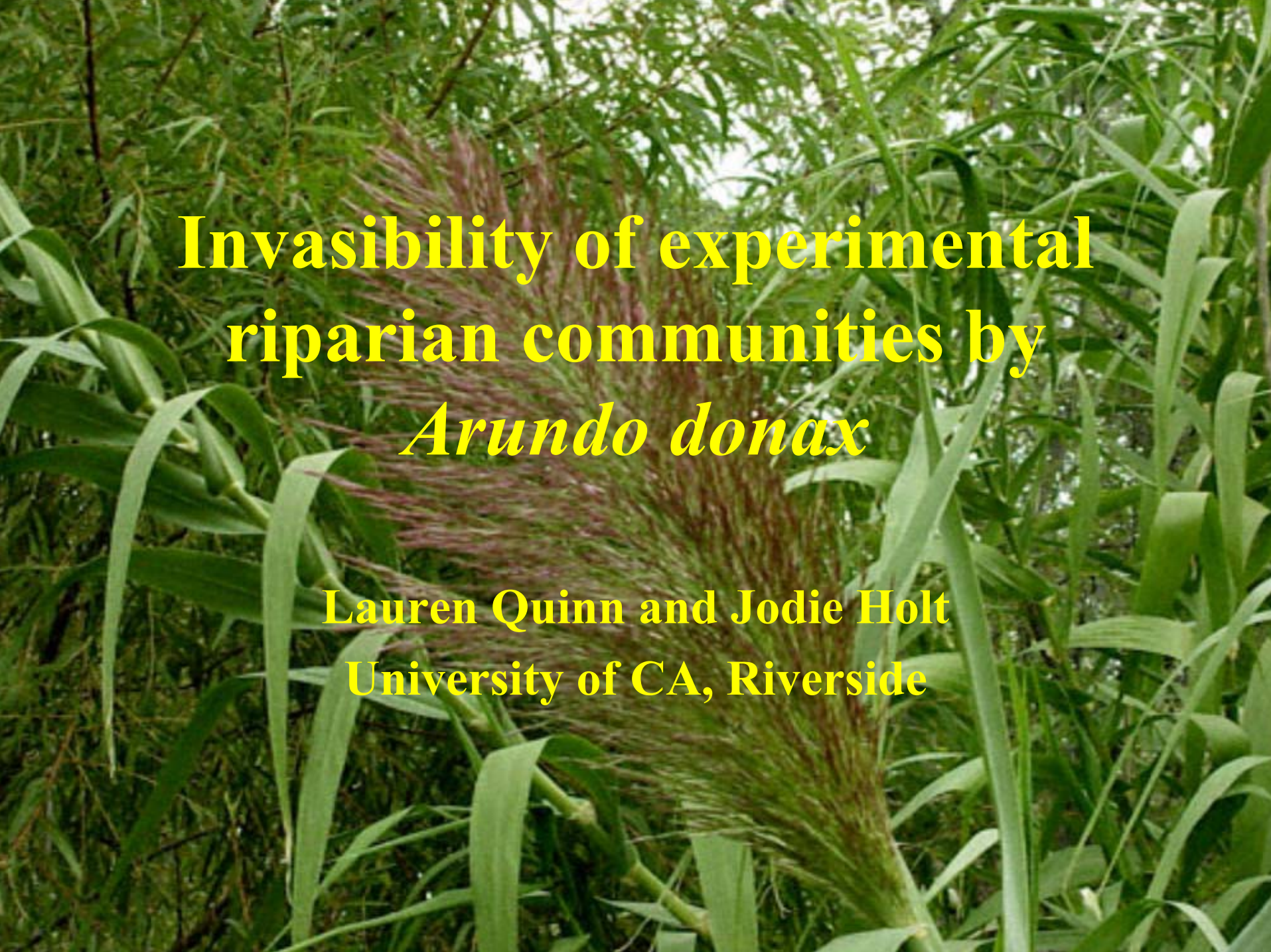

Invasibility of experimental riparian communities by *Arundo donax*

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Outline

- Introduction
  - Brief overview of *A. donax* biology and of the role of diversity in plant community invasibility
- Presentation of the experiment
- First-year results
- Discussion and implications

Arundo donax

- *A. donax*, or Giant Reed, is an invasive plant in California's riparian areas
- Intentionally introduced to southern California in the early 1800's for erosion control
- Native to India or eastern Asia, but widespread in Europe, North Africa, the Middle East, Australia, and North and South America

Arundo donax Biology

- Large (8-10 m) Poaceae species
- Very rapid growth rate (5-10 cm/day)
- Rhizomes can sprout at multiple axillary buds, forming large clones
- Dispersal by rhizome fragments washed downstream during flood events
- So far, no viable seeds have been found in California

Community Invasibility
Diversity matters?

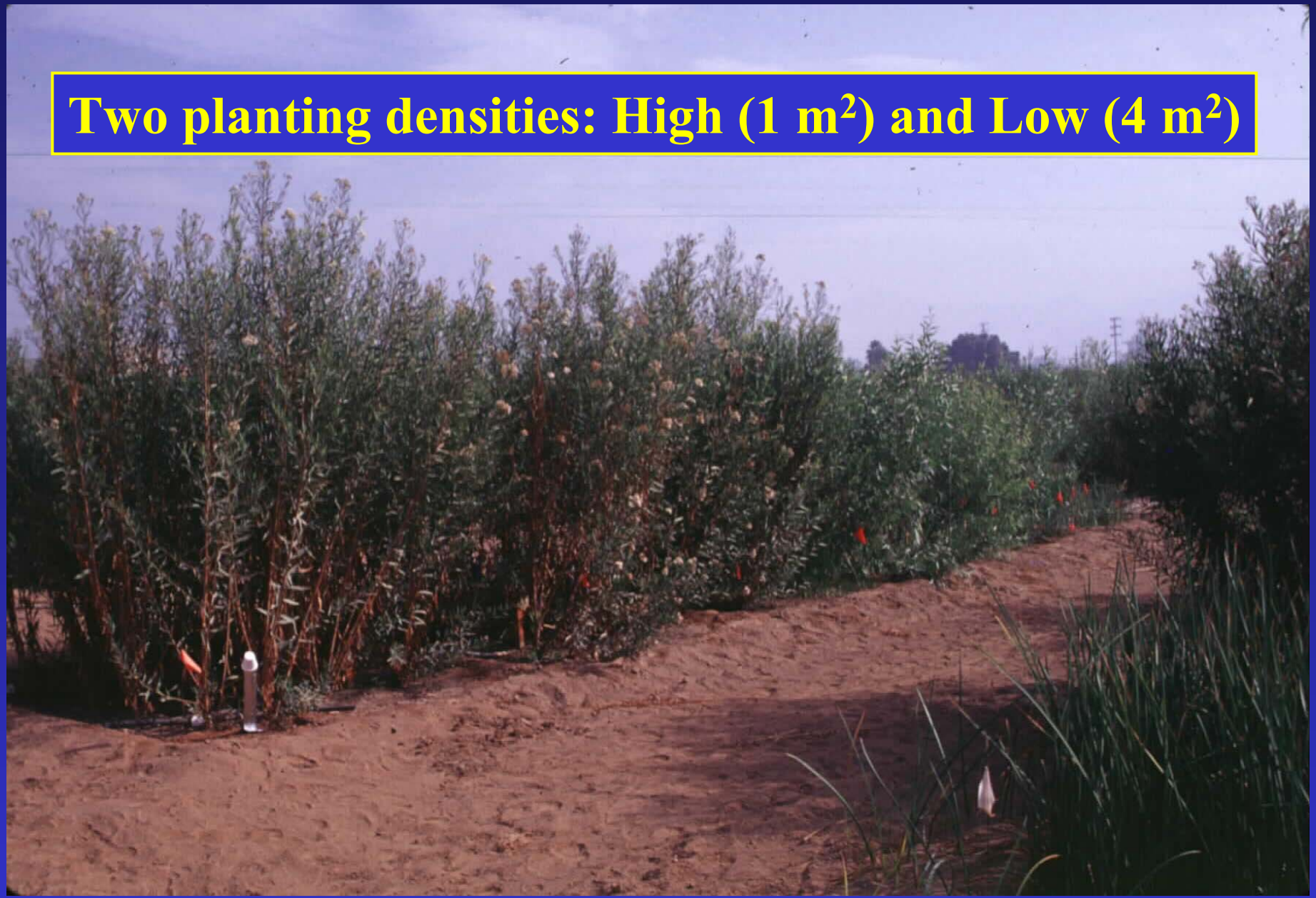
- Opposing views on role of community diversity in invasibility
  - High diversity means less invasibility because of "total niche occupation"
  - High diversity means more invasibility because the site characteristics that favor high diversity favor invasion, as well

Community Invasibility Experiment

- Controlled field experiment in progress
  - Addresses role of functional diversity of native riparian communities in initial success of *A. donax* invasion
  - Examines the effect of *A. donax* on resident community after introduction
  - May provide ideas for restoration design

Experimental Design

- In March 2002, three native species were planted alone and in all possible combinations in a randomized complete block design
  - Tree (*Salix gooddingii*), shrub (*Baccharis salicifolia*), rhizomatous sedge (*Scirpus americanus*)


Two planting densities: High (1 m^2) and Low (4 m^2)

Community Invasibility Experiment
Hypotheses

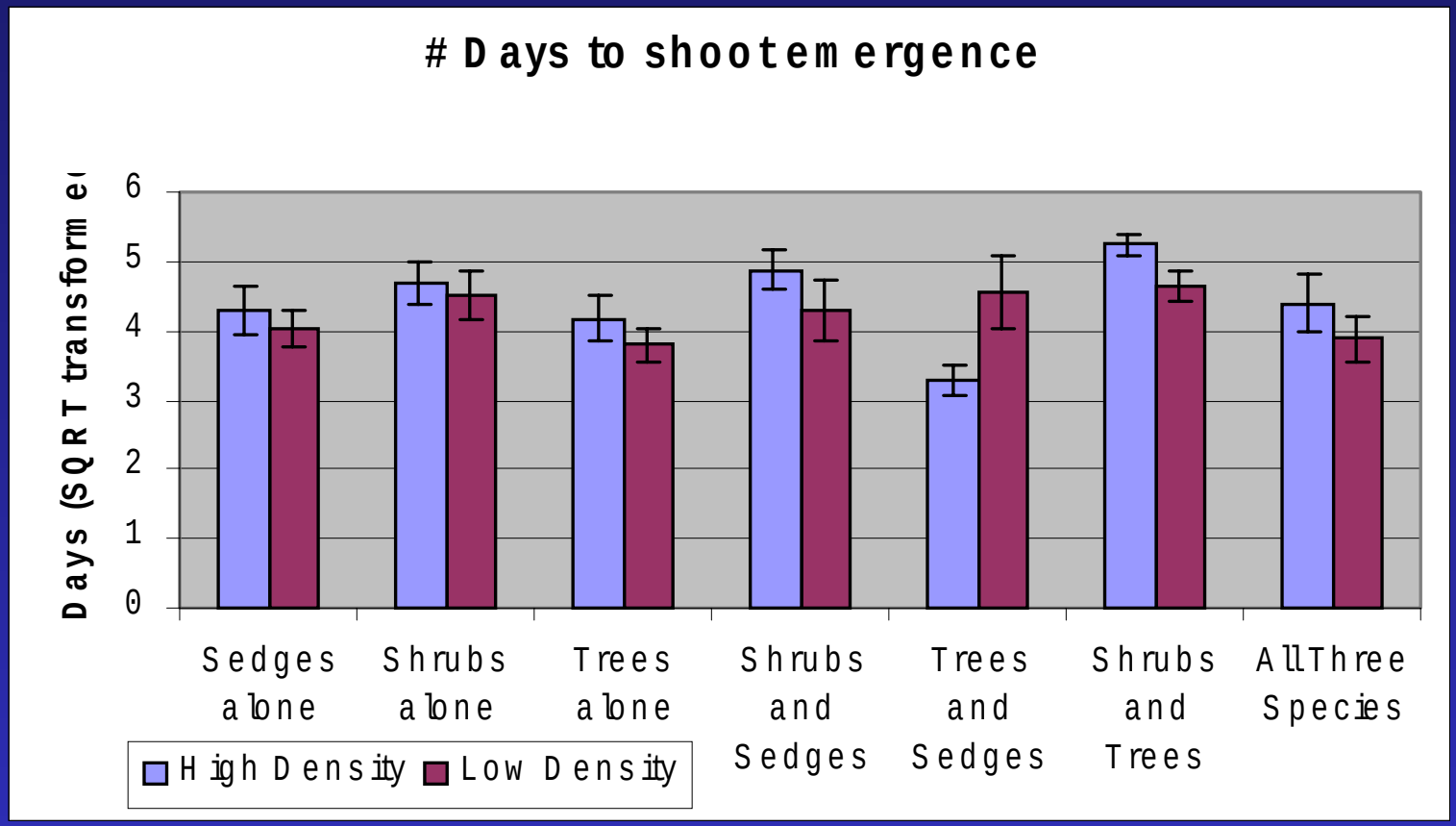
- Early establishment will be most successful in single-species low-density plots with high light penetration

- Early establishment will be slowed by full occupation of spatial resources in mixed, high-density plots

Data Collected

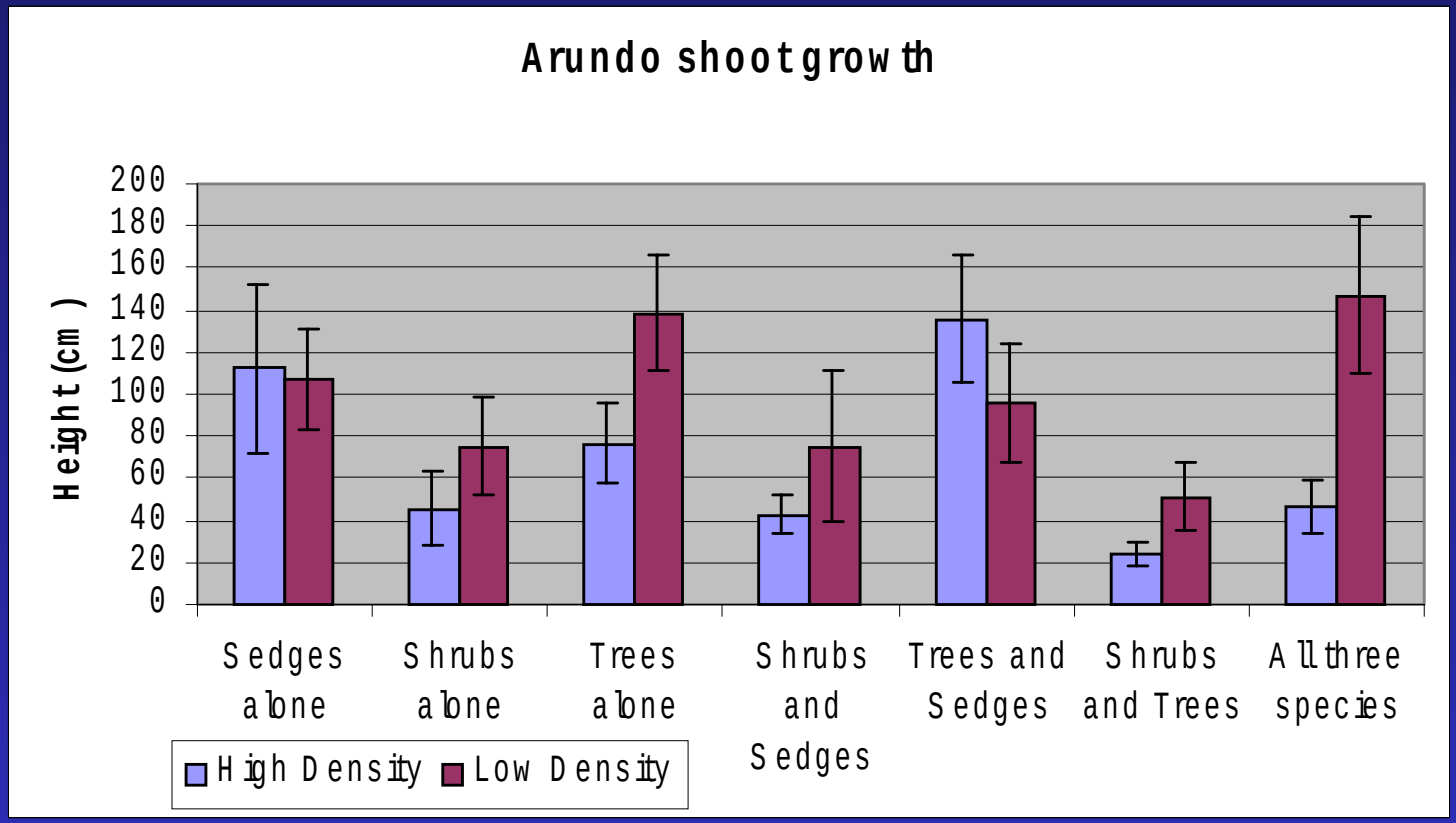
- In May 2003, *A. donax* rhizomes were introduced into half of the plots
  - Initial rhizome fresh weight (FW) and volume
  - *A. donax* establishment, growth, and survival
  - plot data: percent cover and PAR; soil moisture and temperature

A. donax Emergence



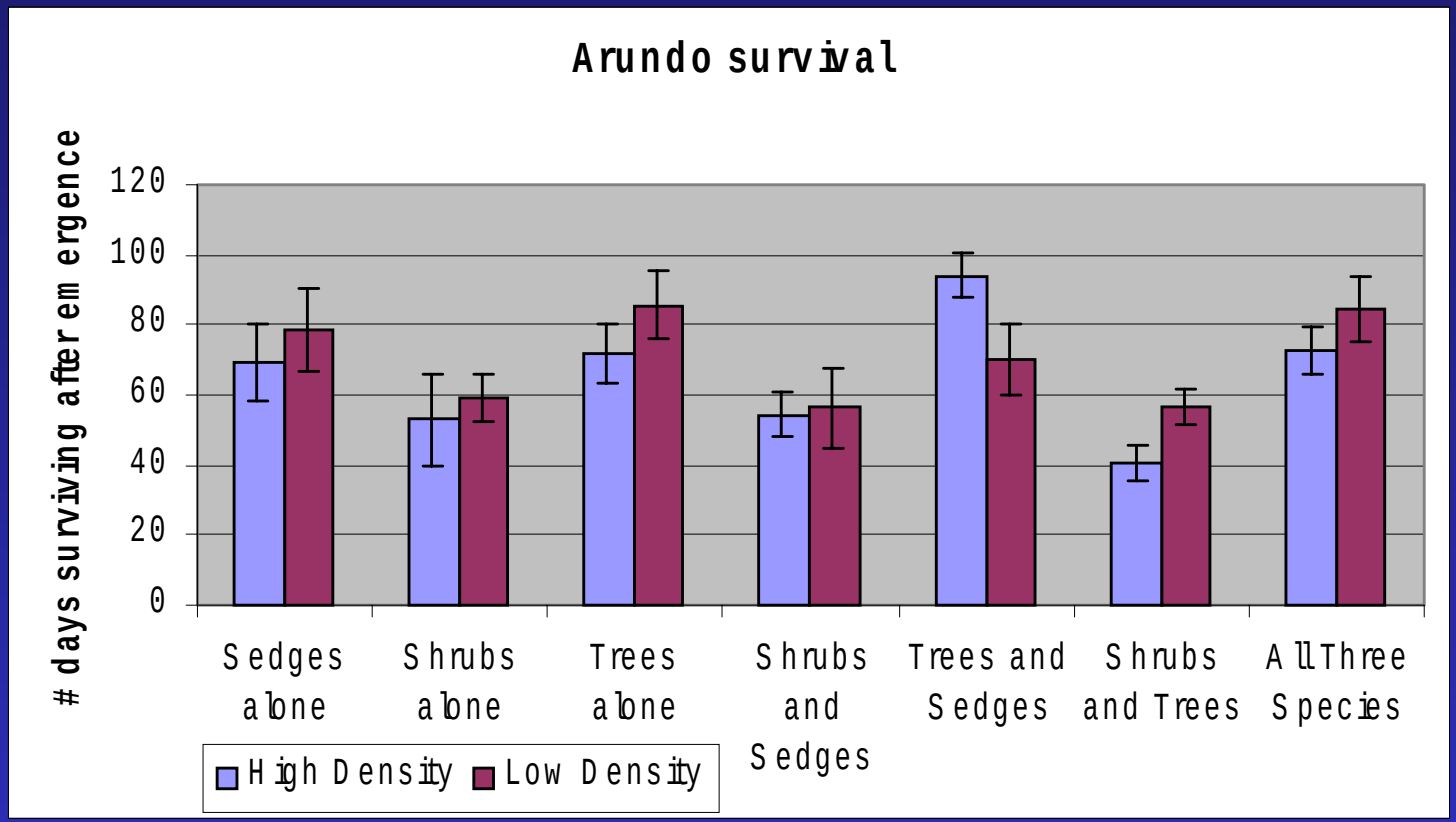
- density difference: NS
- treatment difference: p=0.018
- interaction term: p=0.076

A. donax Growth



- density difference: p=0.038
- treatment difference: p=0.014
- interaction term: NS

A. donax Shoot Survival



- density difference: NS
- treatment difference: p=0.000
- interaction term: NS

A. donax performance
Generalities

- Compared to other treatments, plots comprised of shrubs alone, shrubs + sedges, and shrubs + trees showed the following patterns:
  - Shoots took longer to emerge in high-density plots
  - Shoots were shorter (also shorter in high-density plots than low-density plots)
  - Shoots survived for shorter periods of time

Environmental Variables
Generalities

- Compared to all other treatments, plots comprised of shrubs alone, shrubs + sedges, and shrubs + trees showed the following patterns:
  - PAR was reduced (also reduced in high-density plots compared to low-density plots)
  - In low-density plots, overstory cover was greater

Environmental Variables
Generalities

- Soil moisture was greater in low-density sedges-alone and trees + sedges treatments than in all other plot types
- Soil temperature was greater in high-density plots and in sedges-alone, trees-alone, and trees + sedges treatments

Sorting it all out...

- Stepwise Multiple Regression Analysis (α=0.25) identifies the variables that best explain the performance of *A. donax* in this experiment:
  - number of sedges, shrubs, and trees/plot
  - plot overstory and understory cover, PAR, soil temperature, soil moisture
  - initial rhizome fresh weight and volume

Stepwise Multiple Regression

Arundo Variable	Contributing Variables 1	2	3	4
Maximum Height	Rhizome Fresh Weight	% Overstory Cover	# Baccharis Shrubs/Plot	
	R^2=0.361	R^2=0.442	R^2=0.452	
	p=0.000	p=0.025	p=0.156	
Total # of Growing Days	Rhizome Fresh Weight	# Baccharis Shrubs/Plot	Soil Water Content	% Overstory Cover
	R^2=0.239	R^2=0.341	R^2=0.352	R^2=0.362
	p=0.000	p=0.000	p=0.189	p=0.205
Time to Emergence	# Baccharis Shrubs/Plot	Rhizome Fresh Weight		
	R^2=0.070	R^2=0.129		
	p=0.006	p=0.009		

Summary

- While rhizome weight was an important factor determining initial success of *A. donax* invasion in this experiment, planting density and community composition played critical parts as well
  - In general, shrubs supressed emergence, growth, and survival of *A. donax* shoots in the first year
  - Low-density plots allowed *A. donax* shoots to attain greater heights than high-density plots

Implications

- Potential for use of *Baccharis salicifolia* in high-density planting arrangements for inexpensive native restoration design

- Because high-diversity (3 spp) treatments were not successful in suppressing *A. donax* invasion, these data support the hypothesis that diverse plant communities are more invasible than simple communities

Thank you!

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