



**Are exotic species shrinking  
serpentine refugia for native plants?**

**The case of a rare annual jewelflower  
in Santa Clara County, CA**

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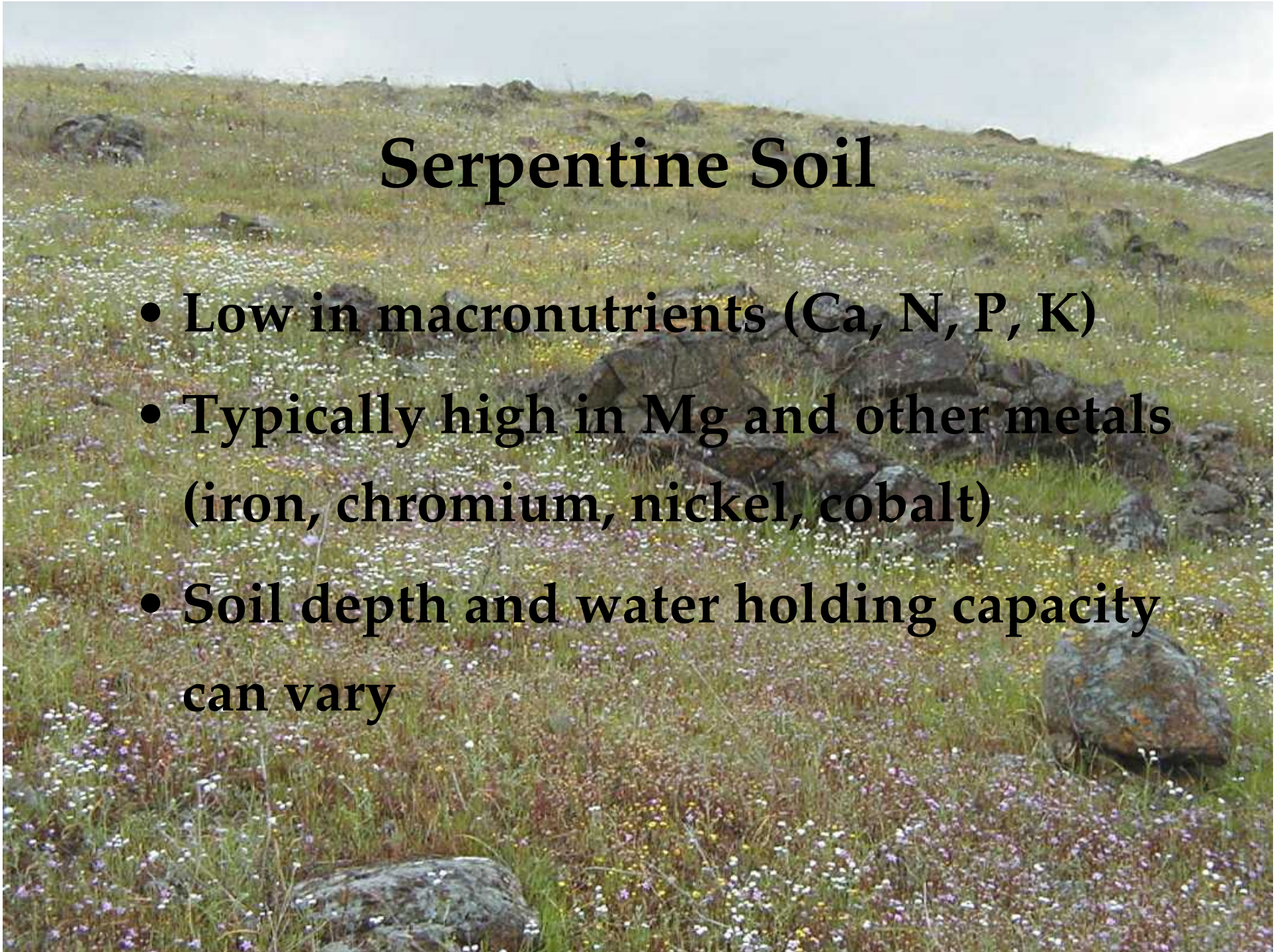
**San Jose State University**

**October 7, 2004**



# Serpentine Soil

- **Low in macronutrients (Ca, N, P, K)**
- **Typically high in Mg and other metals (iron, chromium, nickel, cobalt)**
- **Soil depth and water holding capacity can vary**





# Serpentine Refugia



*Dudleya setchellii*  
Santa Clara Valley  
Dudleya  
**Federally Endangered**

*Calystegia collina* ssp. *venusta*  
South Coast Range Morning Glory  
**Species of Concern**



*Linanthus ambiguus*  
Serpentine Linanthus  
**Species of Concern**



*Lessingia micradenia*  
var. *glabrata*  
Smooth Lessingia  
**Species of Concern**



# The Research Problem:

## Exotic Species

... are now invading serpentine areas

... are outcompeting native species

... are jeopardizing refugia

*Avena barbata* (slender wild oat), native to the Mediterranean region

# The Study Species

*Streptanthus albidus* var. *peramoenus*

(Most Beautiful Jewelflower; Brassicaceae)

Designated as a Species of Concern





# Distribution of *S. albidus* var. *peramoenus*

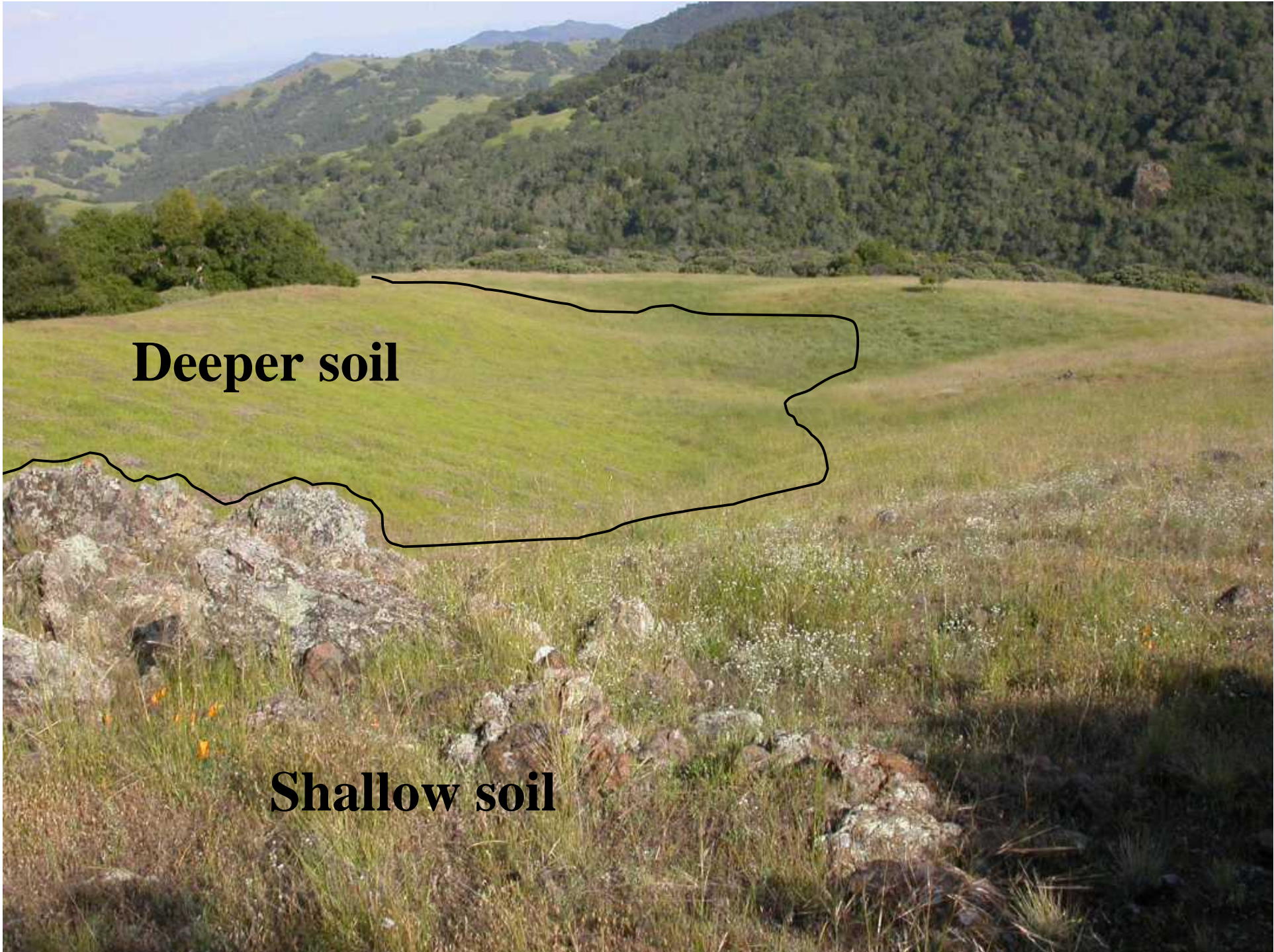




# Study Site







**Deeper soil**

**Shallow soil**



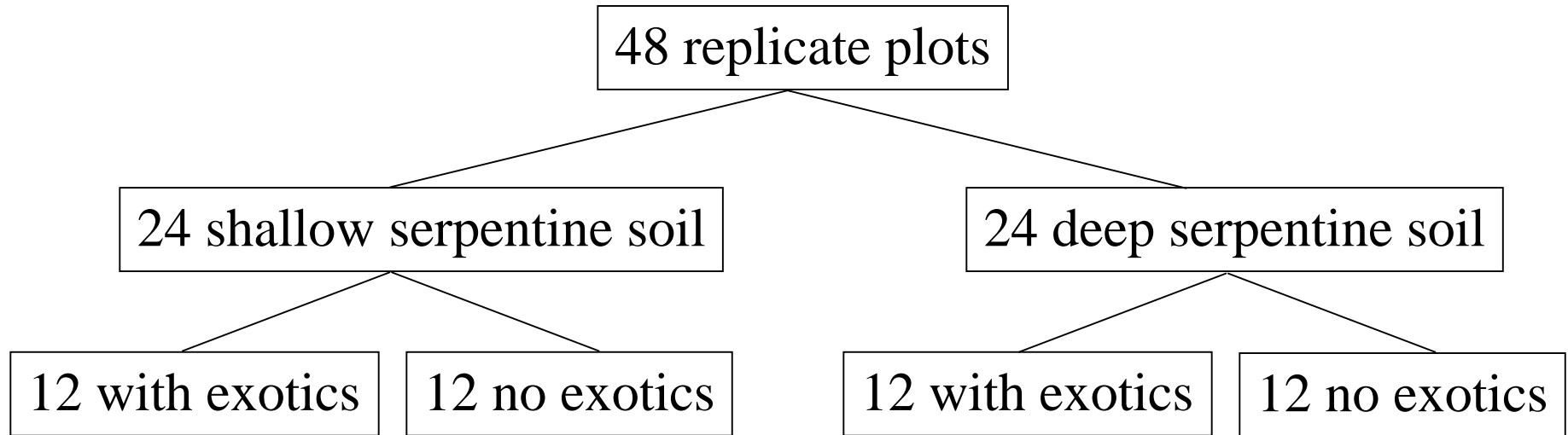
# Questions

A landscape photograph showing a grassy hillside in the foreground, leading up to a ridge covered in dense forest. The sky is overcast and hazy. The text 'Questions' is overlaid in the upper center of the image.

How does removing exotic species in both soil types affect the germination, survivorship, and fecundity of *S. albidus* var. *peramoenus*?



# Experimental Design



50 *S. albidus* var. *peramoenus* seeds per plot  
(2,400 seeds total)

- Germination, Survivorship, Fecundity
- % cover and species richness of community



# Exotic Removal Treatment (every 6 weeks)

Initial  
(Fall)



March  
(following  
Spring)

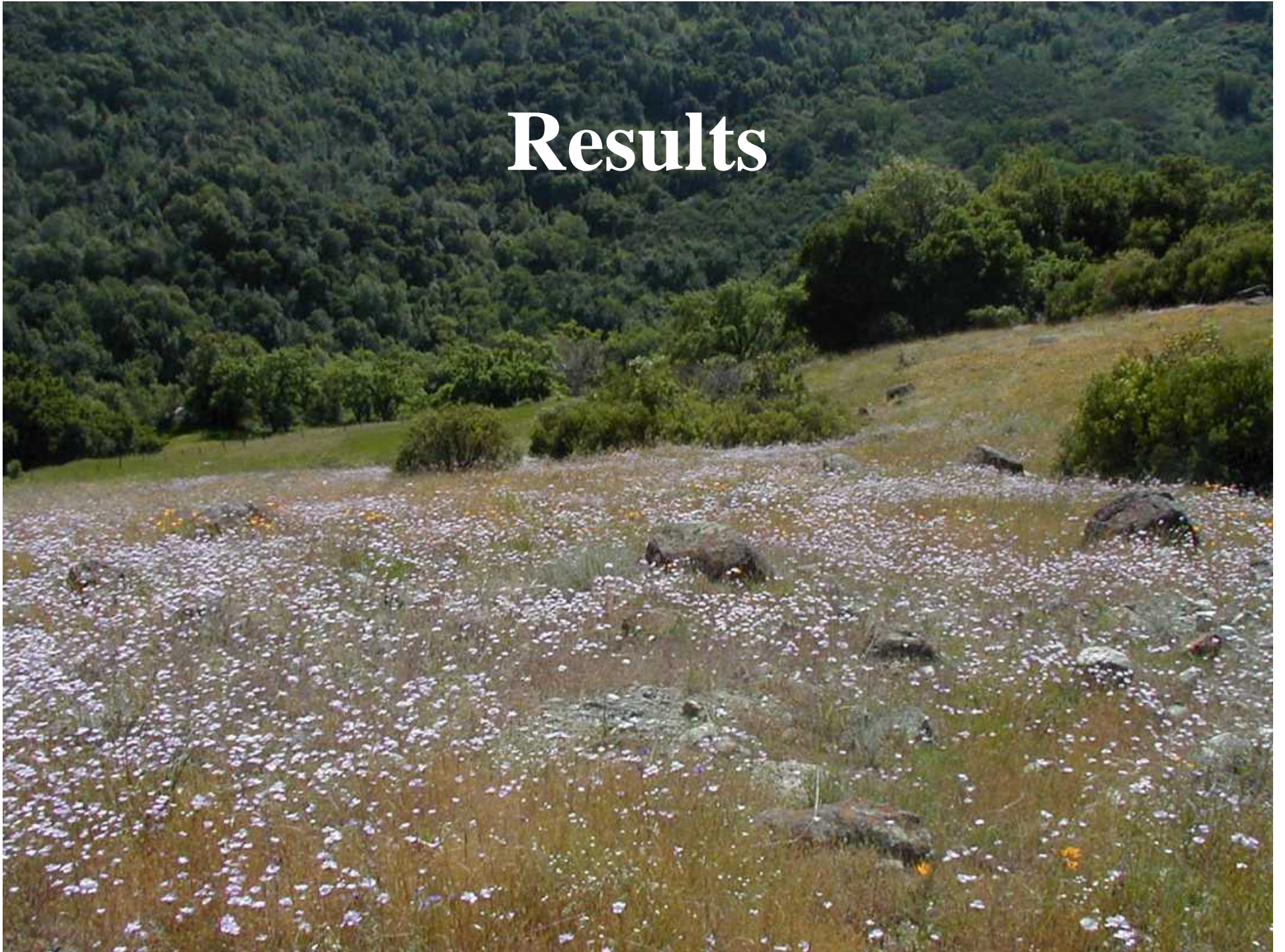








# Results





# Germination = observing germinants



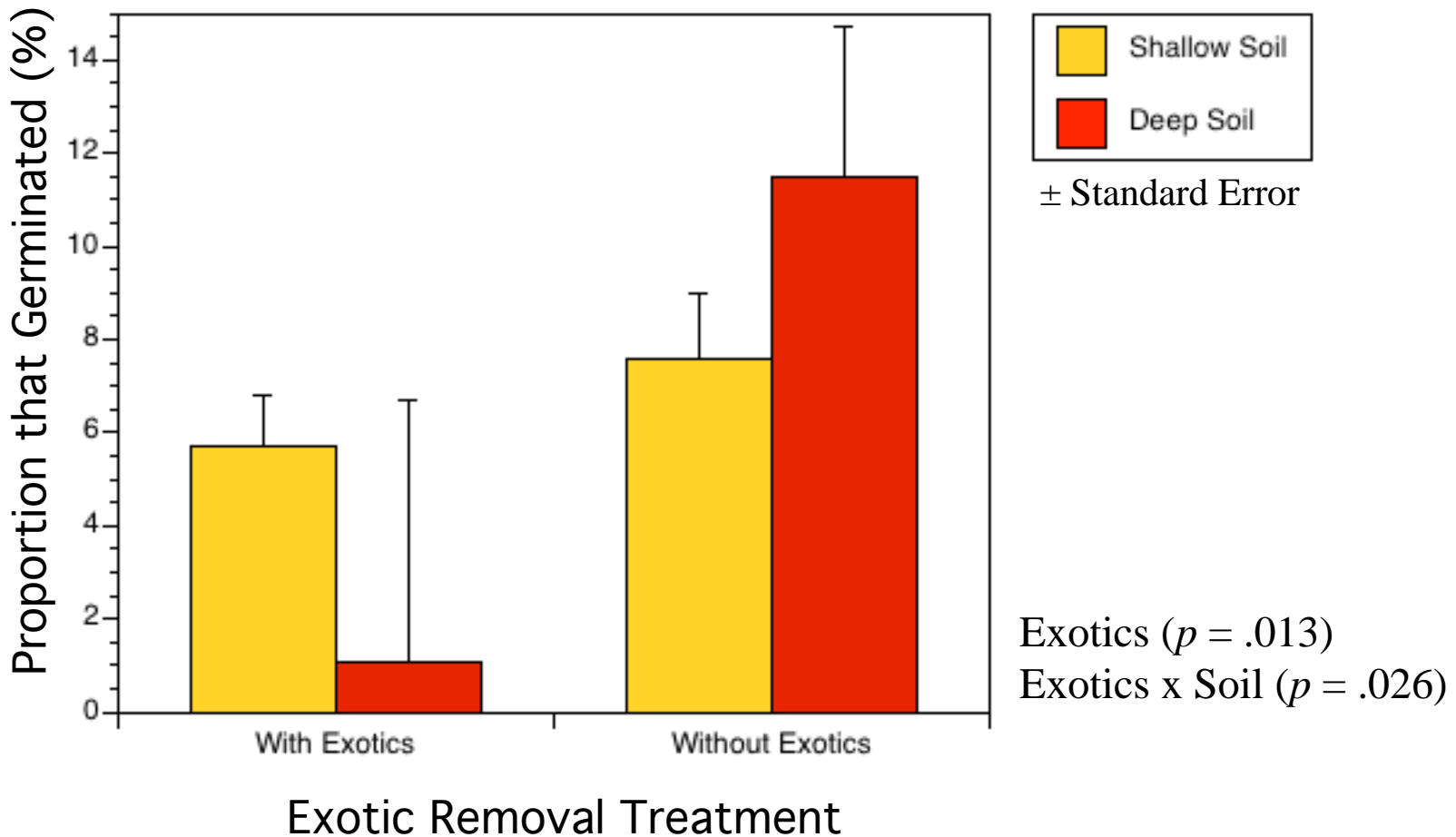
*S. albidus* var.  
*peramoenus*  
germinants

toothpicks





# Exotic species decrease germination of *Streptanthus*



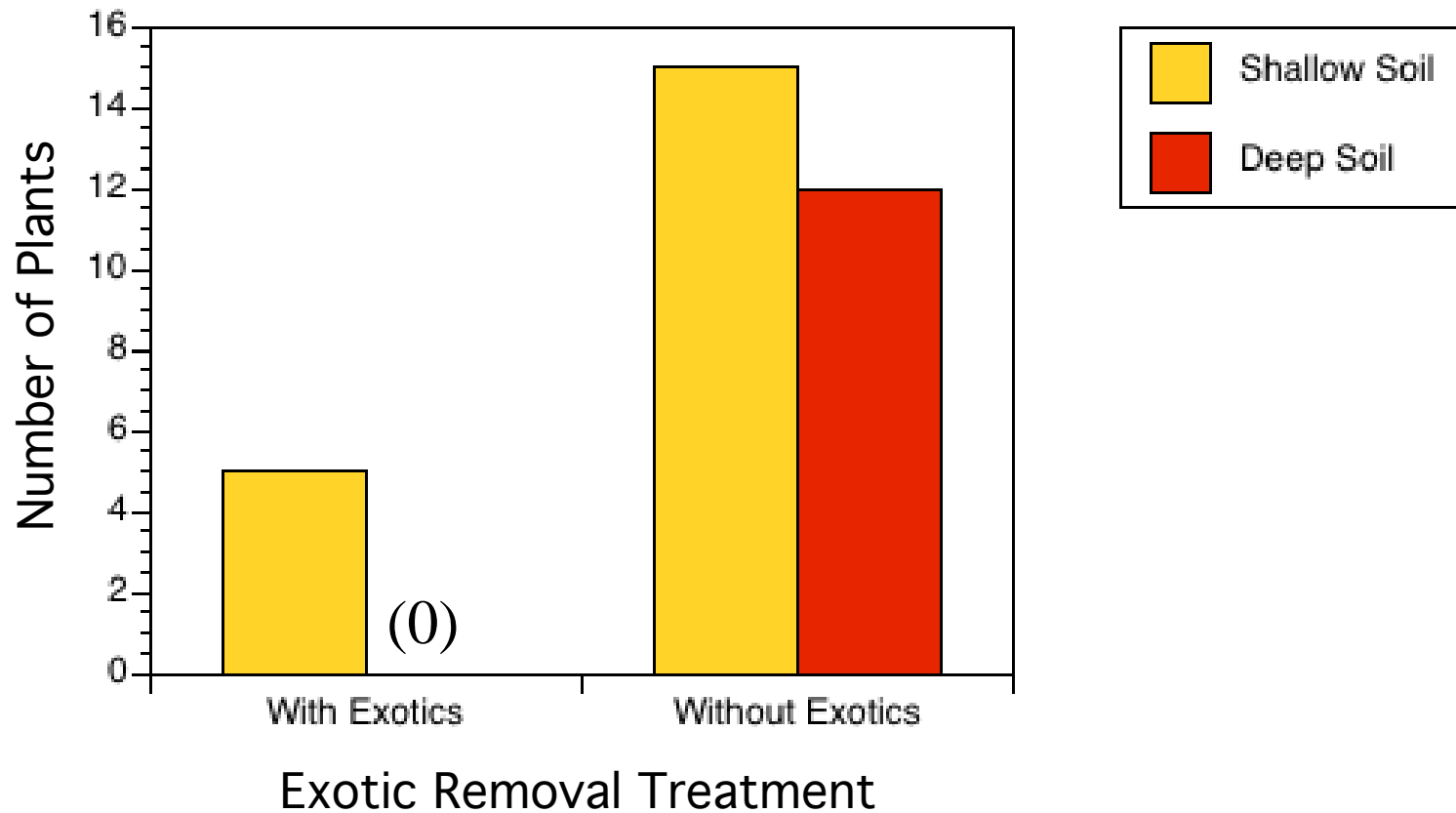


**Survivorship** = survive to  
create seed-bearing fruit





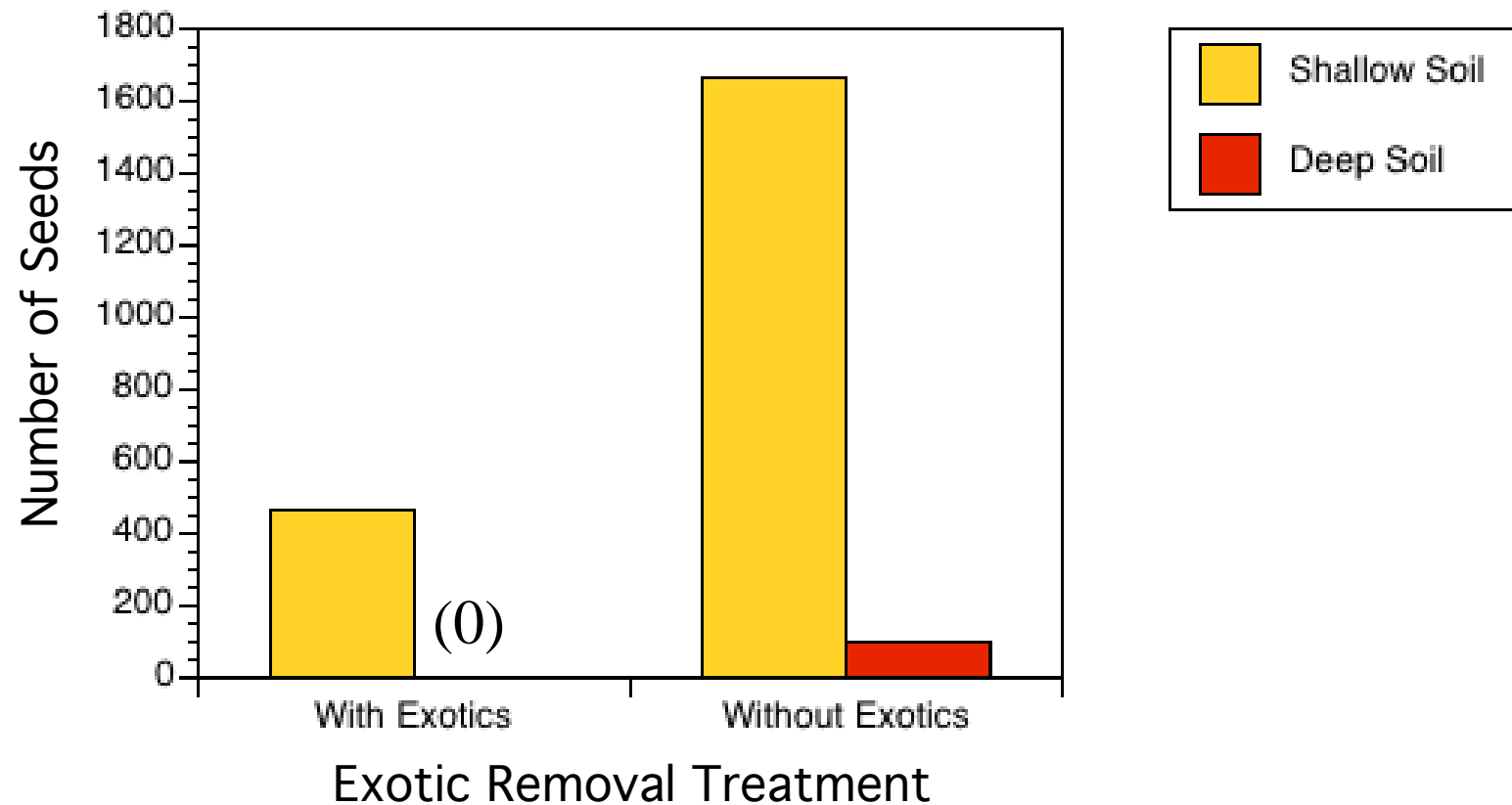
# Exotic species decrease survivorship of *Streptanthus*





# Exotic species decrease fecundity of *S. albidus* var. *peramoenus*

**Fecundity** = number of seeds produced





# Conclusions

- *Streptanthus* did well in deep serpentine soils when exotics were removed
- *Streptanthus* could have had a larger distribution that included the deeper serpentine soil areas
- Populations of *Streptanthus* could be expanded





A large, spreading tree with green foliage stands on a grassy hill. The sky is clear and blue. The text 'Recommendations' is overlaid in the upper right, and 'Expand Refugia' is overlaid in the lower left, followed by a bulleted list of three items.

# Recommendations

## Expand Refugia

- Removing or reducing exotics
- Adaptive management
- Seed bank establishment



# Thank You's

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And my trusty field assistant...