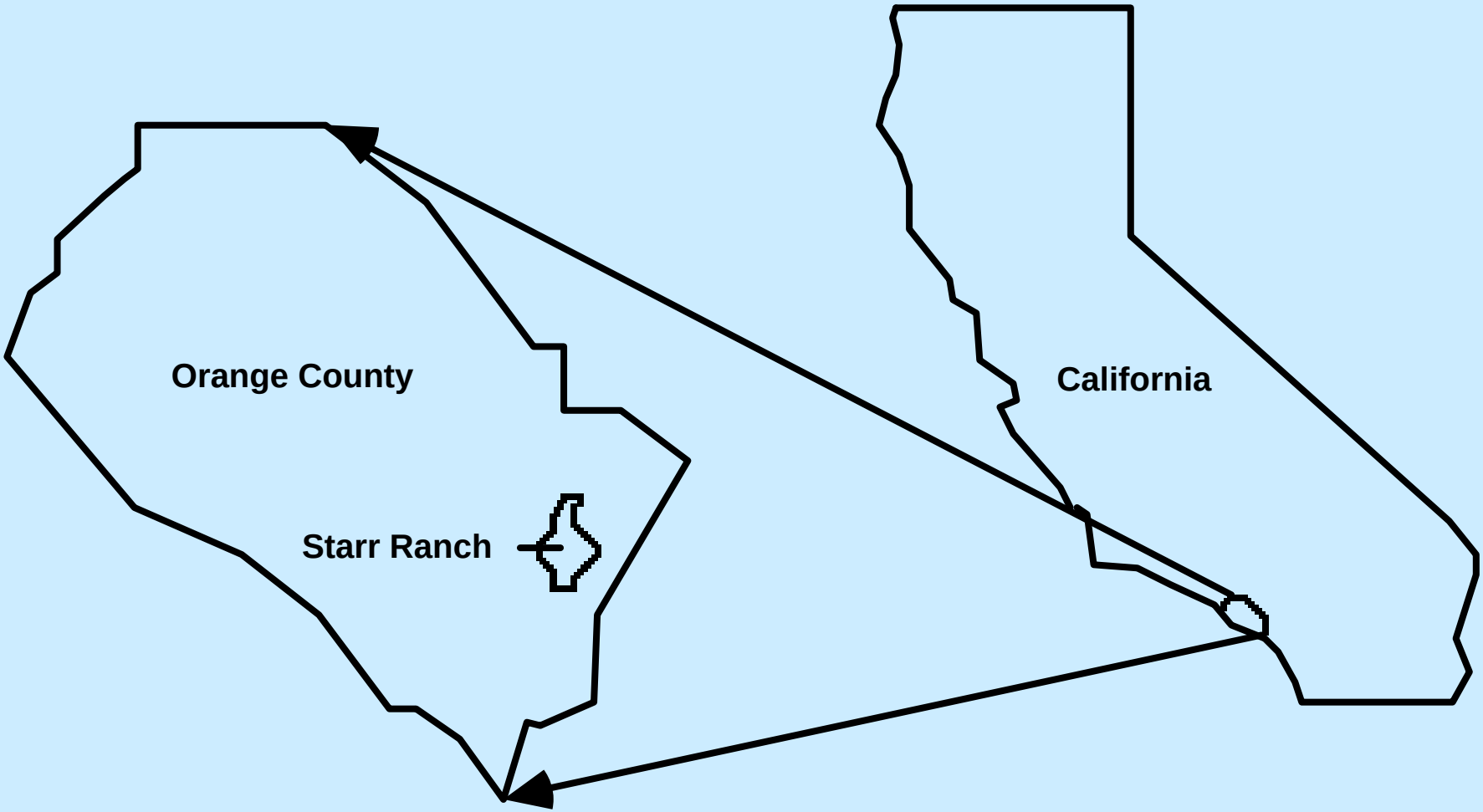
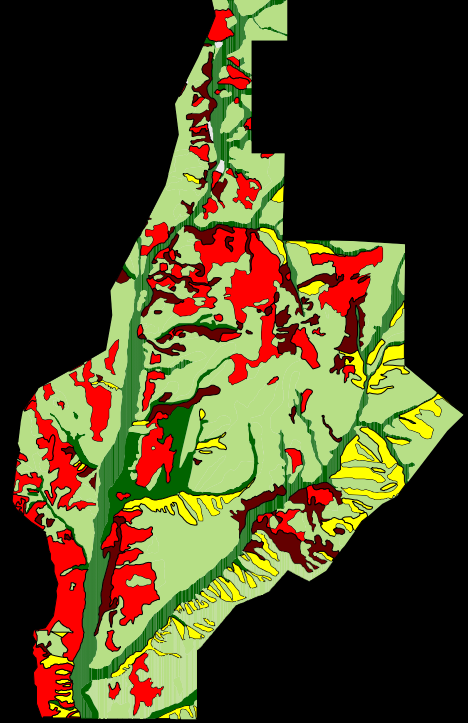
Non-chemical Exotic Control in Coastal Sage Scrub Restoration at an Audubon Preserve

Sandy DeSimone

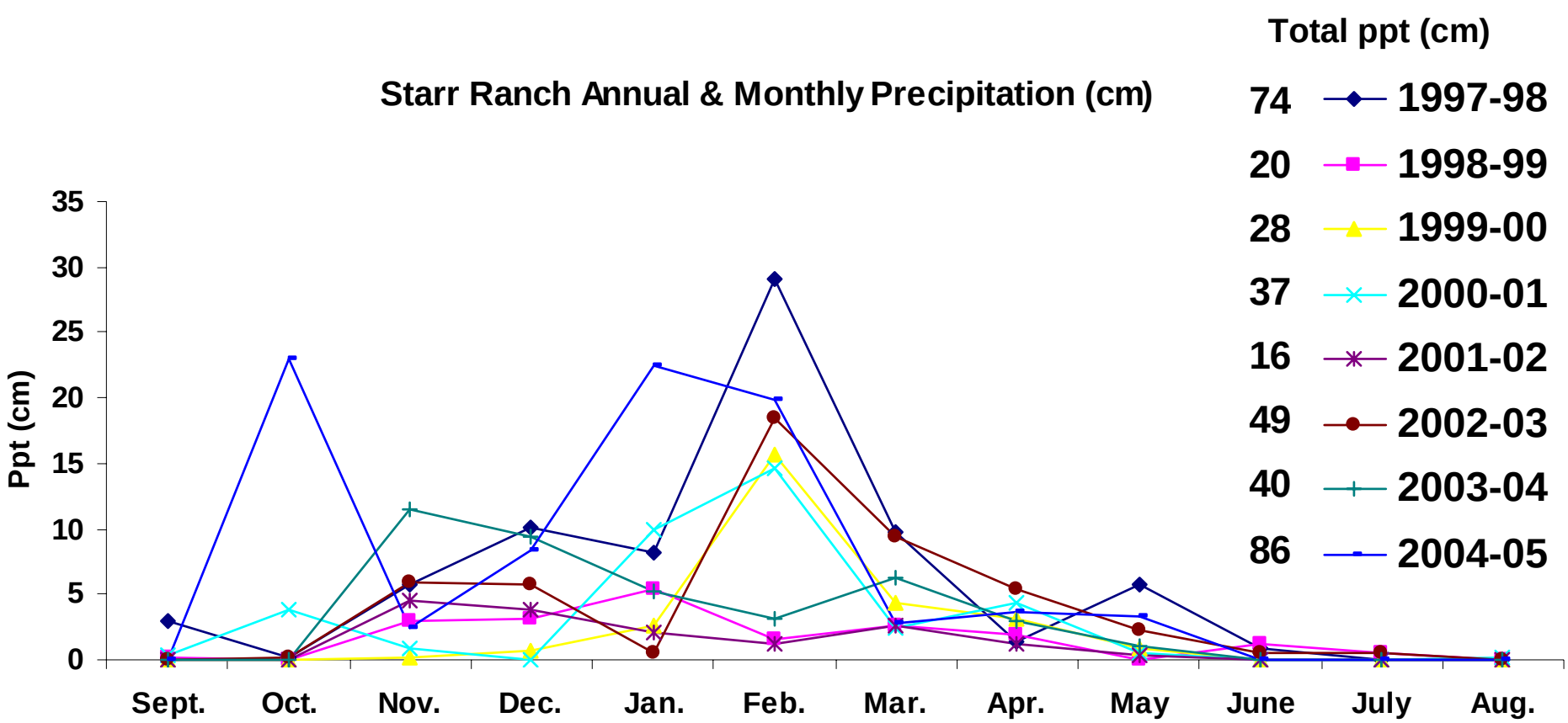
CALIFORNIA

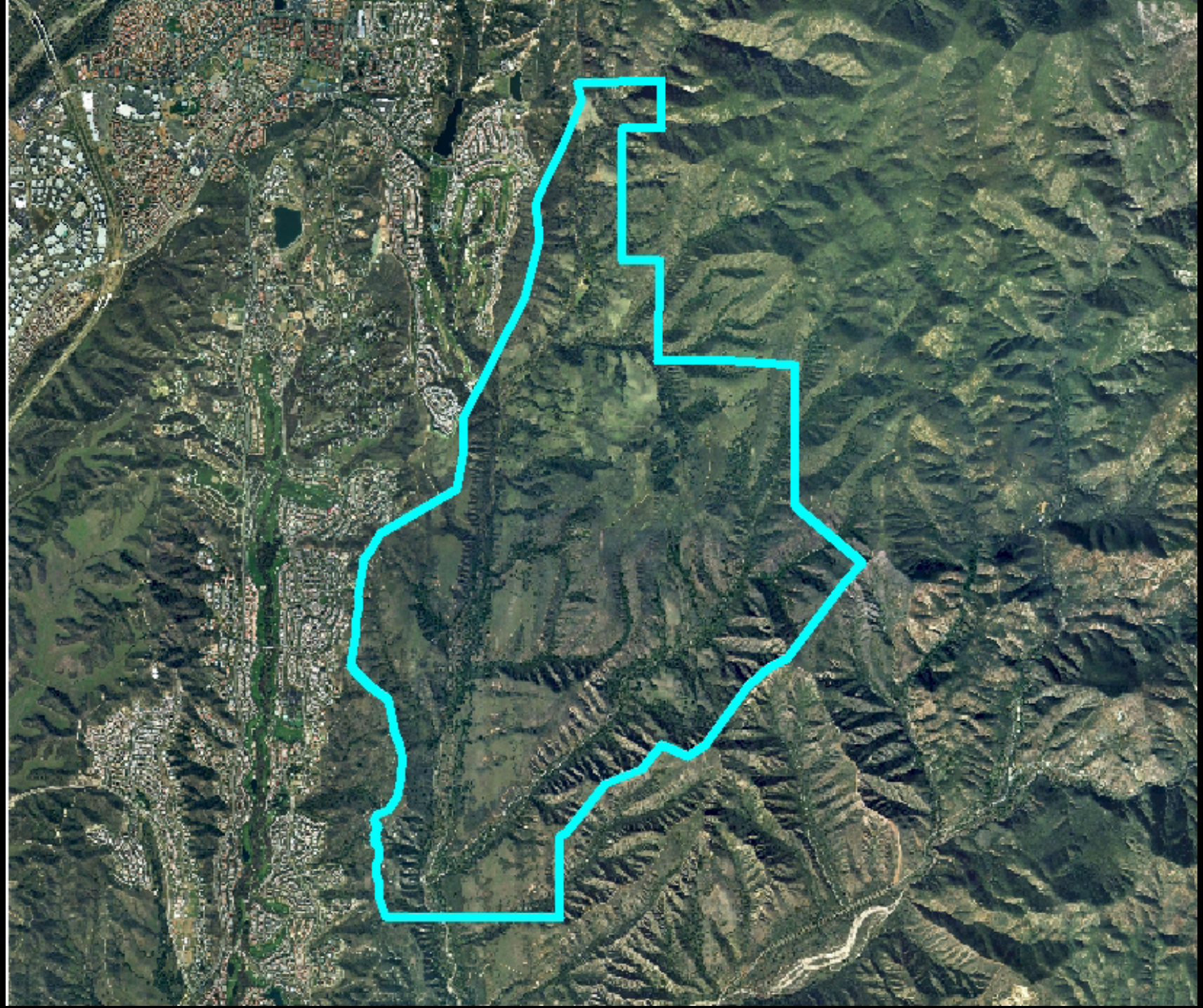

Orange County
Starr Ranch
California



Top Ten "Common Birds in Decline"
Audubon "State of the Birds 2007"

Federally Threatened under the Endangered Species Act


Starr Ranch Annual & Monthly Precipitation (cm)
Total ppt (cm)
74 1997-98
20 1998-99
28 1999-00
37 2000-01
16 2001-02
49 2002-03
40 2003-04
86 2004-05
Ppt (cm)
35
30
25
20
15
10
5
0
Sept.
Oct.
Nov.
Dec.
Jan.
Feb.
Mar.
Apr.
May
June
July
Aug.



Starr Ranch ISC &R Research Team

Manager Pete DeSimone

Biologists Ernie Clarke, Curtis Kendall, Jeff Eickwort

Interns

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Laurie Clarke

Marissa Codey

Karen Laughlin

Megan Lulow

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Noelle St. Cyr

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Bill Webb

Biologist, Helen de la Maza

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Field Assistants

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Leslie Boby

Jake Davidson

Patrick Duggan

Ross Hammersley

Ben Henshaw

Sara Kaiser

Sergey Khomenko

Sasha Keyel

Dave Kimble

Rich LaPaix

Scott Lillie

Erynn Maynard

Thad Miller

Jon O'Brien

Jeff Rau

Andy Reeder

Melissa Riedel-Lehrke

Lindsey Scholl

Jessica Schulte

Daniel Secundy

Stacy Smith

Kim Whorral

Erin Yost

Tom Baker and O'Connell Landscaping (field crew)

Dr. Margot Griswold, Earthworks Construction & Design

Volunteers who hoed thistle resprouts, collected, counted, and processed many, many seeds.

U.S. Fish & Wildlife Service for "Partners for Wildlife" and "Private Land Stewardship funding

Jill Terp & Samantha Marcum, U.S. Fish & Wildlife Service

California Department of Corrections for mitigation funding from the Statewide Electrified Fence Project HCP (Bernd Beutenmuller)

Restoration Assistant, Debbie Gley

Research-Based Land Management

Active & Passive Adaptive Management

“decisions modified as we learn about the system we are managing”

Shea et al. 2002 Ecol. App. 12

"Resilience building" in response to **climate change**

1. Protect adequate and appropriate space.

2. **Limit all non-climate stresses**: habitat fragmentation, overharvest, **invasive species**, pollution.

3. **Use active adaptive management…with on-going monitoring to ensure that actions are truly of the "do no harm" variety.**

L.J. Hansen, J.L. Biringer, and J.R. Hoffman, editors. Buying Time: A User's Manual for Building Resistance and Resilience to Climate Change in Natural Systems. World Wildlife Fund 2003.

Resilience: the speed with which a community returns to its former state after it has been disturbed

Ecology: Individuals, Populations, and Communities **(Begon, Harper and Townsend 1999)**

Cynara cardunculus

Artichoke Thistle

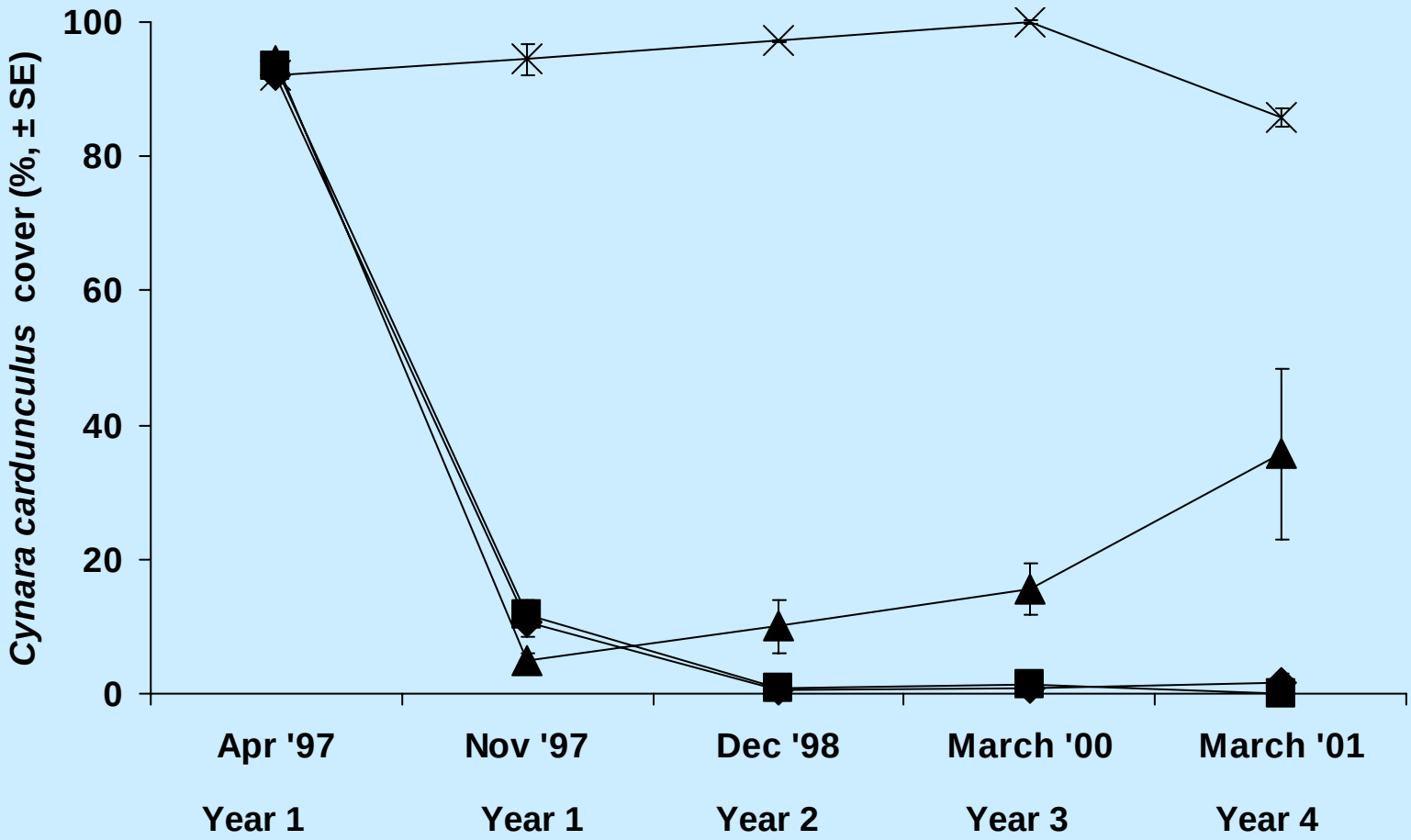
700 acres

Physical Control of *Cynara cardunculus* **2 x 2 m plots**

Randomized Complete Block Design **b = 7 df = 18**

T1 = Mow with brush cutter **T3 = Solarization**

T2 = Mow with brush cutter + rake **x T4 = Control**



Mechanical Control of *Cynara cardunculus*

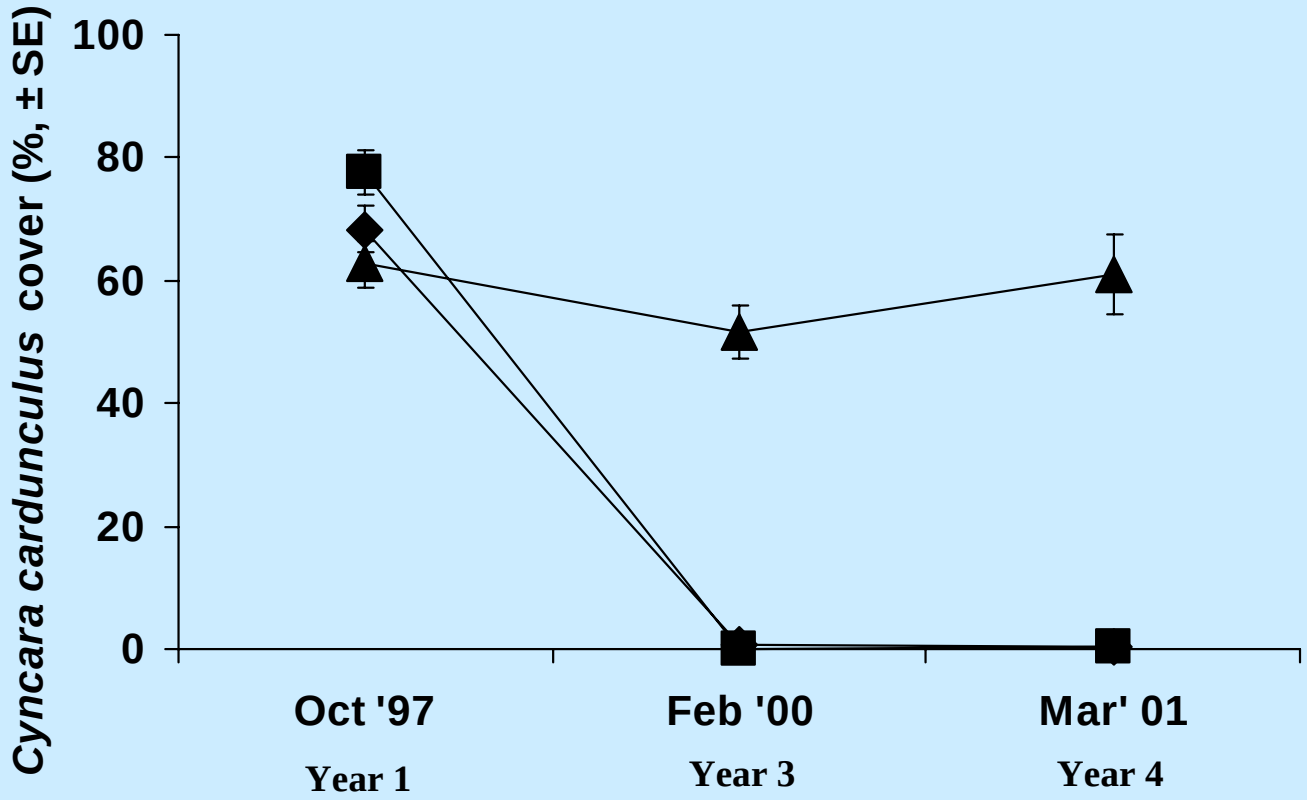
5 x 10 m plots, < 10 % native plant cover, 60- 80% *C. cardunculus* cover

Completely Randomized Design n = 5 df = 12

◆ **T1 = Surface till after first rains, repeat when ≥ 5 plants at 30 cm rosette diameter**

■ **T2 = Surface till at bud, repeat when ≥ 5 plants at 30 cm rosette diameter**

▲ **T3 = Control**



Mechanical Control of *C. cardunculus* **5 x 10 m plots, Native Plant Cover > 20%**

Randomized Complete Block Design **b = 4 df = 12**

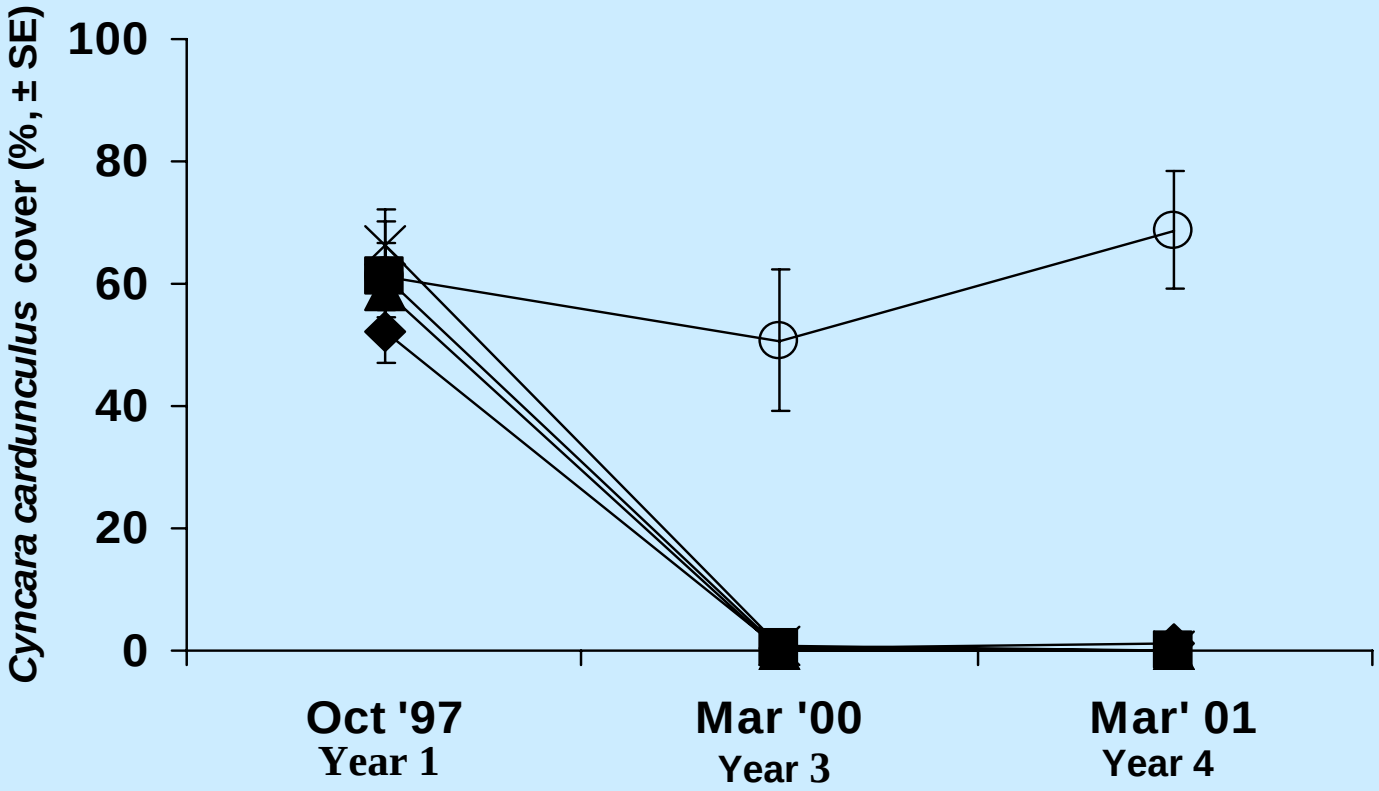
◆ **T1 = Brush cut at first regrowth & remove cuttings, repeat when ≥ 5 plants at 30 cm rosette diameter**

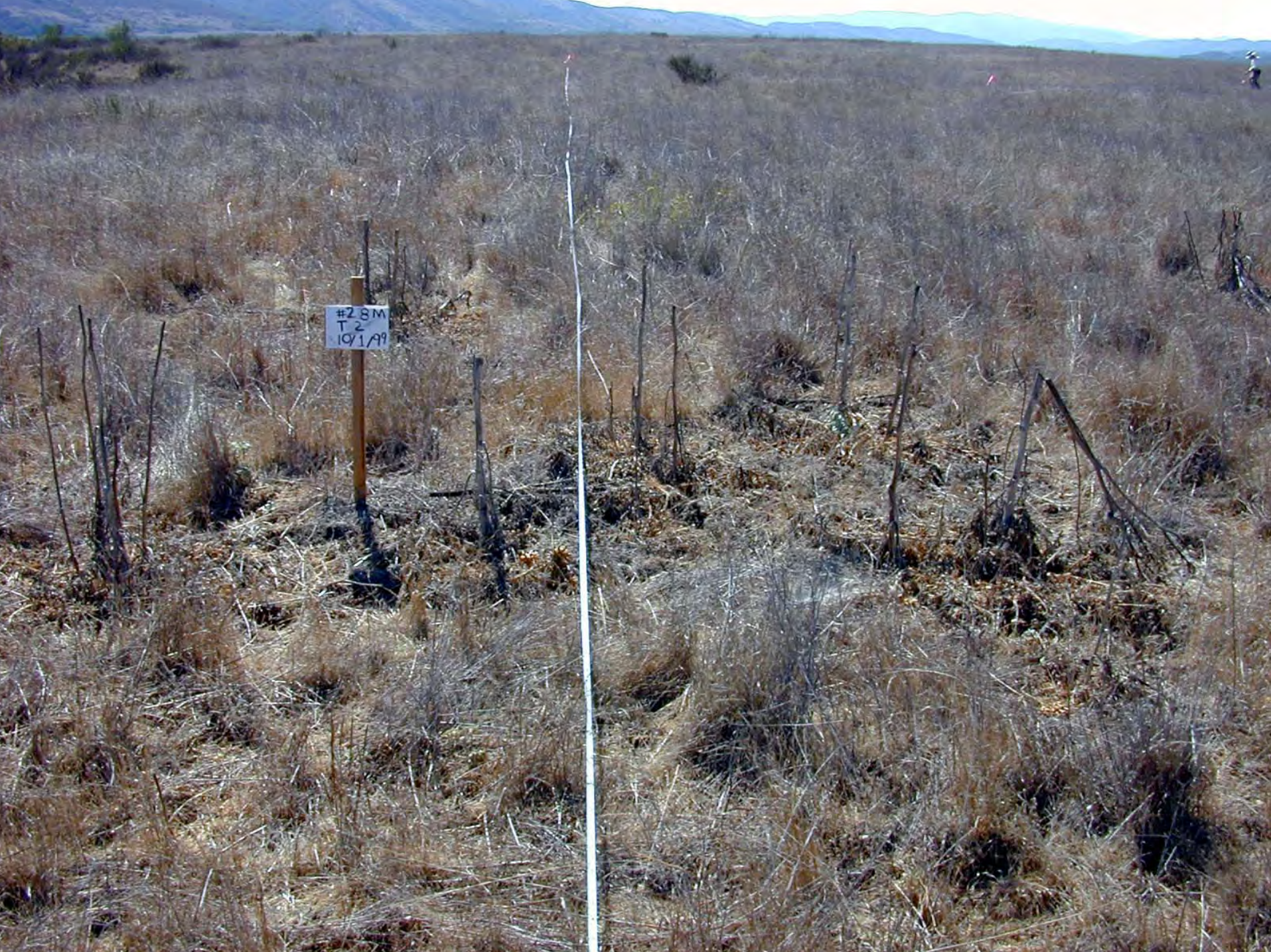
■ **T2 = Brush cut at first regrowth and no removal, repeat as in #1**

▲ **T3 = Brush cut at bud and remove cuttings, repeat as in #1**

x **T4 = Brush cut at bud and no removal, repeat as in #1**

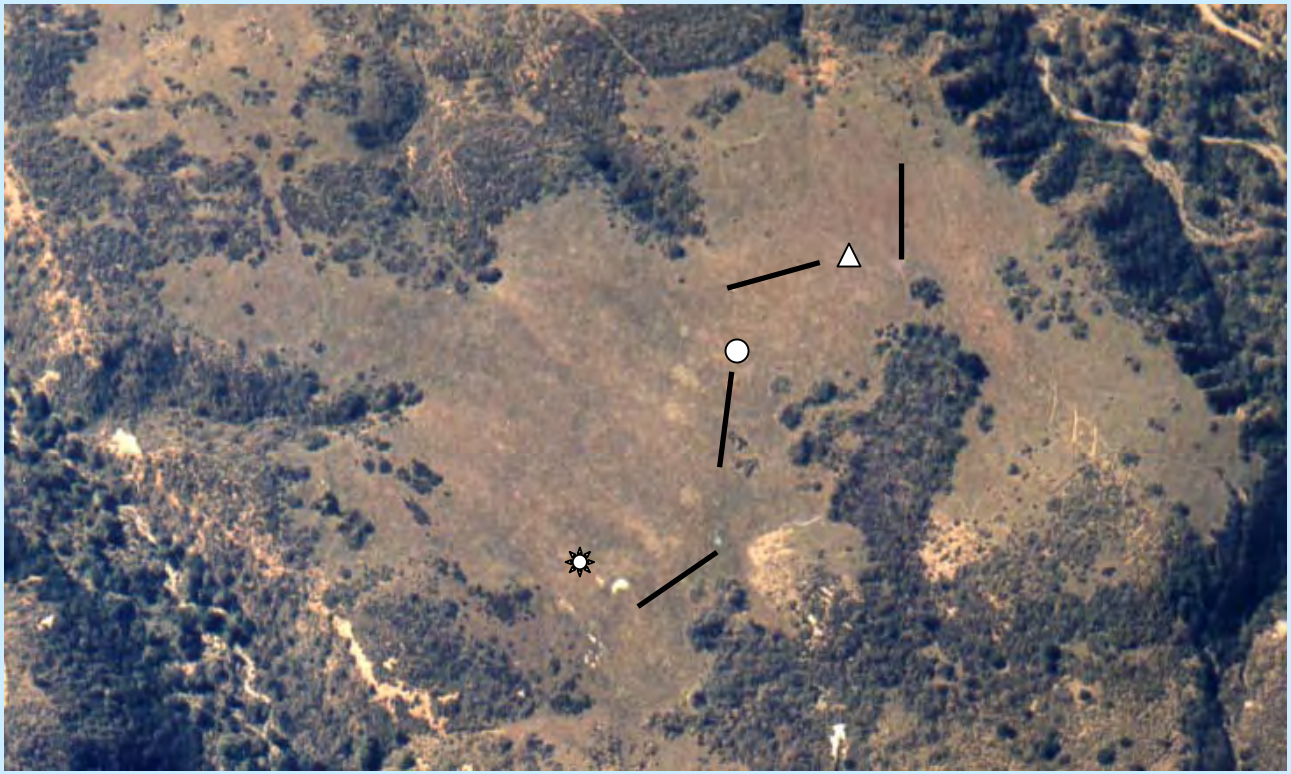
○ **T5 = Control**




#28M
T2
10/1/99

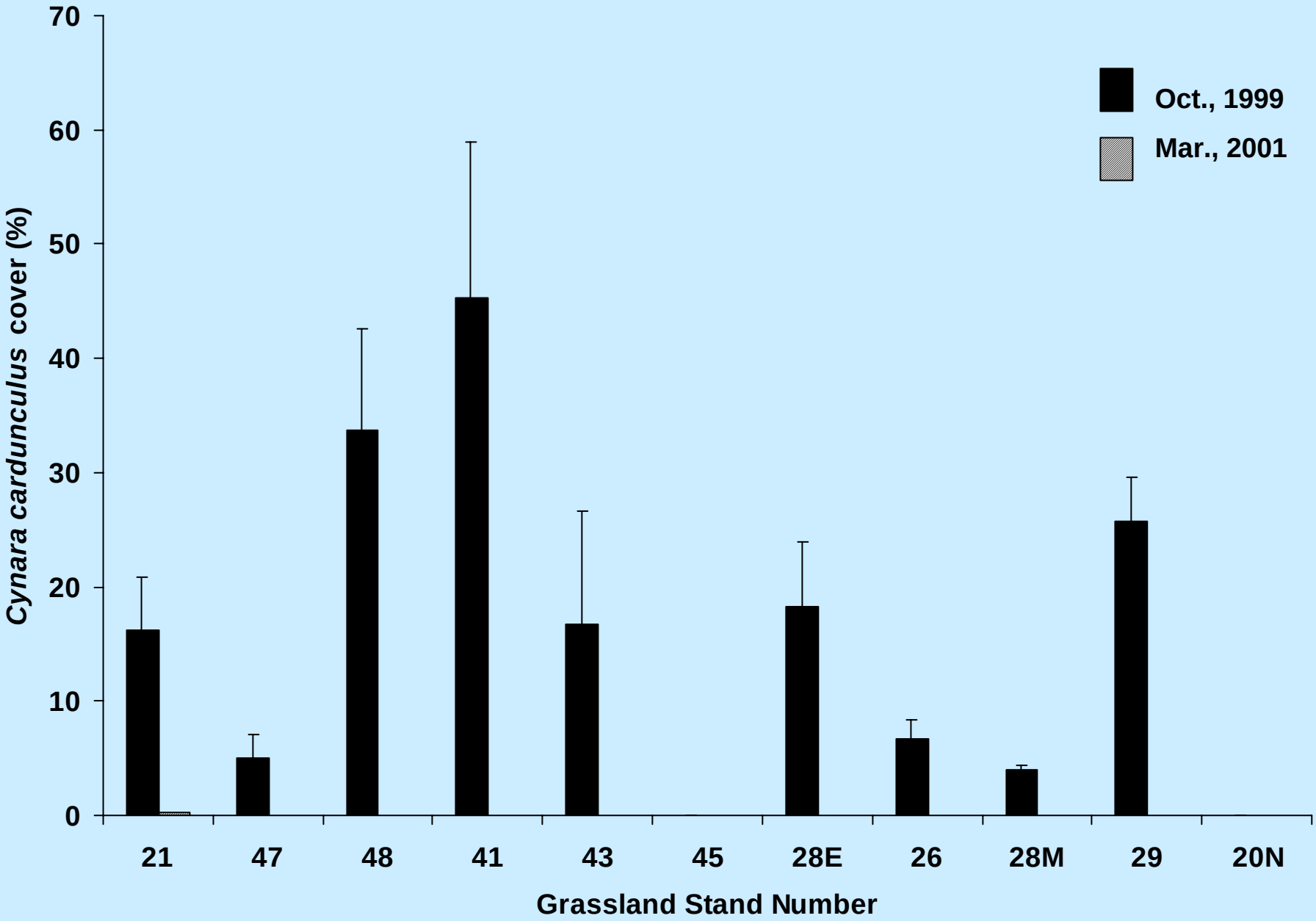
CDC Grassland 48

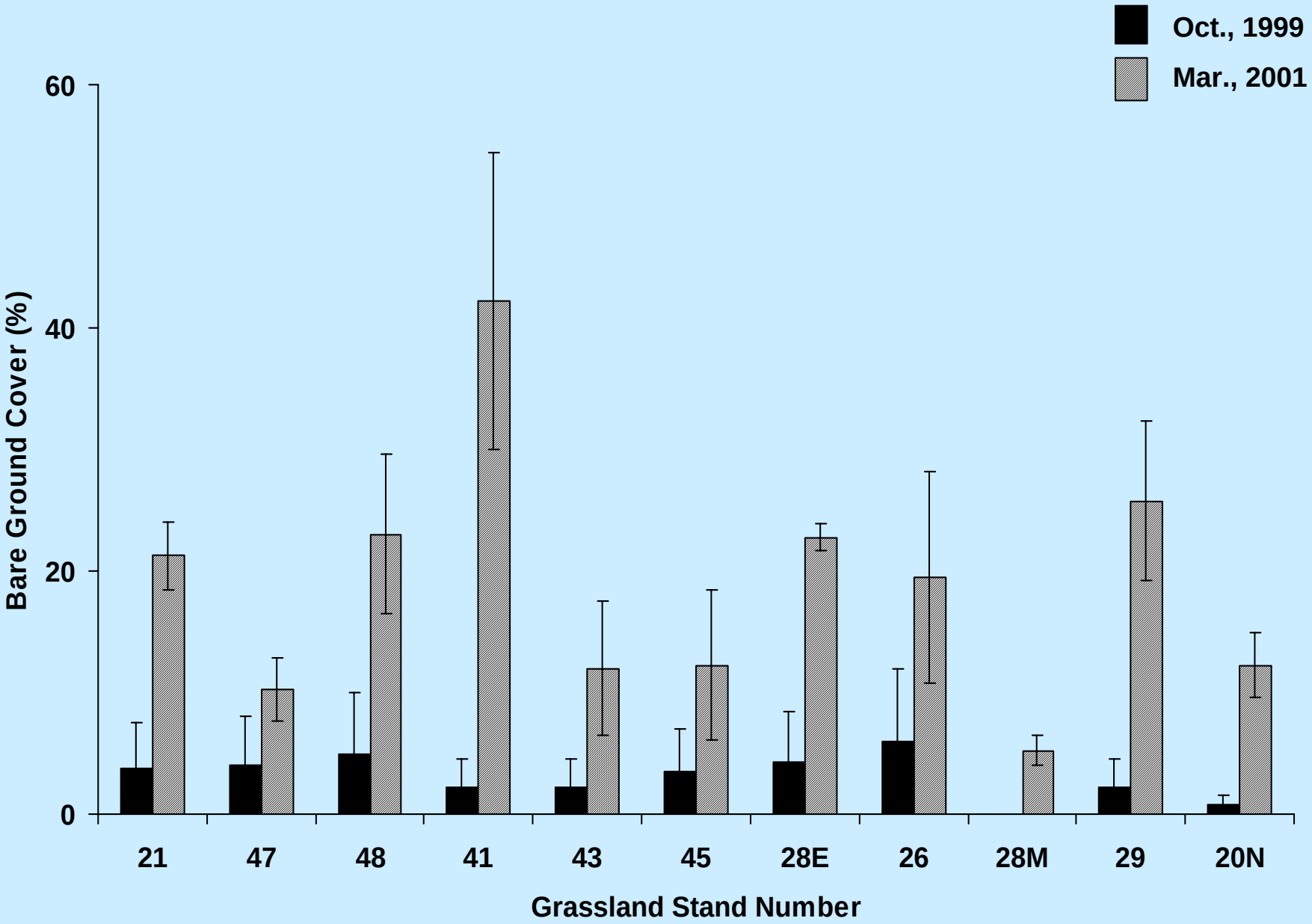
Monitoring Map

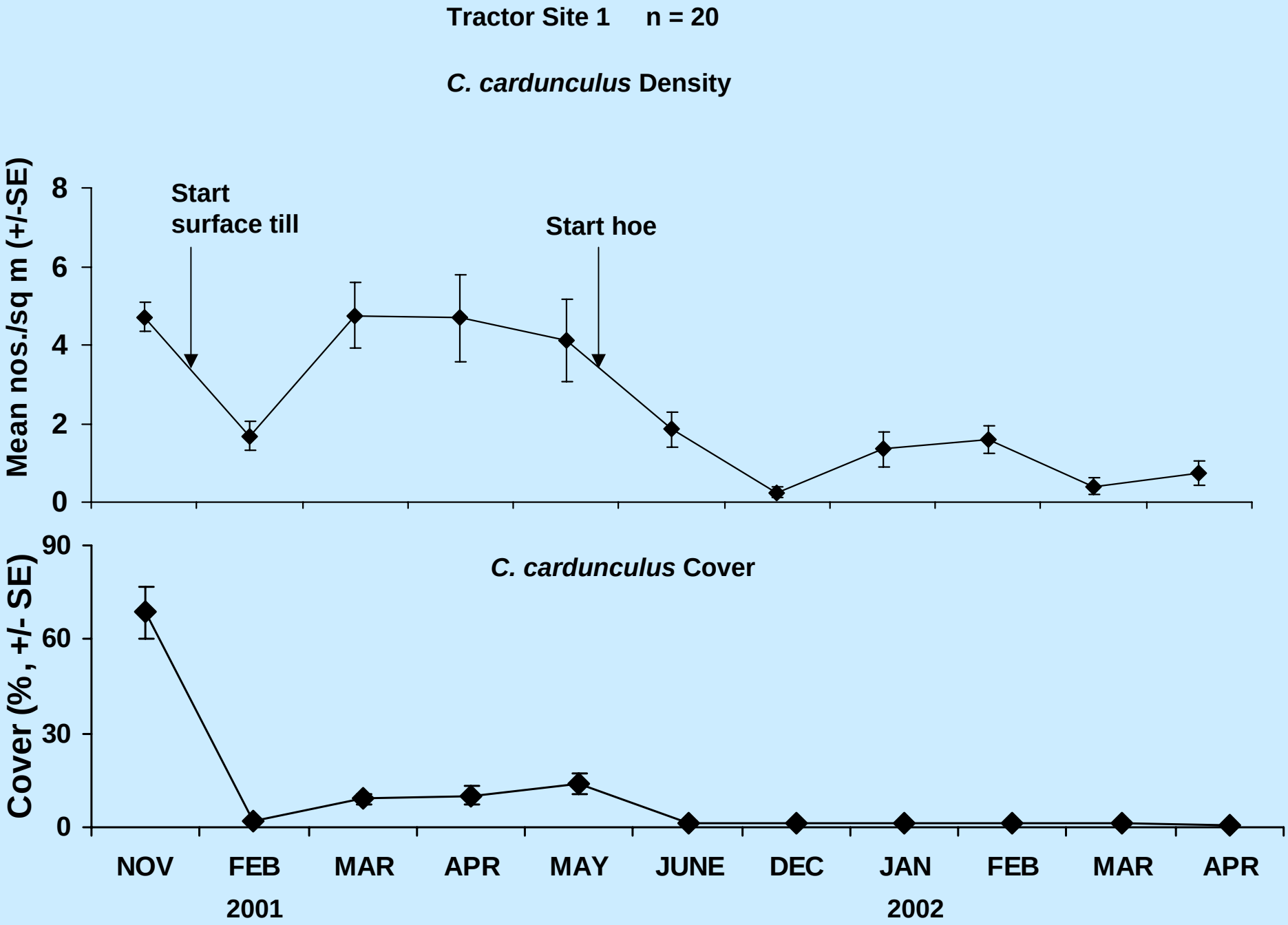


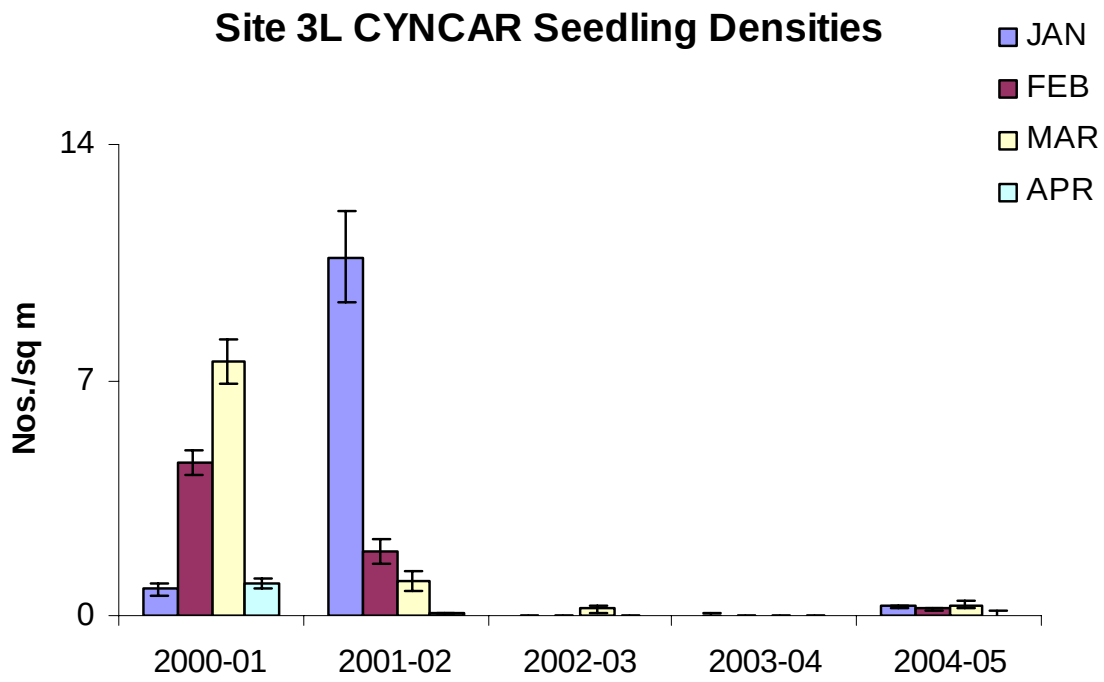
PP1 ☼ **PP2** △ **PP3** °

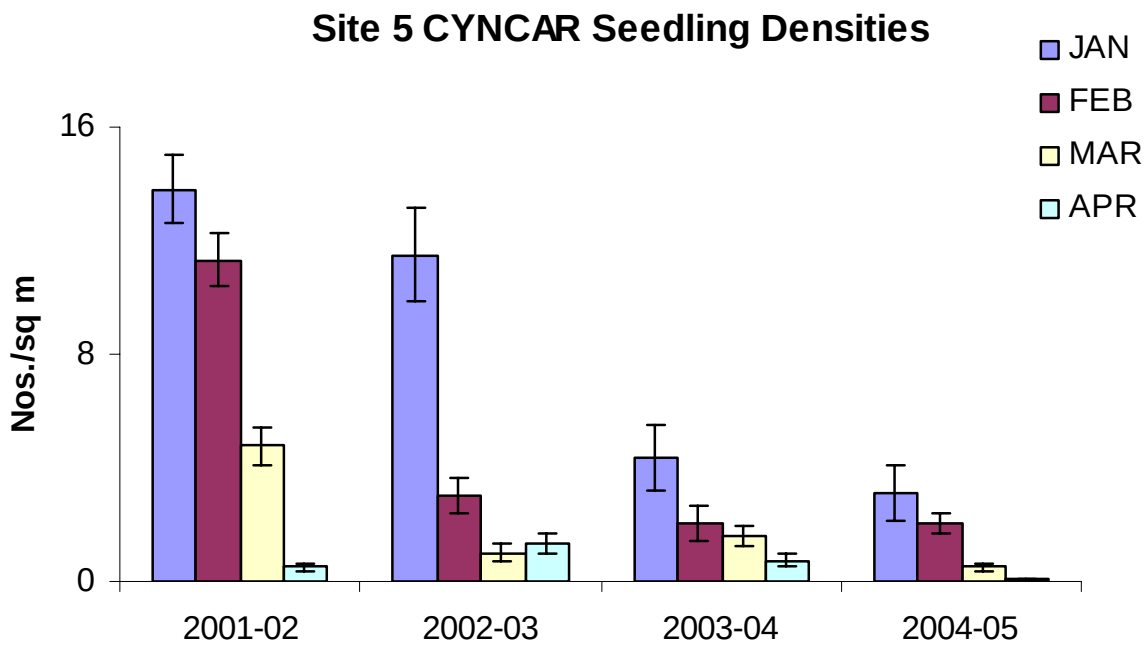
Transects (50m) ——————————


70
60
50
40
30
20
10
0
Cynara cardunculus cover (%)
Oct., 1999
Mar., 2001
21
47
48
41
43
45
28E
26
28M
29
20N
Grassland Stand Number


Oct., 1999
Mar., 2001
Bare Ground Cover (%)
60
40
20
0
21
47
48
41
43
45
28E
26
28M
29
20N
Grassland Stand Number


Tractor Site 1 n = 20
C. cardunculus Density
Mean nos./sq m (+/-SE)
8
6
4
2
0
Start surface till
Start hoe
C. cardunculus Cover
Cover (%, +/- SE)
90
60
30
0
NOV
FEB
MAR
APR
MAY
JUNE
DEC
JAN
FEB
MAR
APR
2001
2002


Site 3L CYNCAR Seedling Densities
JAN
FEB
MAR
APR
Nos./sq m
14
7
0
2000-01
2001-02
2002-03
2003-04
2004-05

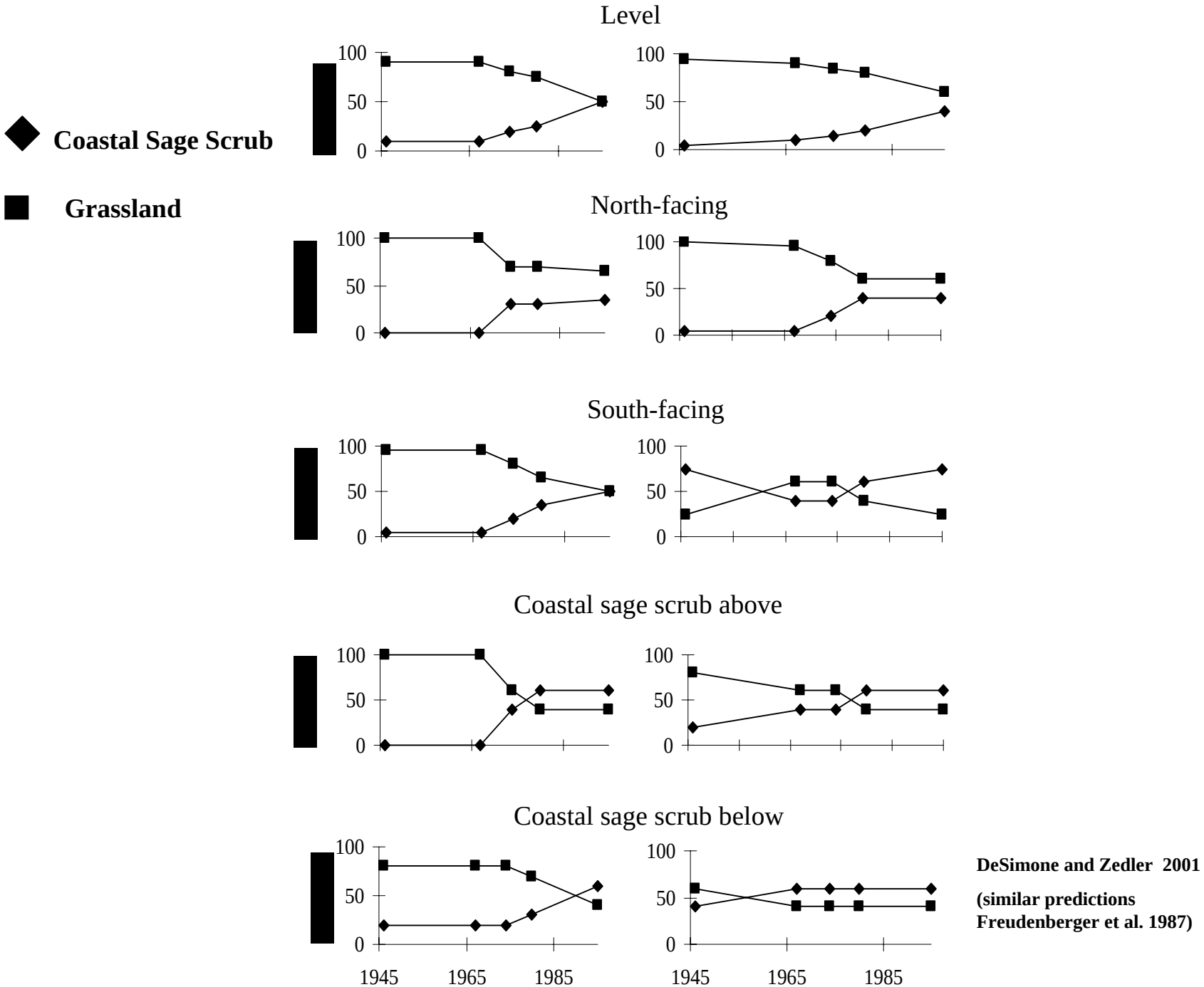

Site 5 CYNCAR Seedling Densities
JAN
FEB
MAR
APR
Nos./sq m
16
8
0
2001-02
2002-03
2003-04
2004-05


WILDERNESS
ADVENTURE
Lake Tahoe

- **Since 1999, ± 152 ha (376 acres) of 283 ha (700 acres) targeted reduced to 0 - 5% *C. cardunculus* cover per stand after 1 – 2 yrs of treatment**

- **8 - 20 new ha (20 - 50 acres)/yr = by 2010, under reasonable control**

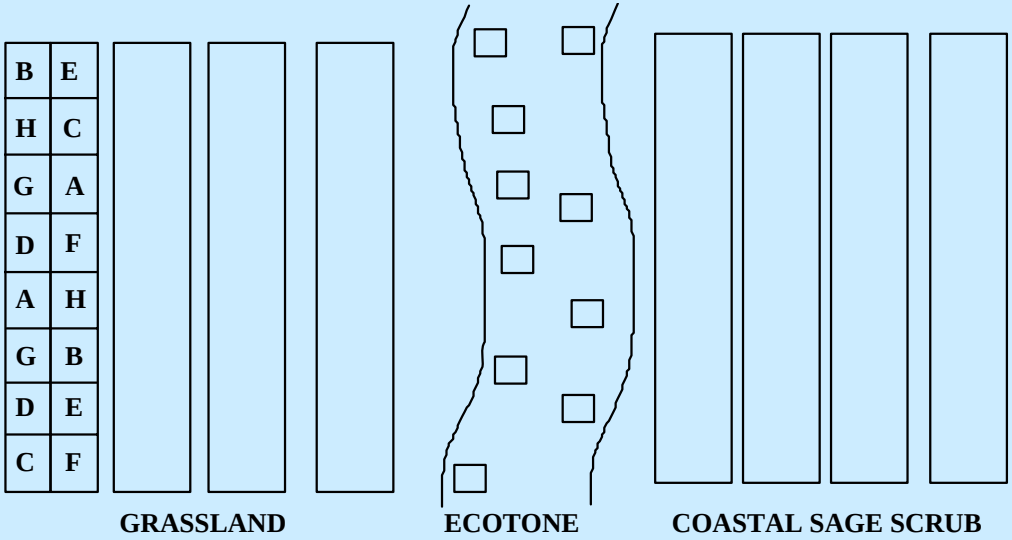

#28m
PP 1
03/24/01



DeSimone and Zedler 2001

(similar predictions Freudenberger et al. 1987)

Mechanisms: Native shrub colonization in grasslands adjacent to coastal sage scrub



ECOTONE

(n = 5, df = 16)

Herbaceous cover (%)

Mean ± SE

CAGE	44.4 ± 4.19 ***
NO CAGE	8.0 ± 1.22
WATER	28.9 ± 6.85
NO WATER	24.4 ± 6.41

Herbaceous cover in 30 x 30 cm plots

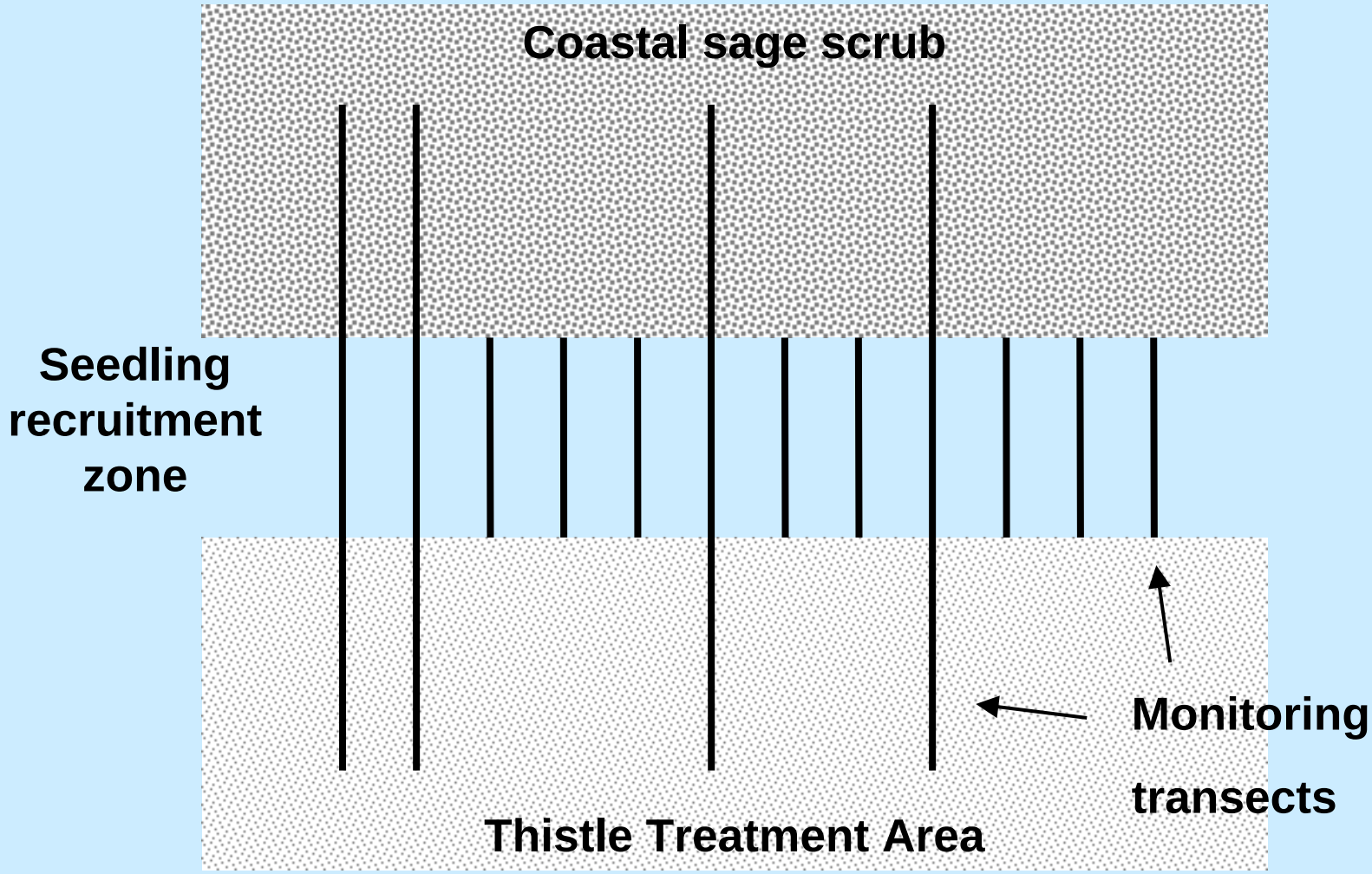
No interactions were significant

Data were arcsine transformed

Factorial completely randomized design

***** p < 0.001**

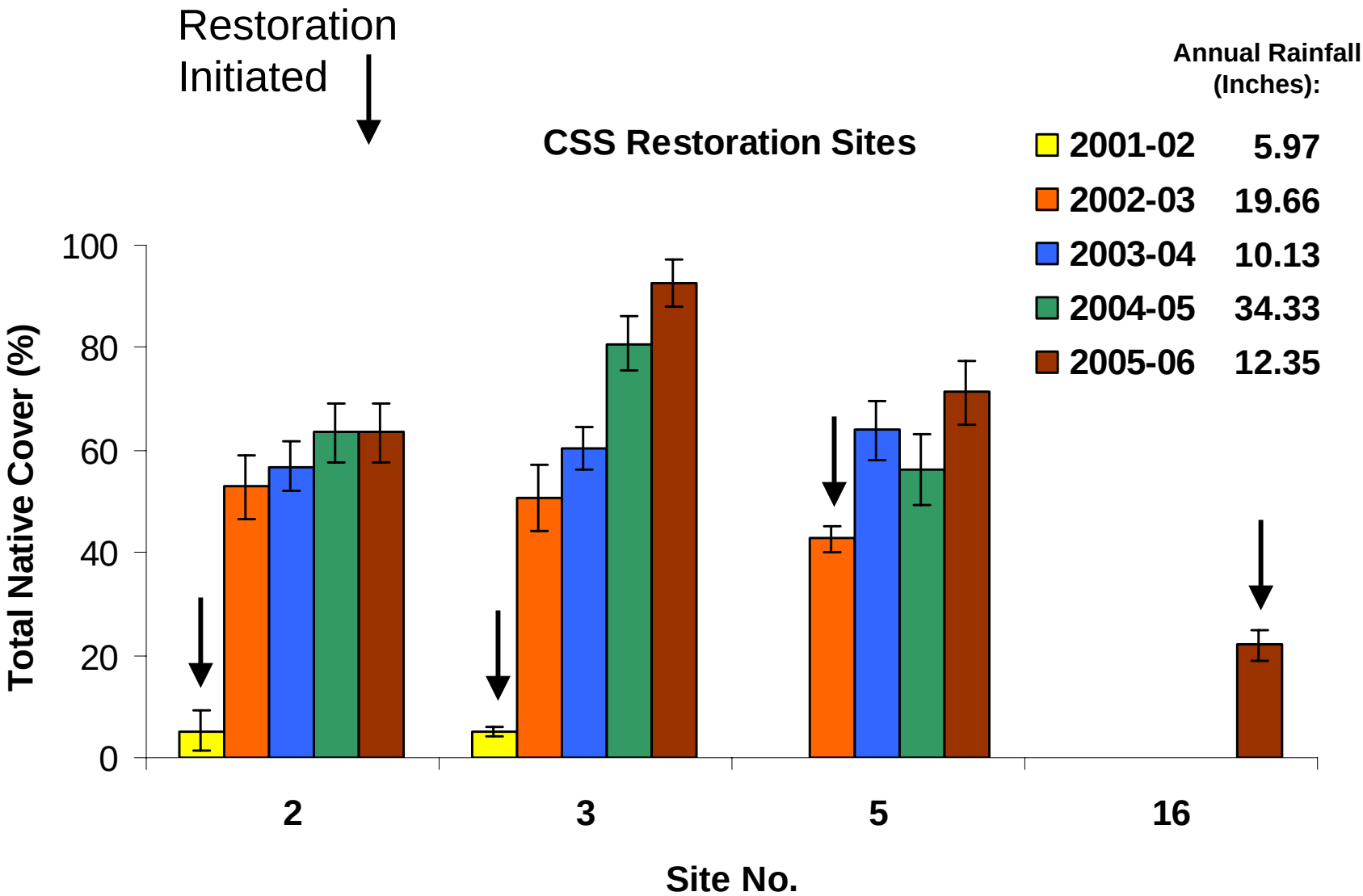
DeSimone and Zedler 1999


Coastal sage scrub
Seedling recruitment zone
Monitoring transects
Thistle Treatment Area

Semiarid ecosystems:

- **high temporal variability in abiotic factors**
- **restoration may be more effective during wet years**

Bakker et al. 2003. Ecological Applications 13



Baseline cover CYNCAR: range 40 – 90%

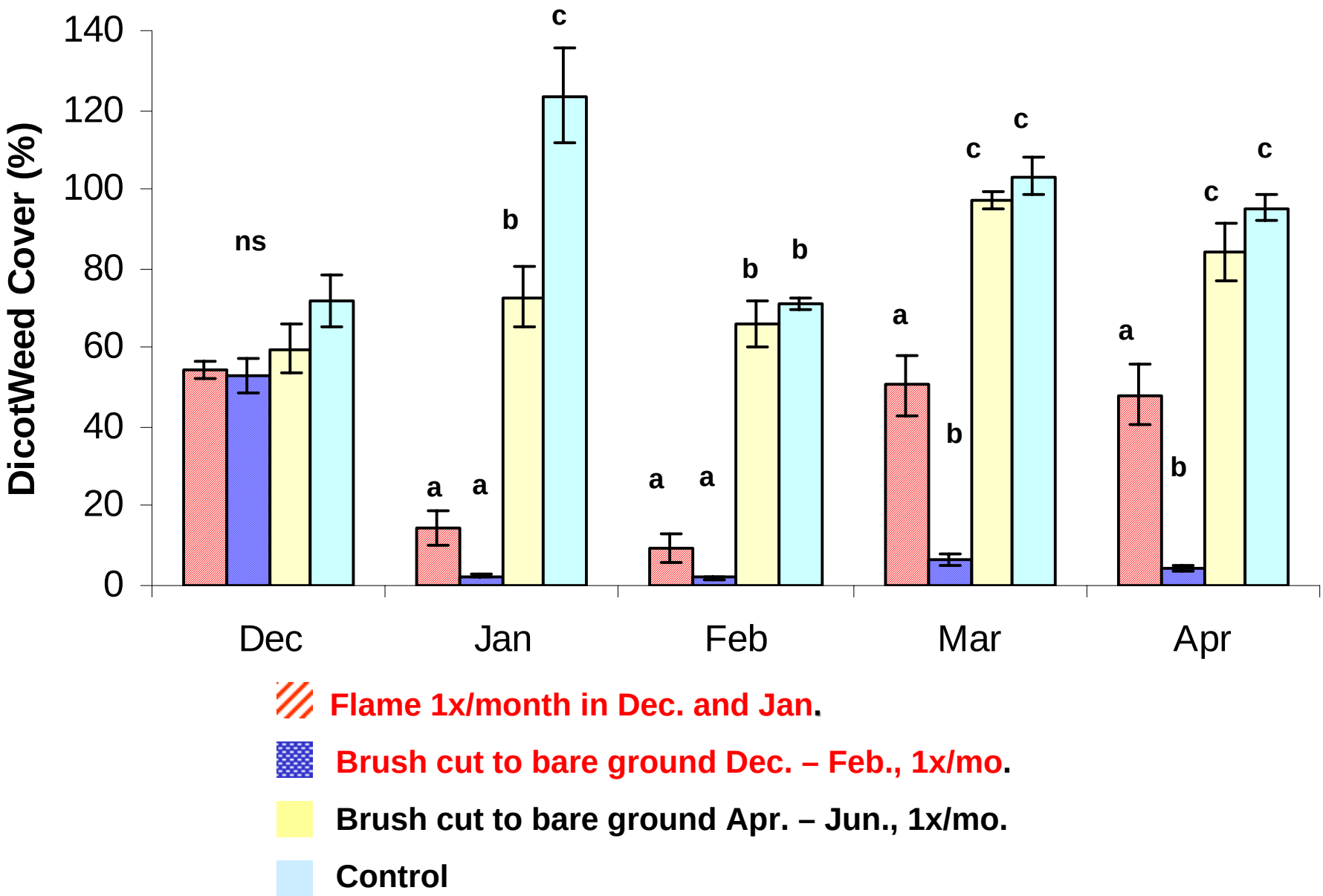
Site acreages: range 3 - 5


#4 3-18-
PP3 T1

Techniques for Control of Exotic Herbs

a = 4, n = 6; df = 20

p < 0.05



Flame 1x/month in Dec. and Jan.

Brush cut to bare ground Dec. – Feb., 1x/mo.

Brush cut to bare ground Apr. – Jun., 1x/mo.

Control

Techniques for Control of Exotics Experiment:

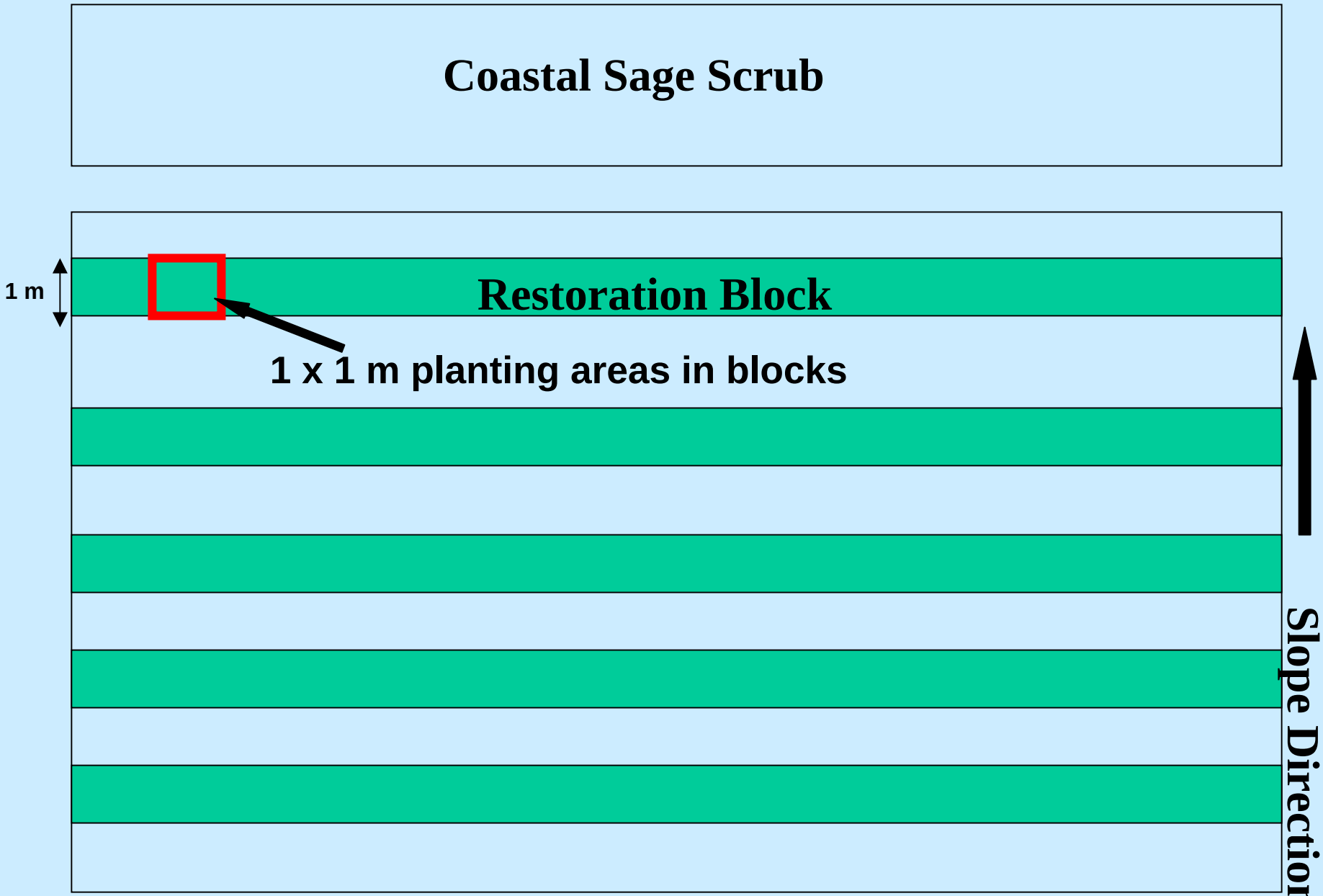
1. **What works in one site in one ppt year may not predict what will work in a different site in a different ppt year**
2. **Experiments on techniques do have value but:**

- **must either run the experiment over several years or**
- **repeat the experiment over different years and in different sites**
- **supplement experiments with long-term observational studies**

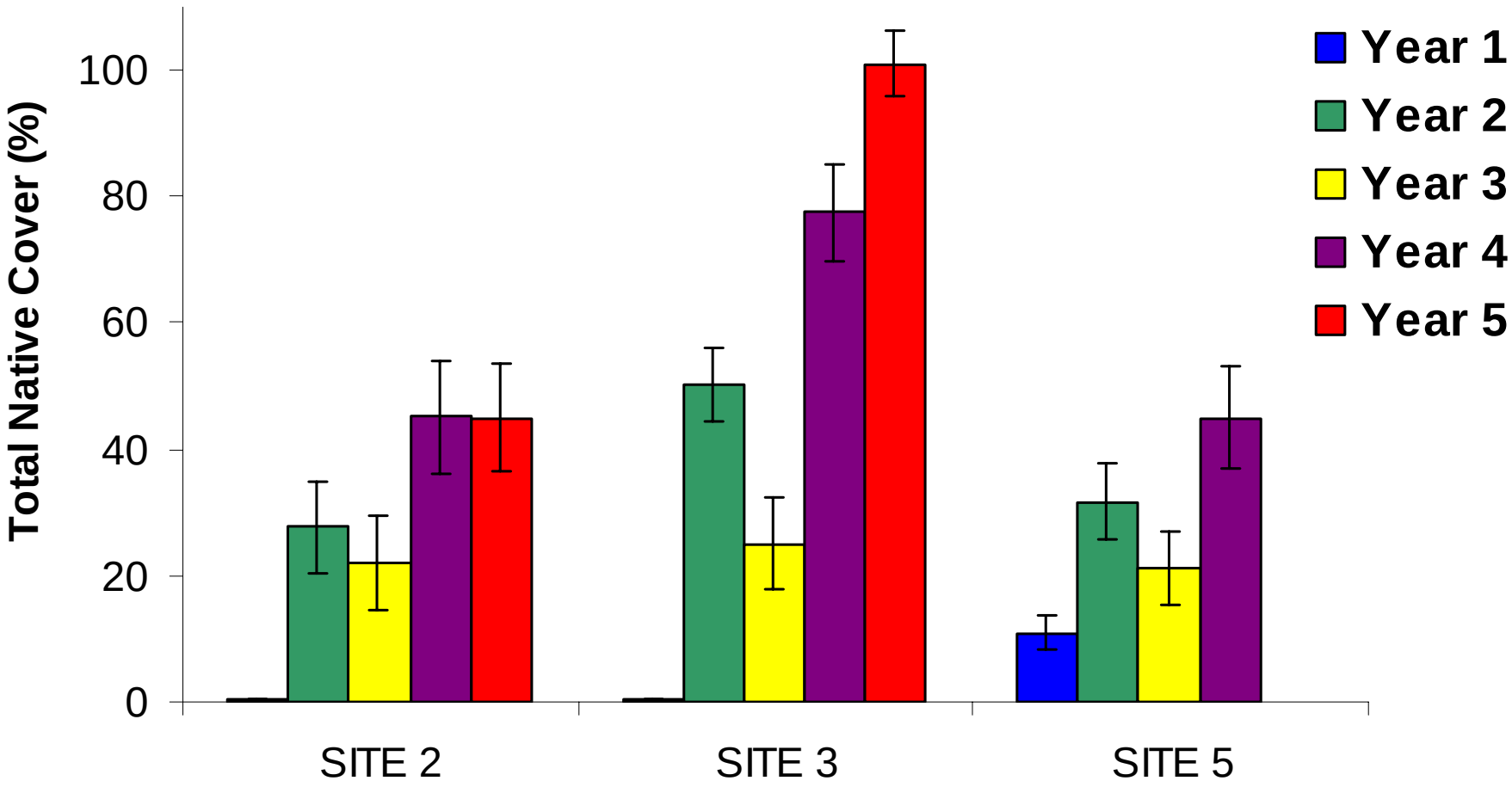
Passive Restoration – Colonization by Natives

“ One of the first tenets of ecological restoration is to consider the option of doing nothing. Rather than spending time and money on the introduction and establishment of species at a restoration site, it may be cost effective to allow natural recruitment processes to take place.”

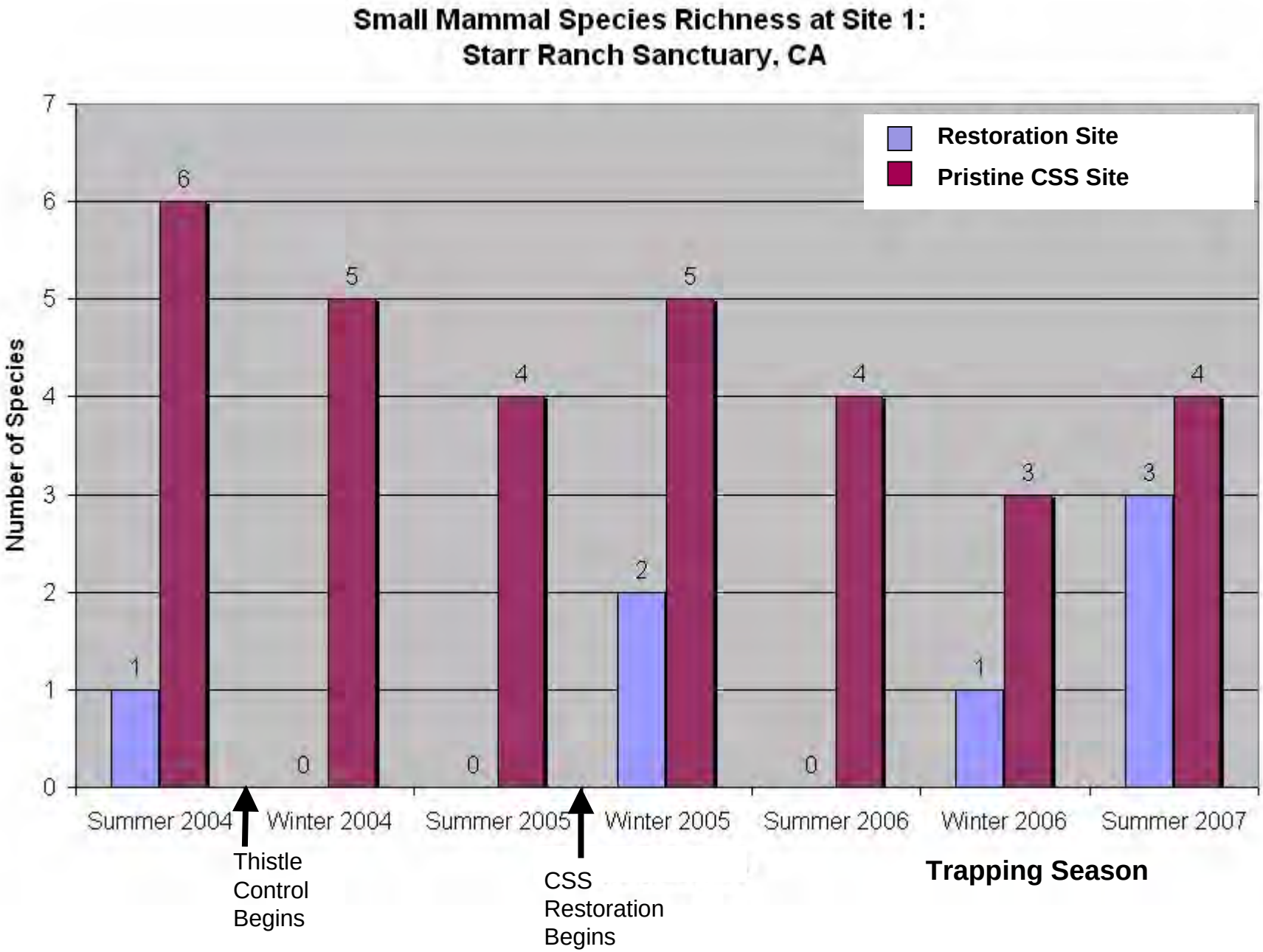
K.J. Rice and and C. Emery. 2003. Frontiers in Ecology and the Environment


Coastal Sage Scrub
1 m
Restoration Block
1 x 1 m planting areas in blocks
Slope Direction

Total Native Cover in Buffers Between Blocks



Is there an optimum buffer or block width? Trials 2005 - ???


Small Mammal Species Richness at Site 1:
Starr Ranch Sanctuary, CA
Restoration Site
Pristine CSS Site
Number of Species
0
1
2
3
4
5
6
7
1
6
0
5
0
4
2
5
0
4
1
3
3
4
Summer 2004
Winter 2004
Summer 2005
Winter 2005
Summer 2006
Winter 2006
Summer 2007
Trapping Season
Thistle Control Begins
CSS Restoration Begins

Weed Removal and Restoration: Field Crew Leader and Field Assistant Hours

Date	Grassland no.	No. in Crew	Start time	End time	Person hrs (crew*(hrs-lunch))	AT Cover (%) [1]	AT Tool [2]	Total person hrs AT removal	Total person Removal Tool [2] Non AT Weed	Total hrs NonAt Weed Removal Acitivity [3]	Restoration	Total person hrs restoration

[1] **Cover Classes**
(R)are < 5%
(I)nfrequent 5 - 20%
(C)ommon 20 - 40%
(A)bundant >40%

Grassland numbers

2	11	20S	29U	47
3L	12	21	39	48
4	15	26BM	41	**(L)**oop (**C**)ut-(**O**)ff
5	16	28LL	43	
9	20N	28M	45	

[2] **Tools**
(B)ruscutter
(F)lamer
(H)oe
(HW) Handweed
(T)ractor

[3] **Restor. Activ. in Blocks:**
(**P**)lanting
(**W**)eeding
(BP)Block**P**rep

Costs

2004-05

Activity	Cost/acre *	Acreage
CYNCAR control	$100.00	342
Exotic annual control	$65.00	262
Restoration (active)	$230.00	46
TOTAL	$395.00	

* (costs based on $20/hour/person)

Conclusions

1. With persistence and diligence, a non-chemical approach to invasive species control can be efficient and effective.

2. We hope that our research-based approach to exotic control and restoration, which combines monitoring and experiments that test alternative management techniques, will promote effective decision-making in the face of climate change.