Long-term Effects of Shrub Treatments on Sagebrush Steppe Resilience and Diversity

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Diversity and resilience

Diverse Sagebrush Steppe

Differing Community Composition

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Ecological resilience

• Resilience
  – System’s ability to recover from disturbance
    (van der Maarel 1993)
  – Characterized by amount of disturbance system can withstand before transitioning to another stable state
    (Gunderson 2000)
Ecological resilience

- **Resilience**
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Legacy effects

- Sagebrush steppe
  - Shrub cover/biomass decline with treatment
  - Gradual recovery
Research Objective

- Assess resilience to shrub treatments
- Expected plant communities to be resilient and differences between treatment types

Chemical

Mechanical

Prescribed Fire
Study area

- Rich County, UT
  - Centered in sagebrush steppe distribution
  - Sagebrush steppe comprises >75% area
  - 50-year history of shrub treatments

- Field Sampling
  - Plant surveys across time-since-treatment and reference sites
Resilience to shrub treatment

• ANCOVA
  – Time since disturbance as factor of interest (covariate)
  – Controls for variation associated with time
  – Test whether disturbance effects exist over time and between treatment types
Resilience to shrub treatment

- Shannon diversity
  - Number of species present
  - Evenness (relative abundance)
  - Greater evenness increases diversity score
Resilience to shrub treatment

- **Simpson diversity**
  - Number of species present
  - Evenness (relative abundance)
  - Probability that two randomly selected species will be the same

![Graph showing Simpson diversity over years since disturbance](image)
Resilience to shrub treatment

• Scored on similarity to pre-treatment conditions (reference communities)

• Jaccard similarity
  \[ 0 < \text{Jaccard} < 1 \]
Resilience to shrub treatment

- Scored on similarity to pre-treatment conditions (reference communities)

- Simpson dissimilarity $0 < \text{Simpson} < \infty$
Community composition

Proportion of total richness vs. Time Since Disturbance

- Native Forb
- Native Grass
- Non-native Forb
- Non-native Grass

Methods

- Chemical
- Mechanical
- Fire

Results Discussion

Context Introduction

Methods

Results Discussion
Community composition

Proportion of total richness

Chemical

Fire

Mechanical

Native Forb

Native Grass

Non-native Forb

Non-native Grass

Time Since Disturbance

Context

Introduction

Methods

Results

Discussion
Conclusions

• Expected
  – Plant community to show resilient response to shrub treatments
  – Differences between treatment types

• Observed
  – Flat, linear response
  – No indication of return to pre-treatment conditions within 50-years
  – Differences between treatment types
Conclusions

• Fire and chemical treatments produce plant communities that are most similar to each other over the long-term
• Mechanical treatments lead to plant communities different from fire, chemical
• All three treatment types create plant communities significantly different from pre-treatment conditions (reference sites)
The end of my tale...

Questions?