



Pilot Project for Native Plant Material Development in Arizona

Year I Progress Report
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1 Background & Conservation Context

The Sonoran Seed Collaborative (SSC) is a partnership of the Central Arizona Conservation Alliance (CAZCA), Arizona Columbine Garden Club (ACGC), Arizona Native Plant Society (ANPS), Tovrea Carraro Society (TCS), the City of Phoenix, and the Desert Botanical Garden (DBG) with the goal of increasing the availability of native plant materials for restoration projects in Maricopa County, Arizona. During the fall of 2019, the SCC implemented a pilot project at Tovrea Castle at Carraro Heights in Phoenix, Arizona (5025 E Van Buren St, Phoenix, AZ 85008) to test and develop best practices for rearing restoration plant materials. CAZCA partners provided input on species choice based on their project needs, and five native plant species were chosen for the project based on restoration needs and paucity of materials in Maricopa County.

The impetus for this project is to address the goals of the Regional Open Space Strategy (ROSS) for Maricopa County¹, see side panel at right. All plant materials utilized in this project originate from seeds collected locally in Maricopa County. The goal of this project is to increase the availability of restoration quality plant materials for Maricopa County and to provide a replicable demonstration site for CAZCA to learn from.

The Arizona Columbine Garden Club and Arizona Native Plant Society have provided project funding and are the heart of the volunteer corps who have installed and maintained this project. Additional funding has been provided through a grant from the Nina Mason Pulliam Charitable Trust to CAZCA.

Strategic Habitat Enhancements, LLC (SHE) was contracted in November, 2019 to assist with the implementation of the pilot project, including volunteer coordination, setting up monitoring protocols, data management, and development of Best Management Practices to guide project success, sustainability, and expansion.

This report covers project activities and lessons learned from November 2019 through July 2020.

2 Tovrea Castle at Cararro Heights

Tovrea Castle at Cararro Heights (hereafter referred to as Tovrea Castle) is a historic site in that is part of the City of Phoenix Parks System and operated by the non-profit Tovrea Carraro Society (Figure 1). The Tovrea Carraro Society has allowed access to this site for the Sonoran Seed Collaborative's first pilot project, and they have been an excellent project partner. Aside from the extensive cactus gardens, the 40-acre parcel is natural

REGIONAL OPEN SPACE STRATEGY FOR MARICOPA COUNTY GOALS

1: Protect & Connect

Ensure a robust network of natural areas to sustain habitat, provide opportunity for recreation, support clean air and water resources, and improve resilience to drought, extreme heat, and flooding.

2: Sustain & Restore

Identify and engage best practices in land management and restoration to sustain and enhance native biodiversity, positive recreational experiences, and socio-economic benefits connected with the Sonoran Desert.

3: Love & Support

Build champions and the constituency of support and action for Sonoran Desert conservation by raising awareness and connecting people with nature.

4: Coordinate & Elevate

Build upon the CAZCA foundation to ensure and amplify regional open space planning, management, and conservation successes.

¹ Beute, S., & Arndt, L. (2019). Regional Open Space Strategy for Maricopa County. CAZCA.

desert vegetation. The partnership at this site has been strategic from a variety of other perspectives, including Tovrea Castle's:

- close proximity to the Desert Botanical Garden;
- presence of water for irrigation; and,
- secure, yet easily accessible location.



Figure 1. Location of Tovrea Castle and Desert Botanical Garden in Phoenix, AZ.

3 Species Selection and Progress to Date

CAZCA partners provided input on native species choice based on their project needs; surveys were sent to both seed users and seed producers, and research was conducted to discover which species were available on the larger market from around the region. Pilot species were chosen based on the fact that they were not already being farmed on a large scale but were good candidates for restoration or were otherwise sought after by seed users or could use more information about their ability to be farmed. Based on that analysis, five native plant species were chosen for the project: sweetbush (*Bebbia juncea*), desert lavender (*Condea emoryi*), fluffgrass (*Dasyochloa pulchella*), desert marigold (*Baileya multiradiata*), and bladderpod (*Physaria gordonii*). The species represent a diverse array of habitat resources, from tough perennial shrubs to annual wildflowers, and can be used to enhance ecosystem services from erosion control to native pollinator support on restoration projects. Although these species are commonly encountered in the natural desert areas of Maricopa County, locally collected and/or propagated materials are not widely available for restoration projects. Photos of the species are shown in Figure 2.

Progress at the site has varied and is addressed in detail by species in the following sections. Three species were installed / seeded at the site (Figure 3). The biggest challenge has been the onset of the COVID-19 pandemic. Tovrea Castle is closed to public visitation until at least September, but the Tovrea Cararro Society allowed us continued access with the implementation of safety protocols, including:

1. Teams of no more than 2 volunteers are onsite at a time, and text Tamera Zivic (Tovrea Cararro Society President) upon arrival.
2. Volunteers adhere to social distancing guidelines and wear masks while onsite.
3. Monthly meetings are held via video conferencing.



Figure 2. Sonoran Seed Collaborative Pilot Species. (TOP LEFT) Sweetbush (photo credit http://southwestdesertflora.com/WebsiteFolders/All_Species/Asteraceae/Bebbia_junceae.html). (TOP RIGHT) desert lavender (photo credit: Carianne Campbell). (BOTTOM LEFT) Fluffgrass (photo credit: Sue Carnahan). (BOTTOM MIDDLE) Desert marigold (photo credit: Carianne Campbell). (BOTTOM RIGHT) Bladderpod (photo credit: Sue Carnahan).

COVID-19 has delayed additional planting onsite until at least October. Regardless, the team is excited to continue building on what has been learned so far and to share our “lessons learned” so that future sites can continue to be successfully developed.



Figure 3. Location of installed/seeded plants at Tovrea Castle.

4 Sweetbush

Sweetbush is a nondescript sub-shrub that is extremely drought tolerant and naturally grows in sandy washes and rocky slopes up to 4,000 feet in elevation. Sweetbush is an excellent choice for site stabilization and erosion control in poor soils, it does well in disturbed areas, and it is easily established from seed. This widespread species is very adaptable and is commonly seen growing in urban areas; in fact, it is a common roadside plant in the vicinity of Tovrea Castle along Van Buren Avenue. In addition, it is a valuable food source for a variety of insects, including pollinators, particularly because it can bloom throughout the year and produces copious nectar. It is in the sunflower (Asteraceae) plant family.

Sweetbush is the SSC's breakout success of the first year of this pilot project. The SSC achieved excellent survivorship of the plants and has been successfully harvesting seeds from the original plantings.

4.1 Site Preparation

On October 26, 2019, volunteers from CAZCA and the ACGC prepared the planting beds by clearing vegetation and digging shallow trenches in rows for the sweetbush planting and irrigation.

4.2 Installation

Thirty-one sweetbush plants were installed on November 5, 2019. These plants were grown in D40 tubes by the Gila Native Plant Nursery. The plants were protected with cages made of hardware cloth and secured with ground staples.

In addition, 16 sweetbush plants were installed at Papago Park on February 29 as part of an effort to enhance the native plant trail. These plants were not caged per the request of City of Phoenix Parks. Photos of that event can be accessed in this photo album: https://www.facebook.com/pg/Strategic-Habitat-Enhancements-606857666403867/photos/?tab=album&album_id=832987657124199.

4.3 Survival

As of July 6, 2020, 26 of the original 31 plants were alive and thriving, a survival rate of 83.8%. Initially, it seemed as though survival was low, but many plants re-sprouted upon recovery from transplant shock. Herbivory issues were not observed at this location. This could be due to a variety of factors, including: 1) effective caging materials and technique; 2) not enough small mammals and rodents to create herbivory pressure at this location; and/or 3) sweetbush may not be as palatable as other plants.

As of this report, protective hardware cloth cages are still in place, and the plants are outgrowing them. We decided to leave the cages in place at least until monsoon precipitation starts; the strategy is to wait until the surrounding vegetation is also plumped up with water so that herbivory pressure on our plants is reduced.

Survival of the plants installed at Papago Park is unknown due to COVID-19.

HELPFUL OBSERVATIONS & LESSONS LEARNED

1: Plant Protection

Hardware cloth cages are sturdier than chicken wire and create a favorable microclimate with light shading of the plants.

2: Transplant Shock

Over the first month, approximately half of the sweetbush plants appeared to be dead. By mid-December, however, several plants recovered from the transplant shock, re-sprouting from the base and beginning to grow vigorously. The lesson is to be patient and expect some transplant shock, and that sweetbush is very resilient.

4.4 Phenology

According to regional botanical literature, sweetbush can flower throughout the year. Our preliminary observations have shown several flowering pulses throughout the spring and summer (Figure 4). The first flower buds appeared in mid-February, with a few individuals flowering in mid-March, and most individuals in flower one week later. Flowering pulses followed approximately every month, with some periods when no flowers were observed.

Seed production began at the end of March and has followed similar pulses, although since seeding began there have been seeds present on at least some plants during each monitoring visit.

4.5 Seed Collection

Seed collection began in March. Volunteers collected seedheads individually at first, into brown paper lunch bags labeled with the species, date, and collector's name. Seedheads that were not quite ready were experimentally covered with organza bags so that the seed was not blown away before the next weekly monitoring visit. Multiple seedheads could be enclosed per organza bag. As the season progressed, it became clear that this technique would be too time-consuming and inefficient given the quantity of seeds that were being produced.

As the flowering and seeding pulsed through the season, we decided to experiment with another harvesting technique. On May 26, the plants were covered in seedheads, and the thought of tediously hand-collecting them in the blazing heat was daunting. The two western-most rows of sweetbush were clipped, and stems with seedheads included were placed in a large bin for later processing. The two eastern-most rows were preserved as is, with seedheads collected by hand in the same manner as before. The difference in seed collection speed and efficacy was surprising (Figure 5). Since clipping, dramatic increase in flowering was observed in the clipped plants; on July 6, 84.6% of the clipped plants had at least some flowers, compared to only 30.7% of the unclipped plants.

We will continue to monitor the difference between these treatments, but it seems like the best approach going forward will be to periodically clip

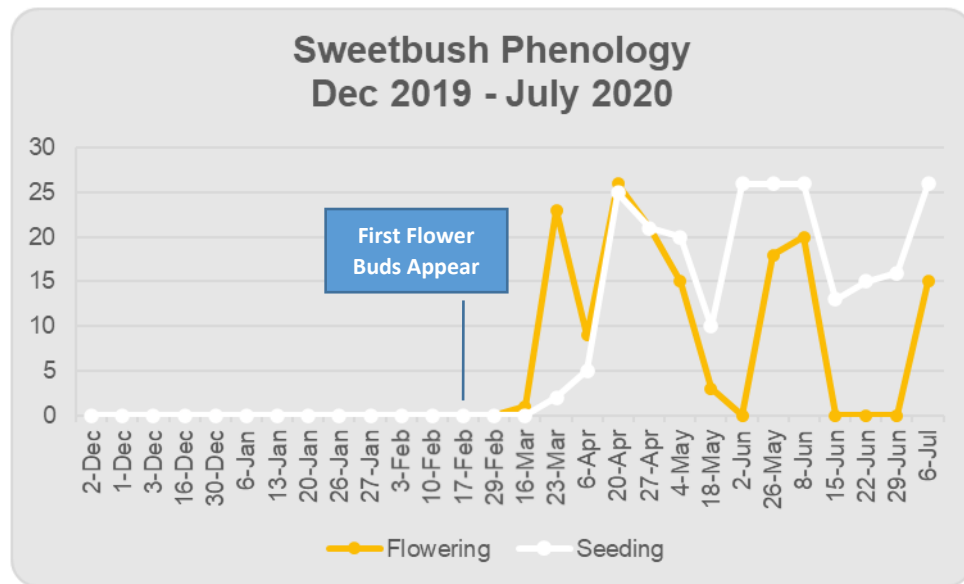


Figure 4. Sweetbush phenology observed at Tovrea Castle December 2019 – July 2020.

HELPFUL OBSERVATIONS & LESSONS LEARNED

1: Harvesting Efficiently

Periodic clipping of plants may result in more efficient and complete harvesting with less effort.

2: Plant Propagation

Native plant nurseries, such as the Gila Native Plant Nursery, have the appropriate facilities and expertise to propagate plants for out-planting.

3: Volunteer Engagement

Regular feedback of results and information keeps volunteers creatively and physically engaged. For this project, monthly team meetings have worked well. Onsite meetings are not possible with COVID-19, but video conferencing allows sharing of photos and data.



Figure 5. (TOP LEFT) Sweetbush seed collection by hand. (TOP RIGHT) Organza bags were used to keep seeds that were not quite ready from blowing away before the next monitoring visit. (MIDDLE LEFT) In late May, the two western-most rows were clipped and (MIDDLE RIGHT) the stems were placed in a bin for transport and later processing. (LEFT) The difference in seed collection via clipped and unclipped techniques. The clipped plants yielded many times more seeds (large bag) than the unclipped, hand-collected seeds (small bag).

the plants to collect the seeds when they are at peak seed quantity. This periodic approach may reduce collection effort and increase seed harvest. Due to COVID-19, we do not have a total tally of the seeds collected so far. Instead of delivering the seeds to the Desert Botanical Garden for cleaning, volunteers have been taking seeds home for safe-keeping until further notice.

4.6 Propagation and Care of Plants

Project volunteers have been experimenting with backyard propagation of sweetbush, but have not yet seen successful germination. This may be due to the hot, dry time of year, and the difficulty of keeping seeds moist enough outside of a nursery setting. In addition, many of the seeds were quite old.

Several sweetbush plants grown by the Gila Native Plant Nursery that were left over were up-planted to 1-gallons and sent home with a AZ Columbine Garden Club volunteer for maintenance until they can be installed. As of July 13, six plants were alive and healthy. They will be installed at the next volunteer day [tentatively] in October. If a volunteer day is not possible, they will be installed during monitoring visits a few at a time.

5 Desert lavender

Desert lavender is a larger shrub with silvery leaves that grows in desert washes and hillslopes up to 4,000 feet in elevation. This species is one of the taller shrubs of the Sonoran Desert and can create shady microhabitats where established. Its small purple flowers support pollinators, especially native bees and butterflies. It is in the mint (Lamiaceae) plant family.

Desert lavender plants were grown by the Gila Native Plant Nursery, however they were not of sufficient size to be included in the November 2019 planting event. Nursery Manager Steve Plath recommended installation during the monsoon or fall of 2020; there are now 20 very healthy plants (Figure 6) ready for installation at the next volunteer day [tentatively] in October. If a volunteer day is not possible, they will be installed during monitoring visits a few at a time. Coordination with the Tovrea Carraro Society will be needed on appropriate siting.



Figure 6. Desert lavender plants at the Gila Native Plant Nursery July 20, 2020.



Figure 7. Plot seeded with fluffgrass and bladderpod on December 30, 2019.

6 Fluffgrass

Fluffgrass is a low-growing perennial grass that is an excellent site stabilizer that is often found in overgrazed and denuded sites, along with other types of disturbed areas. It thrives in dry rocky conditions less than 6,000 feet in elevation and is drought tolerant. It is in the grass (Poaceae) plant family.

Fluffgrass and bladderpod were hand-sown and raked in on December 30, 2019 in linear plots, with fluffgrass to the right and bladderpod to the left (Figure 7). Unfortunately, this seeding was unsuccessful for both species, no germination was observed. During the early spring, weeds invaded the site, including the noxious invasive stinknet (*Oncosiphon piluliferum*). Volunteers weeded as much as possible, but in the end, when no germination of our target species was observed, bark mulch was applied to the site to suppress weeds and encourage moisture retention. Plans for a subsequent trial have not been formulated yet.

7 Bladderpod

Bladderpod is an annual wildflower that responds to winter rains and produces yellow blooms from February through April and sometimes through July. After wet winters, this plant can form carpets of yellow in the low desert and it is an important nectar source for native bees and other pollinators. When established, it will re-seed itself readily. It is in the mustard (Brassicaceae) plant family.

See fluffgrass discussion above; bladderpod was unsuccessfully seeded.

8 Desert marigold

Desert marigold is an annual or short-lived perennial that will re-seed itself readily once established. It blooms between March and October, and its yellow sunflowers are a reliable nectar source for a variety of insect pollinators. Very small native bees sometimes use the old flower stalks for nesting. It does well in disturbed sites and is often a primary wildflower seen on roadsides, where it is easily established from seed. It is in the sunflower (Asteraceae) plant family.

Seeds of desert marigold were collected by an Arizona Native Plant Society volunteer, but have not yet been sown onsite. Fall is the ideal time to sow these seeds, and this will be accomplished at the next volunteer day [tentatively] in October. If a volunteer day is not possible, they will be sown during a monitoring visit in October. In the meantime, another unsuccessful backyard germination experiment was conducted by Strategic Habitat Enhancements.

HELPFUL OBSERVATIONS & LESSONS LEARNED

1: Planting Schedule

Sometimes plants are not on the same schedule as your project. Rely on the advice of native plant nurseries to know when plants are ready to be out-planted. In addition, there can be a lag between collection of ripe seed and the best time to sow the seed. Shortened schedules are likely to bring frustration – play the long game to overcome these challenges.

2: Seeding

Seeding may require several trials and a plan for invasive plant management should be in place. Seedlings of target species and weeds can be difficult to tell apart when they are young.

3: Flexibility

A flexible approach is needed to handle unexpected events (e.g., unsuccessful germination, a global pandemic) and take advantage of new opportunities (e.g., desert senna is doing well on the site).

4: Simple Irrigation

A very simple irrigation system works best when relying on volunteers for watering. A system needing regular adjustment would be better suited to a site that has regular maintenance staff.

5: Mulch

Mixed bark mulch provided an effective weed barrier and helped to retain moisture between waterings.

9 Desert senna

Desert senna (*Senna covesii*) is a short-lived perennial that will re-seed itself readily once established. It blooms opportunistically between March and October. Its yellow flowers attract a variety of pollinators, and it is a host plant for sulphur butterflies. It is in the legume (Fabaceae) plant family, and as an added restoration perk, it is a nitrogen fixer that will contribute to soil health.

Desert senna was not on the original pilot species list, but it is successfully growing on the site and seed collection started on July 6, 2020.

10 Irrigation and Precipitation

The irrigation system at the Tovrea pilot site relies on volunteers to hand-water plants, and with the dedicated group of SSC volunteers, this system has been working well at this location. The irrigation design consists of shallow trenches surrounding the sweetbush plants; a hose is laid in the trenches and water travels to each of the plants due to the slight grade difference. Areas that are seeded are hand-watered with hose spray.

The team fabricated and experimented with a sprinkler system that duplicated a design that is in use at the Desert Botanical Garden for milkweed propagation. This set up proved to be problematic at Tovrea due to difficulty adjusting the spray valves, water pressure, and achieving even coverage of the plot. The sprinkler still required volunteers to be onsite to turn on the water and make any necessary adjustments. When the system was working, volunteers found that it took approximately just as long to water the plants with the sprinkler as it did to use the trench system.

The year to date precipitation total is 4.26 inches, as measured by a nearby rain gauge that reports data to www.rainlog.org (Figure 9). It was a fairly wet spring, with the following monthly precipitation totals:

- January: 0.2 inch
- February: 1.48 inch
- March: 2.57 inch
- April: 0.01 inch
- May: 0
- June: 0



Figure 8. Desert senna at Tovrea Castle, July 6, 2020.

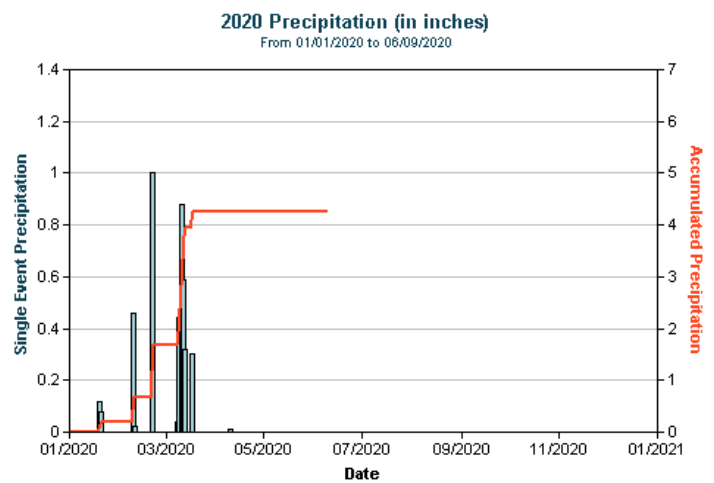


Figure 9. 2020 precipitation to date at Precipitation Gauge #326, located near McDowell and N. 68th Street, Phoenix.

As of this report, there has not yet been any monsoon precipitation in the area. Irrigation is not conducted at the site when there has been 0.25 inch or more precipitation since the prior weekly monitoring visit.

11 Maintenance and Monitoring

11.1 Maintenance Visits

After polling the group, a regular maintenance schedule was set, with visits to occur on Mondays. On the last Monday of the month SHE is onsite to provide guidance for the project. Maintenance visits are not required if there has been 0.25 inch or more rain since the prior visit; rain events/amounts are logged on the online Google Calendar based on the nearest rain gauge reported at www.rainlog.org.

11.2 Monitoring Protocols

SHE worked with the project team to develop a monitoring form in Google Forms that can be accessed by volunteers in the field and filled out quickly. The form collects data about who was onsite, what actions were completed, and weather conditions, as well as simple survival and phenological assessments of the installed plant materials. The form is updated as species are added or deleted. The current form is included as Attachment 1, and the form is available here:

https://docs.google.com/forms/d/e/1FAIpQLSdiT0sQI1tTAXhG3V-HifL-HPoZwa4lw49UncmzUyOtKySisA/viewform?usp=sf_link

These data have been useful in tracking plant phenology, and, ultimately, seed production throughout the year.

12 Next Steps

- A planting event is tentatively scheduled for October 17, 2020 in order to:
 - Install 20 desert lavender plants
 - Install 6 additional sweetbush plants
 - Apply seed for desert marigold
- Consider adding triangle leaf bursage (*Ambrosia deltoidea*) to the target species
- Work with partners to identify new sites in Maricopa County for native seed production
- Create a plan for cleaning, archiving, and distributing seed from the project
- Work with nursery partners to develop a backyard propagation kit that volunteers can use to grow out perennial species.
- Pursue additional funding to keep the project going. Current plans include pursuing an Arizona Game & Fish Department Heritage Grant as well as a National Fish & Wildlife Foundation Monarch and Pollinator Conservation Grant.

HELPFUL OBSERVATIONS & LESSONS LEARNED

1: Maintenance & Monitoring Schedule

A regular schedule helps everyone to know what to expect and stay on track. Email reminders the day before should include all information volunteers need, including access codes and the monitoring form.

2: Monitoring Form

A simple, streamlined form is one that is most likely to be used. Create the form collaboratively with volunteers and update as necessary. Google Forms is a useful platform because data can be exported directly into Excel for analysis.

3: Use Methods that Work for Your Volunteers

We tried various communication and collaboration tools until we found what worked for our group. Find platforms that are comfortable for everyone.

4: Volunteers are Amazing

This project would not be possible without the dedication of an amazing group of volunteers from the Arizona Columbine Garden Club and the Arizona Native Plant Society!