

A landscape photograph showing a green hillside with several houses visible in the distance under a clear blue sky. The foreground is filled with dense green vegetation, including bushes and small yellow flowers.

Sustainable solutions to cross thresholds and build ecological resilience: Orange County Invasive Management (OCIM) project

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Guiding Principles

Sustainable invasive species management

- science-based site evaluations
- economic valuation
- stakeholder feedback



To efficiently allocate a limited budget, we must :

- Weigh ecological constraints and long-term recovery in planning for invasive management .
- Recognize tradeoffs imposed by environmental and economic constraints that vary across the landscape.

Core Objective

- Assess the effectiveness of restoration techniques.
- Compare across gradients:
 - Physical/topographical: soil, aspect, slope,
 - Vegetation: % cover of native and exotic spp.
 - land-use history: grazed, mowed, herbicide, road
 - management history (passive, active, intermediate).
- Develop a web based tool that predicts likelihood of restoration success based on site environmental and historical land used variables and economical constraints.



Four management levels (treatments)

- **No Action**

- **Passive Restoration**

- Exotic plants were managed

- **Intermediate Restoration**

- Exotic plants were managed
- Seeding/planting occurred

- **Active Restoration**

- Restorations fulfilling mitigation requirements
- Exotic plants were managed
- Irrigation may or may not have been used
- Seeding/planting occurred
- Amendment of and/or inoculation of soils
- Regularly monitored and maintained for a period of years



Methods

Vegetation sampling

- Line point intercept
 - Plant species frequency
- 1m² Quadrats
 - Plant species percent cover and richness



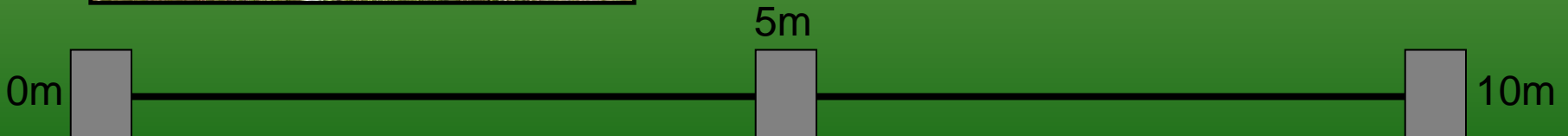
Soil sampling

Chemical analysis:

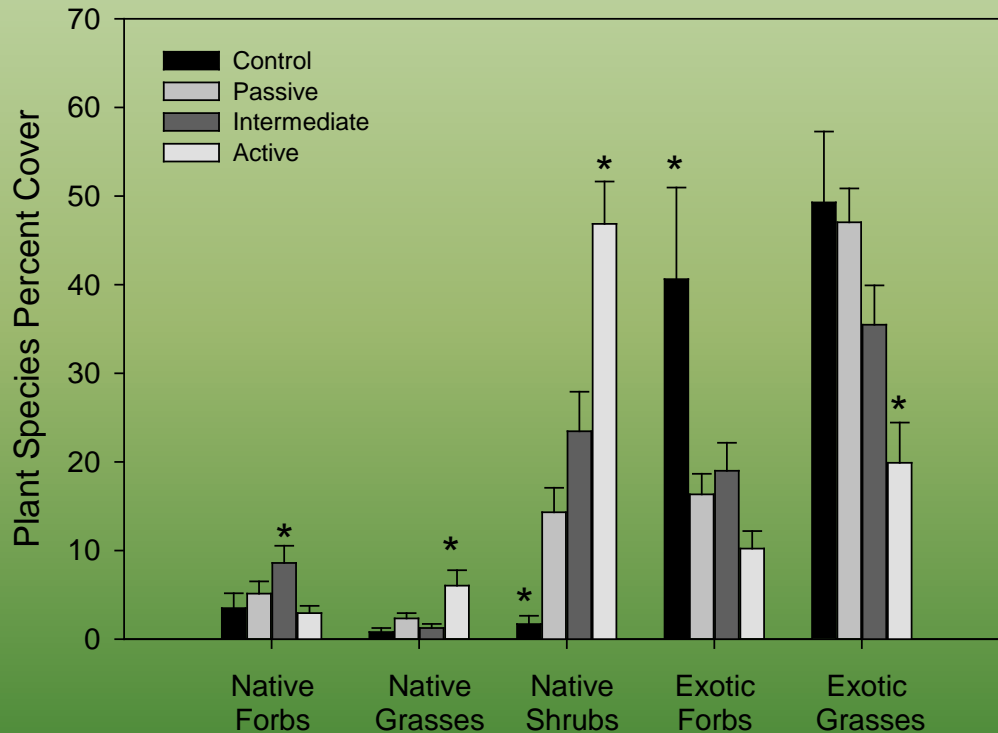
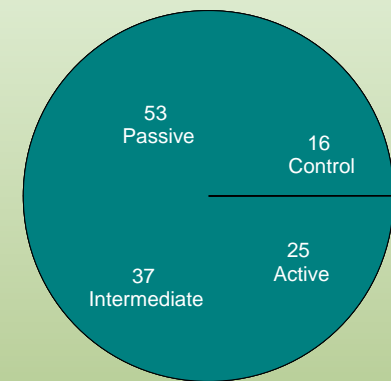
- Soil cores of 10 cm depth
- C,N, pH, soil texture

Seed bank:

- Soil core of 5 cm



Management Level



- Active and intermediate management led to the greatest native grass and native shrub recovery.
- Intermediate management lead to the greatest native forbs cover.
- All management reduced exotic forbs below that of the control, active had the greatest reduction.

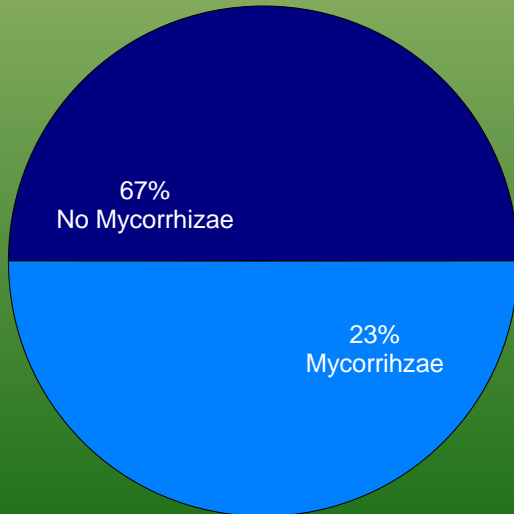
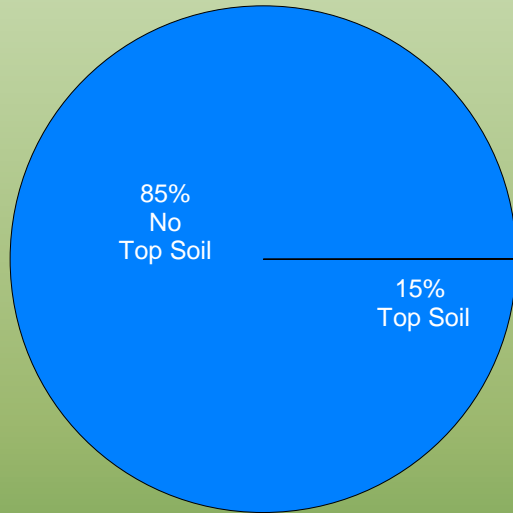
If the level of management alters restoration success, then what differs between the management levels?



- The average restoration was 6 acres.
 - Ranged in size from 0.25 to 31 acres.



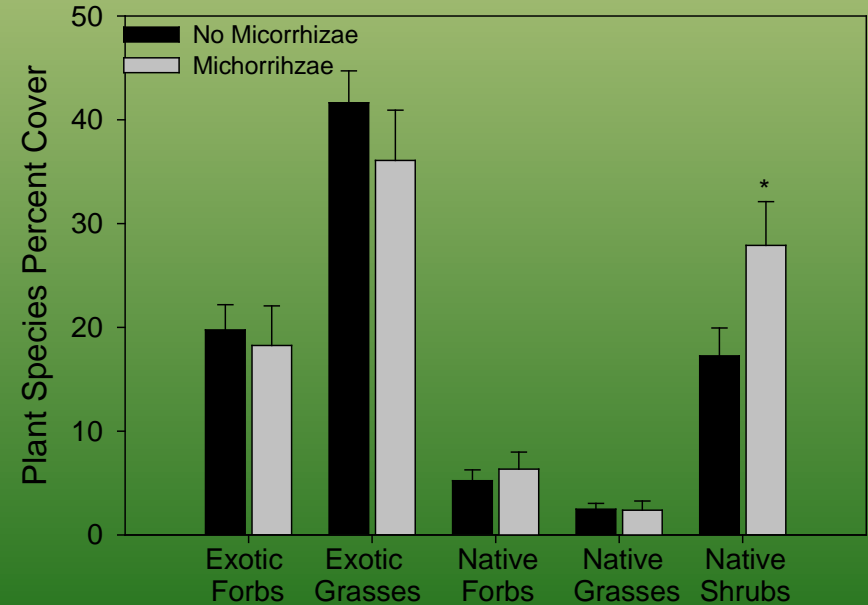
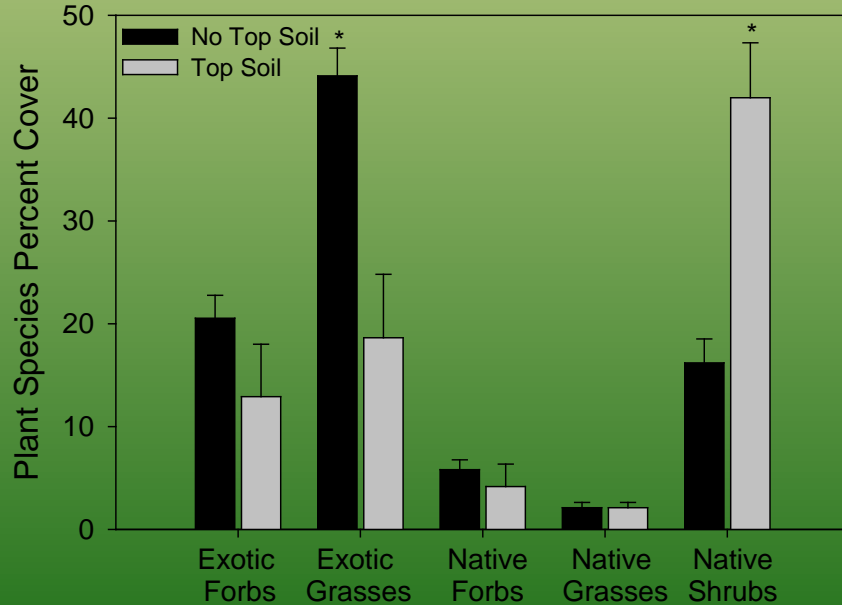
Top Soil Application and Soil Inoculations



- Top soil salvage and application is limited to intermediate and active sites
- Mycorrhizae is applied in intermediate and active sites through broadcasting or imprinting with seed or with container plants.

Top Soil Application and Inoculations

- Top soil application reduced exotic grass cover and increased native shrub cover.
- Mycorrhizae inoculations increased native shrub cover.

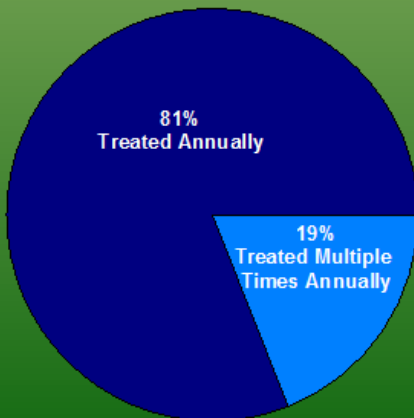
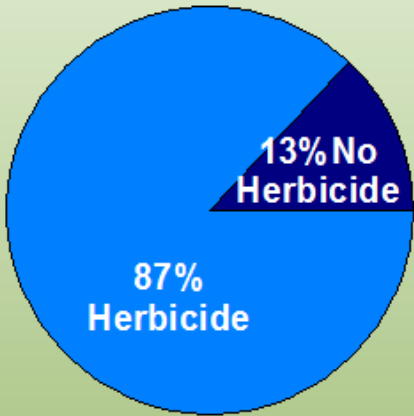


How often is herbicide used?

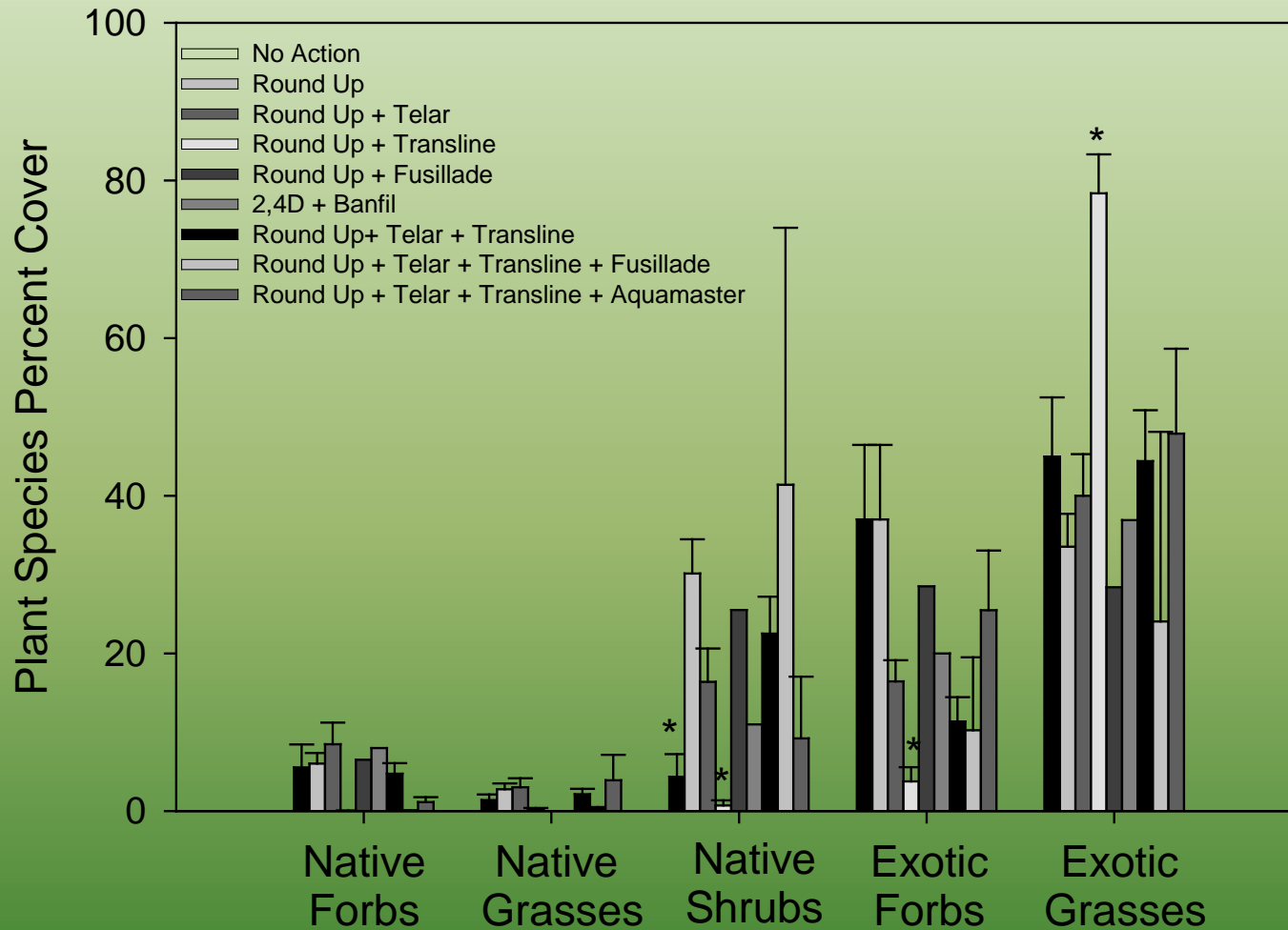
Herbicide was the most commonly used exotic plant control method.

- 53% used multiple herbicides.
- On average, sites were treated for 5 years.

Does Herbicide work?

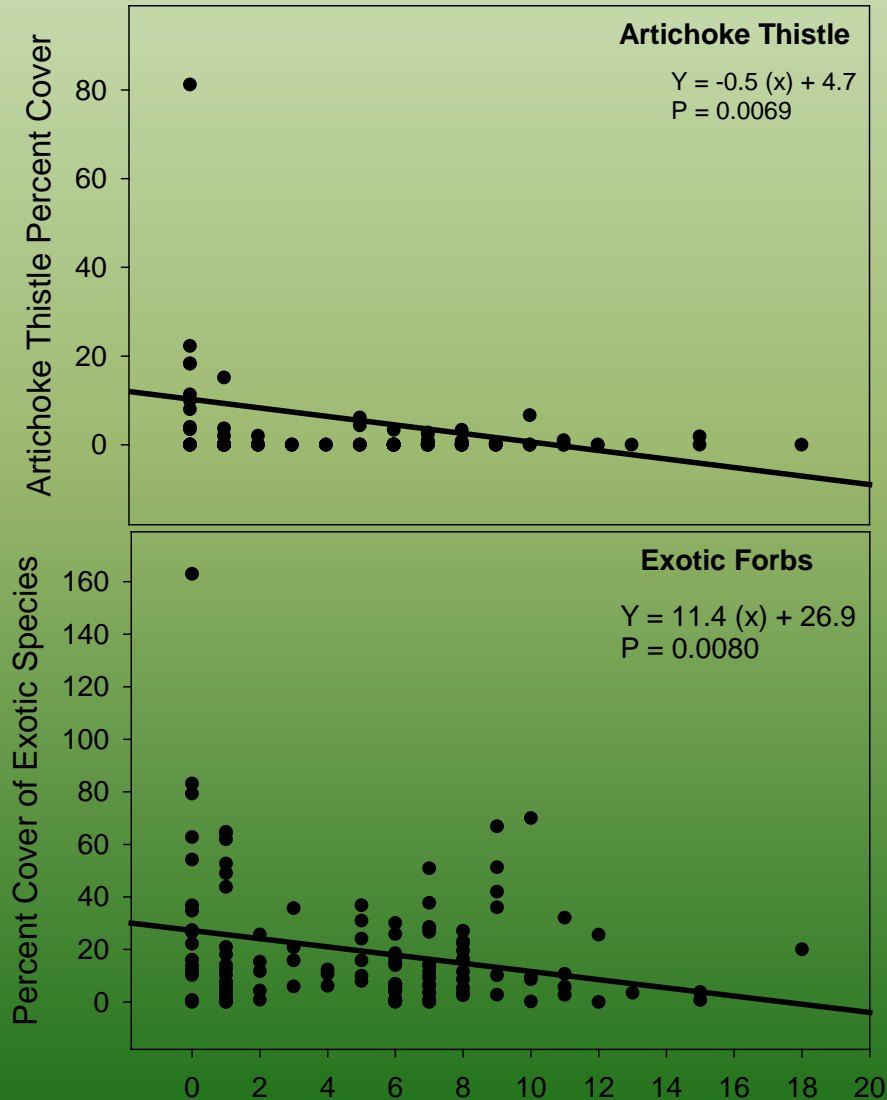


Type of Herbicide



Round Up with Transline was least effective controlling exotic grasses but most effective controlling exotic forbs.

Number of Treatment Years

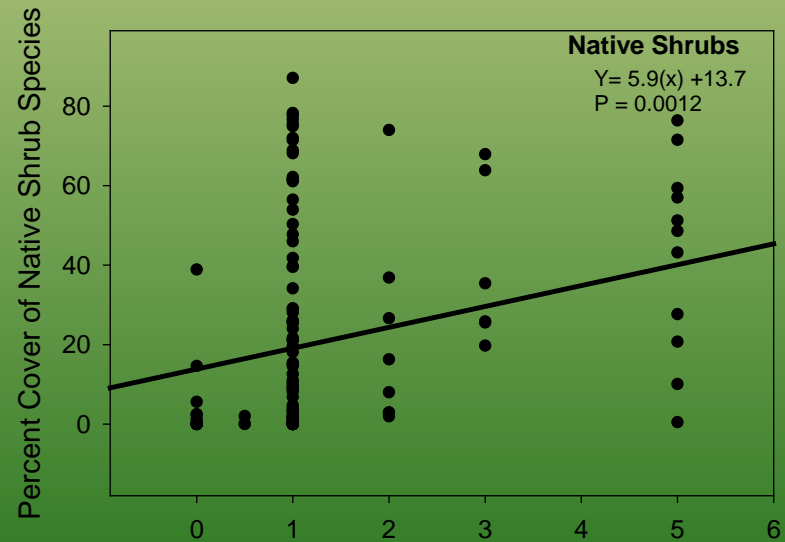
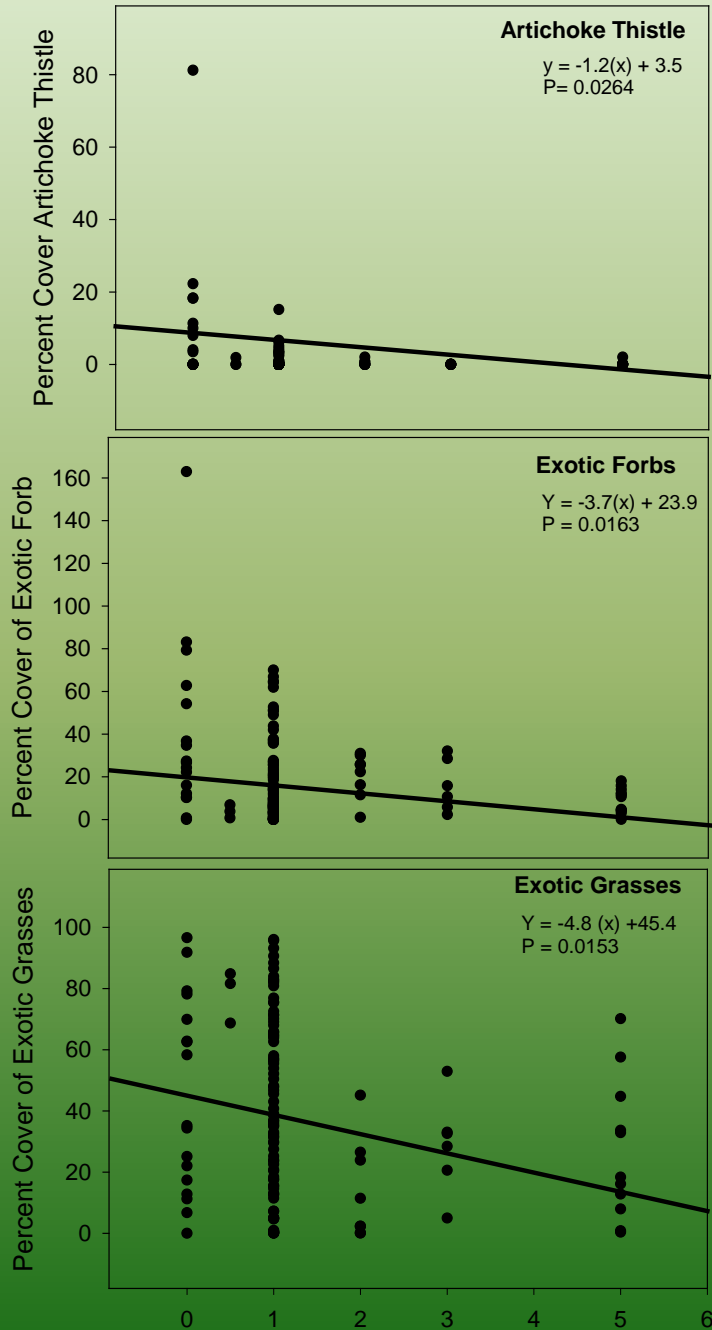


Increased number of years of herbicide treatment :

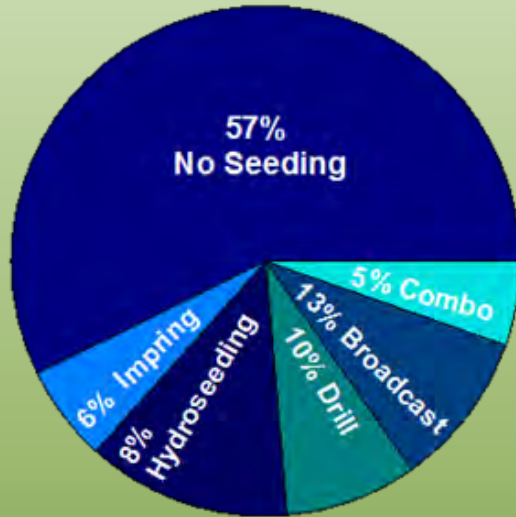
- reduced Artichoke Thistle and Exotic forbs
- did not effect exotic grasses or natives

Yearly Treatment Frequency

Increased treatment frequency reduces exotics and increases native shrub cover

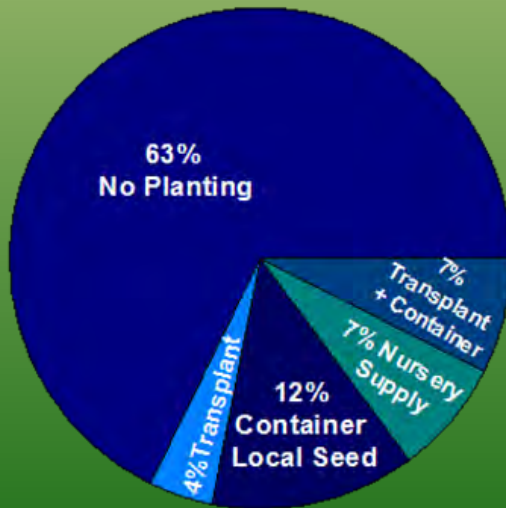


Reintroduction of Native Species.



- Only occurred in Intermediate and active restorations.

- 43% were seeded
- 37% were planted.

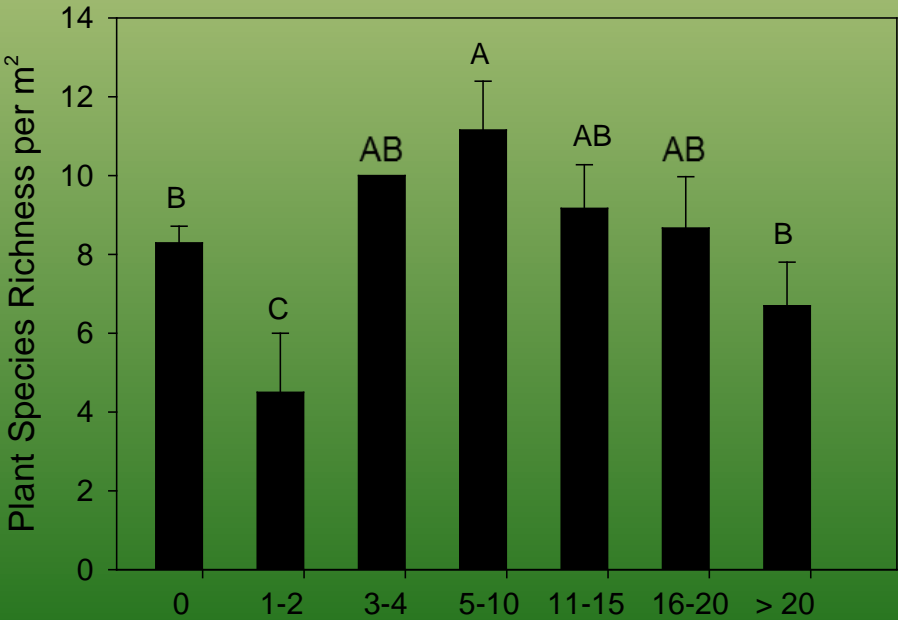
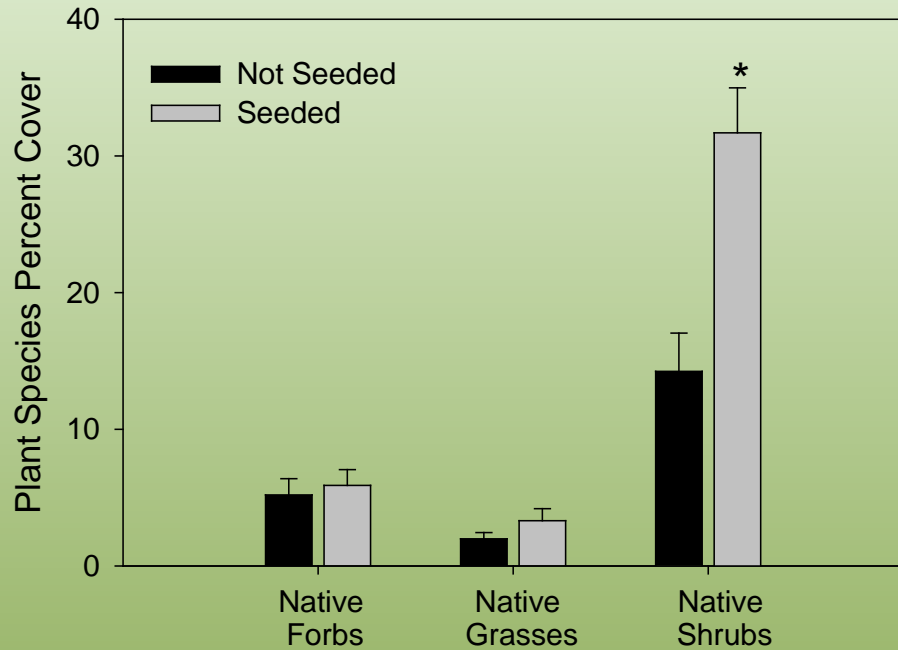


Does seeding and planting increase native richness and cover?

Seeding

Seeding in general only increased native shrub cover.

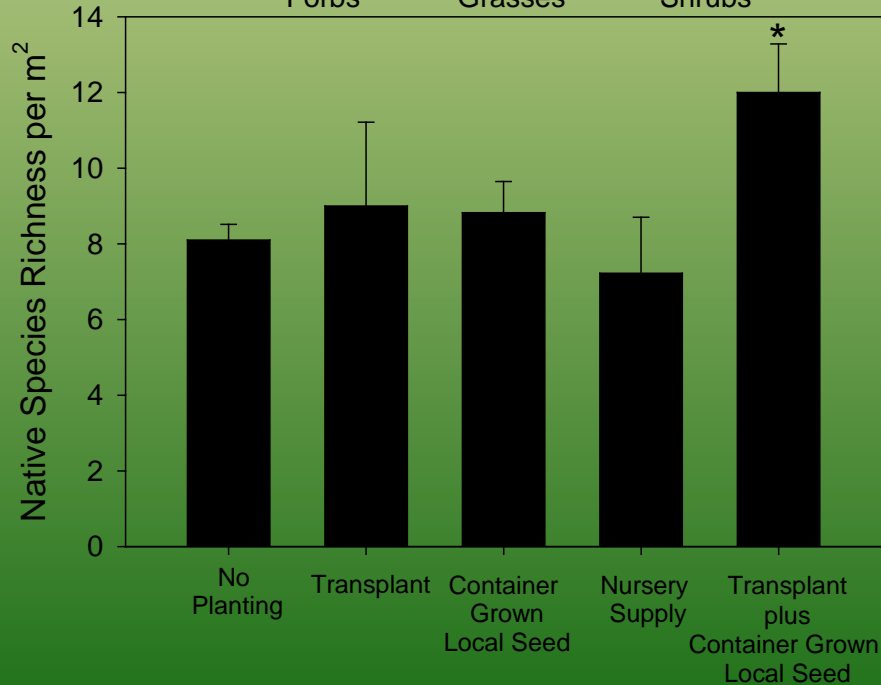
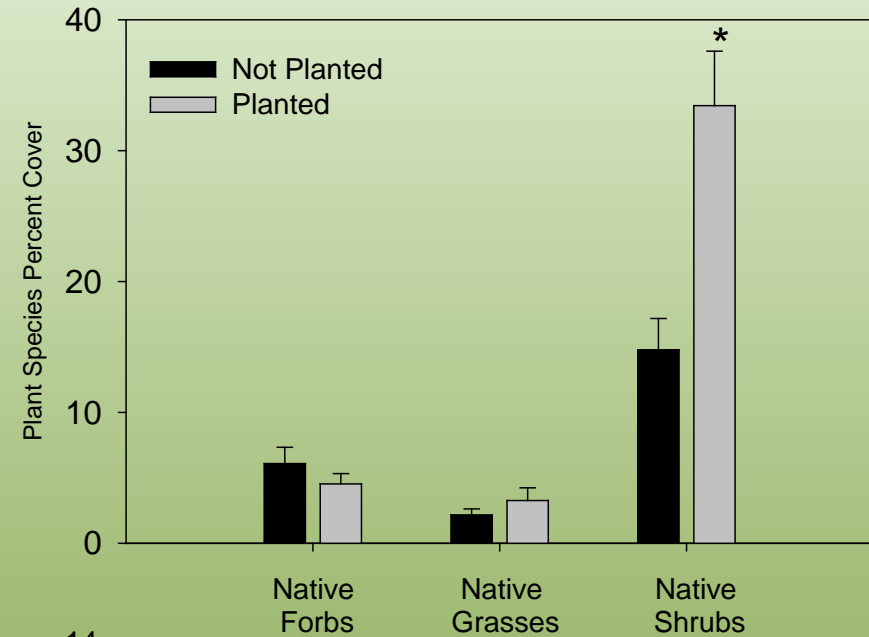
Greatest increases were associated with mixes of 5-10 species.



Planting

Planting increased native shrub cover only.

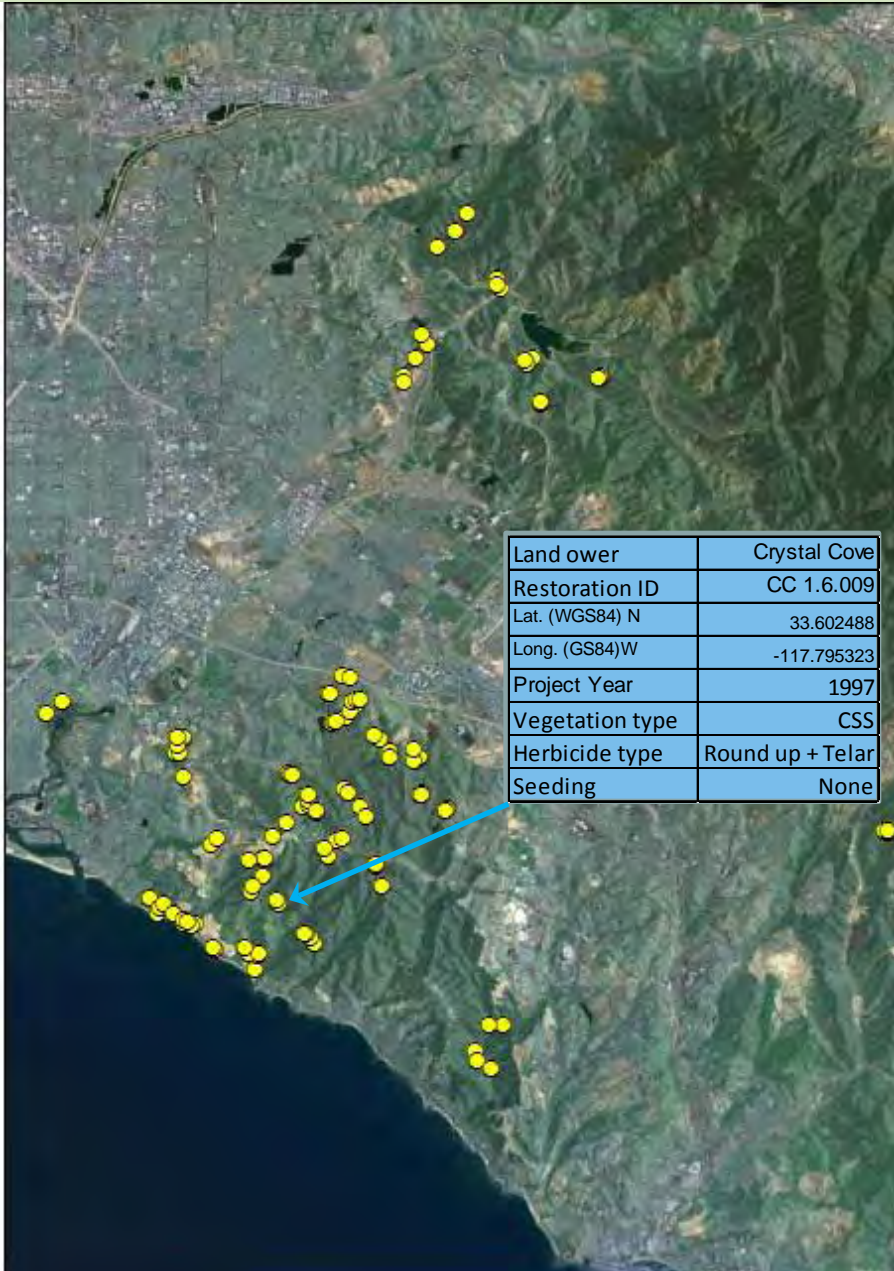
The combination of Transplant and Container grown local seed led to greatest increases in species richness.



Conclusions

- The most active management levels are most effective for reduction of exotic plants and increasing native shrub cover.
- Size of the restoration site did not impact plant community composition.
- Top soil application and mycorrhizae application increased native shrub cover and top soil reduced exotic grass cover
- The use of herbicide while effective for reducing target exotics and increasing native shrub cover, is not leading to recovery of native forb and grass species.
- Long-term maintenance and multiple treatments are most effective at reducing both exotic grasses and forbs.
- Seeding and planting increased native shrubs with transplant plus container grown local seed leading to greatest increases in native shrubs.

Where we want to take the tool



Future Directions

- Analysis of the interactions that may occur between restoration methods and environmental conditions.
- Assess the soil seed bank.
- Assessment of both the cost of restoration and public valuation of restoration.
- Web/GIS based tool to assist land managers in restoration site and method selection

Acknowledgements

Collaborators

Dr Katherine Suding

Dr Kris Preston

Dr. Seema Mangla

University of California Berkeley

Nature Reserve of Orange County

University of Connecticut

The Nature Conservancy

Irvine Ranch Conservancy

Partner Stakeholders

California State Parks

CA Department of Fish and Game

University of California Irvine

Orange County Parks

City of Newport Beach

City of Newport Beach

Funding agency

USDA

Thank you!

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