

Adaptive management of grasslands: lessons from California's coastal prairies

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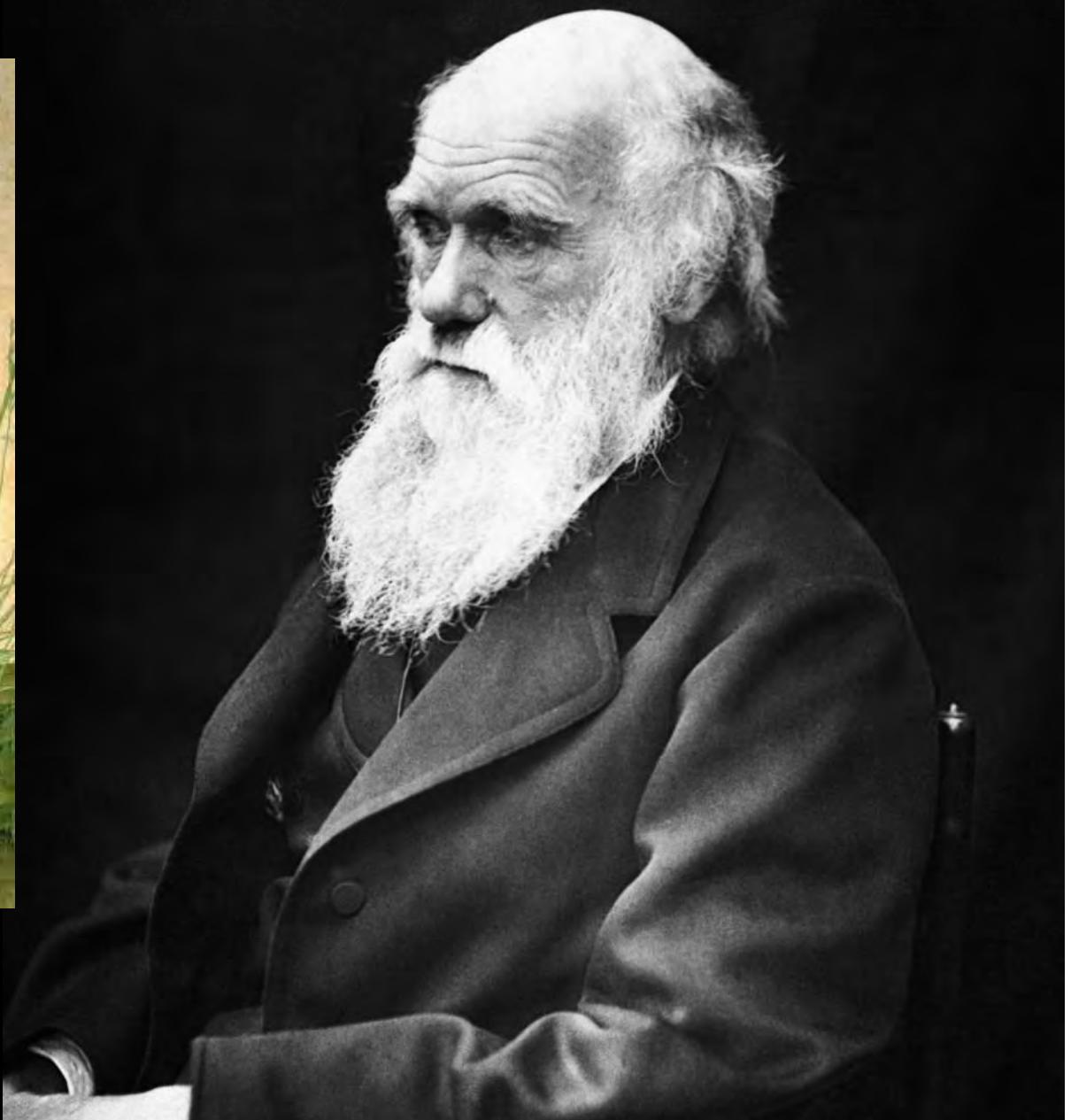




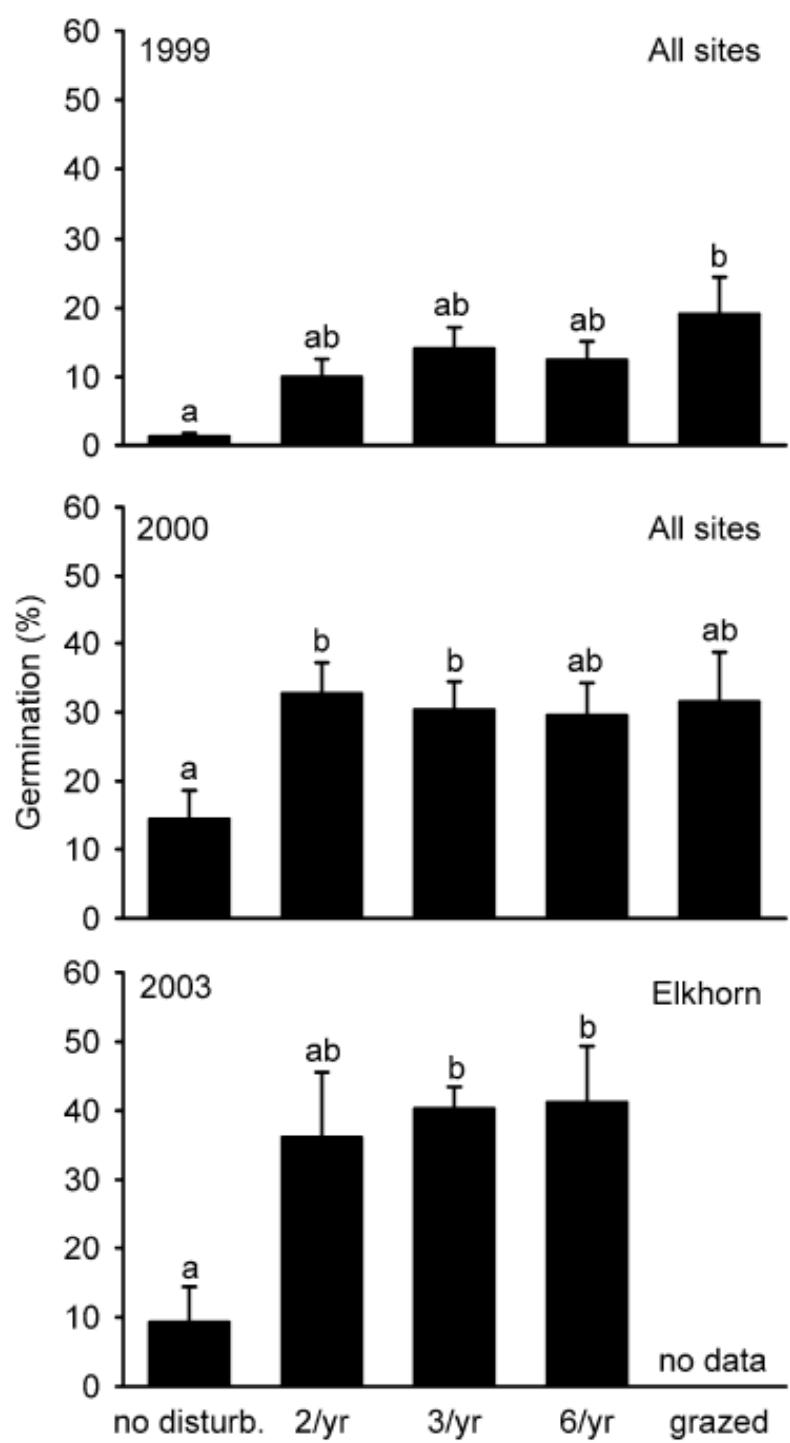


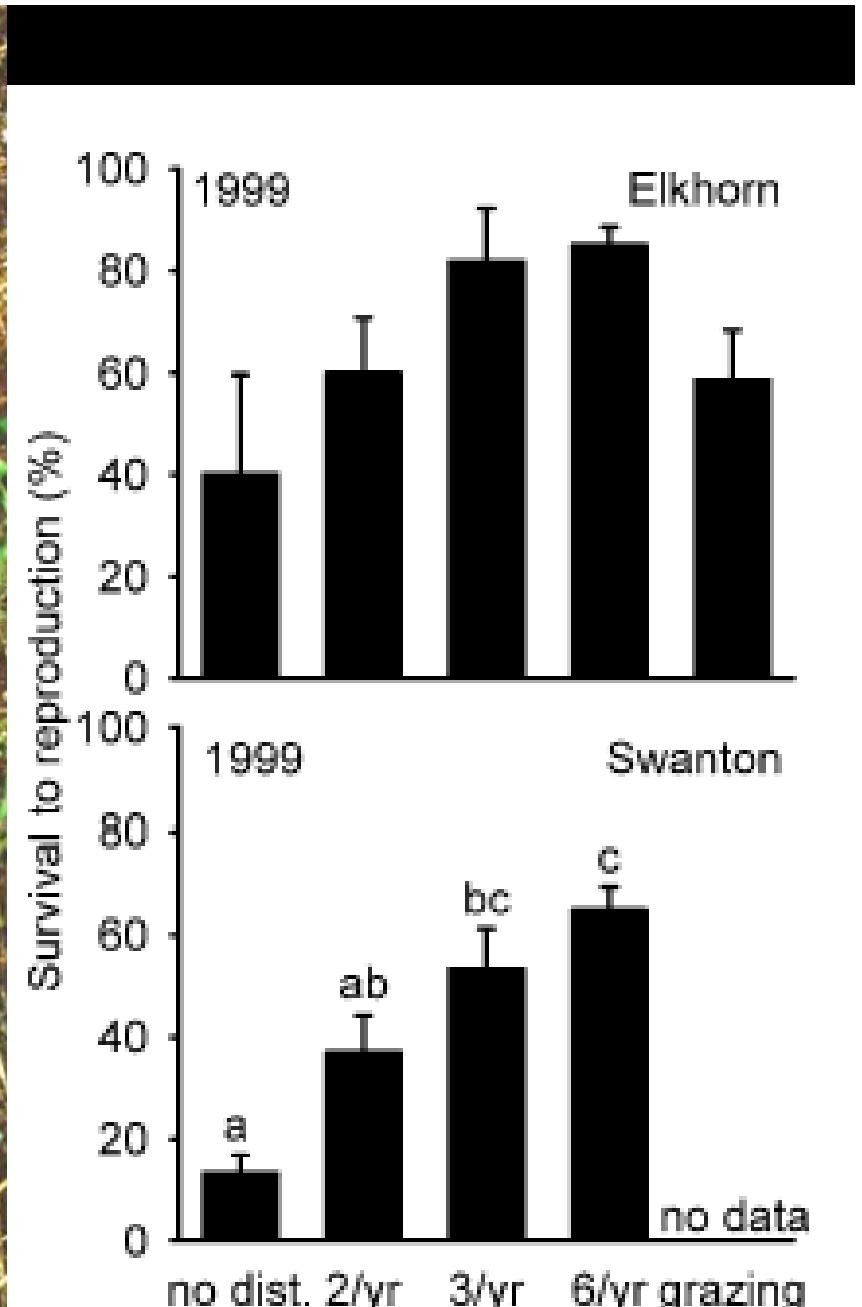


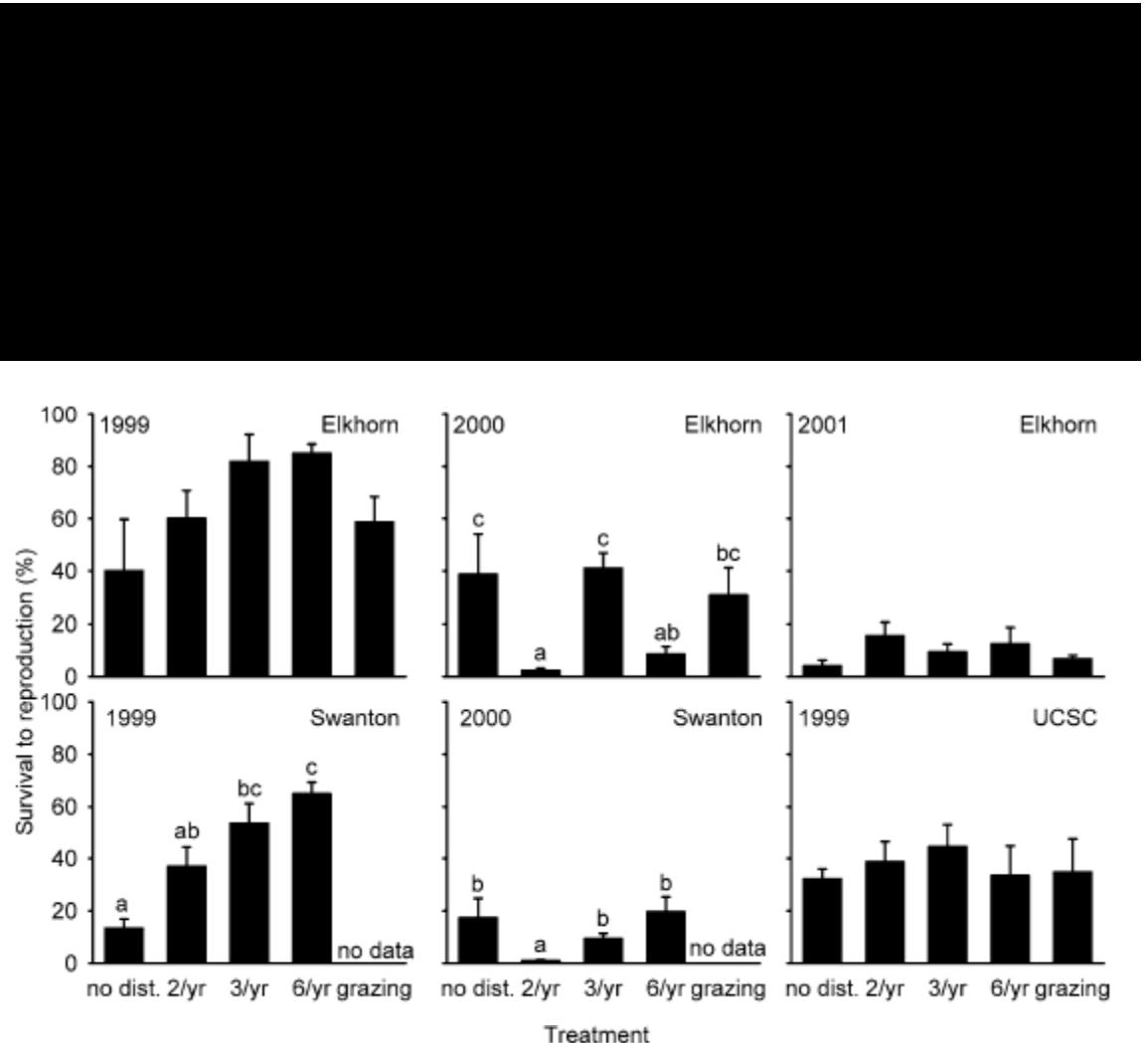


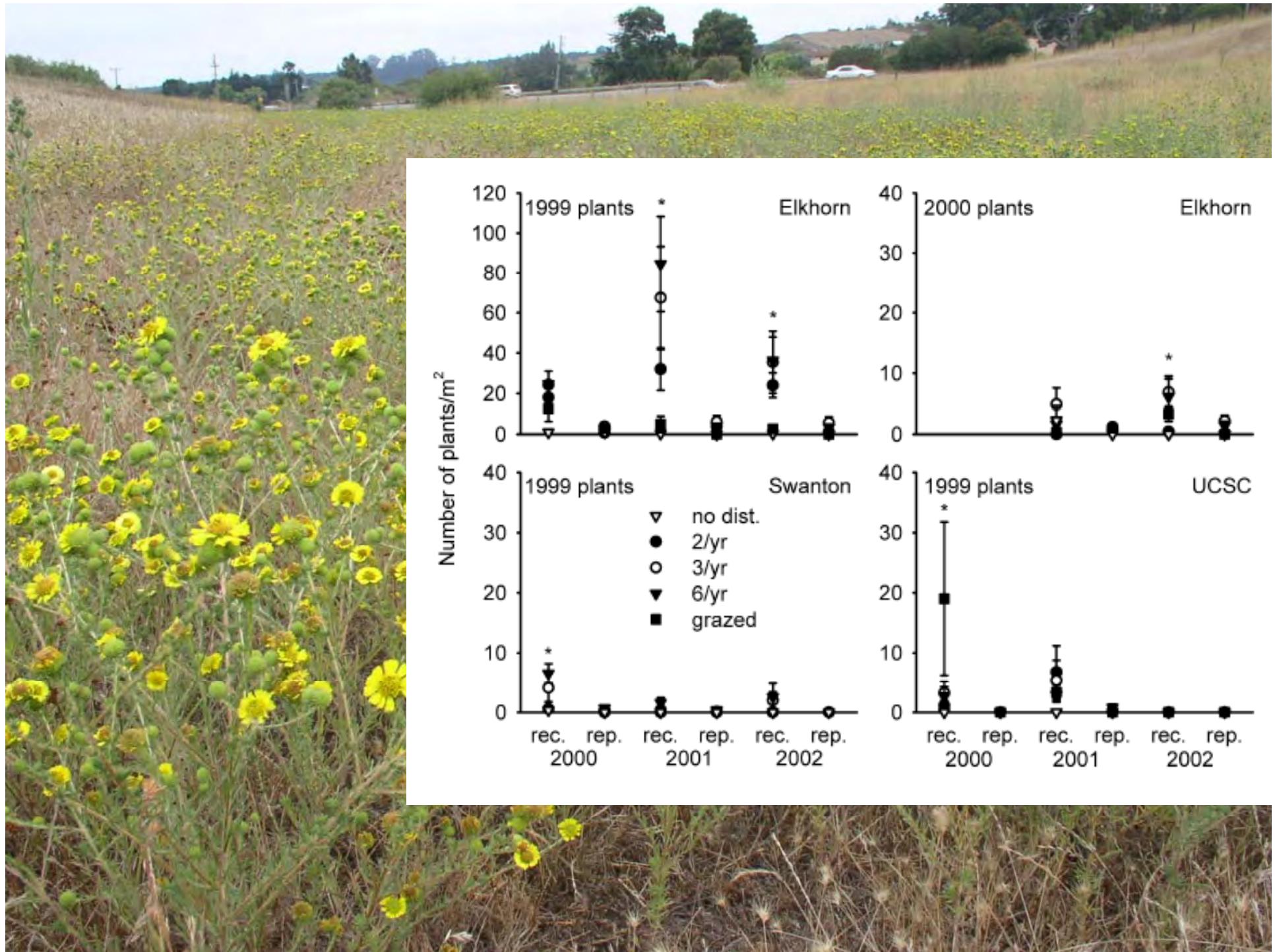


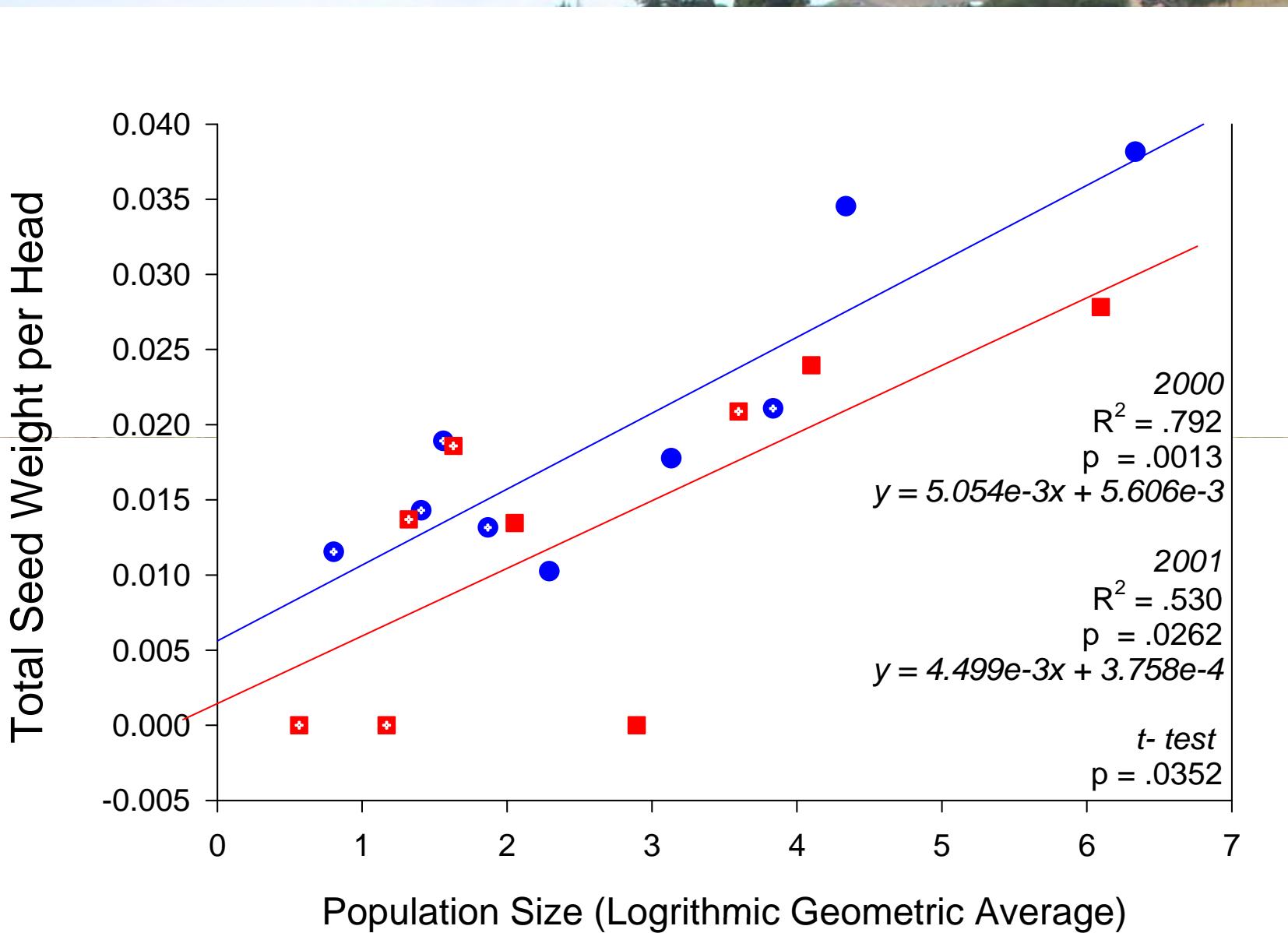


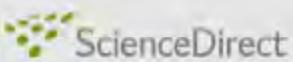












Seed banks in plant conservation: Case study of Santa Cruz tarplant restoration

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ABSTRACT

Although conservation and restoration practitioners have focused on maximizing above-ground population size and seed set of rare plants, a clear understanding of seed bank dynamics is crucial to managing these species. Santa Cruz tarplant (*Holocarpha macradenia*) is a threatened annual forb restricted to coastal prairie habitats in central California. *Holocarpha* produces disk achenes germinating within a year of production and ray achenes forming a persistent seed bank. We constructed both deterministic and stochastic demographic models for a restored *Holocarpha* population, using demographic rates measured separately for unmanipulated plants and plants growing in plots where vegetation was clipped. The deterministic models indicated that regardless of germination from the seed bank, the population would decline without clipping or similar treatments that enhance survival and reproductive output. Deterministic models showed only a slight positive effect of increased ray seed germination rates on population growth, which would need to be balanced against a potential loss of buffering against environmental variation as the dormant seed bank was reduced. Our stochastic simulations suggested that extinction risk for *Holocarpha* populations would be minimized by intermediate levels of ray seed germination. Thus, managers should focus on improving the performance of aboveground plants before considering actions to stimulate germination, since the former will yield a greater increase in deterministic population growth and not sacrifice any buffering effect of the seed bank. This case study emphasizes the importance of considering dormant seeds and seed banks in designing successful restoration and management strategies for plant species at risk of extinction.

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1. Introduction

Successfully restoring plant species through population introductions requires fostering demographic processes that allow

demography and identifying factors that can promote population growth. Demographic modeling and Population Viability Analyses (PVAs) are widely used to address both deterministic and stochastic threats to natural populations of species of





Transplanted Populations of *Holocarpha macradenia*, Contra Costa County, Numbers of Individuals

Stand Name (#) (soil type) EO#/owner- ship ¹	'82	'83	'84	'85	'86	'87 ²	'88	'90	'91	'92	'93	'94	'95	'96	'97	'98	'99	'00	'01	'02
Lower Belgium (1) (Diablo clay) 27/EBRP	100	175	1	47	30	250	130	No data	No data	0	0	0	No data	0	0	0	0	No data	0	
Big Belgium (2) (Millsholm loam) 28/EBRP	600	1,200	900	2,600	3,000	1,750	5,100	1	1	5	463	276	1,792	465	148	318	74	273	No data	821 (robust plants)
Big Belgium West (3) (Los Osos clay loam) 28/EBRP	100	130	25	125	50	300	450	112	415	2	35	242	169	377	51	23	0	44	No data	84
Upper Belgium (4) (Tierra loam) 29/EBRP	300	400	400	550	250	100	375	1	No data	1	4	129	328	76	22	59	59	126	No data	154
Lower Havey (5) (Millsholm loam) 30/EBRP	60	75	0	50	15	0	0	No data	No data	No data	0	0	0	No data	No data	No data	No data	No data	No data	
Mezue (6) (Tierra loam) 30/EBRP		300	125	700	700	500	800	No data	No data	No data	4,051 (count)	6,381 (count)	6,651 (count)	6,000+ (est.)	5,000- 7,000 ⁴ (est.) 60x78'	3,128 (count) 90x61'	10,000 (count) 86'x65'	17,231 (count, perimeter GPS'd)	No data	29, 657 (count, perimeter GPS'd)
Havey Saddle (7) (Millsholm loam) 31/EBRP		130	125	175	100	70	125	0	No data	0	0	0	No data	No data	No data	0	No data	0	0	
Nimitz Way II (15) (Tierra loam) 31/EBRP					750	250	300	1	No data	0	5	4	0	0	See #16	See #16	See # 16	No data	See # 16	
Nimitz Way III (16) (Tierra loam) 31/EBRP					750	700	1,500	10	No data	0	160	0	675	260	0	56	0	87	No data	0
...					20	225	500	12	No	1	0	0	204	28	17	1	2	0	No	1 (near station)

Coastal Prairie



Valley Grassland



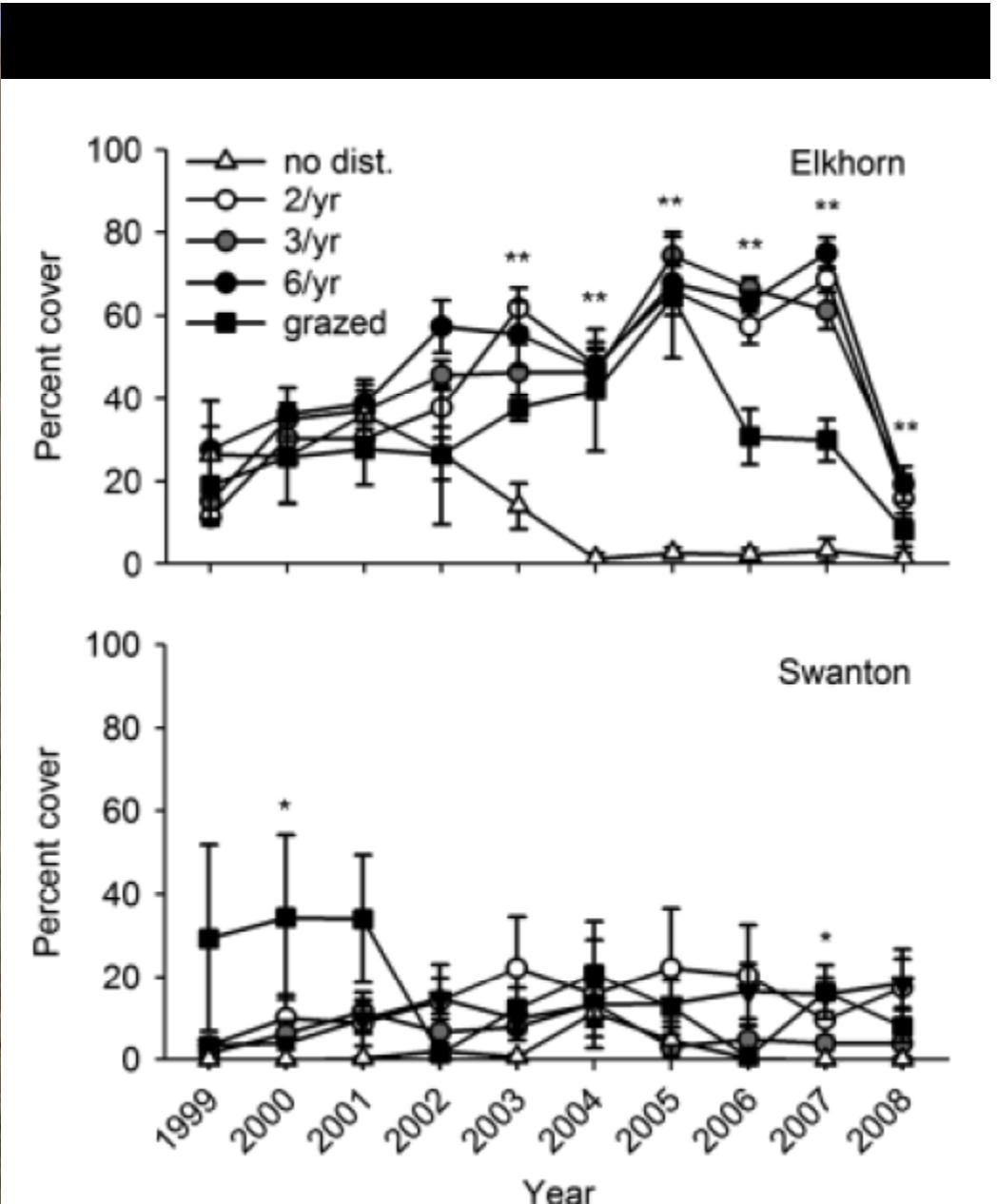






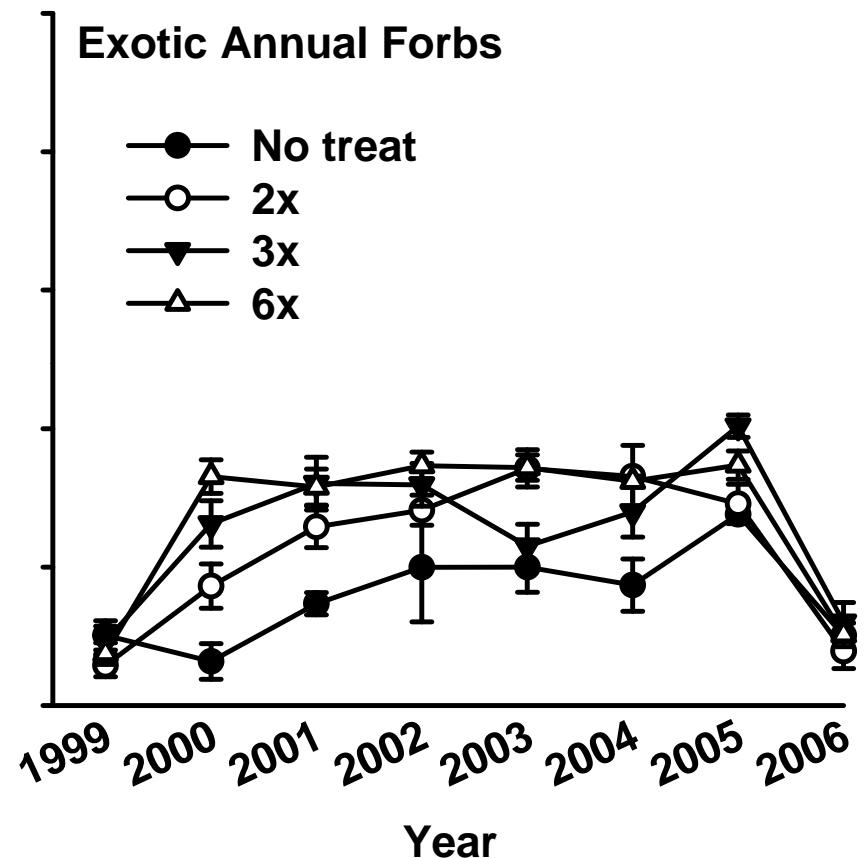
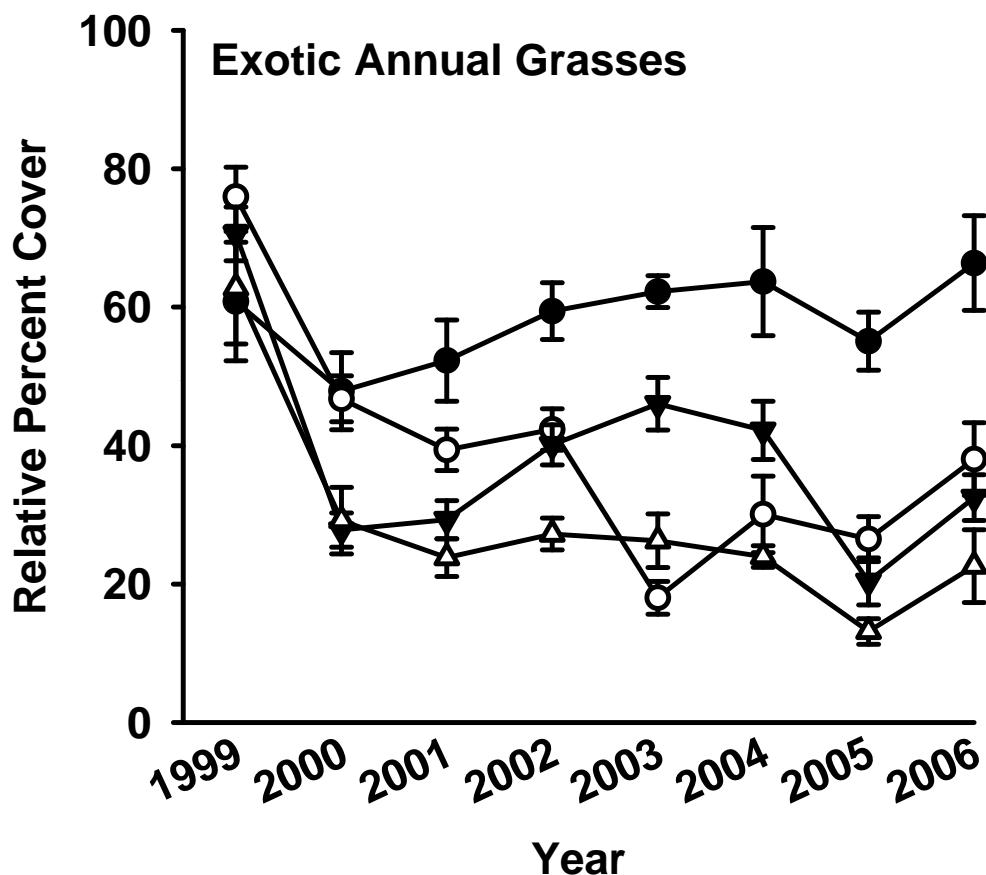


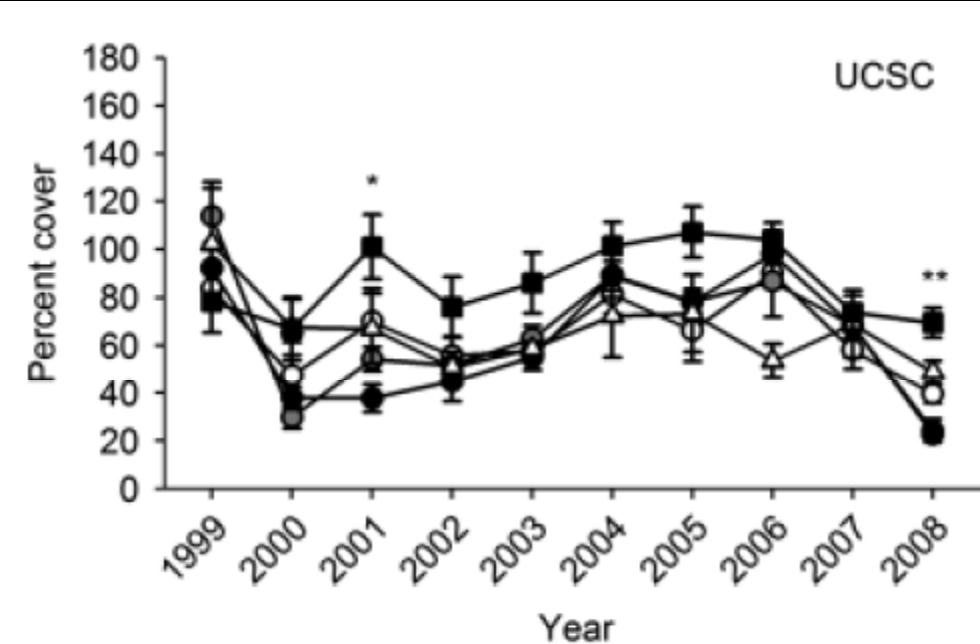






Change in Cover at Elkhorn 1999-2006



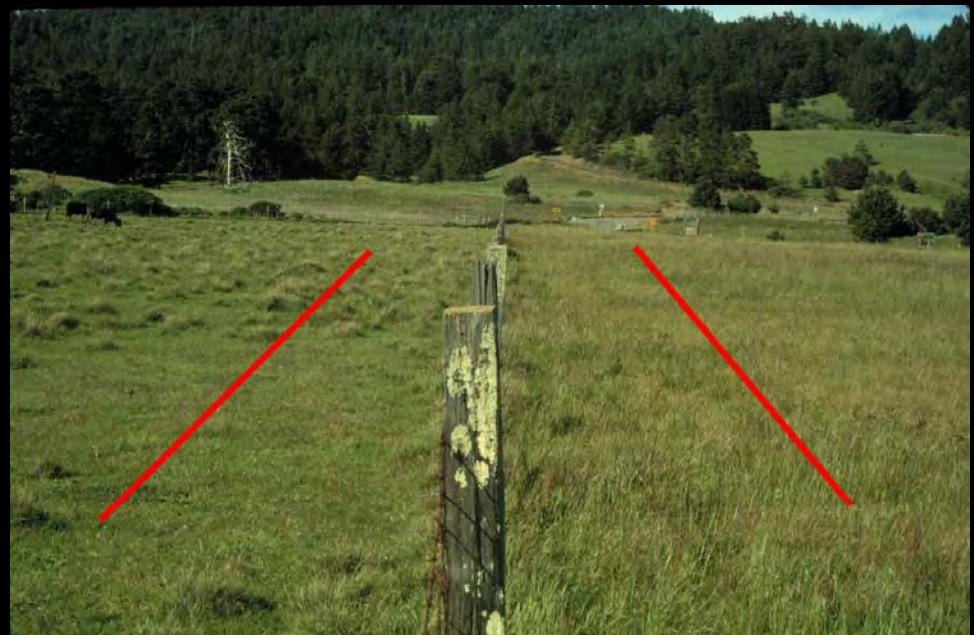
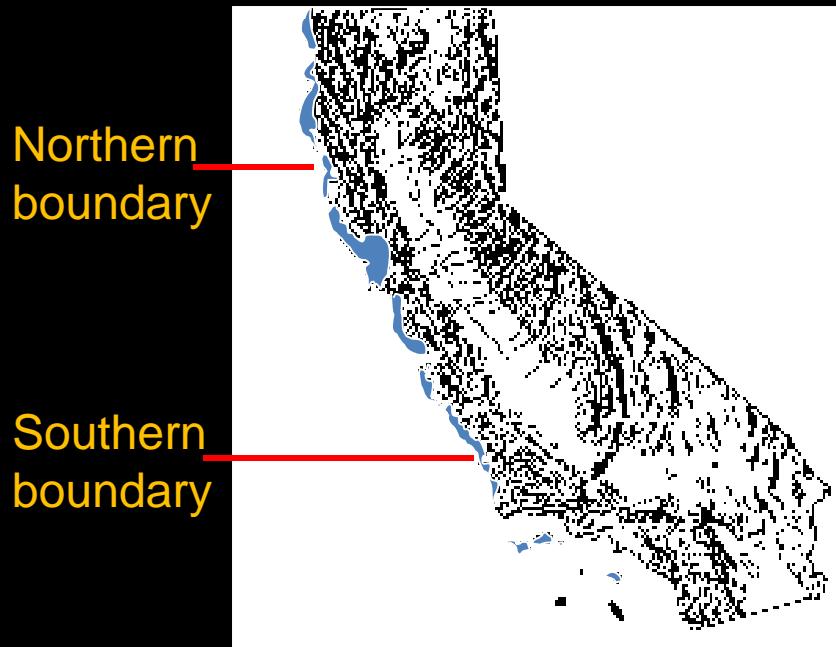


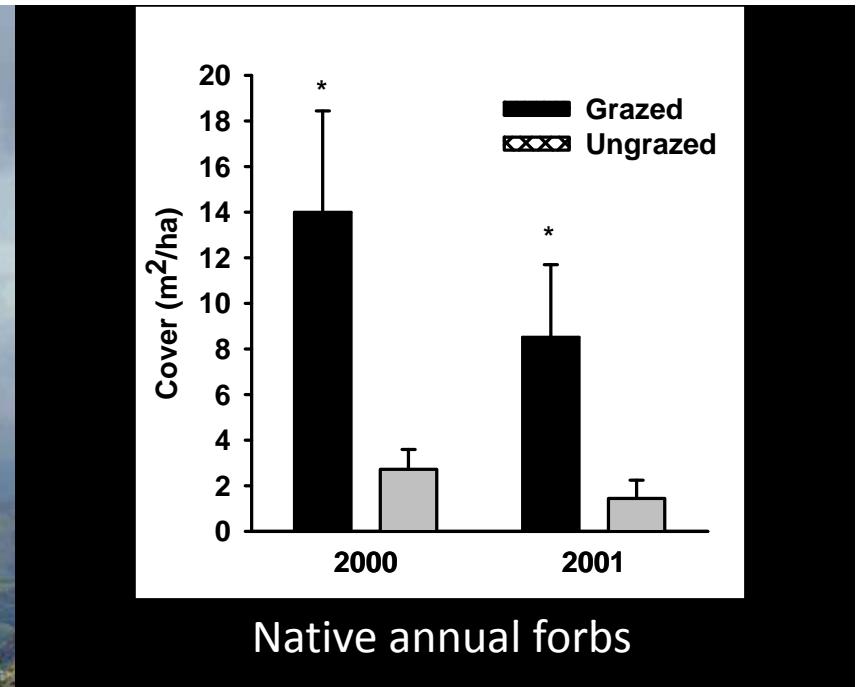


Large-scale survey

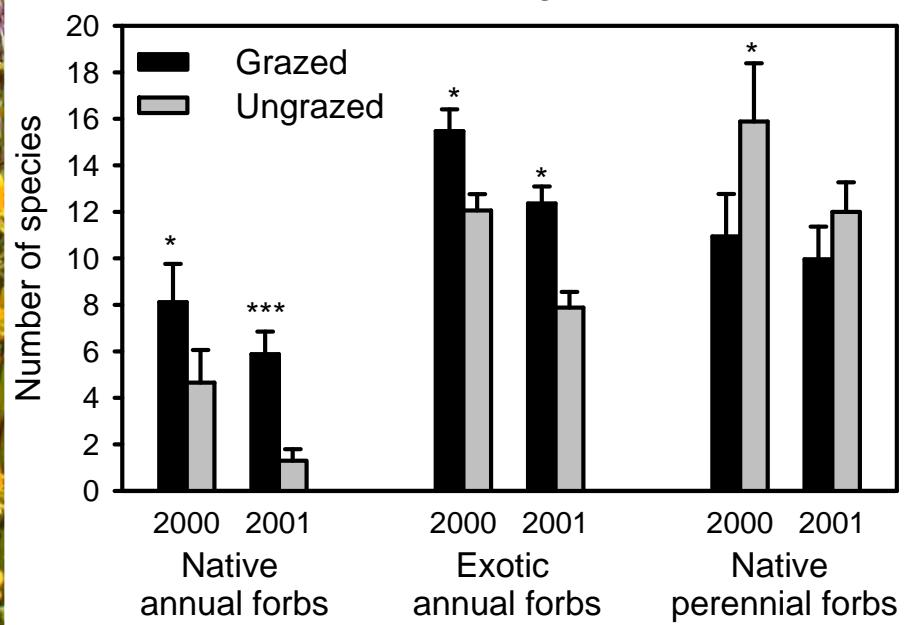
- Measured vegetation composition in 25 paired grazed-ungrazed sites along the central California coast in 2000 and 2001
- Focus on native annual forbs

Hayes and Holl 2003 – Cons. Biol. 17: 1694-1702





Species Richness of Selected Guilds
in Grazed and Ungrazed Sites















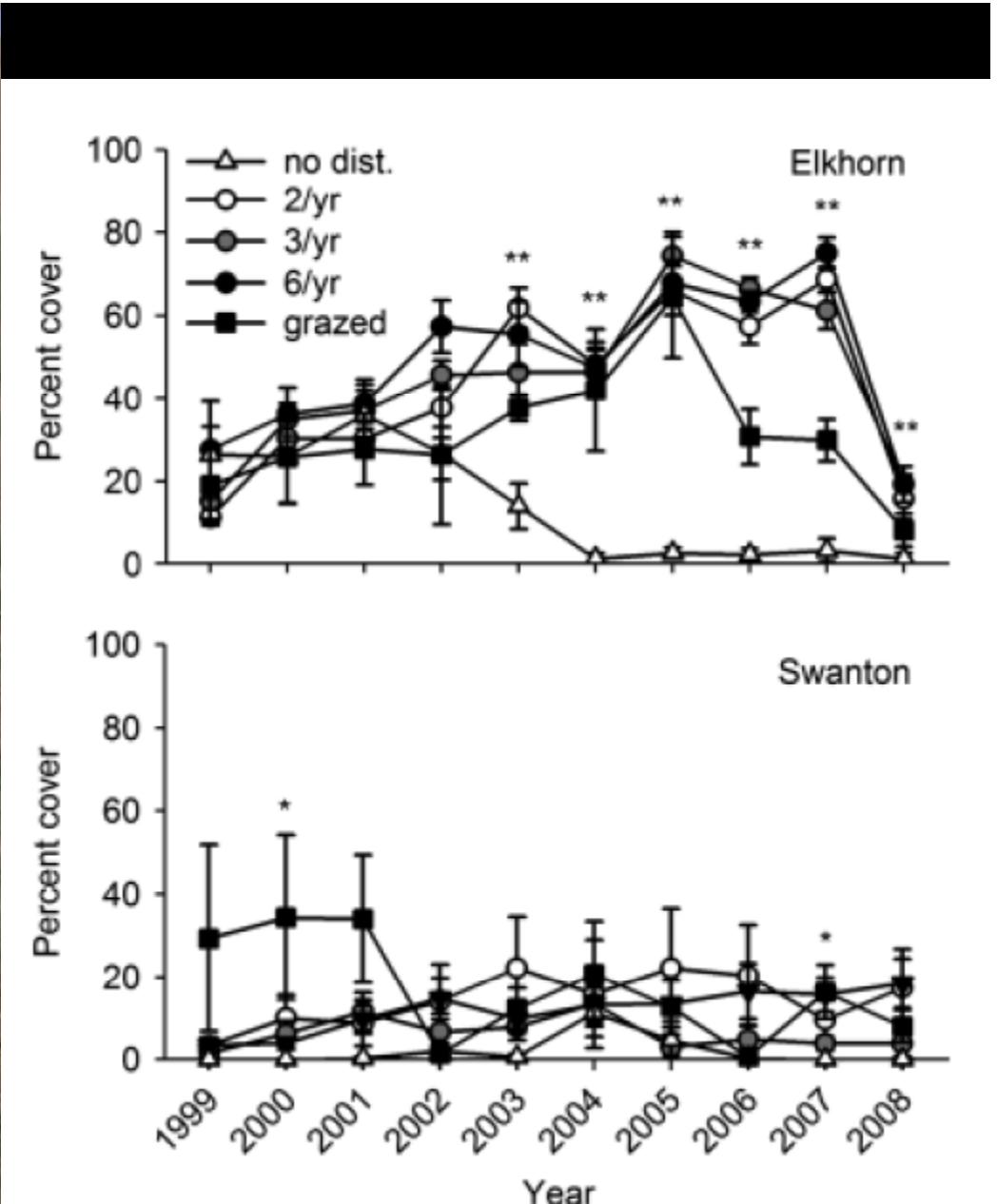












Native Populations: Santa Cruz

