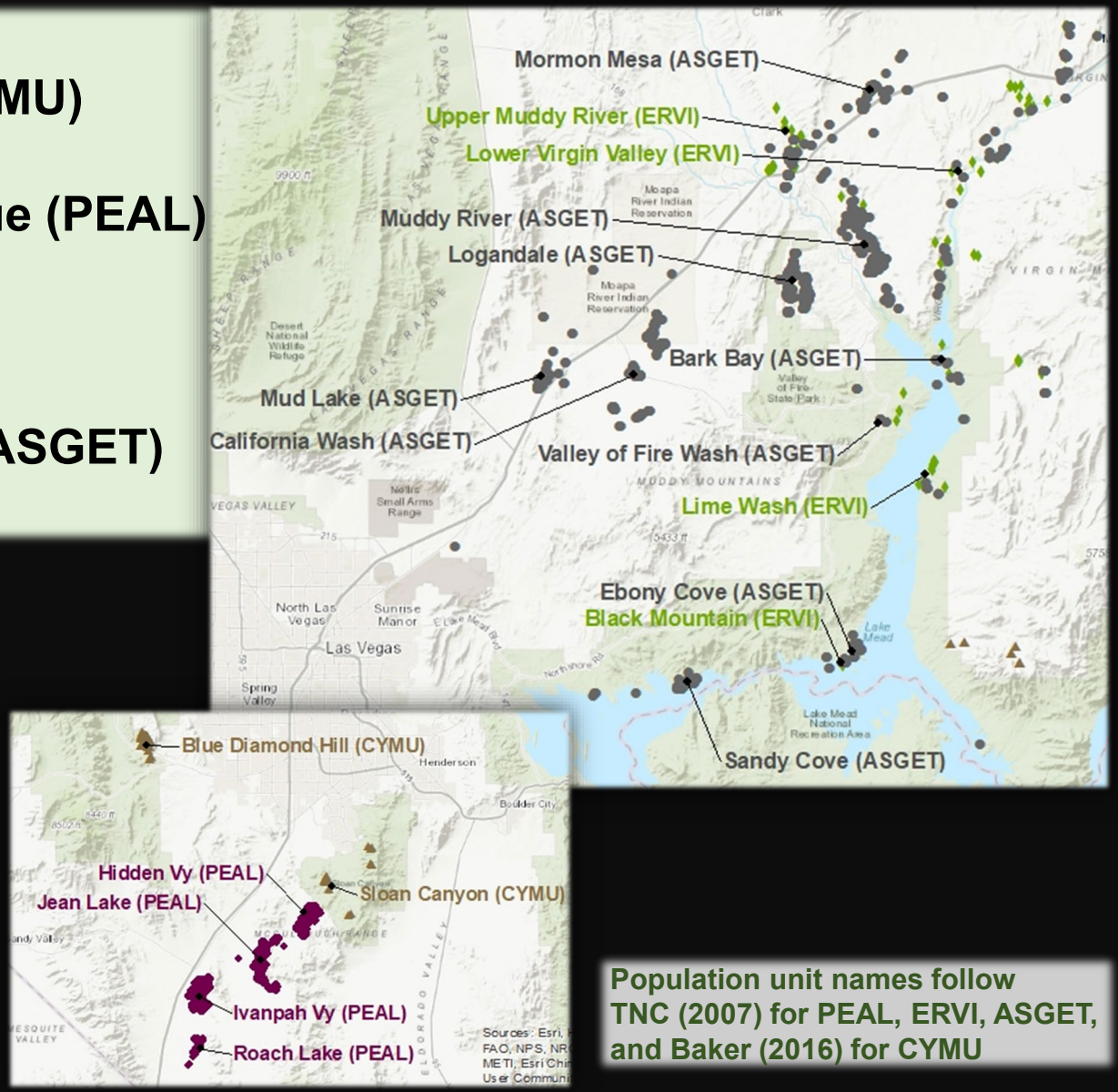
Focal Areas of Rare Plant Propagation Research

Blue Diamond cholla (CYMU)

White-margin beardtongue (PEAL)

Sticky buckwheat (ERVI)

Three-corner milkvetch (ASGET)



Population unit names follow TNC (2007) for PEAL, ERVI, ASGET, and Baker (2016) for CYMU

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Blue Diamond Cholla
Seed vs. Cuttings

1) Compare seed scarification treatments and germination temperatures to optimize seedling production

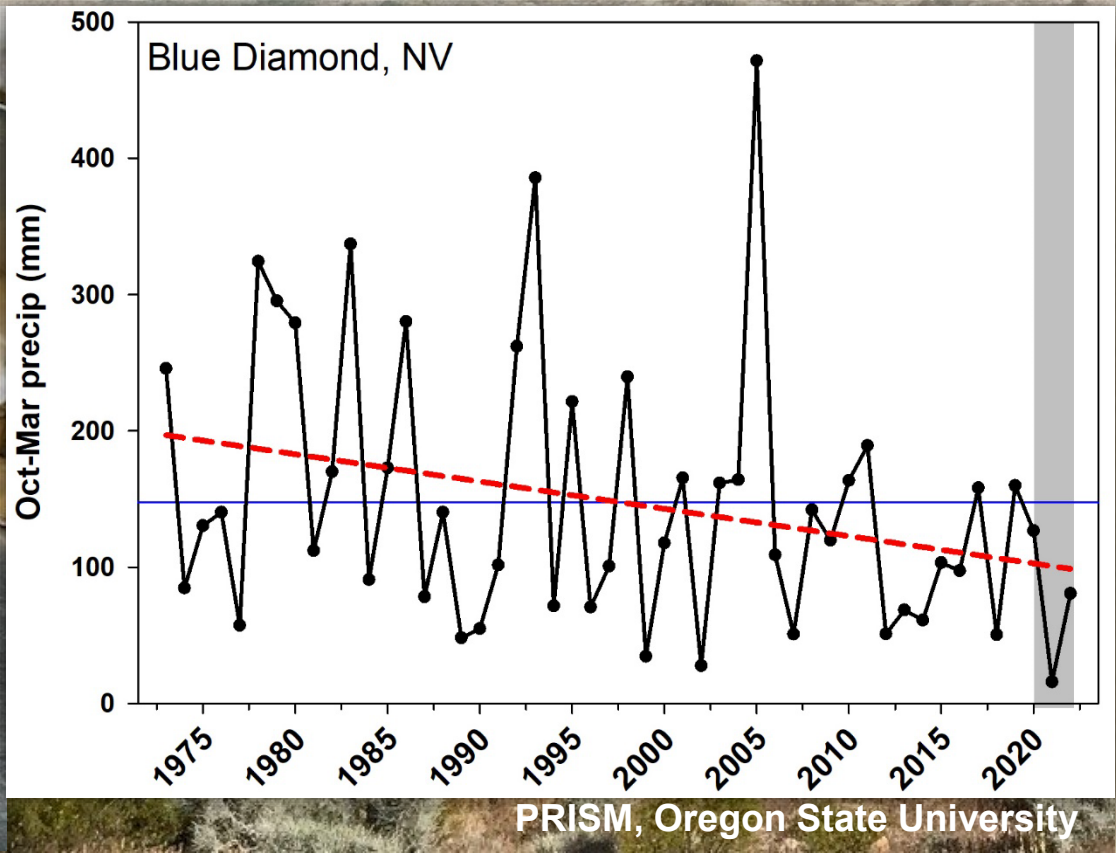
2) Evaluate propagation methods to develop nursery stock using stem joints

Blue Diamond Cholla
Reproductive Failure

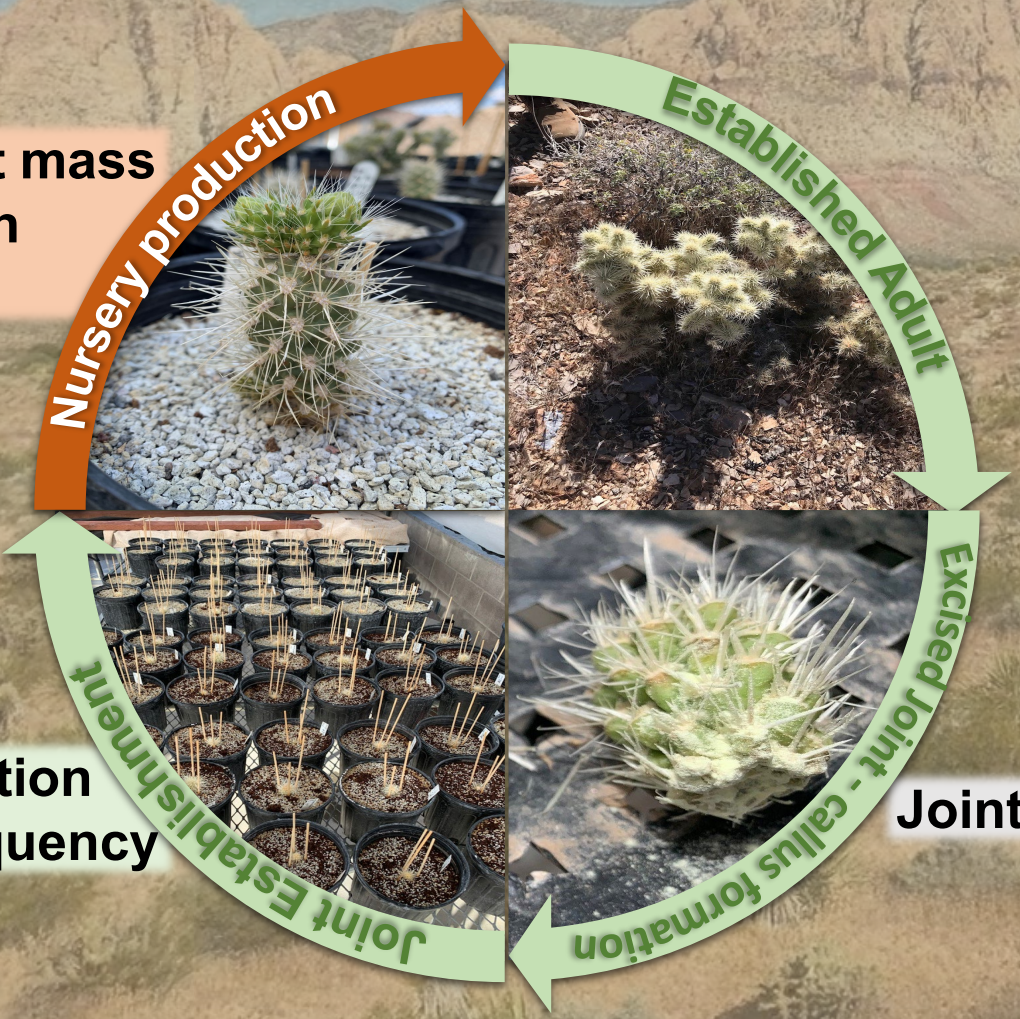
2020: 75 plants (5 visits, May – July); 50% flower, most aborted

2021: 100 plants (June); 0% in flower/fruit

2022: 250 plants (Apr, June); 12% flower, most aborted



Blue Diamond Cholla
Cultivation from Joint Cuttings



Root/shoot mass
Root length
Survival

Soil composition
Watering frequency

Joint health

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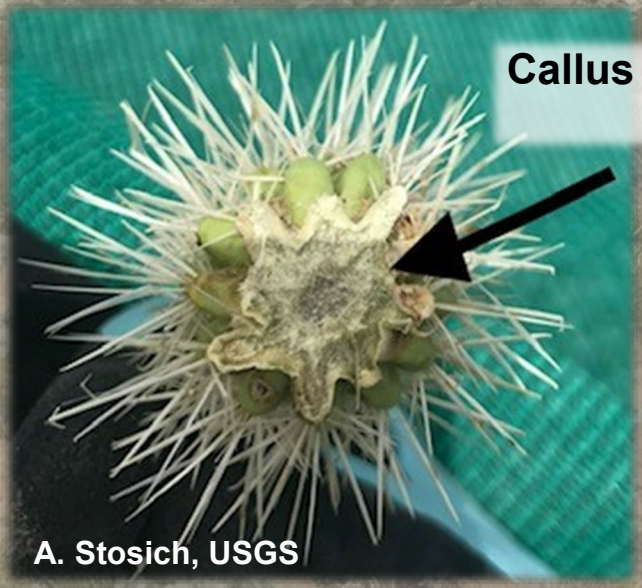
Blue Diamond Cholla
Excised Joint – Callus Formation

Joint heath

- **Freshly-cut joints declined in condition during callus development → 50% joint mortality after one month**
- **Mortality not due to identity, condition, or size of parent plant**



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Blue Diamond cholla
Joint Establishment

- Desired traits of nursery stock for reintroduction
  - High root-to-shoot ratio
  - Deep root system
  - Survival during production
- Soil composition
  - 50:50 vs. 85:15 ratio of inorganic-to-organic
- Watering frequency
  - 250 mL every 5 days (“Frequent”)
  - 500 mL every 10 days (“Infrequent”)

L. DeFalco, USGS

L. DeFalco, USGS

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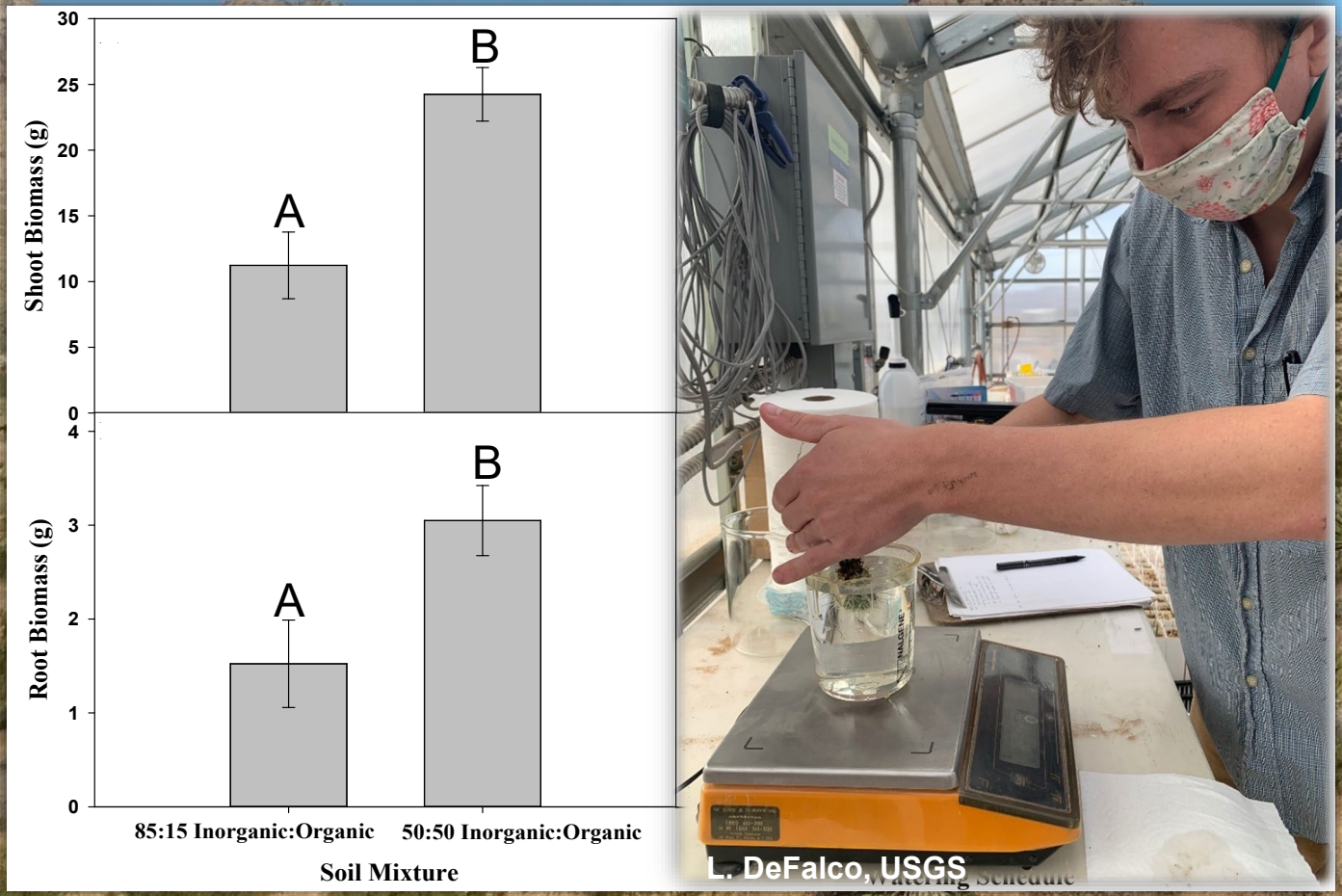
Blue Diamond cholla
Root/Shoot Biomass



Scoles-Sciulla, Stosich, and DeFalco, In review

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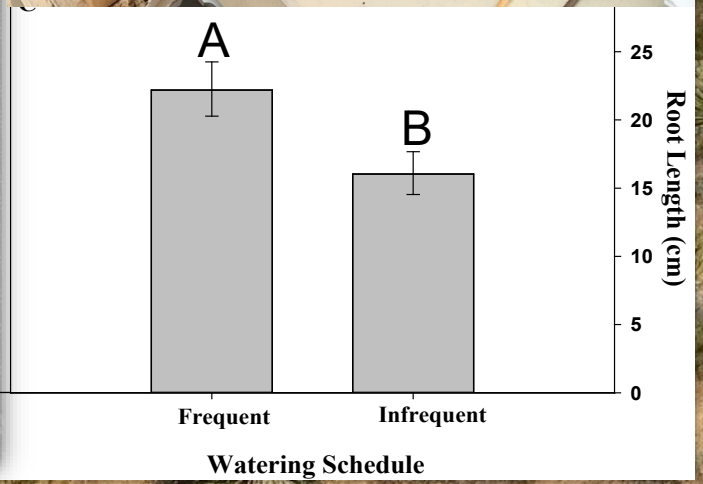
Blue Diamond cholla
Rooting Depth



Scoles-Sciulla, Stosich, and DeFalco, In review

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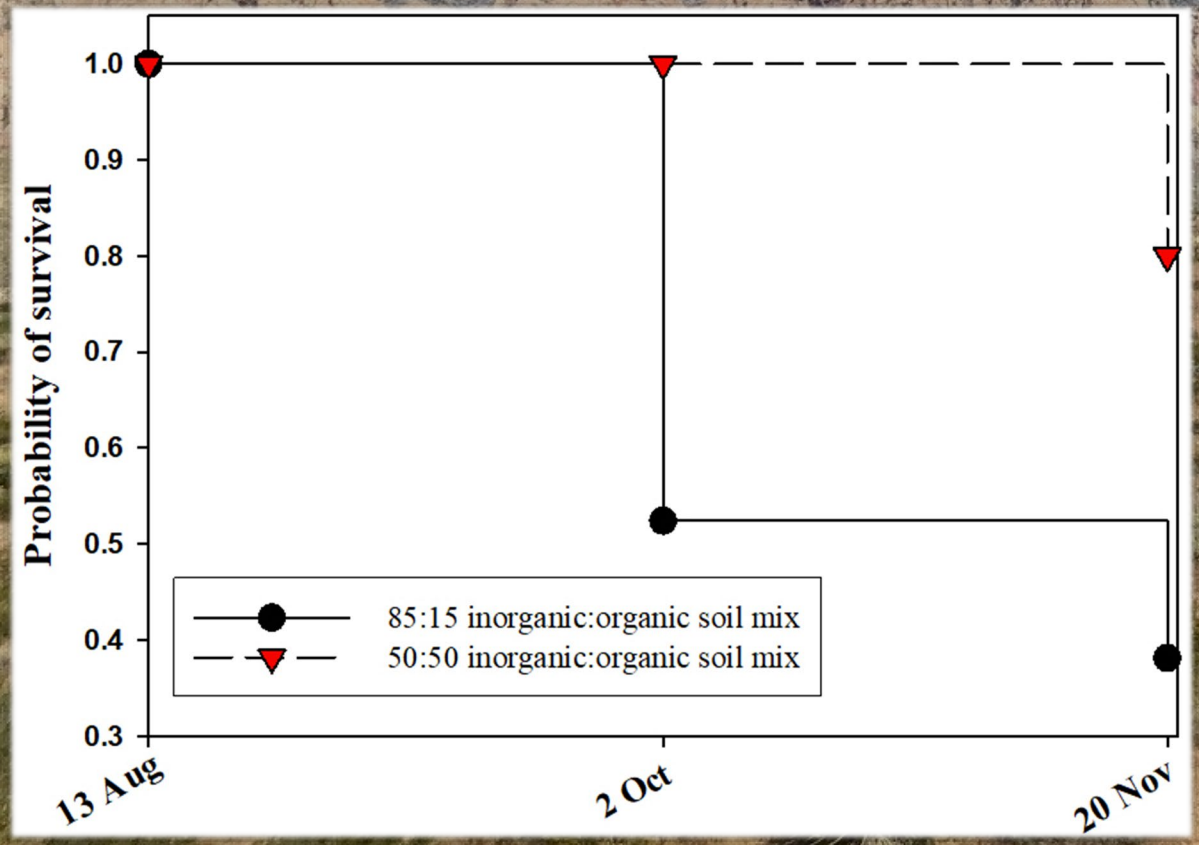
Blue Diamond Cholla
Plant Survival



Scoles-Sciulla, S., A. Stosich, and L. DeFalco. *In review*. Soil medium and watering frequency alter growth and allocation for Blue Diamond cholla (*Cylindropuntia multigeniculata*), a rare cactus of the northeast Mojave Desert, USA. *Native Plants Journal*.

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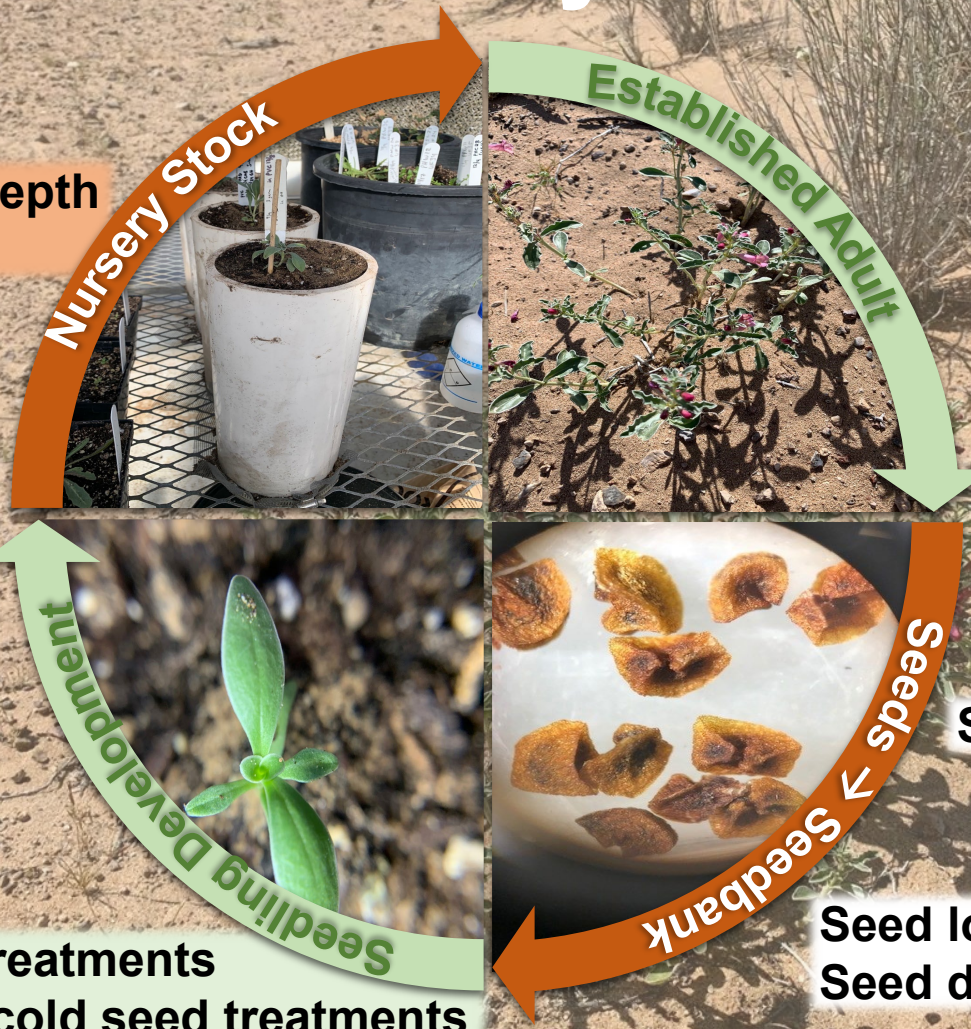
White-Margined Beardtongue Seed Collection and Nursery Stock



Rooting depth
Survival

Pollination

Seed viability

Seed longevity
Seed dormancy

Chemical treatments
Warm and cold seed treatments

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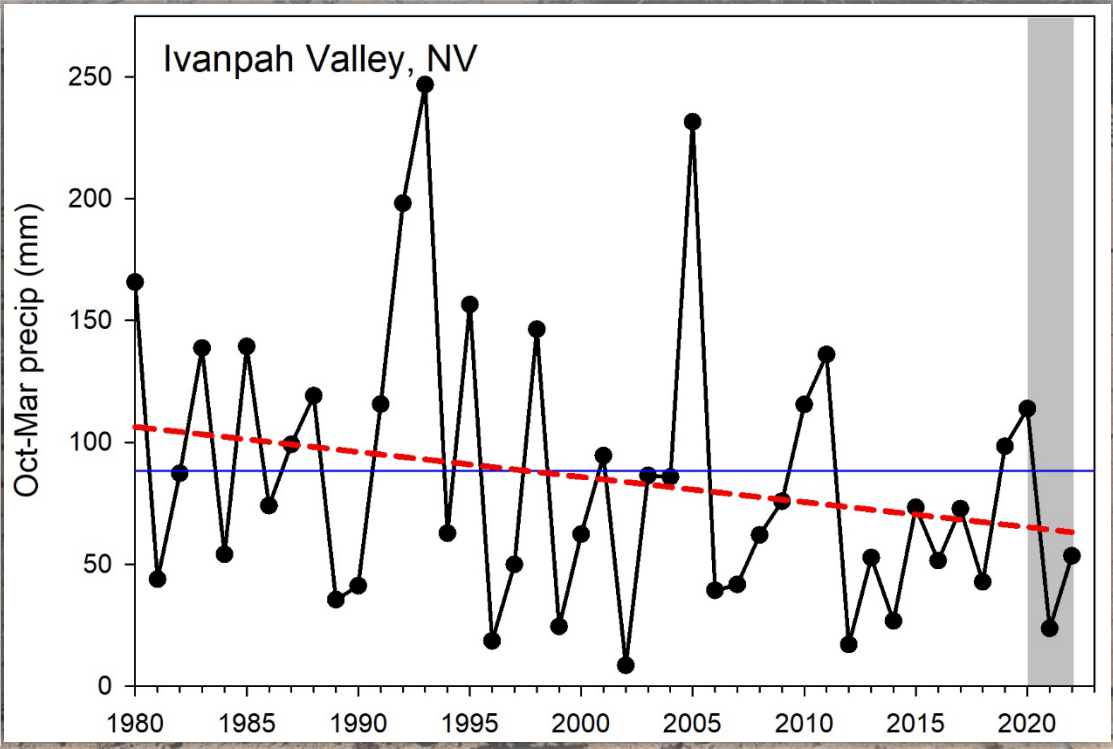
White-Margined Beardtongue
Seed Collection

2020 (Apr, May, Jun): 1,676 seeds from 8 plants at Ivanpah (~30% viability)
0 seeds from Roach Lake, Jean Lake and Hidden Valley

2021 (Mar): No growth/flowering at four populations; 0 seeds collected

2022: (Feb, Mar): Flowering at Ivanpah; no seeds collected at others



PRISM, Oregon State University

White-Margined Beardtongue
Pollination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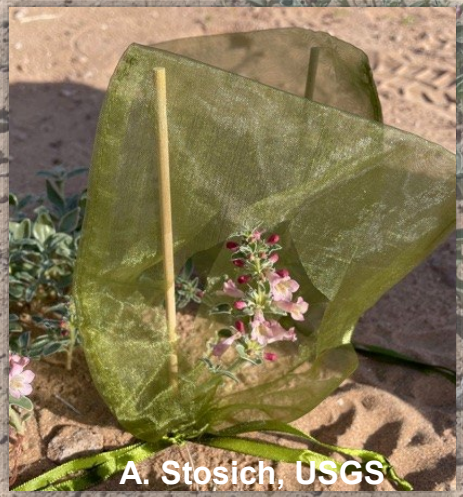
Greenhouse trial (Spring 2021)

- Bagged/unbagged flowers (n = 2); pollen transfer
- Fruit was formed, but seed aborted
- No flowering occurred during Spring 2022

Field trial (Spring 2022)

- Ivanpah population only, ~20 plants flowering
- Bagged, bagged w/access, and unbagged (n = 10)
- Fruit maturity low, despite possible pollinators

(Seed processing and data analysis is in progress)


A. Stosich, USGS

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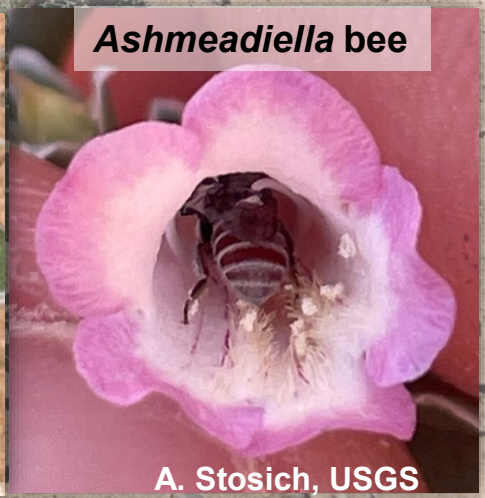

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White-Margined Beardtongue

Seed Bank


L. DeFalco, USGS


L. DeFalco, USGS

Greenhouse seed bank trial (Oct 2020 – Jul 2021)

- 20 plants x 4 populations
- 123 seedlings emerged→68 transplanted (55%)→ 39 established (57%)→22 surviving (56%)

Seed longevity field trial (Jul 2020 – Jul 2021)

- Germinants from seeds exhumed in late winter and spring had lower vigor

Seed dormancy/temperature trials (Jun – Nov 2020)

- Period of after-ripening needed to break dormancy

(Data analysis/interpretation is in progress)


S. Scoles-Sciulla, USGS


A. Stosich, USGS


A. Stosich, USGS

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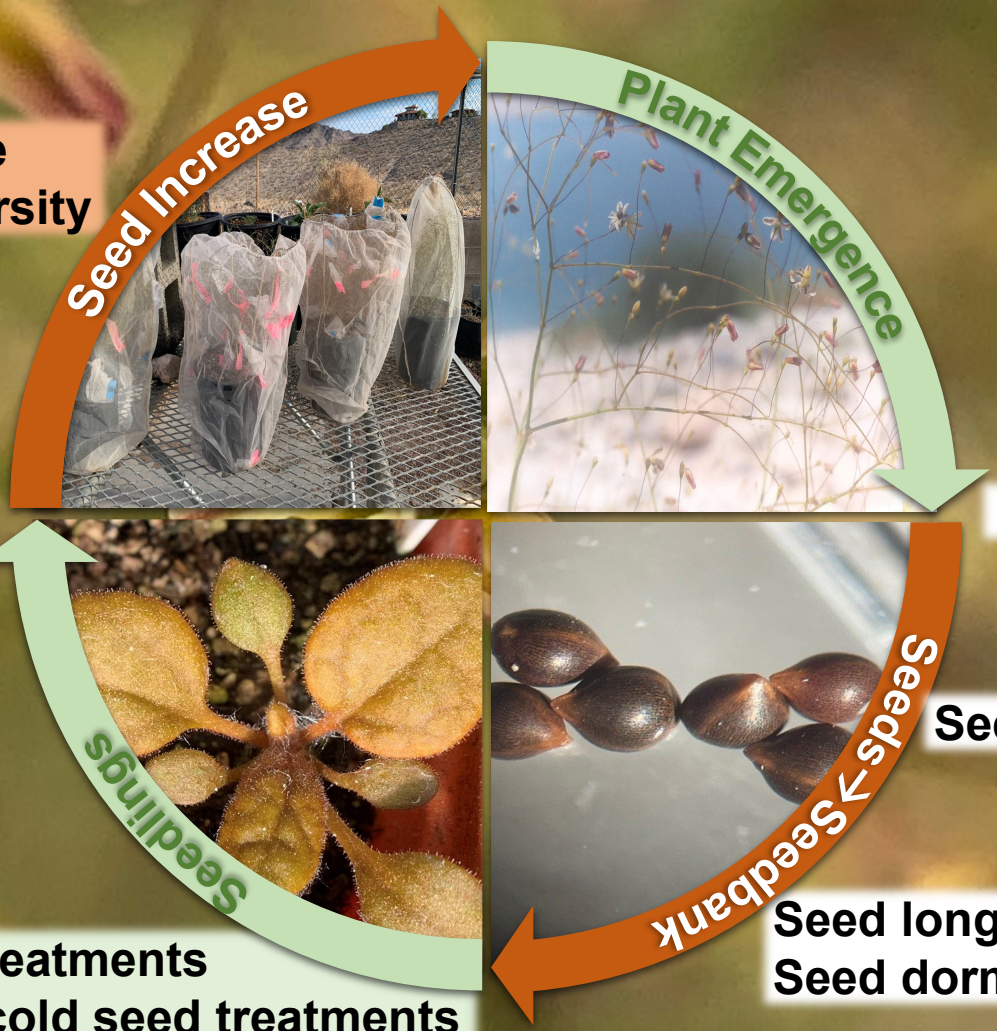
Sticky Buckwheat
Seed Collection and Seed Increase



Seed storage
Genetic diversity

Pollination

Seed viability

Seed longevity
Seed dormancy

Chemical treatments
Warm and cold seed treatments

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Sticky Buckwheat
Pollination

Field trials

- 2020: No plants at Weiser Wash, Upper Virgin Valley, Tuquop Wash, Ebony Cove, Black Mtn, Overton Arm
- 2021 and 2022: Continued low precipitation and poor emergence of annuals

Shadehouse trial (Mar – Jun 2022)

- Seedlings matured from seed bank were used due to poor field emergence
- Whole plants either bagged or bagged w/access
- Flies (Bombyliidae) observed visiting flowers

**Seed processing/data analysis is in progress

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Sticky Buckwheat
Seed Bank


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L. DeFalco, USGS


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Greenhouse seed bank trials (2020/21 and 2021/22)

Lime Cove, Middle Point

- 20 seedlings, 6 produced seeds
- 70% emerged during first of four waterings
- 2,542 seeds collected (97% viability)

Virgin Valley, Upper Muddy River

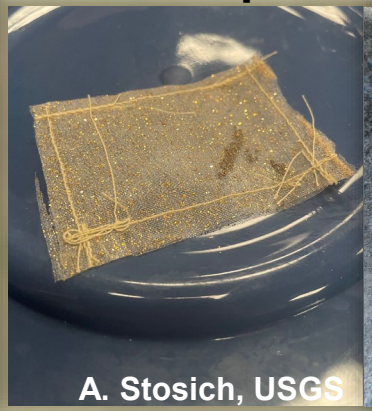
- 2 seedlings emerged (5% samples), 0 survived

Seed longevity field trial (Aug 2022 – Aug 2023)

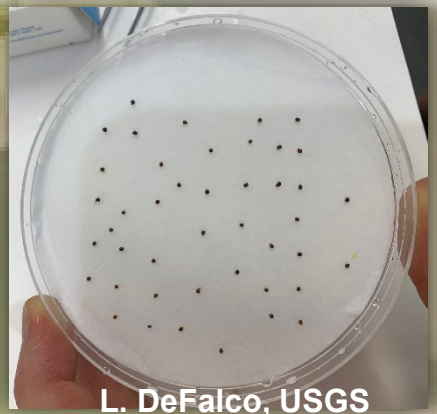
- Seed bags scheduled for placement in field

Seed dormancy/temperature trials (Aug – Dec 2022)

- Seeds currently undergoing warm and cold temperature stratifications


A. Stosich, USGS


S. Scoles-Sciulla, USGS


L. DeFalco, USGS

Three-Corner Milkvetch

Seed Collection

2020 – Mud Lake, California Wash → sparse plants with fruits

Weiser Wash, Logandale, Muddy River, Tuquop Wash,Ebony Cove/Black Mountain, Overton Arm, Sandy Cove → No plants

2021 – Continued low precipitation, and poor emergence of annuals

2022 – Mud Lake, California Wash, Tuquop Wash, Mormon Mesa, Muddy River, Logandale, Glendale Wash → No plants

Greenhouse seed bank trials (2020/21 and 2021/22)

Mud Lake, California Wash, Sandy Cove, Mud Wash → No emergence

****Seed longevity, Seed dormancy/temperature trials could not be completed because of the lack of seed for the duration of the project**

Current Seed and Nursery Stock

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Sticky buckwheat
25,215 filled seeds
(cold storage)

White-margined beardtongue
22 2-yr old adults
(summer dormant)

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Blue Diamond cholla
20 2-yr old juveniles

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Rare Plant Propagation in a Drying Climate

Blue Diamond cholla

- Joint cuttings are a reliable means of nursery production.
- Reproductive failure due to extended drought limits the dependability of propagation by seed.

White-margined beardtongue

- Propagation from soil seed bank produces viable plants; dormancy and pollination requirements are being determined.
- Seed collection across populations was unreliable due to reproductive failure but is possible at populations in some years.

Sticky buckwheat

- Seedlings produced from seed bank were difficult to transplant and develop; however, once established, plants were prolific seed producers with high seed viability.

Three-corner milkvetch

- Failure of field collections and seed bank to produce seed emphasizes the urgency for alternative approaches.

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Questions?

We gratefully acknowledge, for their support, assistance and insights…

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