



Restoration Research Update

Developing Best Practices and Identifying Target Areas

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Need for restoration research

- Goal to successfully restore degraded lands within the Preserve
- Improving restoration practices is a high priority in our region (Central Arizona Conservation Alliance, Restoration Labs)
- United Nations declared 2021-2030 as the decade of ecological restoration



Photo credit: Debbie Langenfeld

Parsons Field Institute restoration research

Developing best practices

- Past restoration surveys
- Closed trail restoration experiments
- Soil biocrust experiments

Identifying target areas

- Degraded lands mapping
- Provide data driven recommendations for restoring degraded areas in Preserve and other arid lands



Photo credit: Lisa Rivera

Parsons Field Institute restoration research



Photo credit: Lynne Janney Russell

Past restoration surveys



What can we learn from what has already been done?

- Areas restored between 2011 and 2012
- Previously used as roads and parking areas (large sites)
- Treatments primarily cactus transplants; also seeding and soil treatments

Photo credits: Lisa Rivera

Past restoration surveys

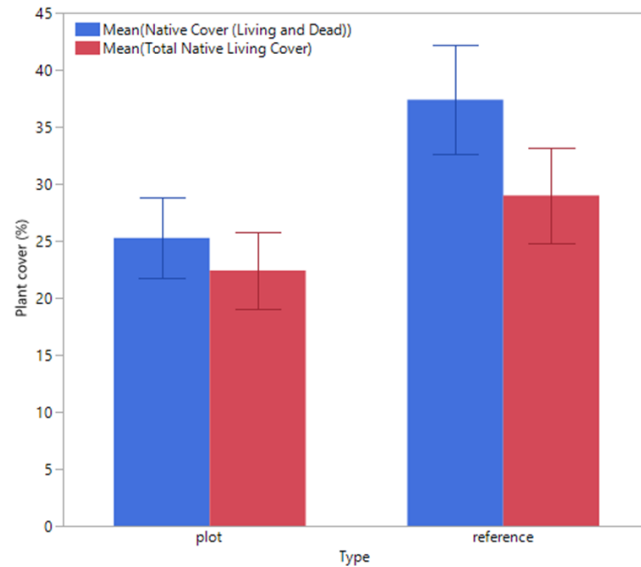


Photo credit: Debbie Langenfeld

Research questions

- Are the treated areas recovering?
- Did the applied treatments work?

Past restoration surveys



Overall, the treatments seemed to restore the degraded areas

- Native plant recovery, but composition differed from nearby reference areas

Seeding treatment had limited success

- *Bouteloua aristidoides* (needle grama grass) was the only seeded species that established

Functional group	Treated area	Reference area
Trees	-	-
Shrubs	-	+ cover and richness
Perennial forbs	-	-
Perennial grasses	-	-
Succulents	+ cover and richness	-
Annual forbs	-	+ richness only
Annual grasses	-	-
Litter	-	+ cover
Non natives	-	+ cover
Overall plant cover	-	-

Closed trail restoration experiments



Photo credit: Lisa Rivera

How can we improve upon past practices?

- Closed trails are mechanically ripped and covered with large vegetation litter (to deter human use)
- Is there a more successful and quicker method to restore degraded lands to a natural condition?
- Can seeding be a successful method for restoration?

Closed trail restoration experiments



Photo credit: Debbie Langenfeld

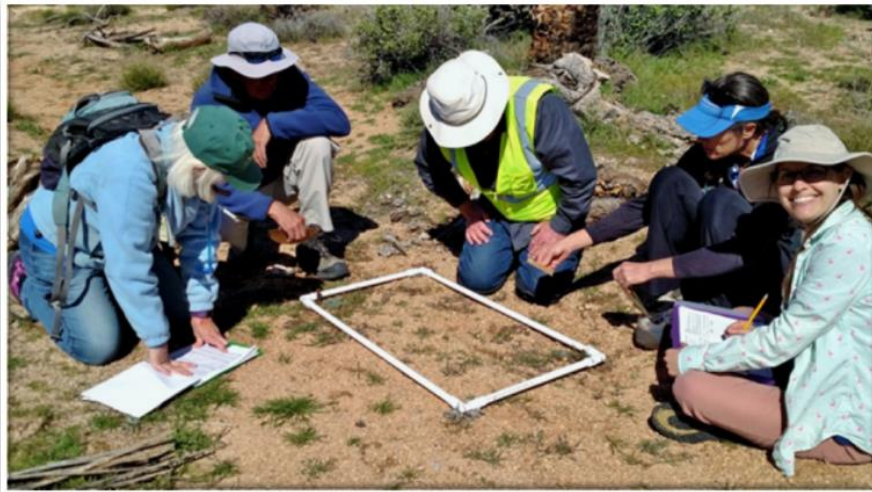


Photo credit: Bill Soule

Objectives

- Test various ecological restoration techniques on closed trails
- Develop best practices and methods for restoring degraded areas with soil compaction

Closed trail restoration experiments

Location of study sites

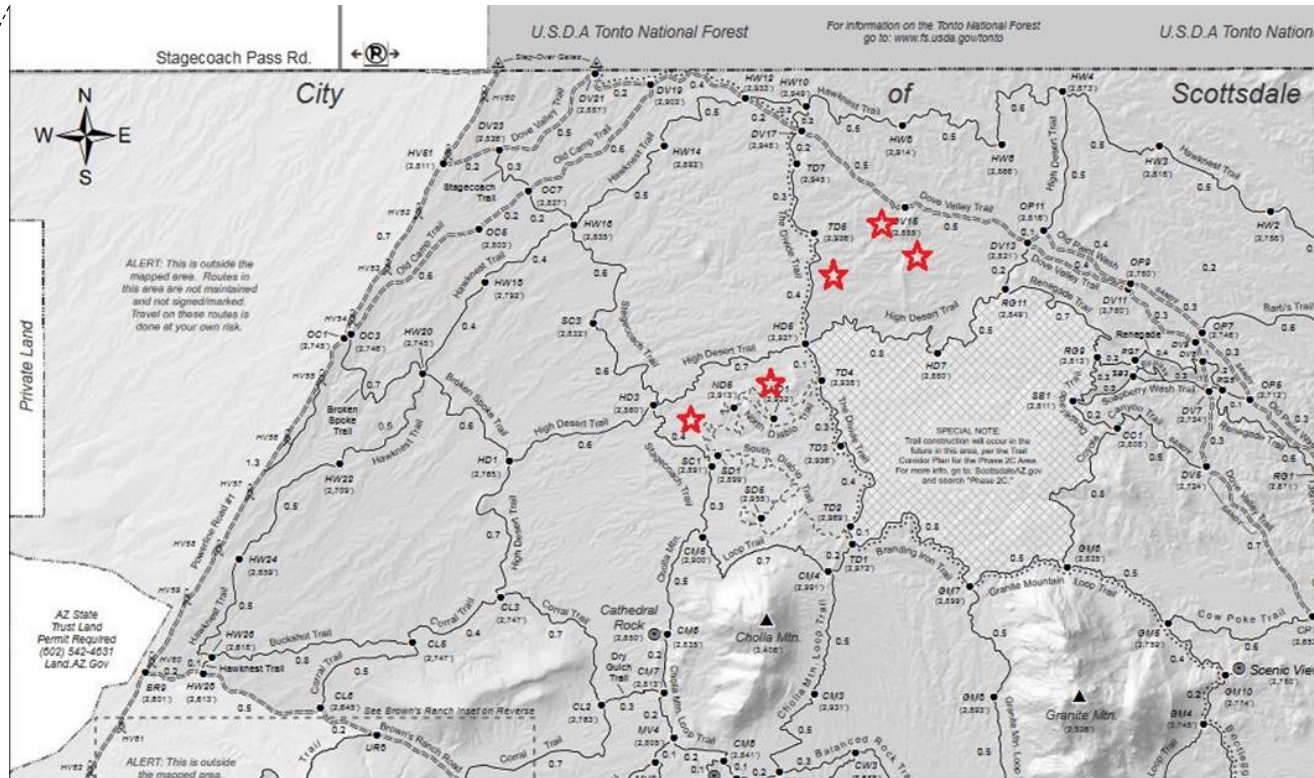


Photo credit: Leona Weinstein

Closed trail restoration experiments

Research questions

- Does soil ripping improve establishment of the native plant community? And establishment from seed mixes?
- Does establishment of seed differ when seed mixes are applied before monsoon vs winter rains?
- How does using purchased seed mix compare with using local topsoil in establishing diverse native plant communities?



Photo credit: Leona Weinstein

Closed trail restoration experiments



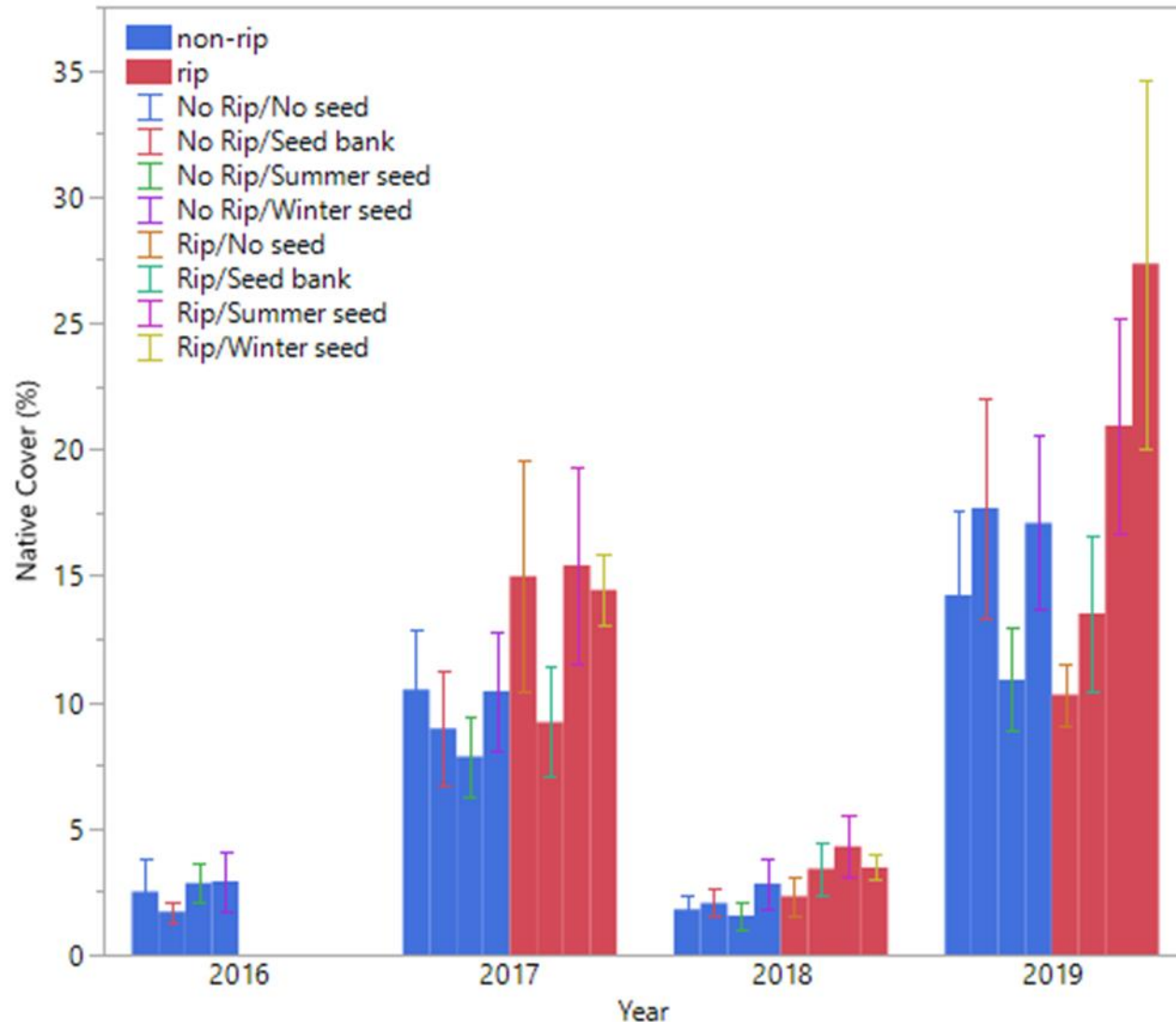
Photo credit: Lisa Rivera

Four restoration methods being tested

- Seed mix applied before summer monsoons (July 2016)
- Seed mix applied before winter rains (November 2016)
- Application of local topsoil (November 2016)
- No treatment applied (control)

Study plots visited in March of 2017, 2018, 2019 to monitor plant growth

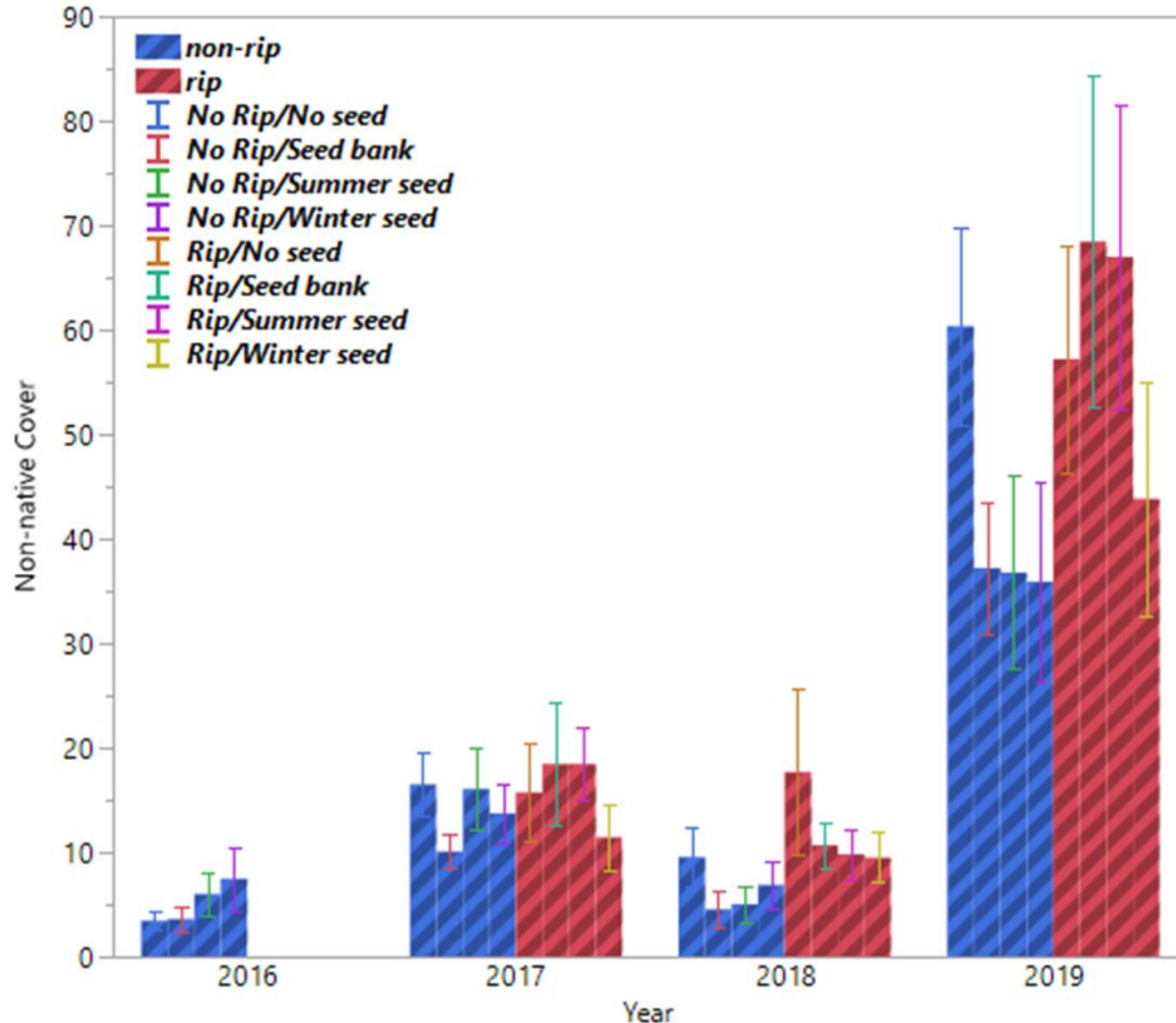
Closed trail restoration experiments



Results: Native plant cover

- Overall, native plant cover is higher in ripped plots
- Higher in ripped plots in 2018 (borderline higher in 2017)
- In 2019, ripped winter seed treatments were significantly higher than control

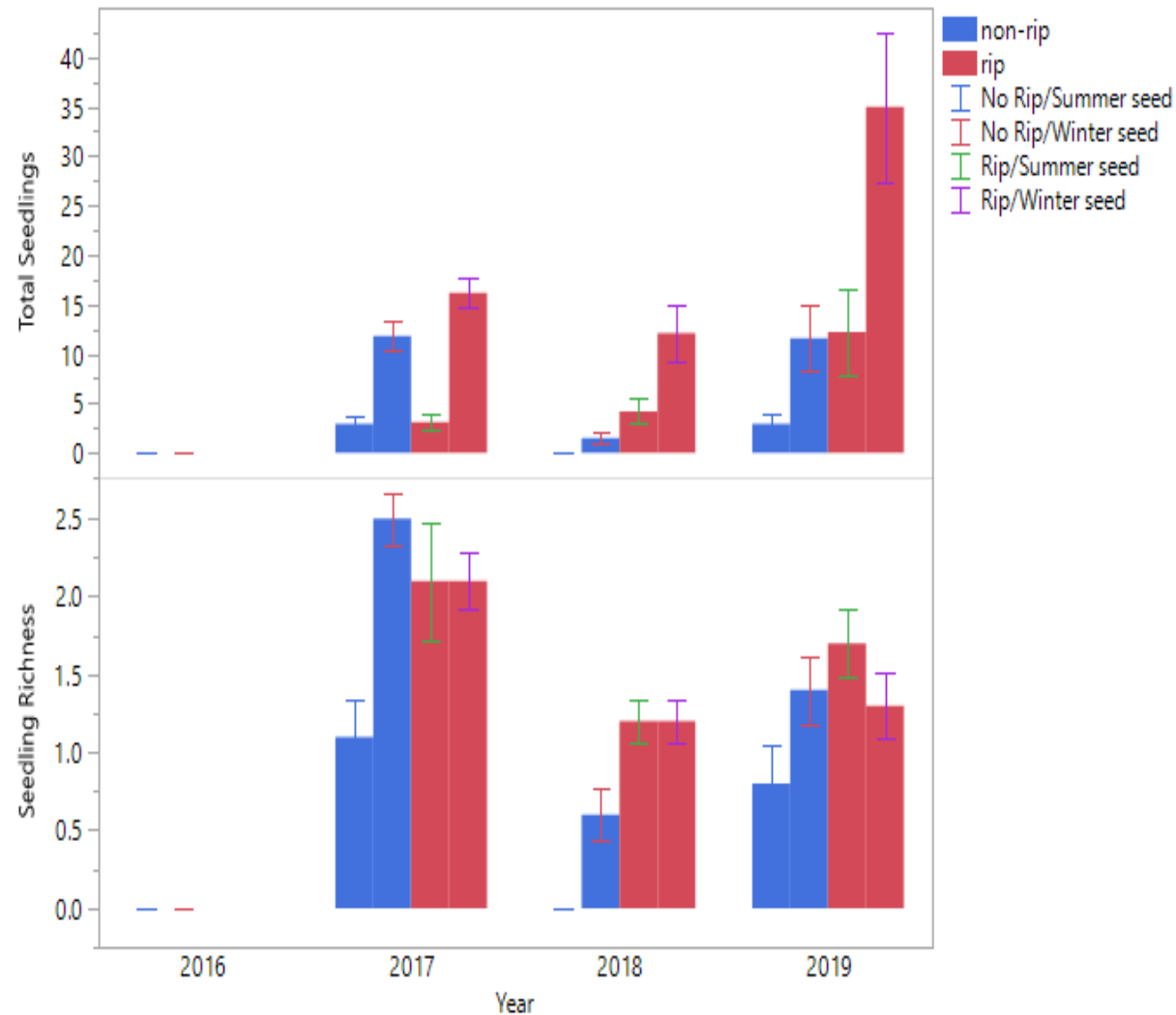
Closed trail restoration experiments



Results: Non-native cover

- Non-native plant cover is higher in ripped plots, when analyzed across years, so is a consistent effect
- In 2018, significantly greater non-native cover in ripped plots than unripped (near significant in 2019)

Closed trail restoration experiments



Results: Seedlings

- Native plant seedling richness highest in both winter and summer treatments with ripping
- Ripped plots had higher seedling counts than unripped
- Winter seeding resulting in more seedlings than summer seeding

Closed trail restoration experiments

Summary of results

- Ripping is effective option in times of drought, but the effect is diminished with enough rain
- Appears that seed mixes did not significantly increase overall cover and diversity (or perhaps not yet)
- Appears that natural regeneration is occurring in all plots, even untreated plots



Photo credit: Lisa Rivera

Soil biocrust restoration experiments



How can we improve upon past methods?

- Soil biocrust is vital to arid ecosystems (erosion control, nutrient cycling)
- Often overlooked as a method for restoring degraded lands
- Salvaged biocrust from Preserve prior to new trailhead development



Soil biocrust restoration experiments

Objectives

Test biocrust restoration through salvage, cultivation (biocrust farming or “bulking”), and field experiments

Research partner

Dr. Anita Antoninka, Research Associate,
Northern Arizona University, School of
Forestry



Soil biocrust restoration experiments

Research questions

What are the best practices for “bulking” or cultivating biocrusts?

- Substrate (native soil or sand)
- Stabilization (jute treatment intact, scraped, none)
- Climate control (hoophouse, flat, greenhouse)

What are the best practices re-establishing biocrusts in field?



Photo credit: Andrew Brand

Soil biocrust restoration experiments

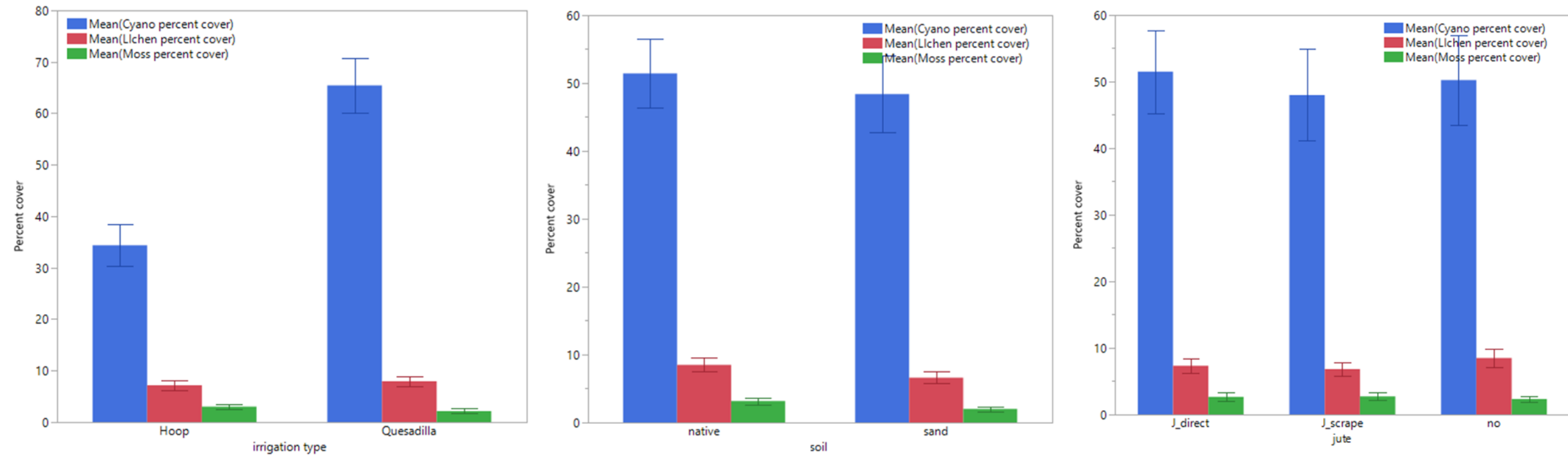
Cultivation experiments at Scottsdale Community College (Winter-Spring 2019)

Field trial in Preserve (start Fall 2019)

- Grow out cultivated (all treatments) and not cultivated (salvaged)
- Monitor plots for growth



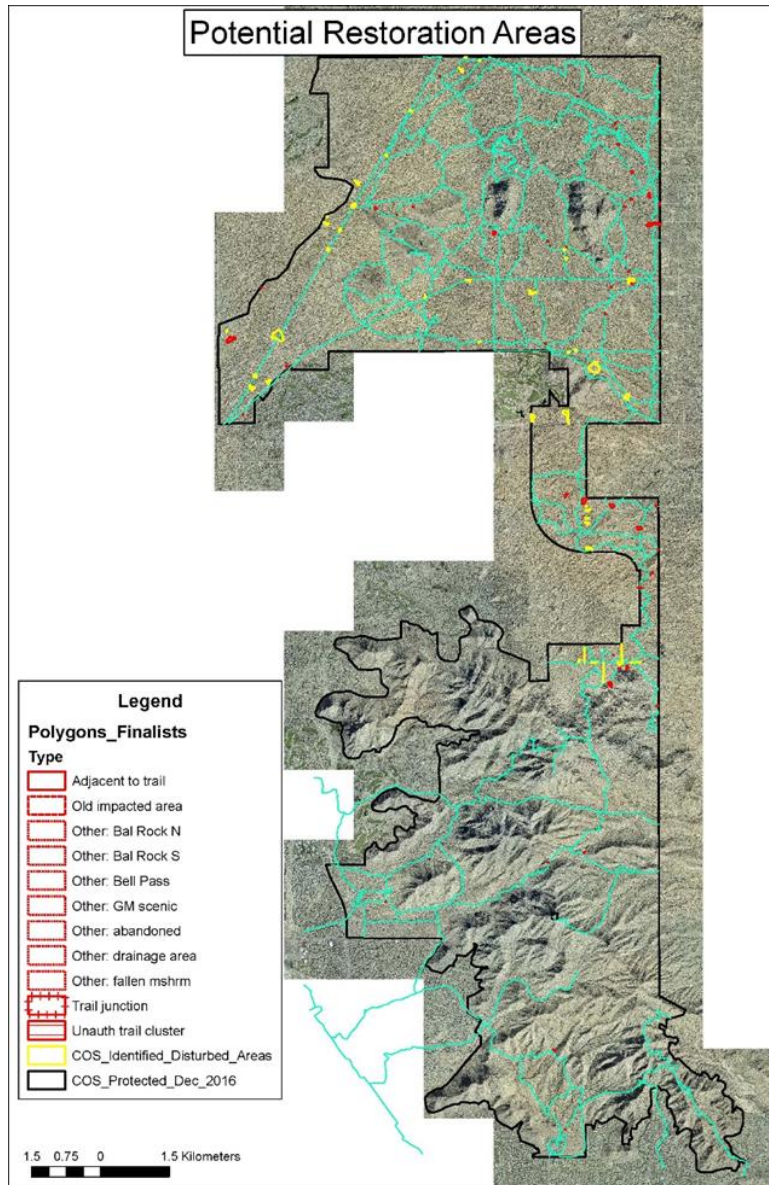
Soil biocrust restoration experiments



Preliminary results

Main difference is that cyanobacteria prefer the flat irrigation/climate control treatment

Degraded lands mapping



How can we put what we learn into practice?

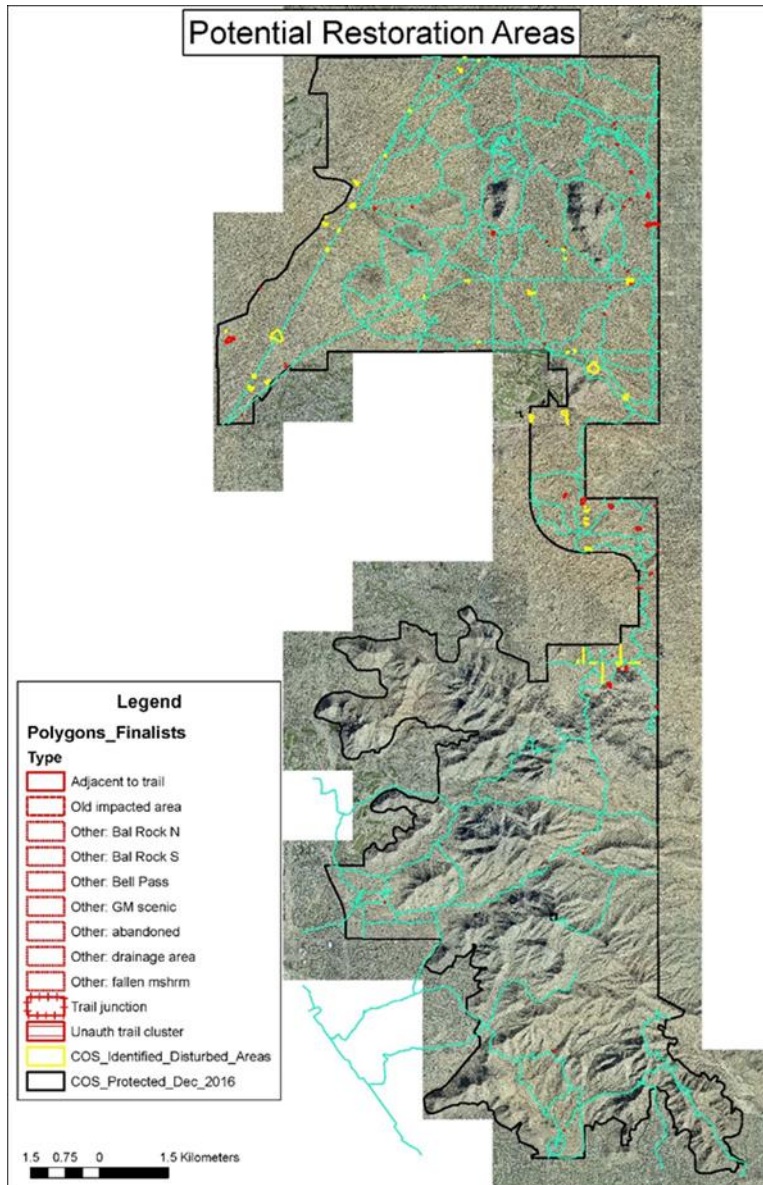
- Citizen scientists used Google Earth to map degraded areas
- Identified 67 additional degraded areas (plus 50+ known areas)
- Will be used to prioritize sites for future restoration

Next steps



Photo credit: Lisa Rivera

Management implications



Prioritize

- Where are the degraded areas?
- What kind of disturbance – ongoing or ceased?
- What is the size and visibility?

Plan

- What treatments are needed?
- Are native plant materials available?
- How to select site specific plant/seed species?

Take Action

Acknowledgements

Thank you to our research partners and citizen scientists that assisted on our restoration research projects!



Questions

For further information about these research projects, please contact:

Dr. Helen Rowe – helen@mcdowellsonoran.org

For information about our restoration citizen science opportunities, please contact:

Lisa Rivera – restoration@mcdowellsonoran.org



Photo credit: Lisa Rivera