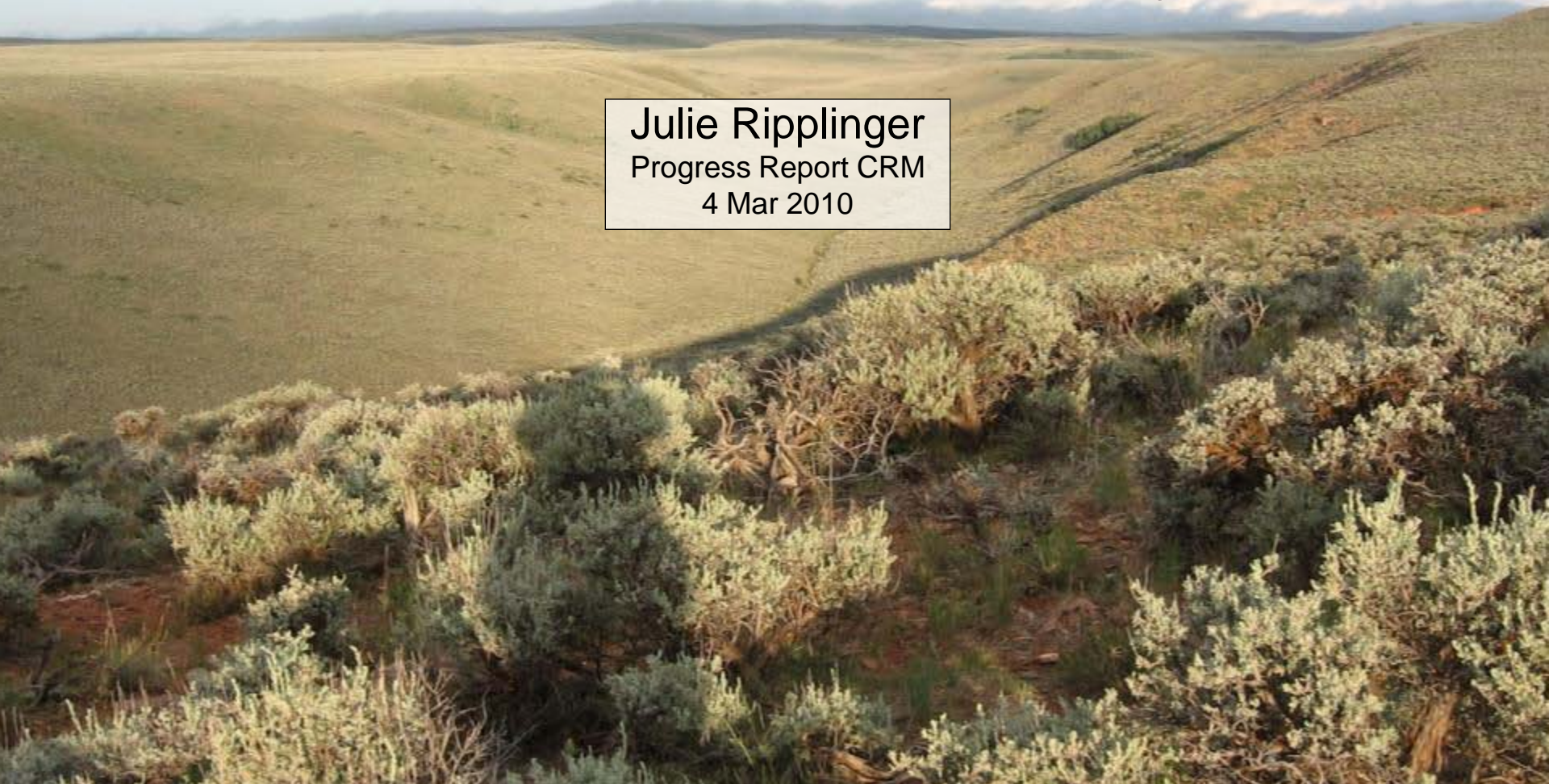
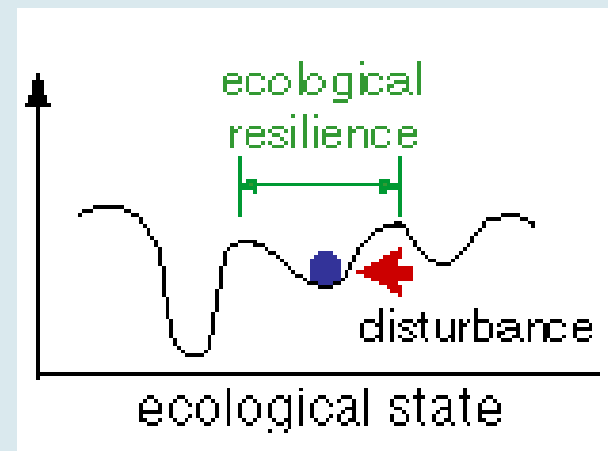


# Long-term Effects of Shrub Treatments on Sagebrush Steppe Resilience and Diversity

Julie Ripplinger  
Progress Report CRM  
4 Mar 2010



# Diversity and resilience



# Ecological resilience

- Resilience



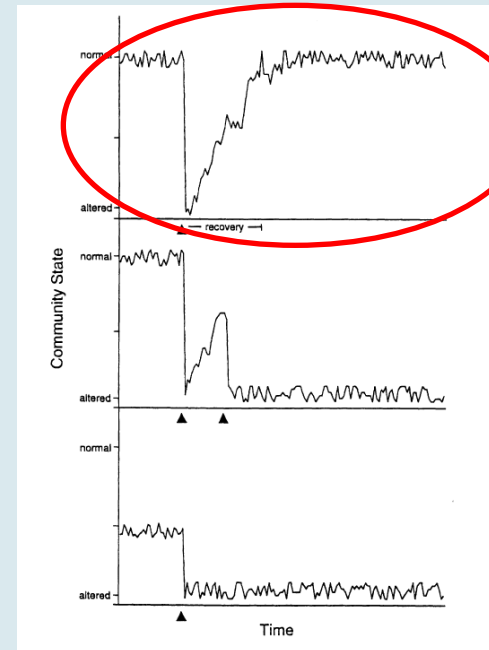
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- System's ability to recover from disturbance

(van der Maarel 1993)

- Characterized by amount of disturbance system can withstand before transitioning to another stable state

(Gunderson 2000)



Paine et al. 1998

# Ecological resilience

- Resilience



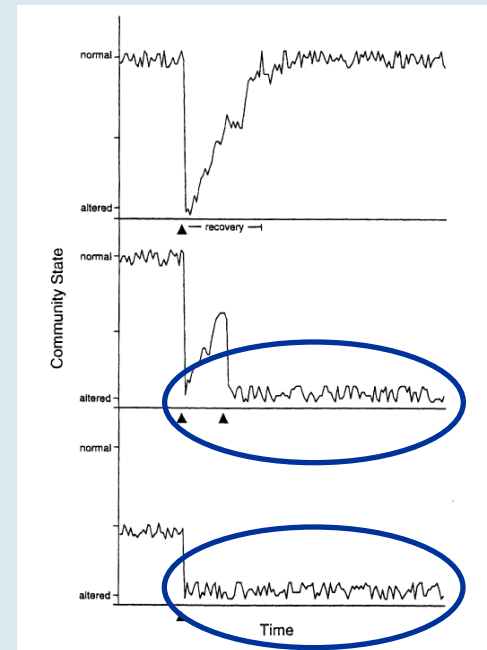
open.salon.com

- 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)



Paine et al. 1998

# Legacy effects

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

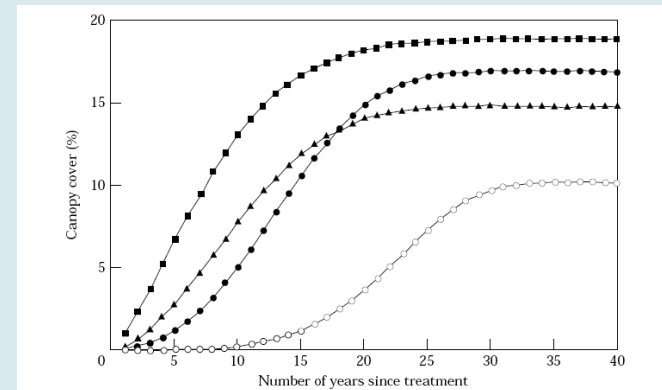


Figure 1. Expected Wyoming big sagebrush recovery paths calculated at a control level of 13.5% canopy cover. All long-term treatment effects were significantly different ( $P \leq 0.025$ ) except between burn and control. ○ = Burn; ■ = plow and seed; ▲ = rotocut; ● = chemical spray.

Watts and Wambolt 1996

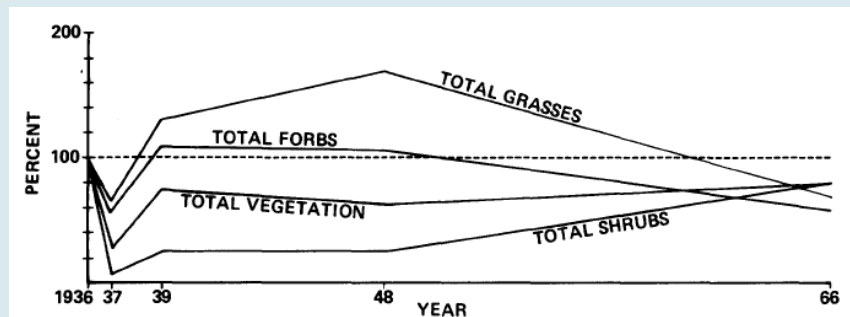


Fig. 1. Trends of species classes on a planned burn near Dubois, Ida., 1936-1966. Values on burned plots are adjusted for the natural variation between years.

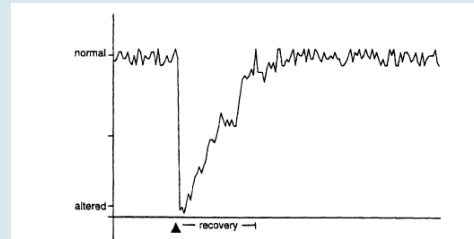
Harness and Murray 1973

# Research Objective

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

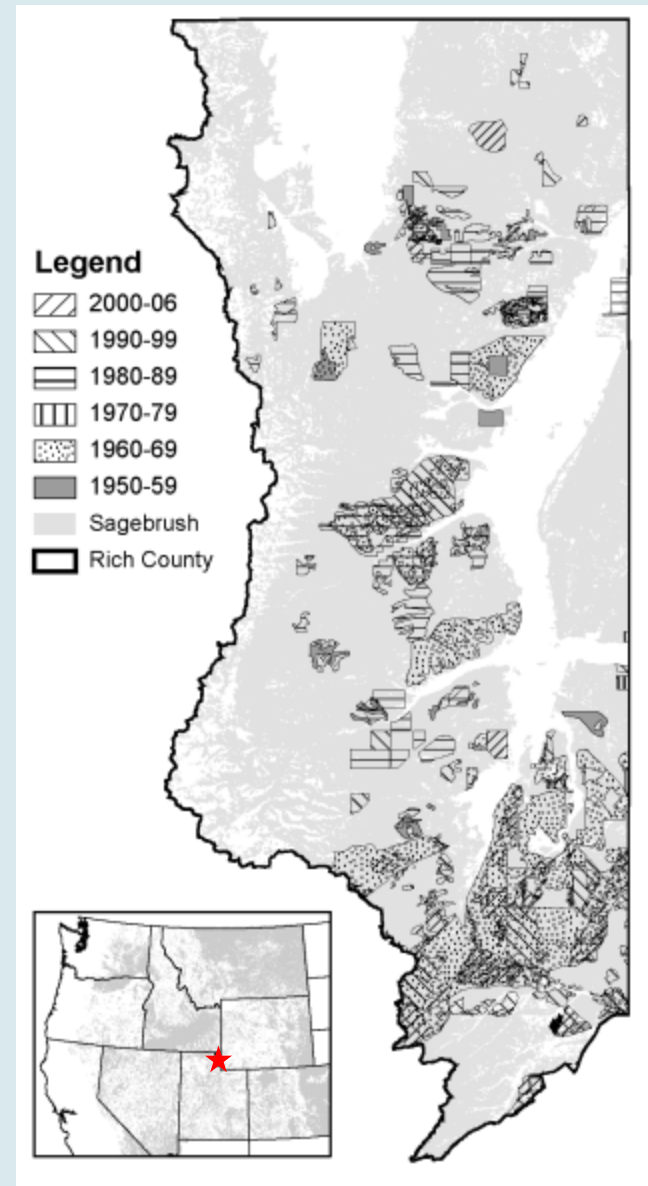


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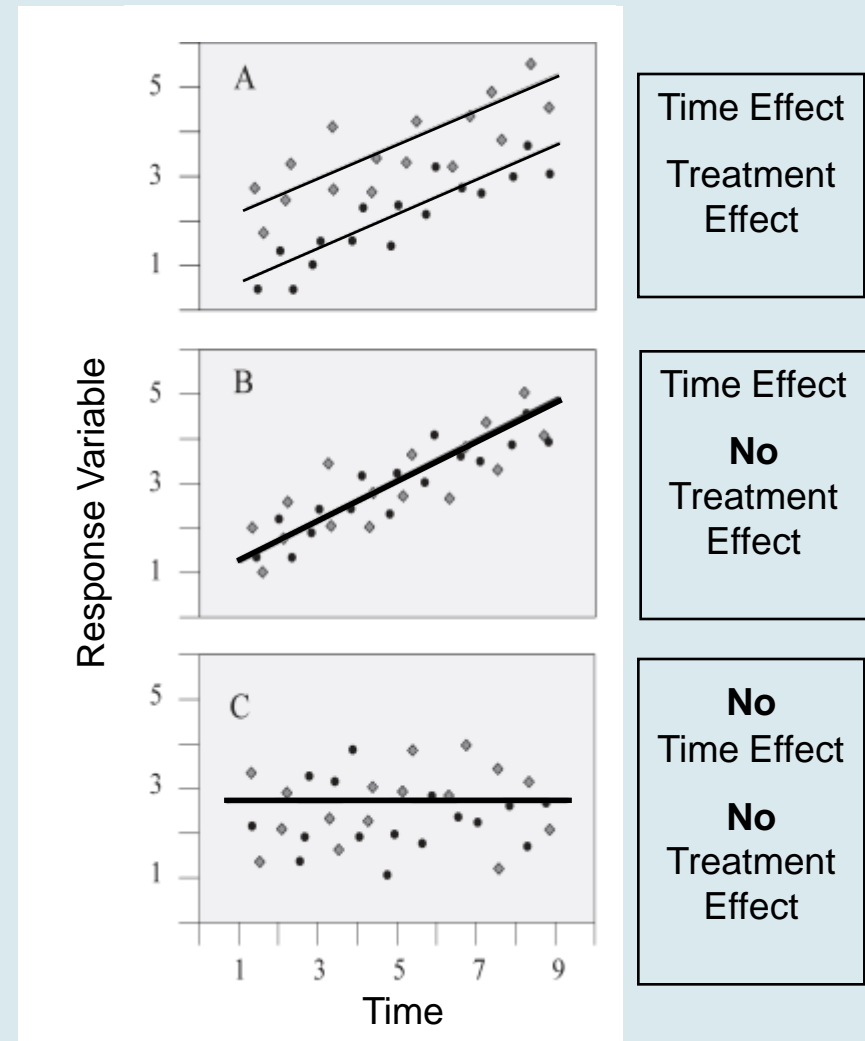
# Study area

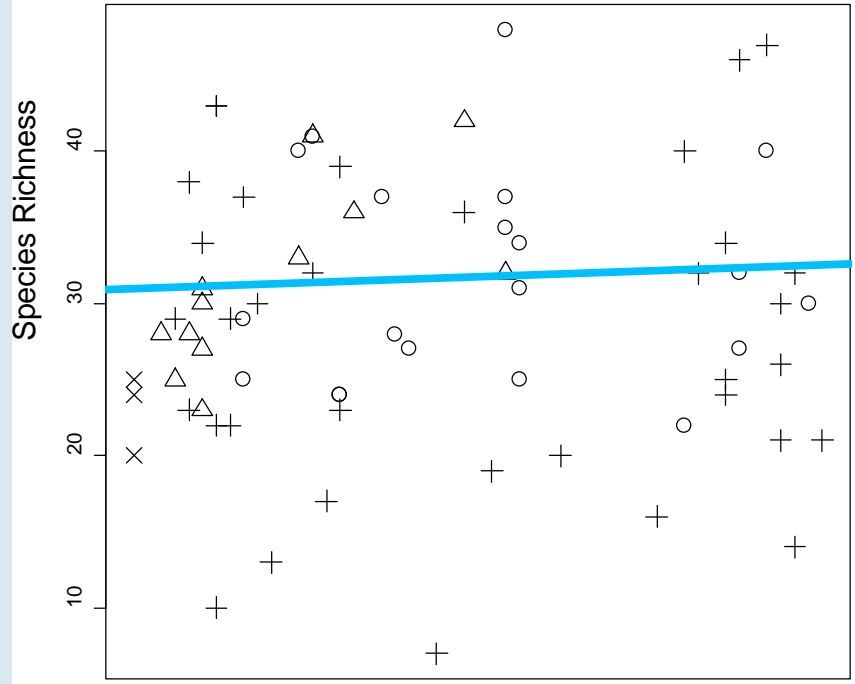
- Rich County, UT
  - Centered in sagebrush steppe distribution
  - Sagebrush steppe comprises >75% area
  - 50-year history of shrub treatments
- Field Sampling
  - Plant surveys across time-since-treatment and reference sites



# Resilience to shrub treatment

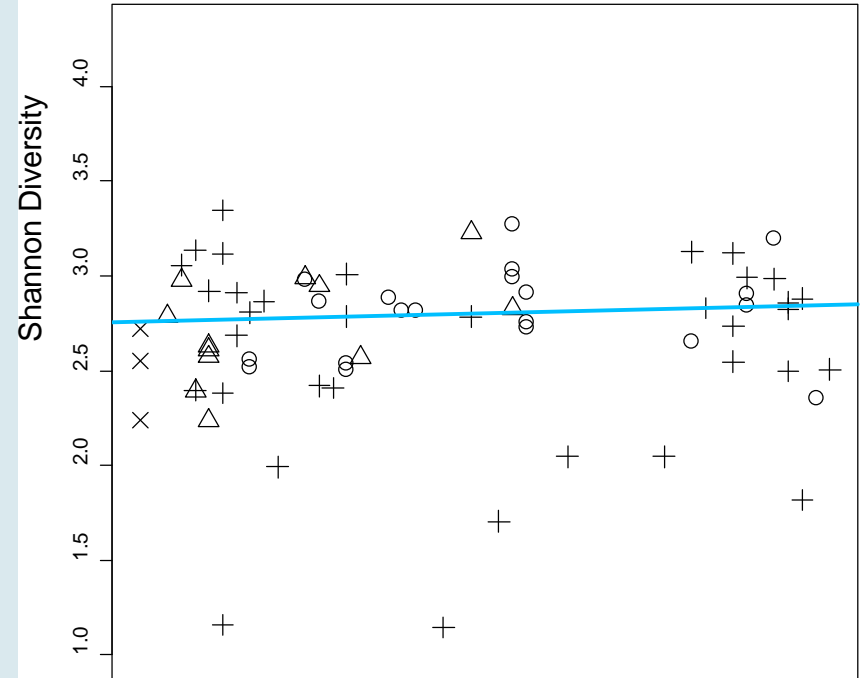
- ANCOVA
  - Time since disturbance as factor of interest (covariate)
  - Controls for variation associated with time
  - Test whether disturbance effects exist over time and between treatment types





# Resilience to shrub treatment

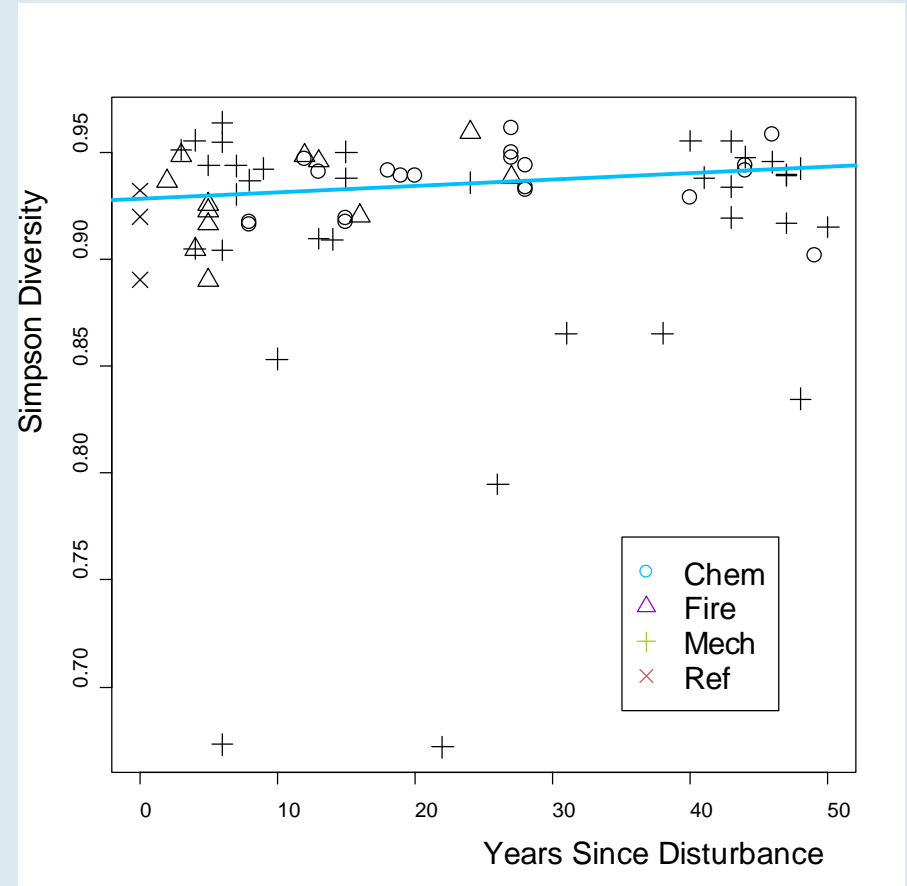
- Shannon diversity
  - Number of species present
  - Evenness (relative abundance)
  - Greater evenness increases diversity score



# Resilience to shrub treatment

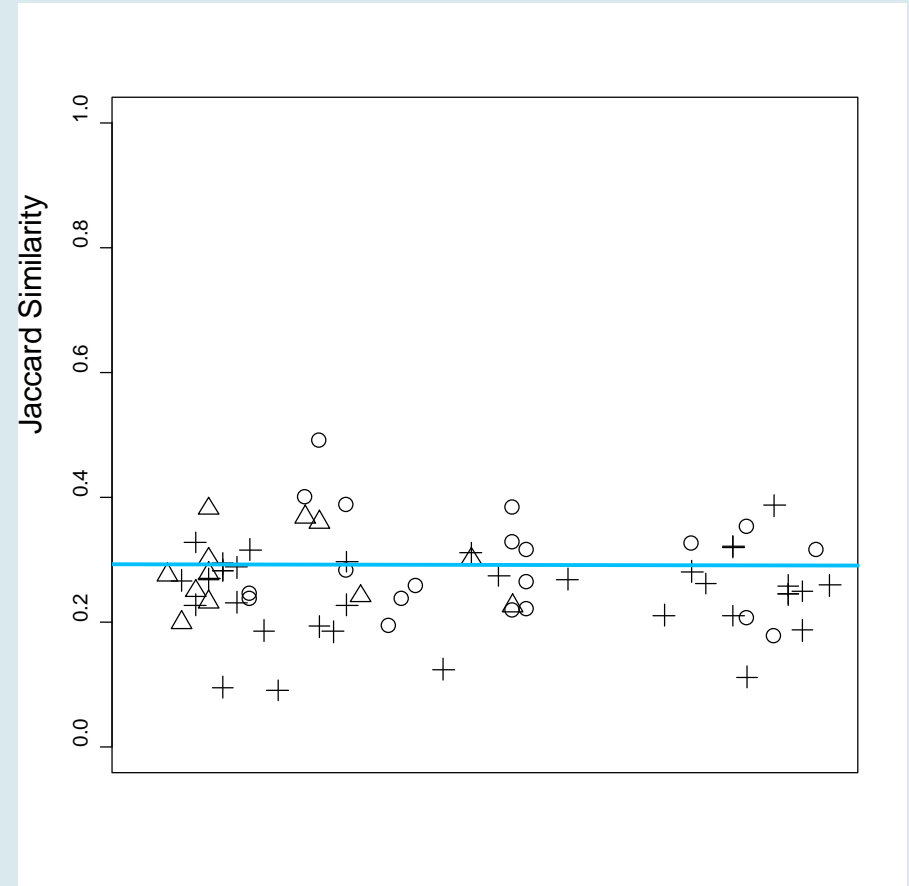
- Simpson diversity

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



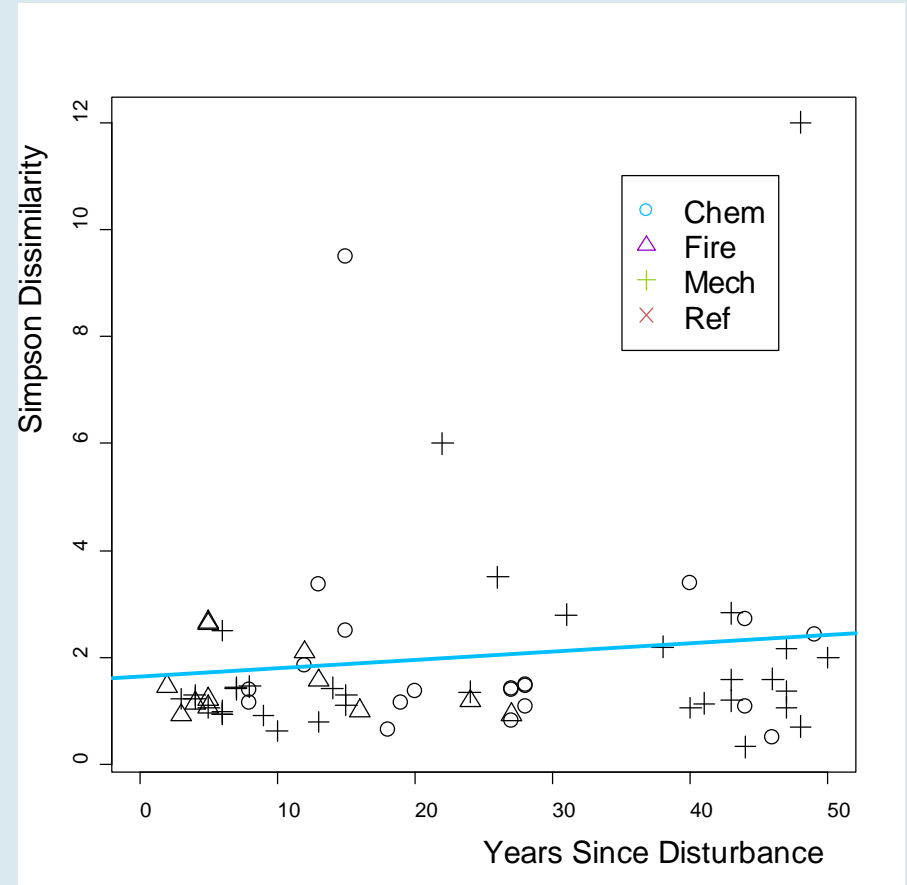
# Resilience to shrub treatment

- Scored on similarity to pre-treatment conditions (reference communities)
- Jaccard similarity  
 $0 < \text{Jaccard} < 1$

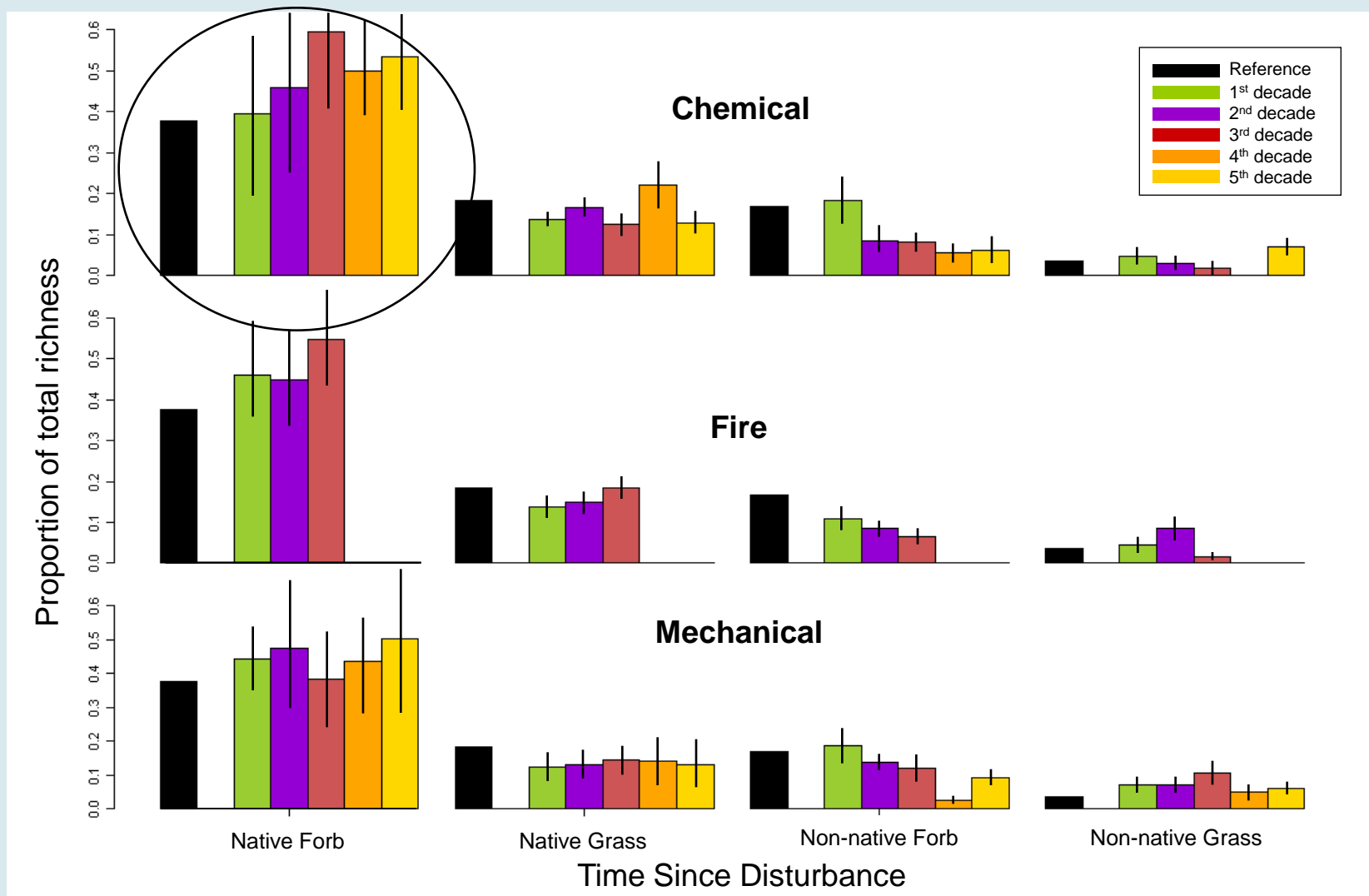


# Resilience to shrub treatment

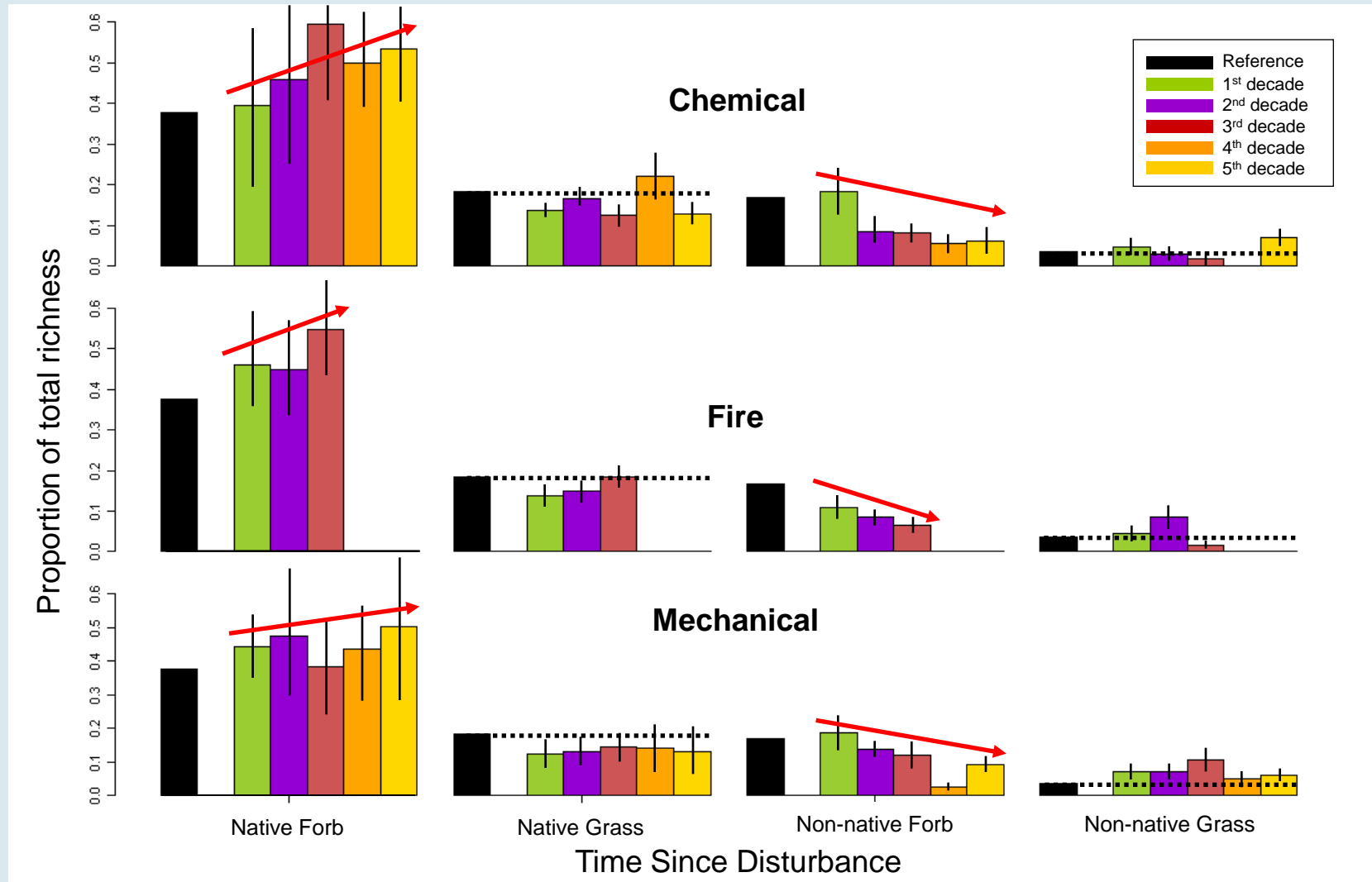
- Scored on similarity to pre-treatment conditions (reference communities)
- Simpson dissimilarity  
 $0 < \text{Simpson} < \infty$



# Community composition

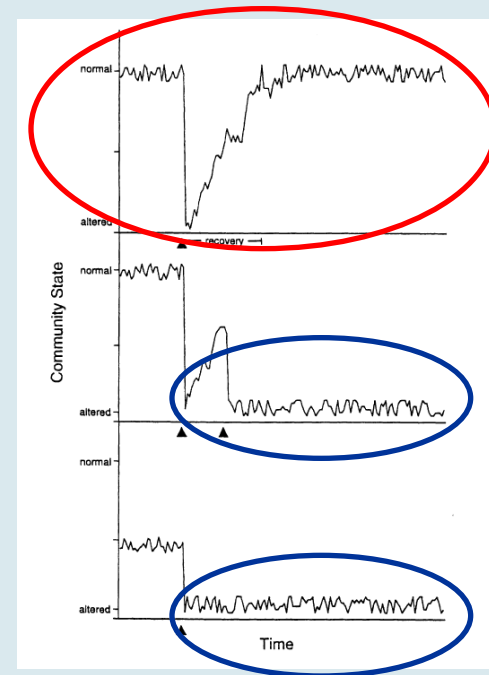


# Community composition



# 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?**