Artichoke Thistle (*Cynara cardunculus*) control efforts and community recovery in historic southern California rangeland

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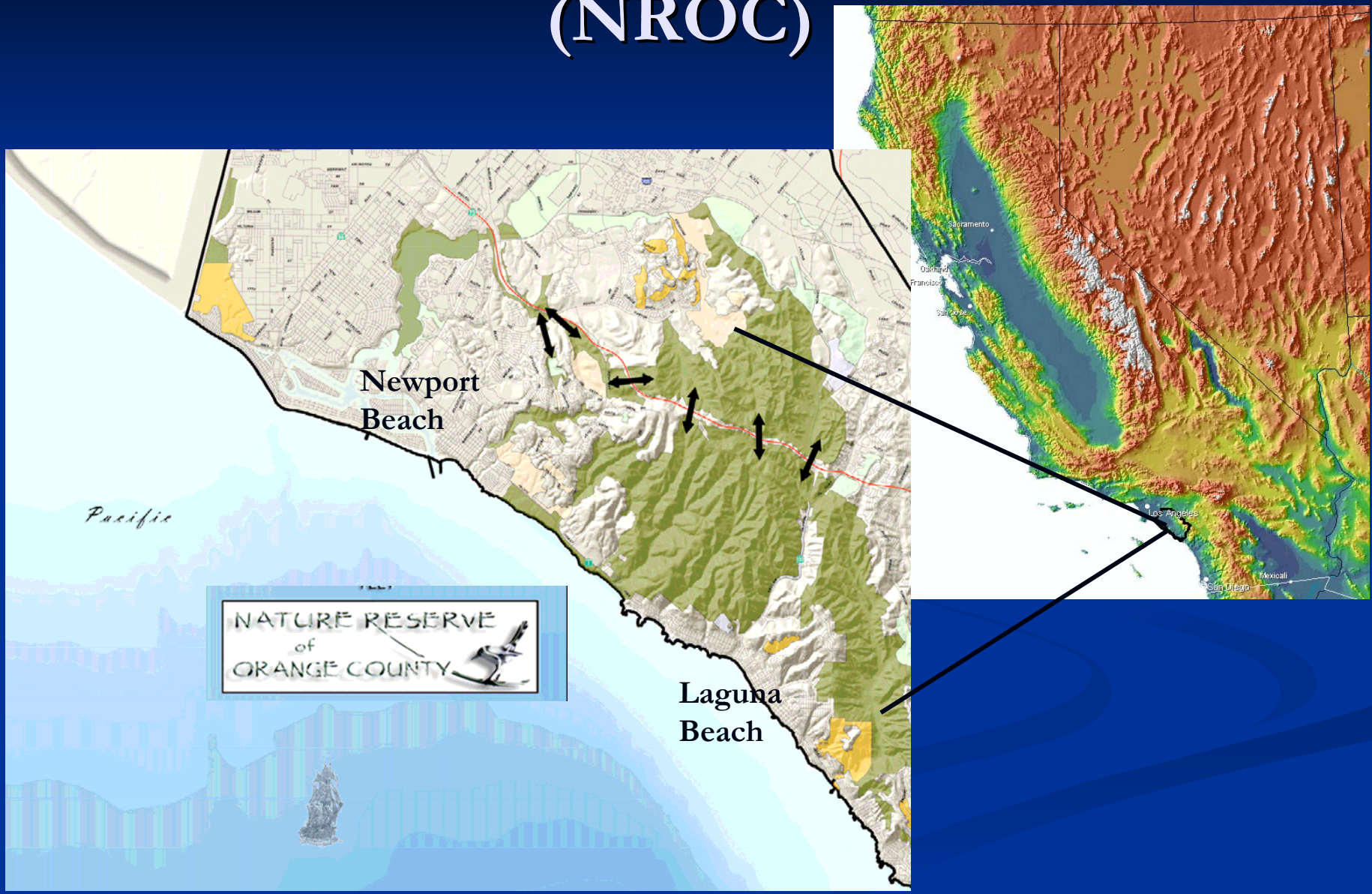


Artichoke Thistle Invasion

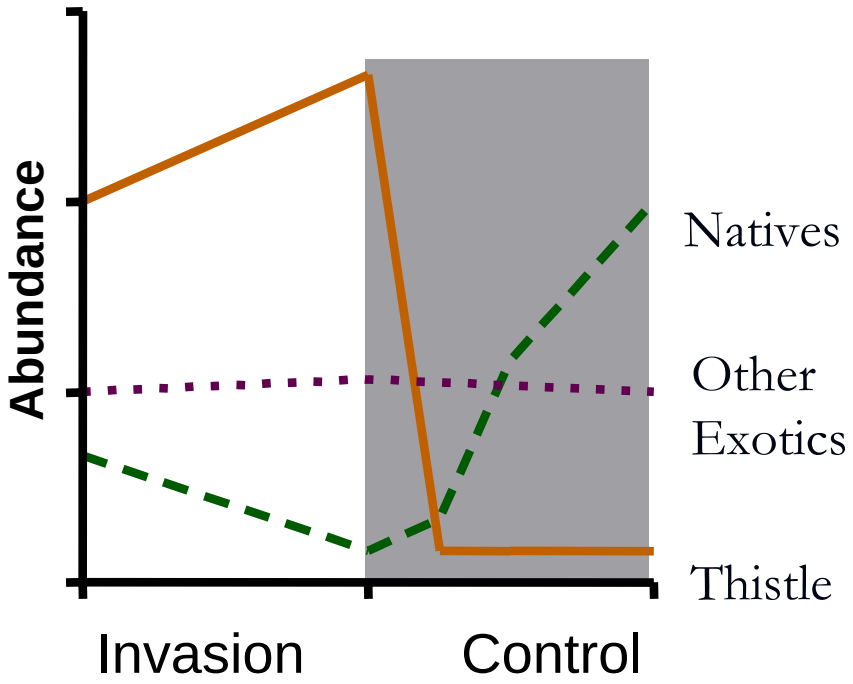
- **Native to the Mediterranean**
  - Escaped cultivation as early as the 1880s in California
  - Problematic rangeland invader here since the 1930s
  - Invades disturbed coastal grasslands, particularly in Southern California
- **NROC Control program started in 1994**
  - spot broadleaf herbicide (Transline)
  - >4,000 acres treated

Important Questions

Is the control program reducing Artichoke thistle cover? How is success related to treatment history?

What is replacing Artichoke thistle? Is passive restoration occurring?

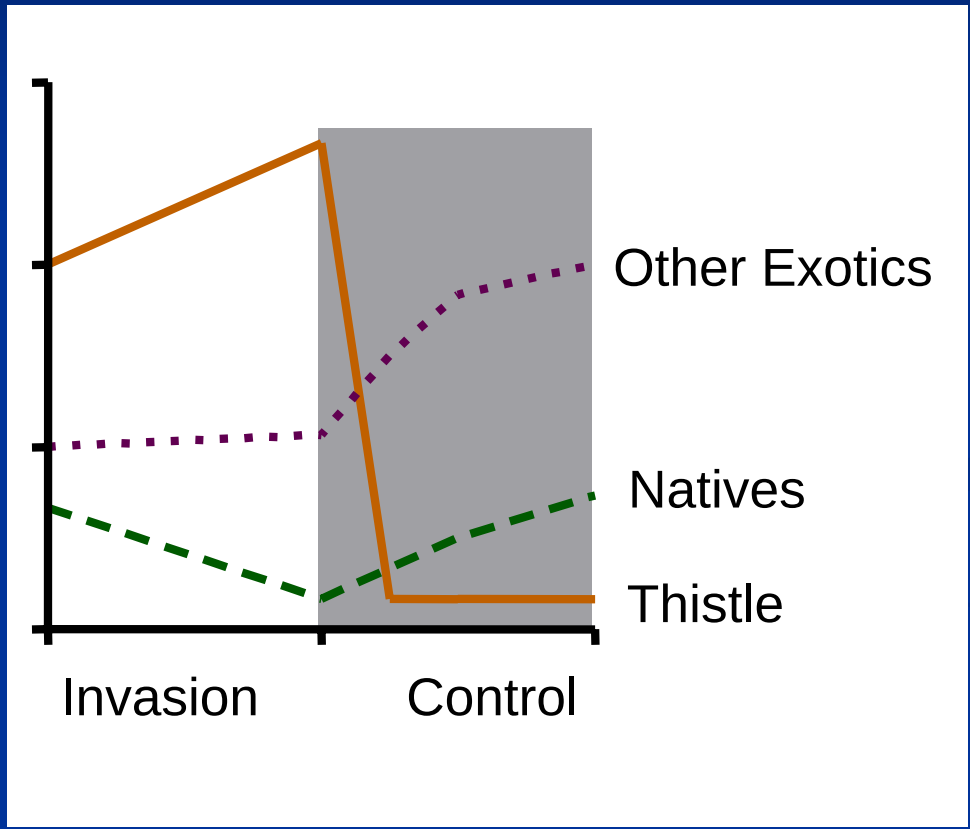
Is passive restoration occurring?



Control efforts reduce Thistle

Natives able to increase without further restoration

Or is another exotic replacing thistle?

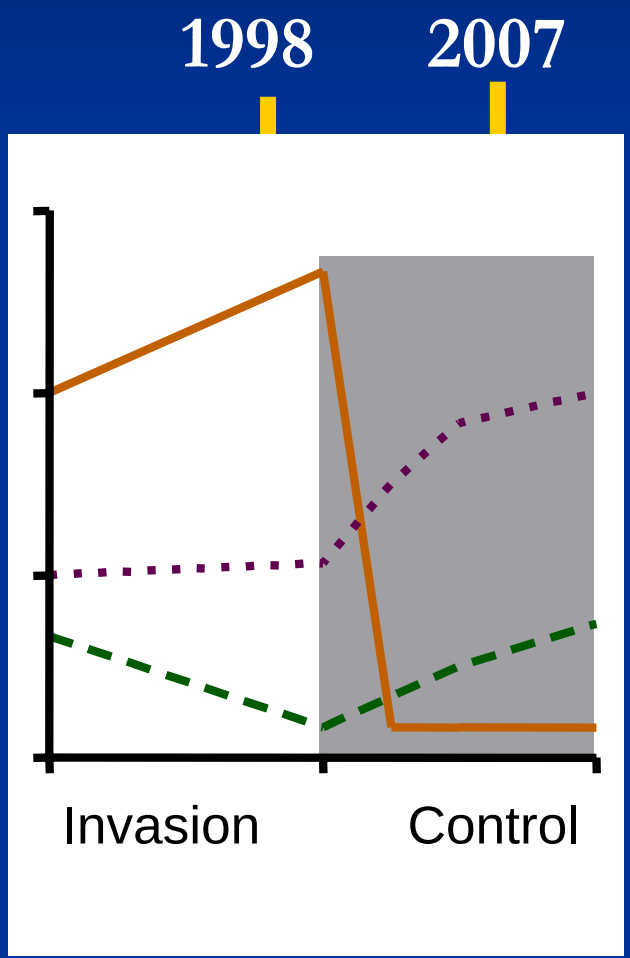


Control efforts reduce Thistle

But other exotics replace Thistle (e.g., Mustard)

Further restoration needed

Assessing effects of the thistle control program



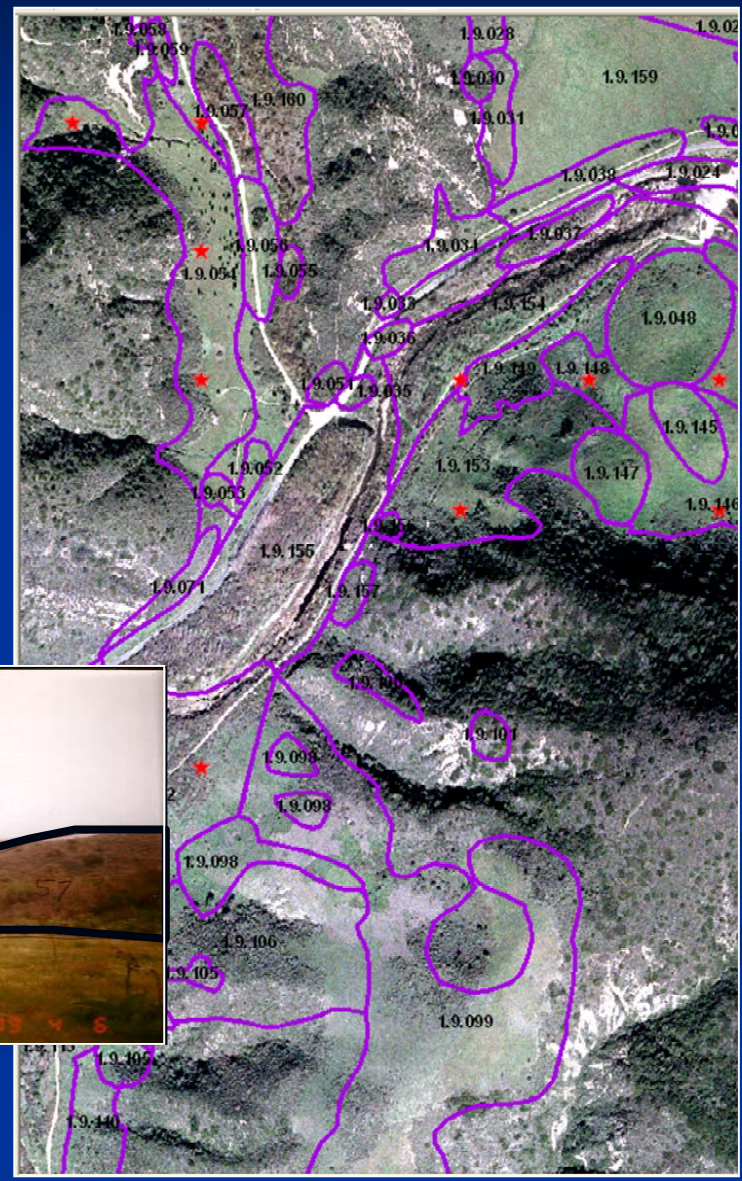
In 1998, prior to extensive control efforts, a large scale survey was conducted by TNC

In 2007, we resurveyed many of those same areas.

NOTE: 2007 was dry!

Survey Methods

- **Delineated polygons**
  - Natural boundaries
  - Variable size
  - Resurveyed 113 polygons in 2007
    - >2 years treatment since 1998



Polygons outlined on landscape

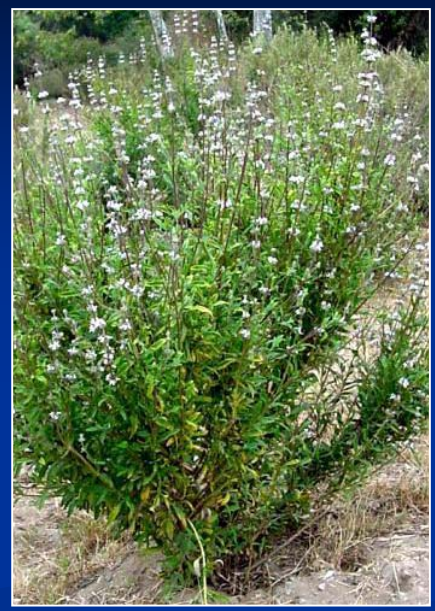
Survey Methods

- Delineated polygons
- **Estimated cover of species groups**

Thistle
(Cynara cardunculus)

Mustard
(Brassica nigra)
Exotic

Needlegrass
(Nassella pulchra)
Native



Other Natives

Survey Methods

- Delineated polygons
- **Estimated cover of species groups**
  - Needlegrass cover was only estimated in 2007 survey

Needlegrass
(Nassella pulchra)
Native

Survey Methods

- Delineated polygons
- Estimated cover of species groups
- **Estimated # native species**

Survey Methods

- Delineated polygons
- Estimated cover of species groups
- Estimated # native species
- **Used consistent cover classes**

Class	% Cover
0	0
1	1-10%
2	11-30%
3	31-50%
4	>50%

Outline

- Thistle cover change: is control working?
- Changes in other species: is passive restoration occurring?
  - Mustard
  - Needlegrass and other natives
  - Native diversity
- Treatment history: will control be sustainable?

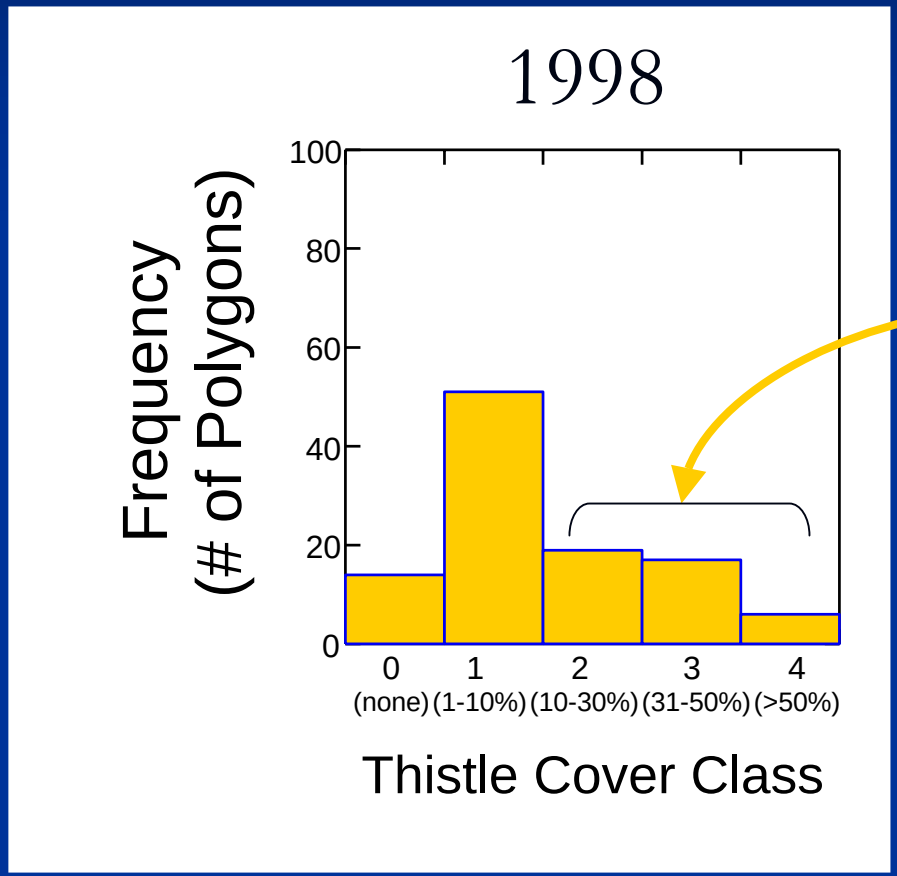
Thistle cover change

Decreased from an average of **20% to 5%** across all polygons re-surveyed.

1998

2007

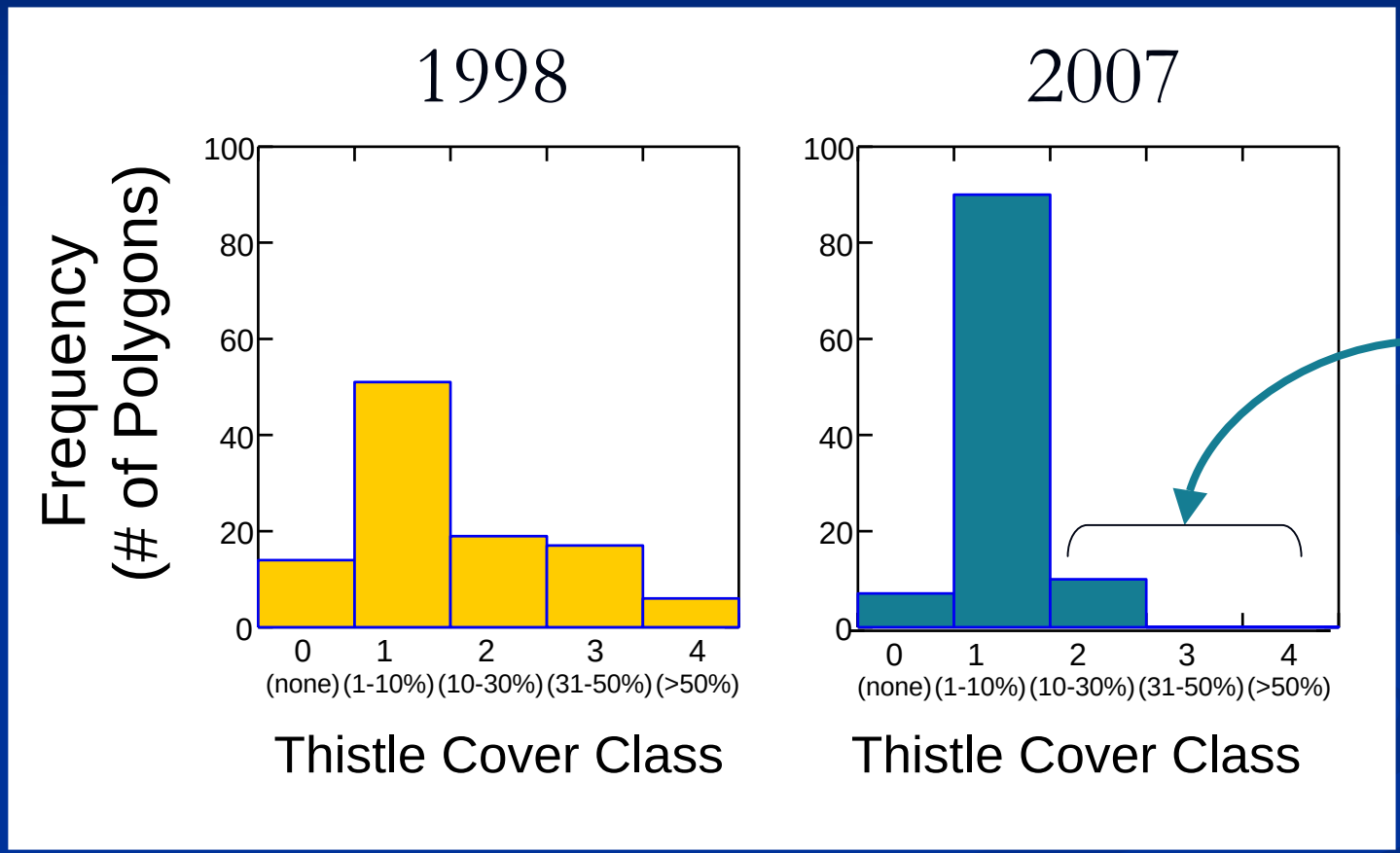
Control efforts reduced Thistle cover most in heavily invaded areas



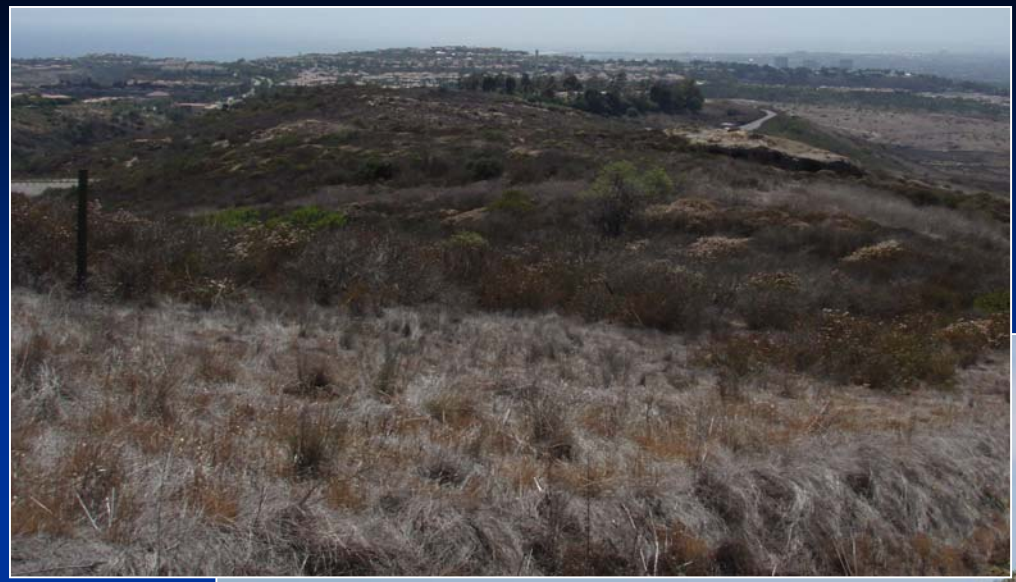
In 1998, Thistle cover was more than 10% in half of the areas.

Invasion in 1998

Control efforts reduced thistle cover most in heavily invaded areas



In 2007, only 8% of the surveyed areas had over 10% Thistle cover



2007

Outline

- Thistle cover change: is control working? **YES**
- Changes in other species: is passive restoration occurring?
  - Mustard
  - Needlegrass and other natives
  - Native diversity
- Treatment history: will control be sustainable?

Outline

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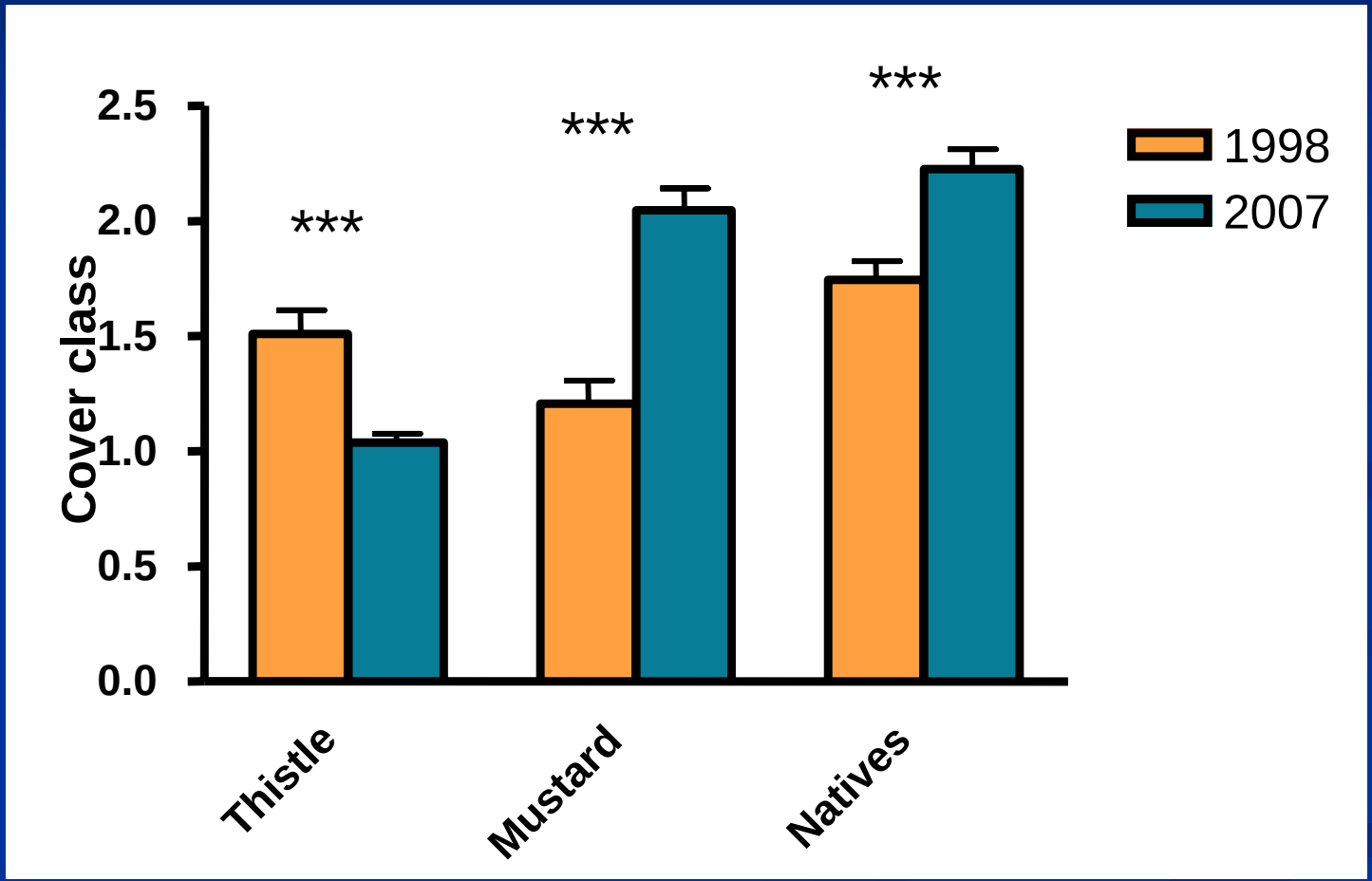
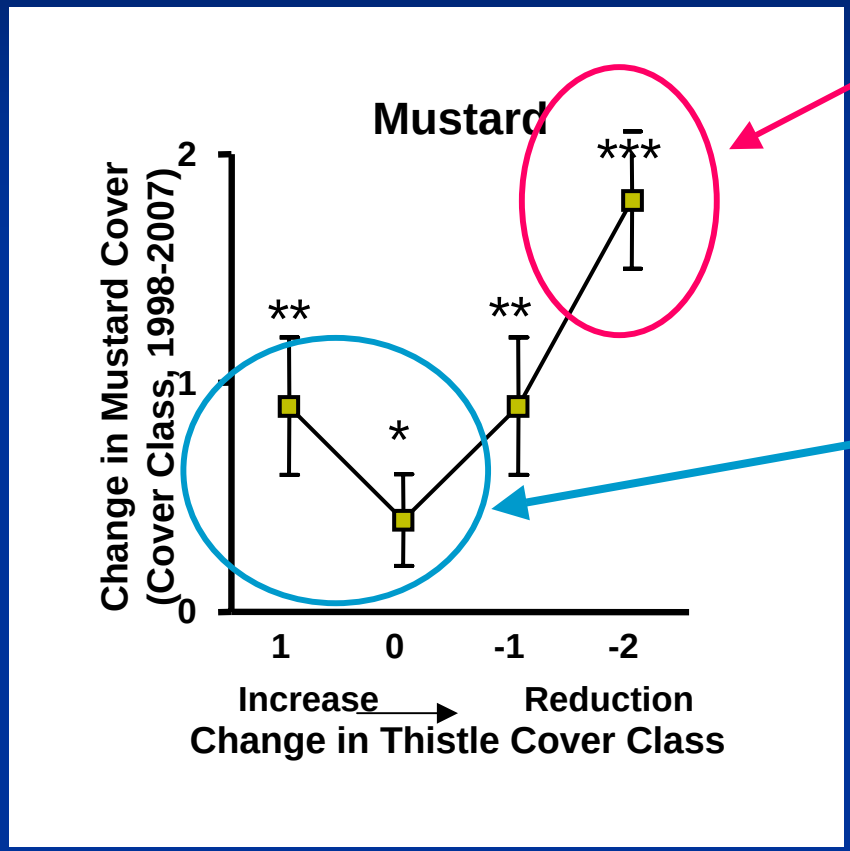
Across all 113 polygons, Thistle decreased but Mustard AND Natives increased



Mustard (*Brassica nigra*)

Mustard (*Brassica*)

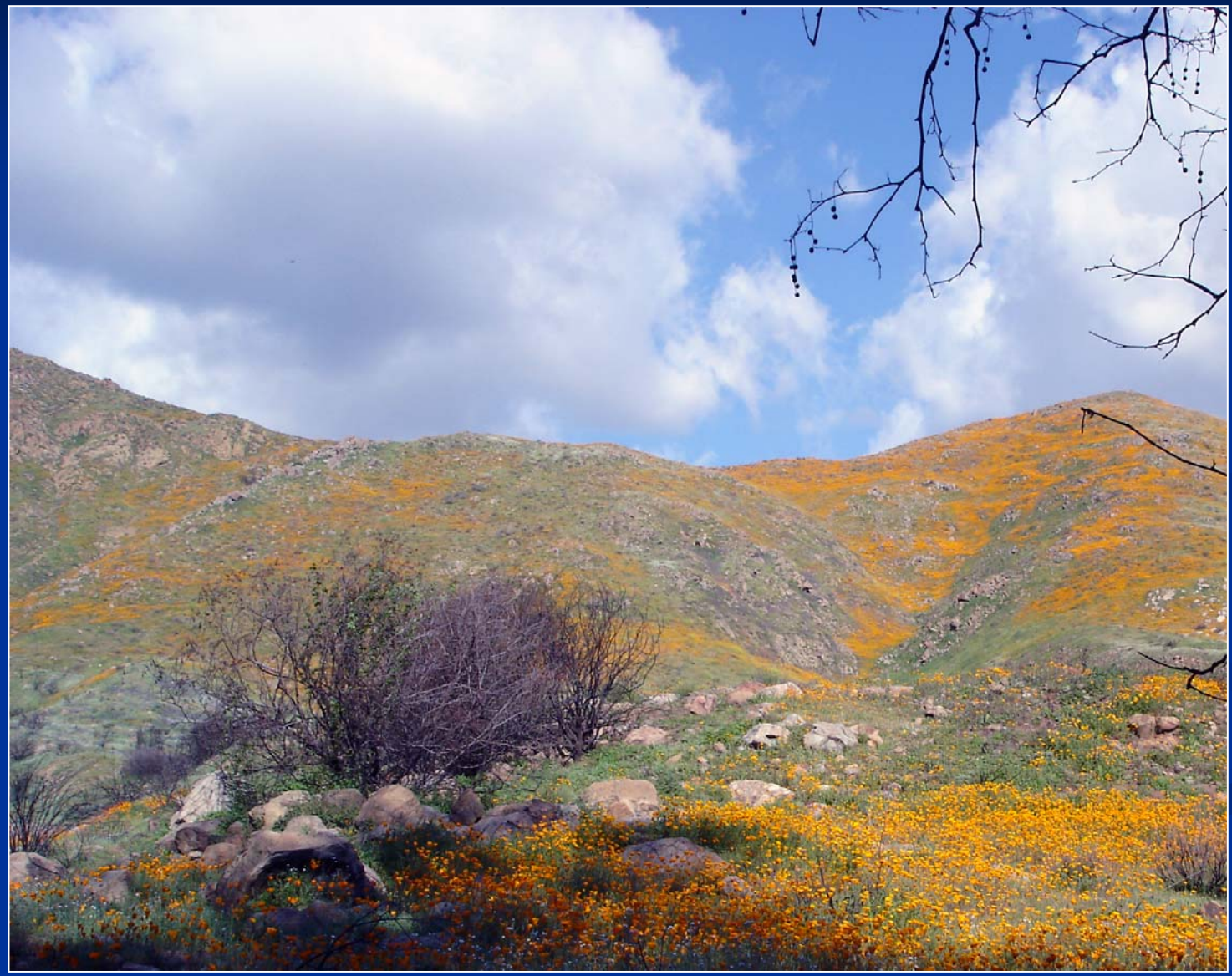


Mustard increased the most in areas where Thistle was reduced the most

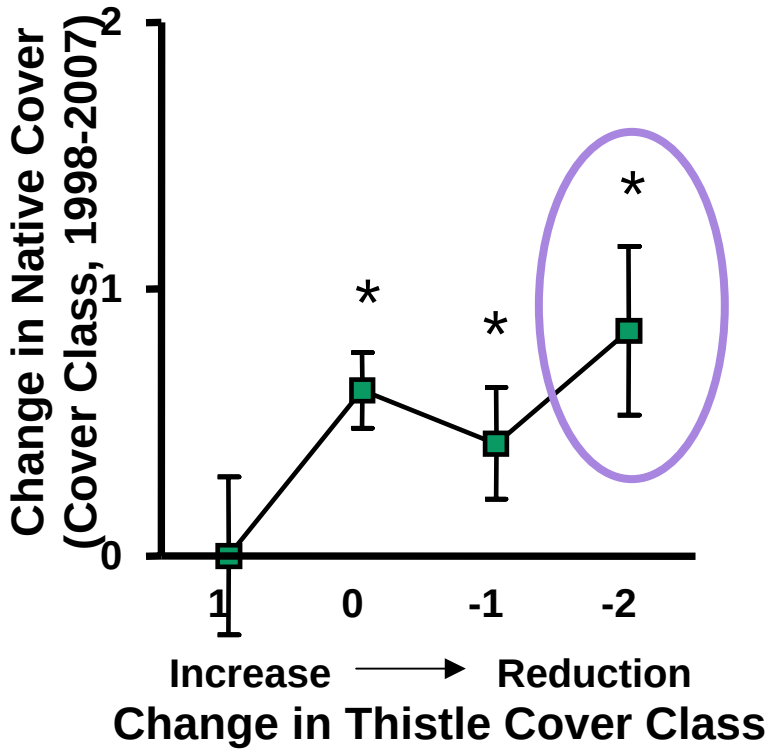
It also increased in areas where Thistle cover did not change or increased

Additional factors (removal of grazers, other disturbances) important?

Natives



Native Cover

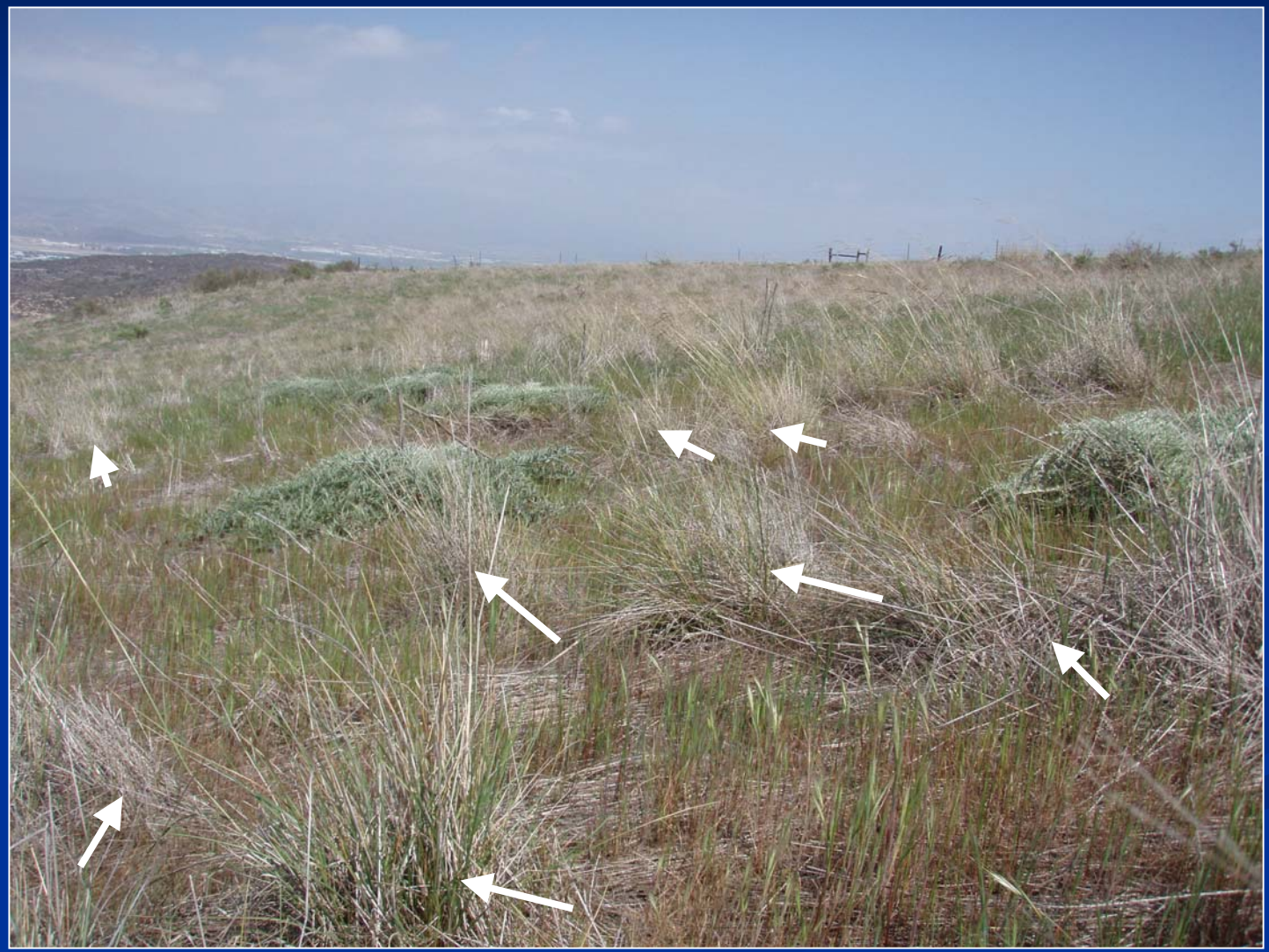


Native Cover also increased the most in areas where Thistle cover was most reduced

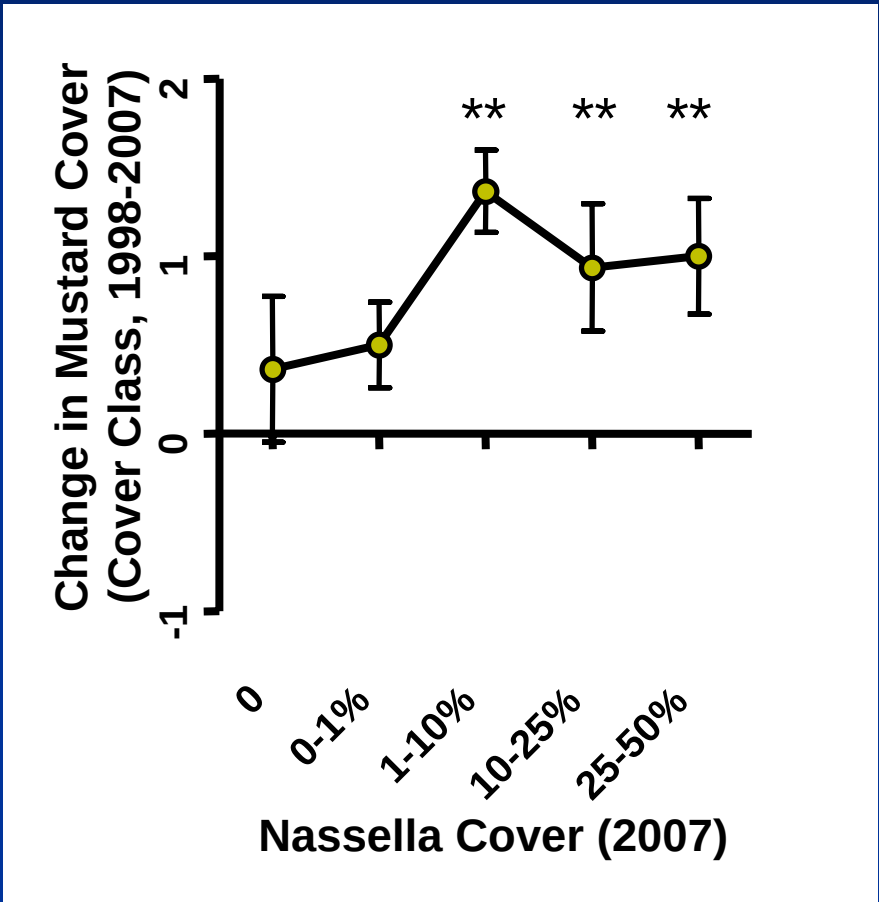
It did not increase in areas where Thistle increased

Native diversity did not change

Needlegrass (*Nassella pulchra*)



Needlegrass (*Nassella*)



Mustard also increased in areas that were high in Needlegrass cover

Is passive restoration occurring but accompanied by a transient increase in Mustard?

Outline

- Thistle cover change: is control working? YES
- Changes in other species: is passive restoration occurring? PARTIALLY
  - Mustard HAS INCREASED
  - Needlegrass and other natives HAVE INCREASED
  - Native diversity NO CHANGE
- Treatment history: will control be sustainable?

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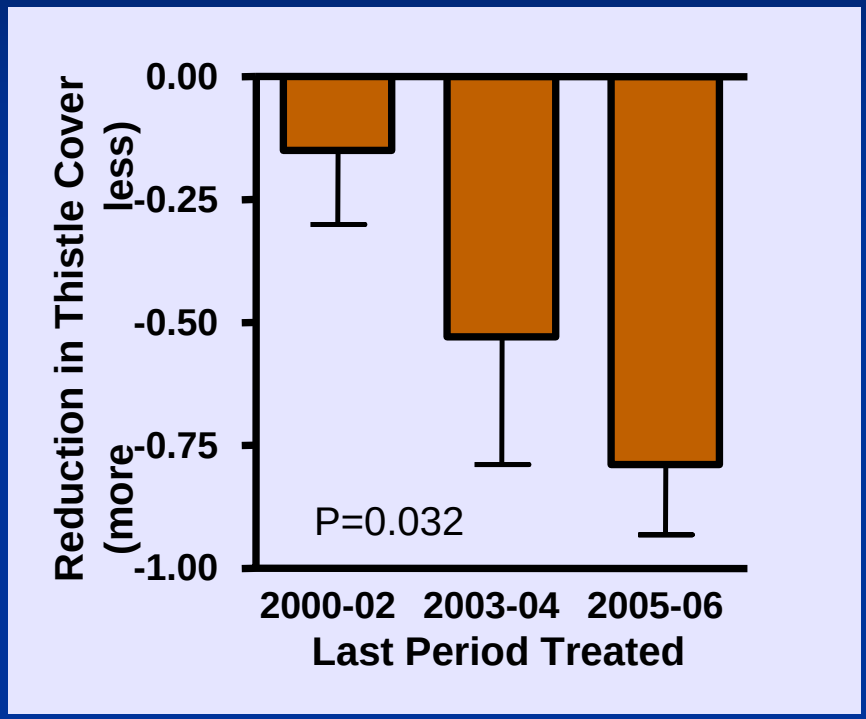
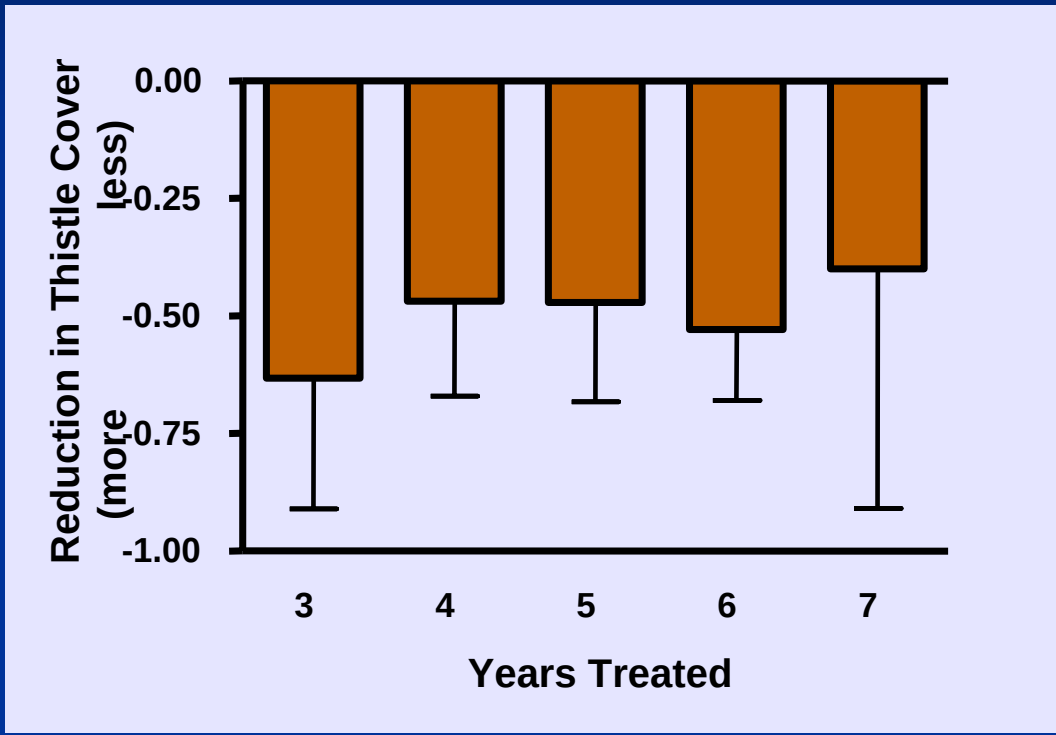
Control Program Sustainability



Thistle reduction is greatest in areas most recently herbicided

Thistle might re-invade over time in areas that are not consistently treated

Control Program Sustainability

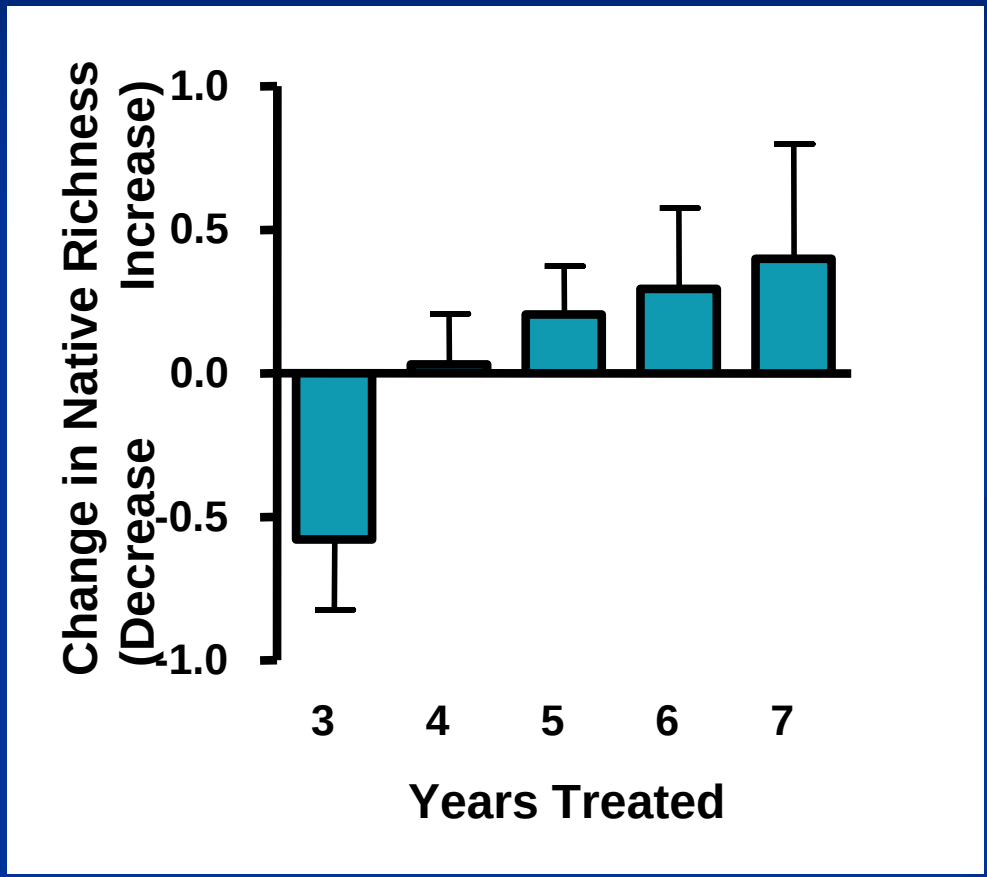


Thistle reduction occurs in 3 years.

The number of years treated does not appear to affect Thistle reduction.

Soil type and other environmental factors also do not appear to affect success

Control Program Sustainability



However, longer treatment history may allow native diversity to recover.

Suggests possible trajectory to a community that could resist Thistle re-invasion?

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  - Mustard HAS INCREASED
  - Needlegrass and other natives HAVE INCREASED
  - Native diversity NO CHANGE
- Treatment history: will control be sustainable? NOT CLEAR

Summary and implications

- Control has dramatically decreased thistle cover
- Mustard and Natives (likely Needlegrass) are both increasing
- Passive restoration is occurring, but with Mustard
  - Is mustard transient in the restoration trajectory?
- Likely has not reached the point where the native community can resist re-invasion of Thistle
  - Active control still needed, but richness response is encouraging

Acknowledgements

- The Nature Reserve of Orange County
- The Nature Conservancy
- The County of Orange
- The Suding Lab at UCI