

## Managing to Coastal Prairie to Conserve Biological Diversity

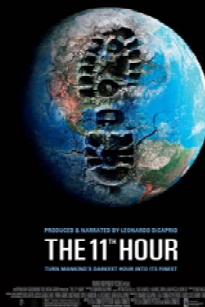
Grey Hayes, PhD  
Elkhorn Slough  
Coastal Training Program

## Outline of Talk

- Threats
- Stewards
- Management goals
- Tools
  - Grazing
  - Fire
- Conclusions/recommendations

## Threats

## Global Warming

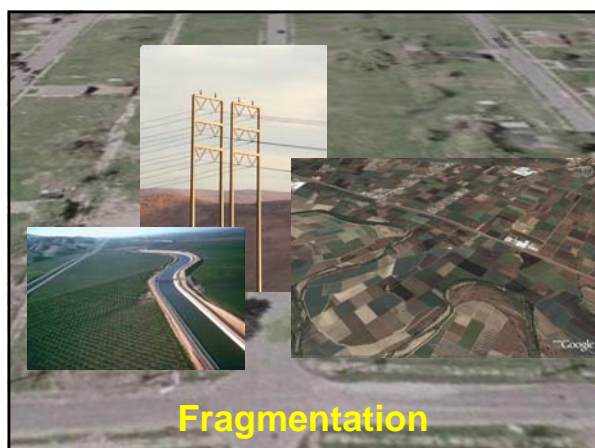
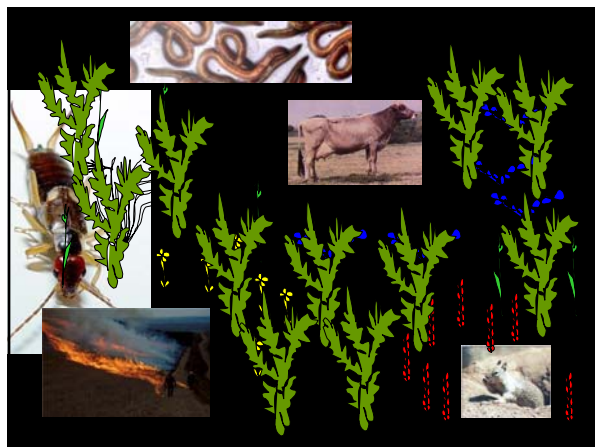


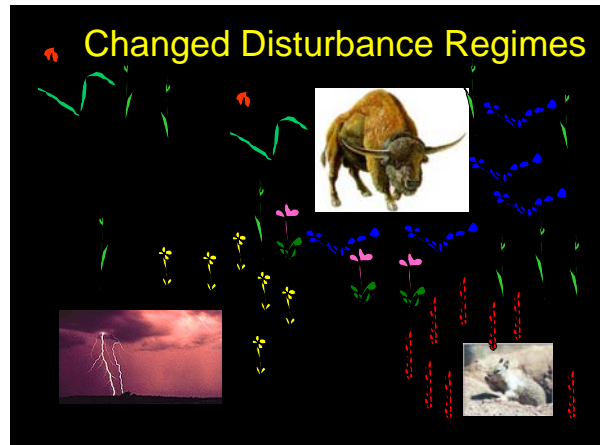
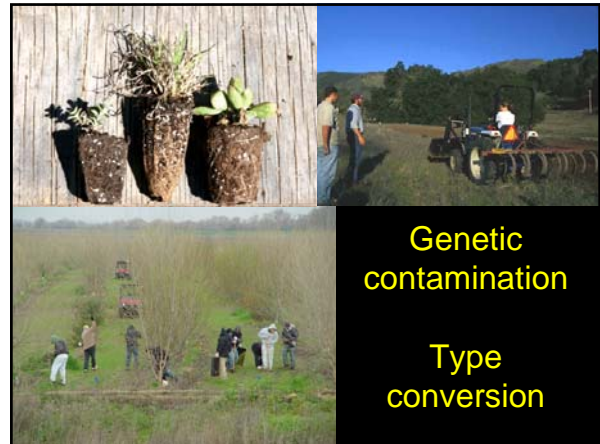
## Genetically Modified Organisms



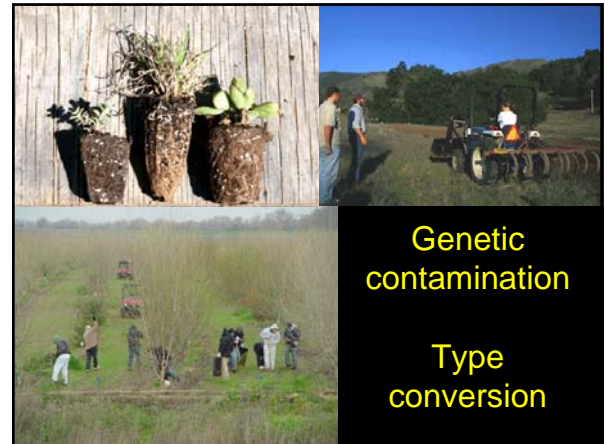
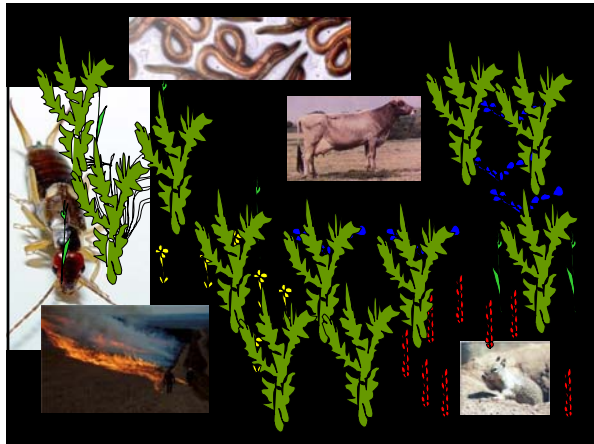
## Changed Disturbance Regimes











Genetic contamination

Type conversion

Who is Involved?

The Land Use Planner, Regulators and Consultants



Restorationists and Land Managers



Scientists



## Grassland Managers

- >250 public land managers in Central California
- > 50% of publically owned grasslands in the SF Bay area actively managed

Elkhorn Slough Coastal Training Program 2005 Grassland Manager Survey Results

## Public Grassland Manager Goals

- Reduce all non-native species
- Increase targeted sensitive species
- Increase native grasses

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## Private Grassland Manager Priorities

- Maintain way of life
- Maintain/increase productivity
  - Increase perennial grasses
- Sustain wildlife

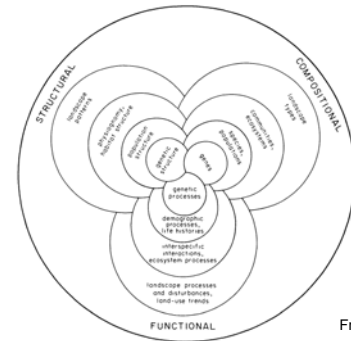


## Restorationists and Land Managers

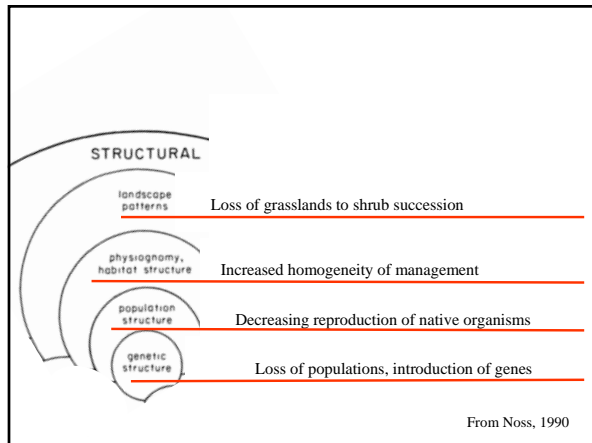


## Goals

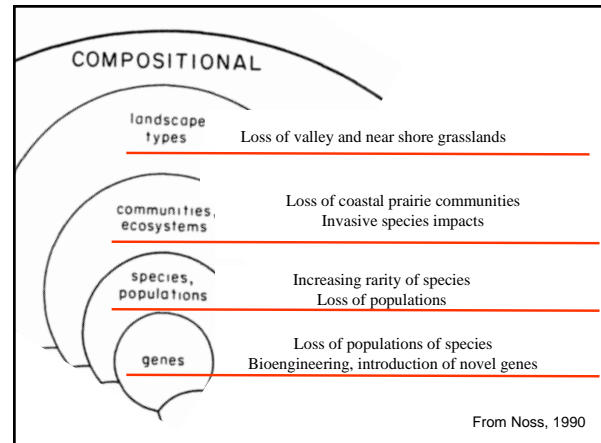
## What is Biodiversity?



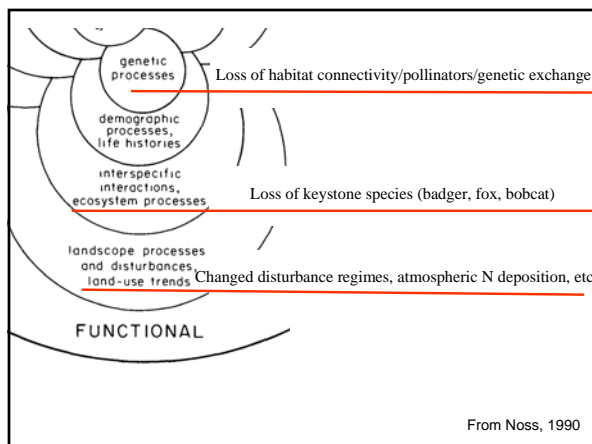
From Noss, 1990



From Noss, 1990



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From Noss, 1990

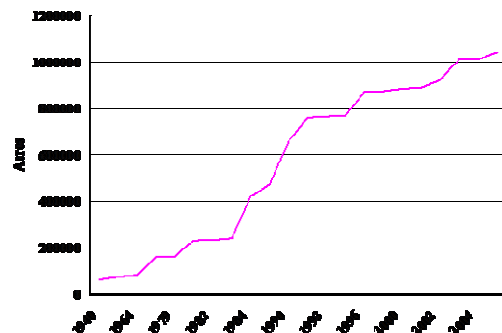
## Public Grassland Manager Goals

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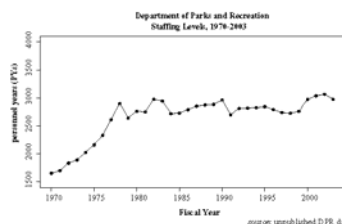
## Why such simple goals?

## Acres of grassland-oriented conservation purchases



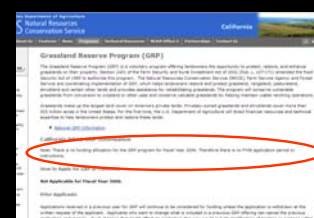
## The Public Lands Manager

- Parcels are not visited yearly
- <1 staff person for 16,000 acres
- Loss of endangered species = greater burden on private property owners



Holloran, P., and D. Press. 2005. Obstacles to Land Stewardship in California. Draft Report

## Policy Failures



8.3 million private  
grassland acres  
45 advisors  
=  
185,000 acres  
of grassland each



## The Scientist

- Almost no reserve design studies
- A few species-specific studies  
(mostly dominant grasses)
- Many studies on invasives, with little application
- 27 fire studies; 19 useful for meta-analysis
- 25 grazing studies; 6 useful for meta-analysis

## Public Grassland Manager Goals

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- Increase native grasses

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### New, Improved Goals Might Look Like...

- Maintain native species diversity
- Restore/maintain/increase specific species
- Maintain structure
  - Tall vs. short canopy
  - Shrub/tree vs. herbaceous cover
- Control specific invasive species

### New, Improved Goals Might Look Like...

- Maintain native species diversity
- Restore/maintain/increase specific species

Just because you can't see it  
doesn't mean its not there



It takes a long time to prove that  
something's not there



If its not there....  
you might need to plant it

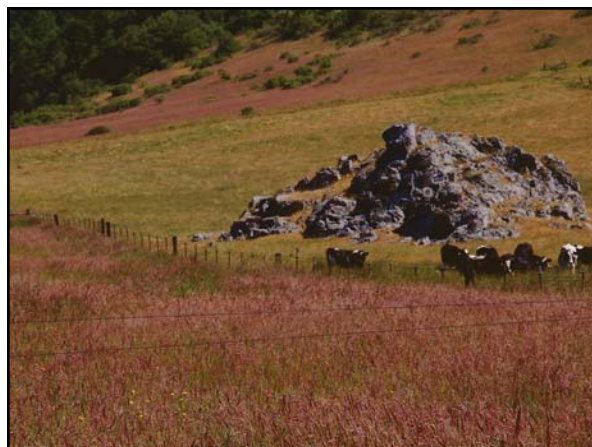
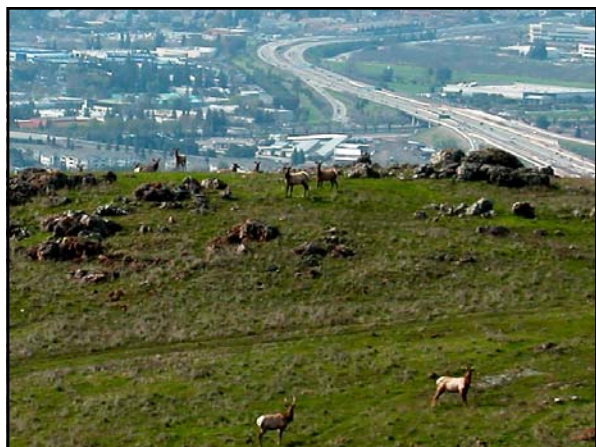


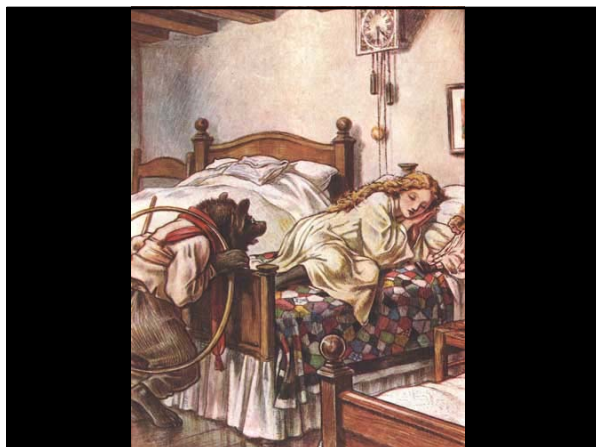
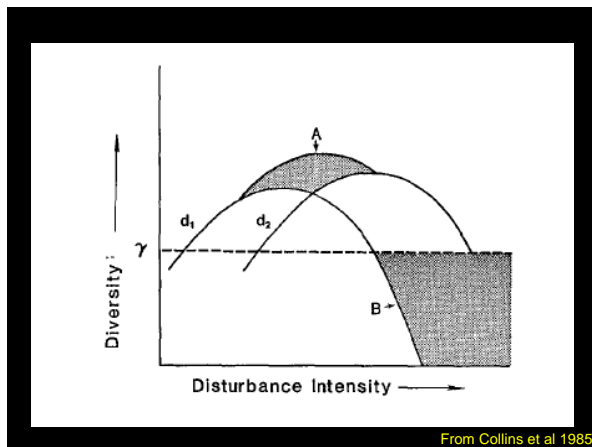


## Tools

## Evolutionary Disturbance Regimes

Grazing, Fire, and Soil  
Disturbances









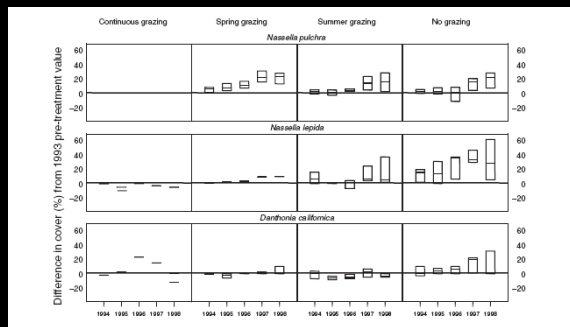
## Grazing effects



## Grazing Literature Summary

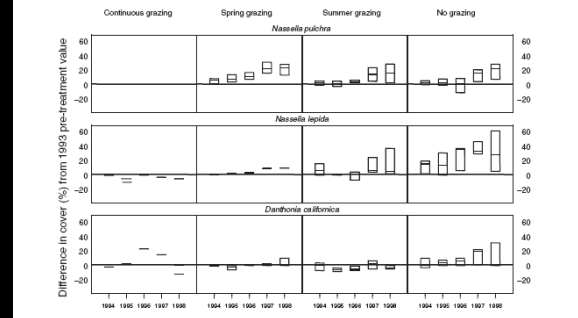
- "Variable, non-equilibrium system"
- Large site variability
- Season of grazing may matter
  - Mixed results for different sites/species
  - Growing season/spring greatest positive effect for perennial grasses
- Removal of grazing changes system
  - Change in perennial grass abundance
  - Increase in shrub and tree cover
  - Loss of annual wildflowers
- Little data on class of grazing animal
  - Elk similar to cow
  - Horse dissimilar to cattle
- Species specific responses

## Season of grazing effects



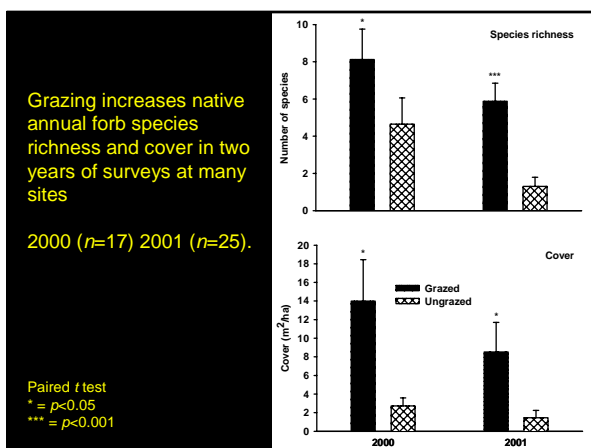
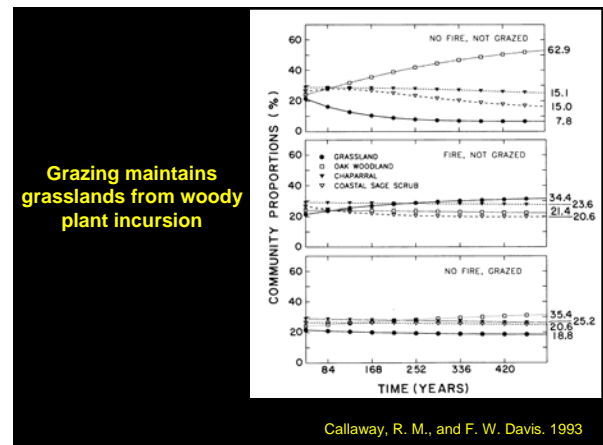
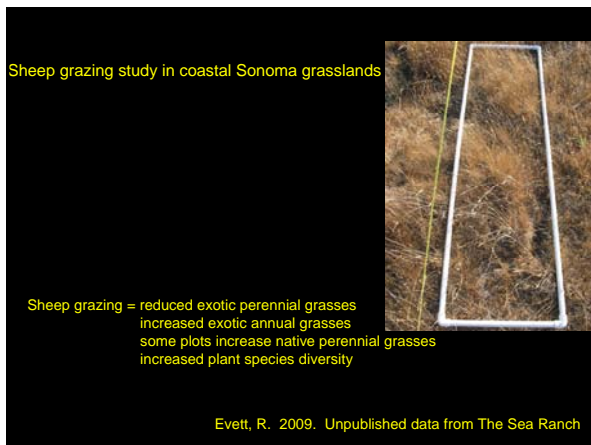
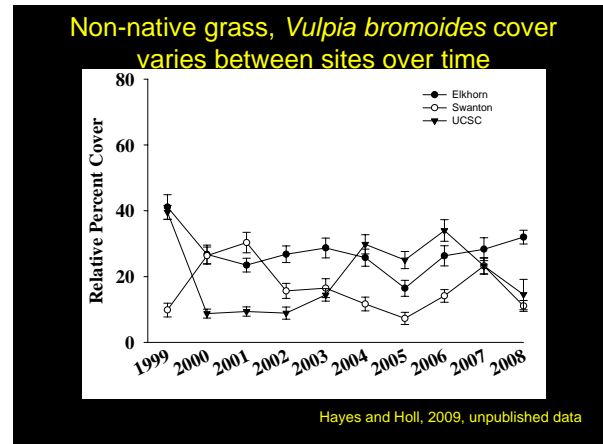
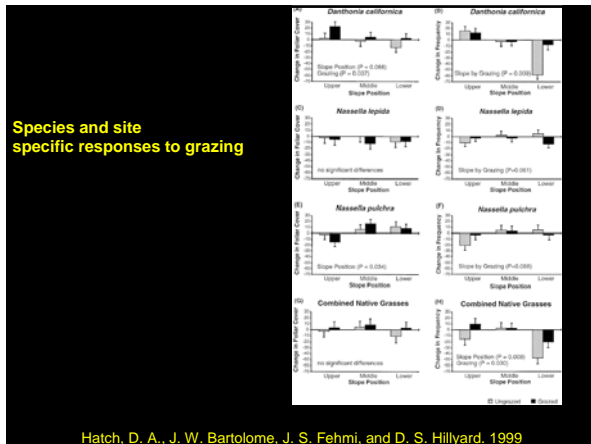
Bartolome, J. W., J. S. Fehmi, R. D. Jackson, and B. Allen-Diaz. 2004

## Species specific grazing effects



Bartolome, J. W., J. S. Fehmi, R. D. Jackson, and B. Allen-Diaz. 2004





## Fire effects

- Reduces woody vegetation
- Species-specific native grass effects

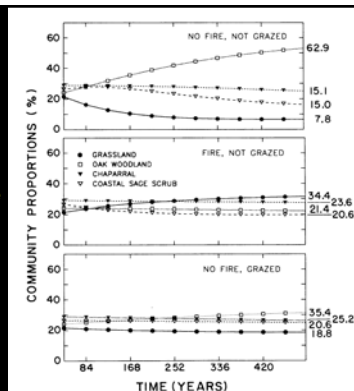
## Fire and woody species control

Table 2. Average percent survival and average proportional change in cover (%) of woody species within treatment areas between 1994 and 1995 and between 1994 and 1997. Reported values are untransformed means. Positive values of cover indicate increases in abundance after manipulation; negative values show declines. *P* is the probability that survival and changes in cover differed significantly among treatments just by chance (Friedman's Rank Sum Test). Treatment means with the same letters were statistically indistinguishable.

		Treatment				<i>P</i>
		Burn	Hand-Removal	Mow	Control	
Survival	1995	33.3b	60.0ab	88.3a	83.3a	0.03
Cover	1994-1995	-0.91bc	-0.82c	-0.44ab	-0.32a	0.02
	1994-1997	-0.63b	-0.70b	0.25a	0.20a	0.00

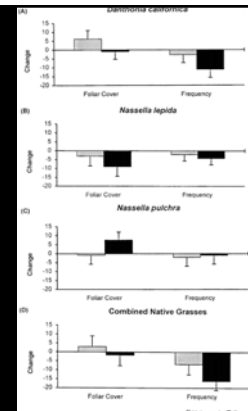
Clark, D. L., and M. V. Wilson. 2001

## Fire prevents grassland to shrub/tree conversion



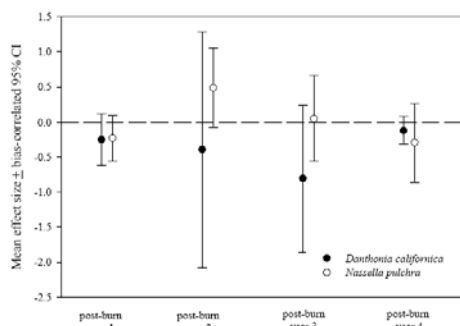
Callaway, R. M., and F. W. Davis. 1993

## Burning affects different native grass species differently



Hatch, D. A., J. W. Bartolome, J. S. Fehmi, and D. S. Hillyard. 1999

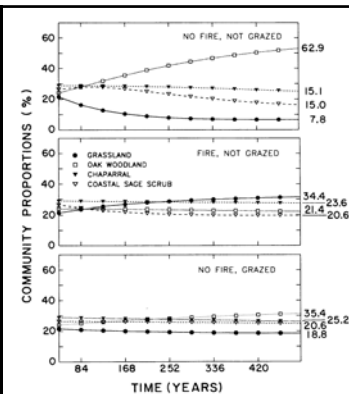
Figure 5. Post-burn abundance mean effect size of *Nassella pulchra* and *Danthonia californica*, all fire treatments 1-4 years after fire.



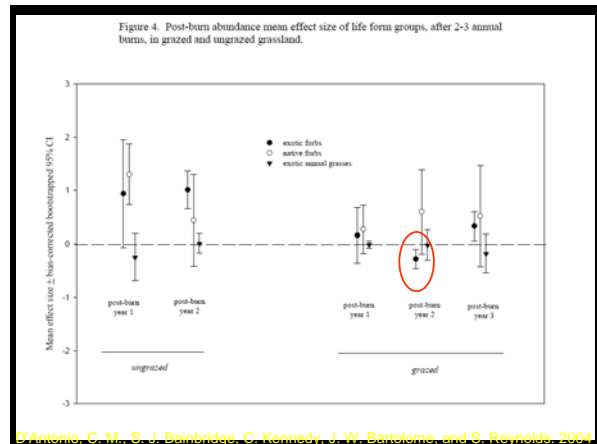
D'Antonio, C. M., S. J. Bainbridge, C. Kennedy, J. W. Bartolome, and S. Reynolds. 2004

## Mixing: Fire and Burning

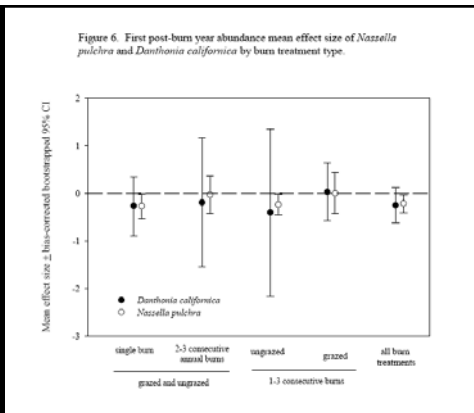
Without fire or grazing:  
Loss of coastal grassland



Callaway, R. M., and F. W. Davis. 1993



D'Antonio, C. M., S. J. Bainbridge, C. Kennedy, J. W. Bartolome, and S. Reynolds. 2004

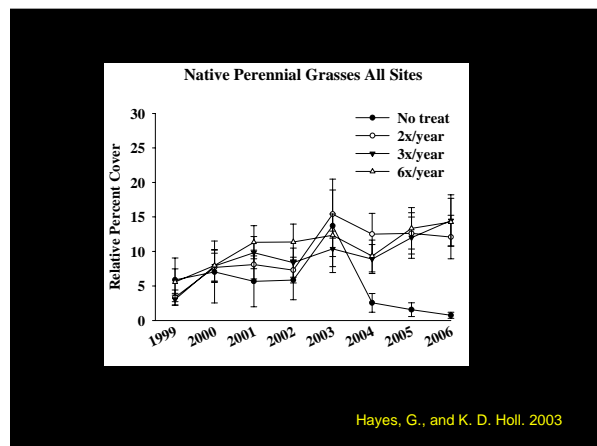


D'Antonio, C. M., S. J. Bainbridge, C. Kennedy, J. W. Bartolome, and S. Reynolds. 2004



## Mowing Effects

- Mowing may maintain native grasses
- Infrequent mowing may maintain forb diversity; more frequent mowing may not



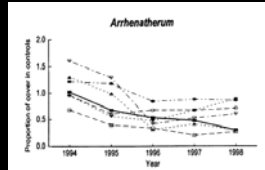
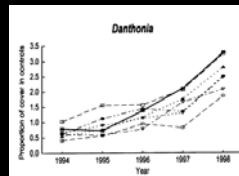
Hayes, G., and K. D. Holl. 2003



### Single Spring Mowing

Increases *Danthonia cal.*  
Decreases exotic perennial grass

(varying mowing timing/intensity)



Wilson, M. V., and D. L. Clark. 2001.

Grass and forb species richness  
In coastal prairie in response to mowing

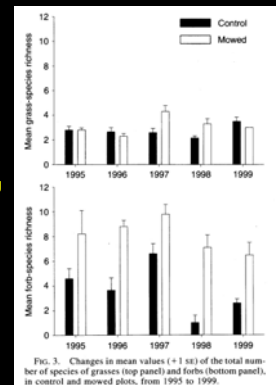


FIG. 3. Changes in mean values ( $\pm 1$  SE) of the total number of species of grasses (top panel) and forbs (bottom panel), in control and mowed plots, from 1995 to 1999.

Maron, J. L., and R. L. Jefferies. 2001

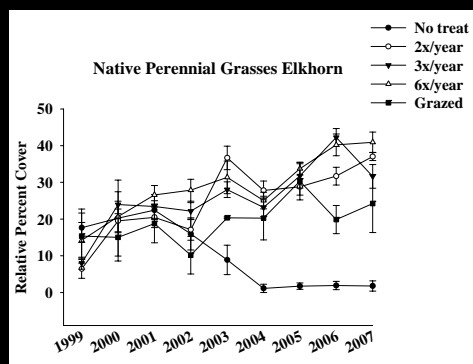
## Conclusions

- Disturbance regimes can assist in maintaining aspects of coastal prairie biodiversity
- More information is needed

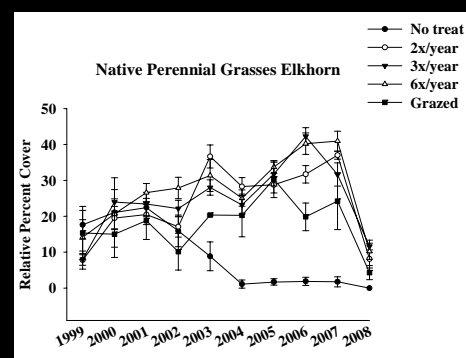
## Recommendations

- Define reference system
- Define goals
- Cooperate and vary management regimes across landscape
- Overlay management tools
- Wait and monitor before changing

## Wait and Monitor....



## Wait and Monitor....



### If you are a regulator...

- Is the reference system defined?
- Are the goals defined and reasonable?
- Is there enough time to see effects?
- Is there enough funding to manage?

### Public Grassland Manager Goals

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