

McDowell Sonoran Conservancy Parsons Field Institute
Scope of Work #3 Restoration of Degraded Lands Summary

Project #18-RP-009 - On-call Services for McDowell Sonoran Preserve Analysis & Assessment

Background and Project Objectives

Natural areas can be negatively affected by human use, including off-trail travel, use of motorized vehicles, livestock grazing, and more. These activities are now restricted within the McDowell Sonoran Preserve, but several areas within its boundaries show disturbance from before the Preserve was established. Some ongoing disturbance is expected with current and future levels of visitation and should be carefully managed. Degraded lands generally support fewer plant species, which diminishes their scenic value and reduces wildlife habitat. Additionally, these areas typically no longer have biological soil crusts, which are an important living cover on the ground surface that minimizes dust and erosion while providing important benefits to the ecosystem.

To maintain scenic views and provide high quality habitat for wildlife and plants, the city is interested in restoring degraded lands. Understanding where these disturbed lands occur and the best techniques to restore them helps minimize cost and effort while providing effective restoration.

The purpose of Scope of Work #3 is to help determine the most effective techniques for restoring disturbed lands (Part A) and to develop an action plan for identifying and restoring degraded areas in the Preserve (Part B).

Approach

Part A: Techniques

We have four projects to determine the most effective ways to restore degraded areas. These projects investigate how successful different seeding and ground surface treatments are, as well as how to best re-establish soil crust in areas where it has been lost.

Past restoration

As one step in comparing seeding and ground surface treatments, we investigated how effective restoration projects that occurred more than five years ago have been. We selected eight old road sites where some combination of soil treatments, plant seeding, and cactus transplants had occurred. We compared plant and soil cover in plots on the roads with nearby undisturbed lands.

Ripping and seeding

As a second step, we have been conducting an experiment since 2016 to test how plant growth is affected by timing of seed application (before summer rains vs. before winter rains) and breaking up the top layer of the ground (a process called “ripping,” which increases the ability of water to soak into the ground and allows plants to root easier).

RestoreNet

In 2018, we initiated a partnership with the U.S. Geological Survey (USGS) and the Central Arizona Conservation Alliance (CAZCA) to install a RestoreNet experiment that includes a site in the Preserve and three others in the region. These locations represent the first Sonoran Desert sites in a network field trial with sites in the Mojave Desert, Chihuahuah Desert and on the Colorado Plateau. At each site, three treatments are being tested: pits dug in the ground (to collect moisture, litter and seeds), mulch (to retain moisture), and connectivity modifiers (upright “x” structures made of wire mesh to capture litter and seeds). Two seed mixtures of eight species each are also being evaluated.



Figure 1. In the RestoreNet project, pits (bottom) and connectivity modifiers (top) help capture seeds and litter, which might increase plant growth.

Biocrust cultivation

To develop methods for restoring biocrust to degraded areas, we tested innovative new approaches for “farming” biocrusts in two stages. In stage I, we salvaged biocrusts from the Fraesfield, Granite Mountain and Pima Dynamite trailheads prior to construction of new facilities for cultivation. We tested different methods for growing crusts for reintroduction back into the field; these treatments included cultivating the crusts under different climate regiments in a controlled setting and direct transplant into the field. In stage II, we applied the cultivated biocrusts into field plots near the Granite Mountain trailhead to test how well phase I treatments establish in the field.



Figure 2. Data collection at field biocrust plots near Granite Trailhead. Photo includes (from left to right): biocrust steward leads, Jane Brady and Debbie Langenfeld, and Conservancy staff, Helen Rowe and Tiffany Sprague.

Part B: Action plan

Previously, we completed a map of degraded lands in the Preserve indicating areas of bare ground with associated seed menus. This year, we ground-truthed a subset of 22 the 66 identified sites to compare our GIS mapping methods with actual field conditions.

We worked with the City of Scottsdale Preserve staff to determine that the priority for restoration should be given to those area in proximity to the Pima-Dynamite trailhead. We have developed a survey tool for assessing each degraded site to inform restoration planning of those sites.

Summary of findings

Part A: Techniques

Past restoration

We found that overall native plant cover was similar between the restored and undisturbed areas, but species composition was different. Succulents dominated the treated areas due to the cactus transplants, whereas the undisturbed areas had more shrubs and grasses. Although the seed mixture had 11 plant species, only five species appeared in the treated area plots. Of these five species, only one species had more

cover in the treated plots compared to undisturbed areas. These results were published this year in *American Midland Naturalist*.

Ripping and seeding

Ripping increased plant growth in plots. Unfortunately, non-native plants had greater cover in ripped plots when compared with unripped. Of the 11 species included in the seeding mix, only four species persisted after four years. Four of the seeded species did not appear to germinate, including all three native grasses. We completed sampling in 2020, and results will be published in 2021.

Table 1. Total number of plants by year of each seeded species.

Common name	Total # plants/year			
	2017	2018	2019	2020
Chia	278	172	601	176
Desert globemallow	3	2	16	6
Desert senna	8	5	4	5
California poppy	51	1	2	0
Teddybear cholla	10	5	2	1
Desert marigold	17	0	0	0
Fairyduster	5	0	0	1
Purple threeawn	0	0	0	0
Squirreltail	0	0	0	0
Tanglehead	0	0	0	0
Paperflower	0	0	0	0

RestoreNet

Out of 16 species seeded in the two seed mix treatments, a total of six species germinated in the Preserve RestoreNet plots (Table 2). The lack of monsoon rains in 2020 likely affected germination results. As a preliminary trend, the mulch treatments seem to provide the best conditions for seedling establishment. Continuation of this project will determine longer-term trends.

Table 2. Number of plants established in Preserve RestoreNet plots by treatment. Data was collected in April 2020.

Common Name	Treatment				
	Mulch	ConMod	Control	Seed only	Pits
Chia	36	32	0	33	34
Coulter's lupine	18	7	0	9	20
Desert marigold	8	9	0	7	0
Arizona cottontop	1	0	0	0	0
Desert indianwheat	16	14	0	25	33
Desert senna	1	3	0	1	1

Biocrust cultivation

Field plots were sampled in the spring. Preliminary results indicate that the most effective treatment includes cultivating crusts in a greenhouse on jute, then transplanting the crusts on the jute into the field. Continued monitoring will determine long-term viability of this and the other treatments being evaluated. We tested different approaches of applying crusts, including pellets, psyllium, and watering, but there are no clear trends between these treatments yet.

Part B: Action plan

Ground-truthing revealed that our technique of using GIS to remotely identify degraded lands is a viable technique. All of the sites we checked were degraded and fit our remotely tagged descriptions of size, type, and vegetative cover, making this an effective method for identifying potential restoration sites across a large landscape like the Preserve.

To collect information on each of the disturbed areas in the vicinity of the Pima Dynamite Trailhead, we developed an assessment tool that we will pilot in 2021. . We will use this tool to further characterize vegetation and soil type on the degraded sites. This information will be used to create restoration plans for these sites in 2021.

Recommendations

Taken together, these projects can help direct restoration efforts in the Preserve. Based on findings to date, we recommend prioritizing restorations near the new Pima Dynamite Trailhead, as identified in the degraded lands map. When restoring these areas, we will consider lessons learned from our experiments. Site-specific plant species lists that we generated, as well as results of seeding establishment, will guide selection of appropriate seed mixes. Ripping will be suggested with caution, due to the increase in non-native cover seen in our experiment.

We recommend continuing our biocrust, RestoreNet, and restoration planning projects so that we can provide further recommendations on the most effective restoration practices in the future. In general, these experiments will help us to restore and maintain the Preserve for future generations.