



Effects of Environment on
Establishment of *Arundo donax*
in Three Southern California
Riparian Areas

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Arundo donax L. (Poaceae)



- Multiple axillary shoots from large rhizome
- Rapid growth rate (5-10cm/day)

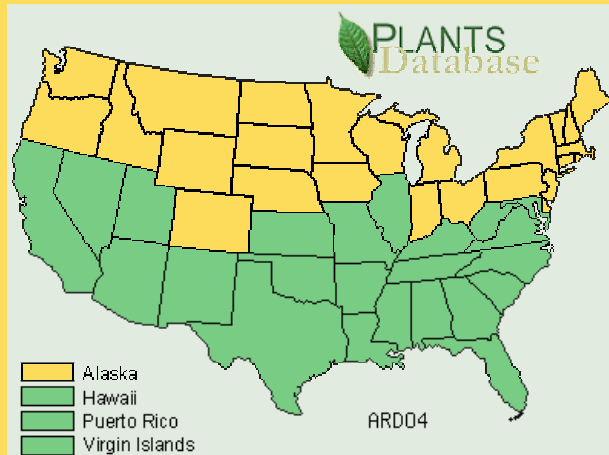
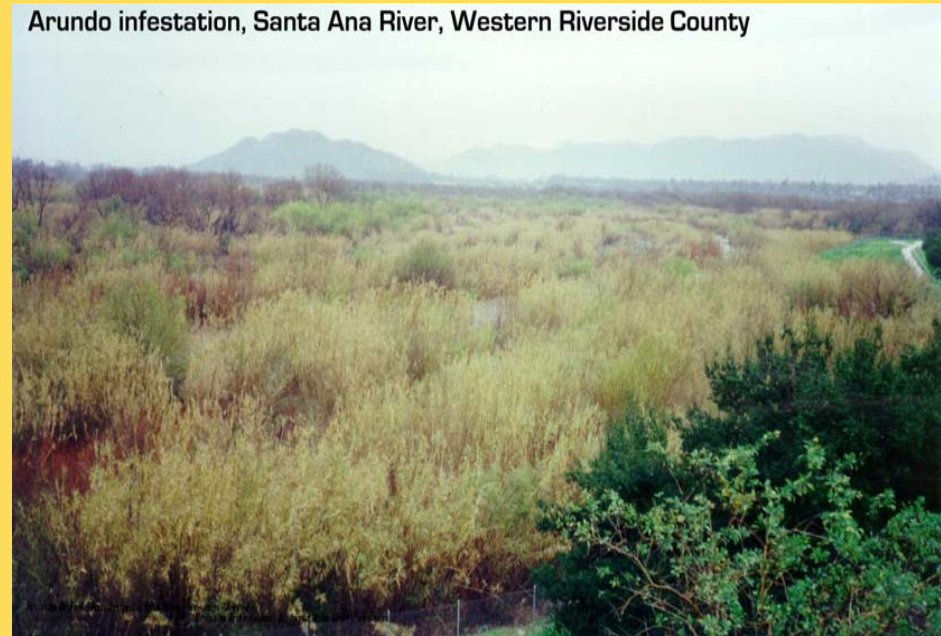


- Large, impenetrable clones



- Flowers, but inviable seeds

Arundo donax Introduction and Spread



Arundo donax Impacts



Initial Stages of Invasion

- My studies focus on understanding the initial stages of invasion by *A. donax*
 - when a rhizome fragment lodges in a particular microsite, what variables allow it to successfully establish and survive through the first growing season?

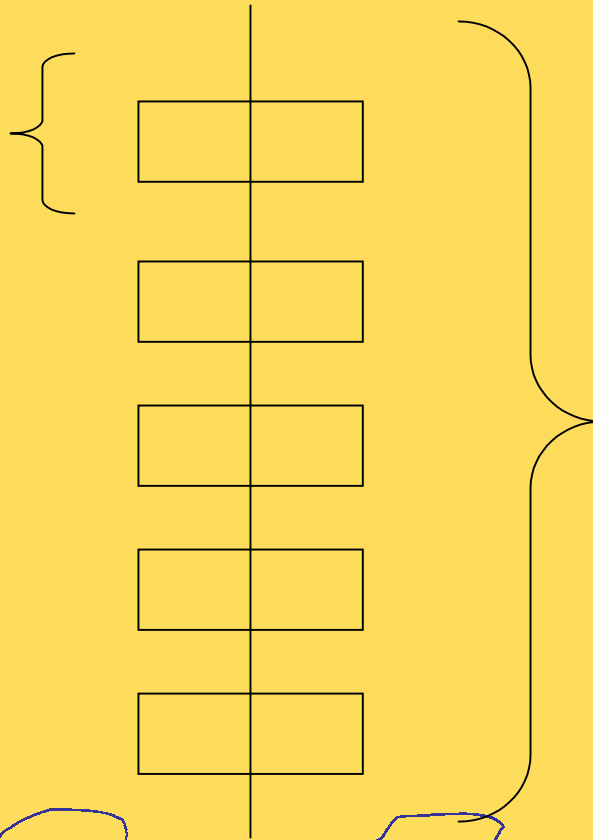
Experimental Design

- Three sites were chosen in 2003:
 - Riverside (Santa Ana River)
 - Orange Co. (Aliso Creek)
 - Oceanside (San Luis Rey River)
- Five 25-meter transects per site
 - Five plots/transect n = 25 plots per site
 - Four locally-harvested *A. donax* rhizomes were planted in each plot
 - These were weighed and measured before being planted

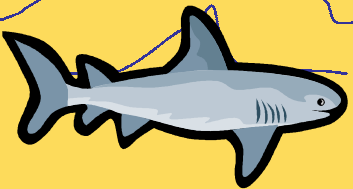
Field Design

Five 1.5 x 0.5 m plots per transect

Each planted with 4 locally harvested *A. donax* rhizomes



Five 25 meter transects per site
(perpendicular to water flow)



2003 vs. 2004

- Rhizomes were planted according to the timing of the last major flood of each season
 - Season 1: Late April 2003
 - Season 2: Early March 2004
- Rodent exclosures were built around each of the planted rhizomes **in season 2 only**



2003



2004, with rodent exclosures

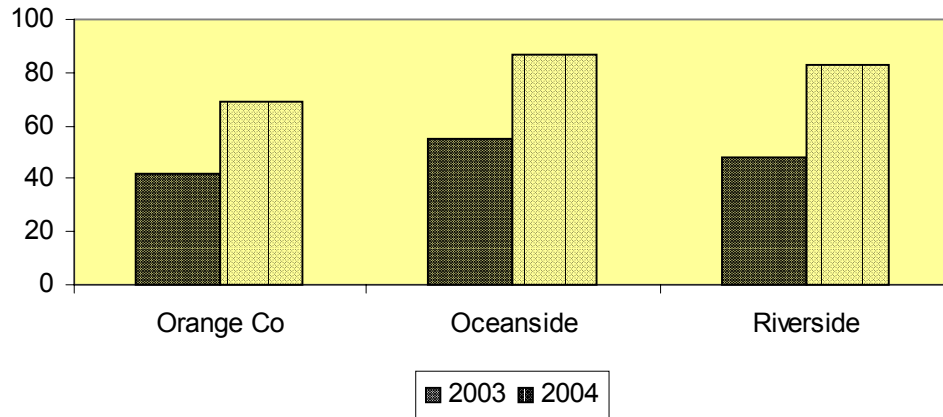
Data Collected

- Rhizome fresh weight
- Shoot emergence timing (weekly)
- Shoot height and senescence date (biweekly)
- Soil moisture, soil temperature, and PAR (monthly)
- Resident plant identity and percentage overstory (seasonally)



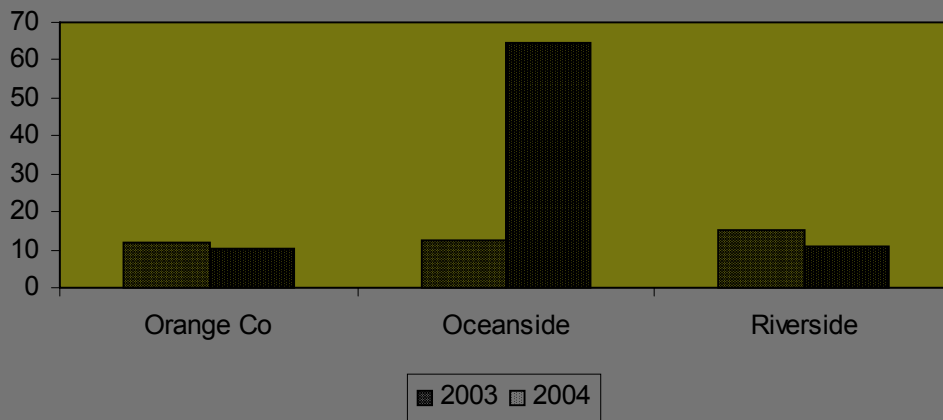
A. donax performance

Arundo plants emerging per site per year



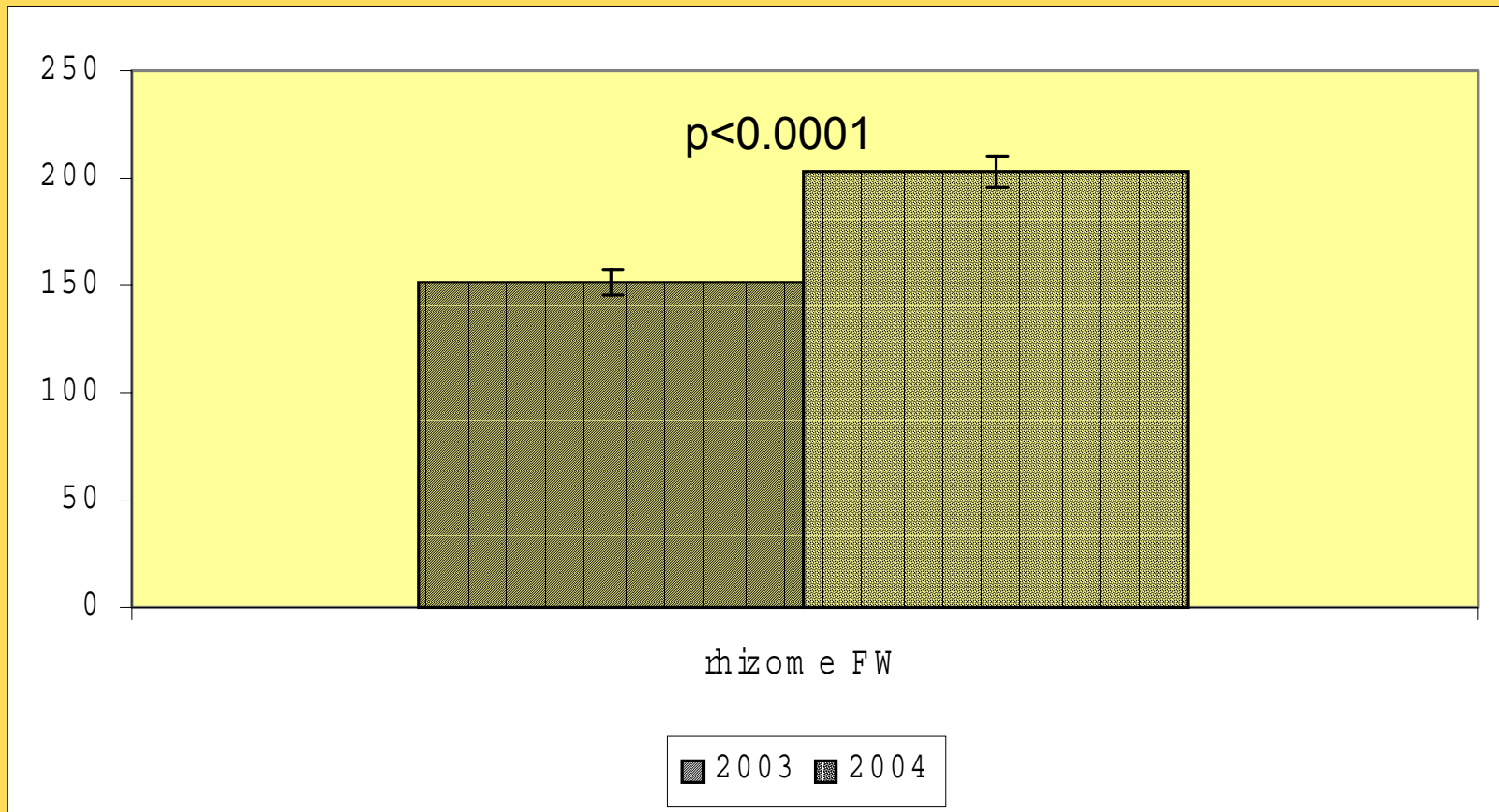
- Of 300 rhizomes planted across all sites:
 - 49% sprouted in 2003
 - 80% sprouted in 2004

% *Arundo* plants surviving per site per year

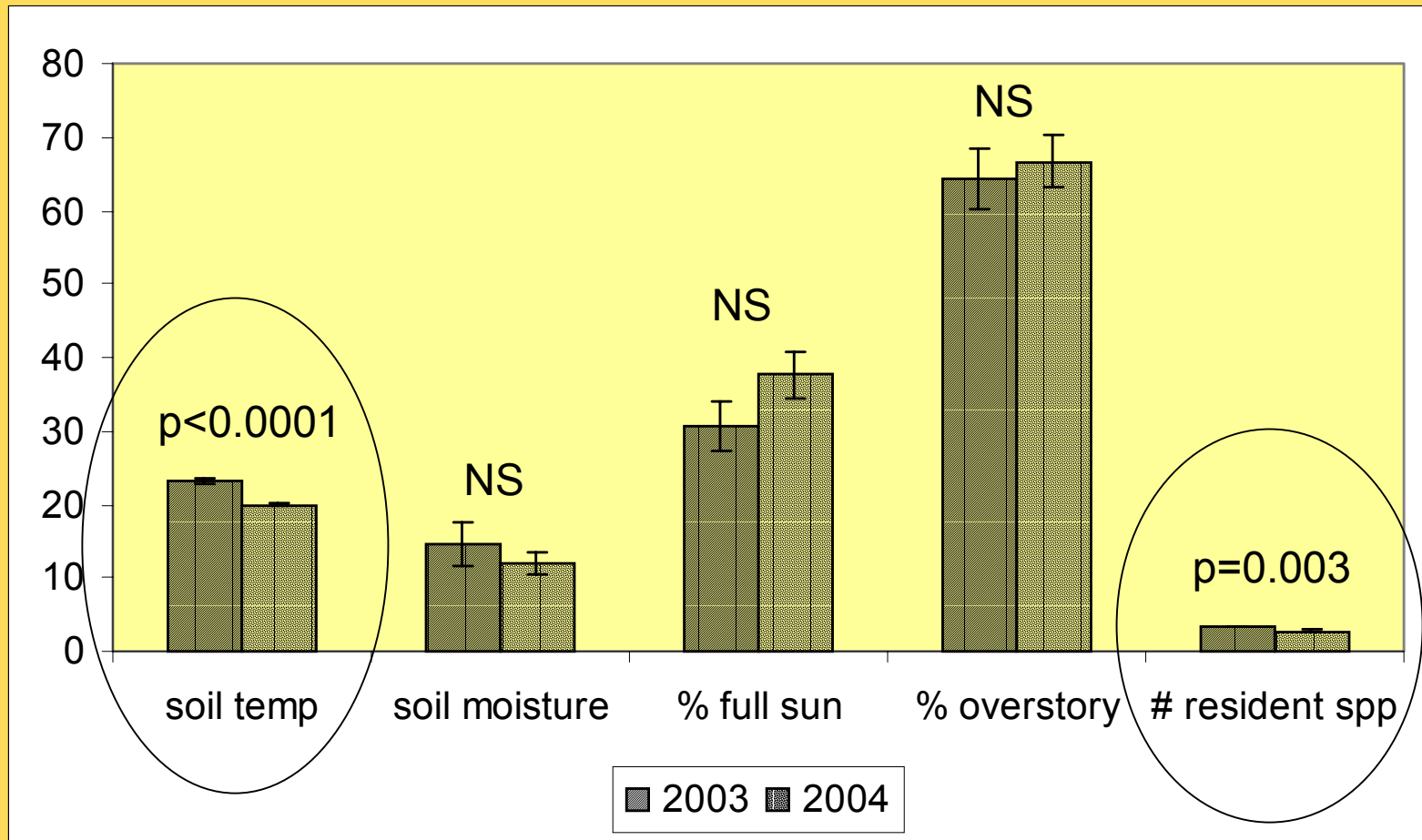


- Of those that sprouted across all sites:
 - 13% survived in 2003
 - 28% survived in 2004 (64% in Oceanside)

Rhizome Differences By Year



Environmental Differences By Year

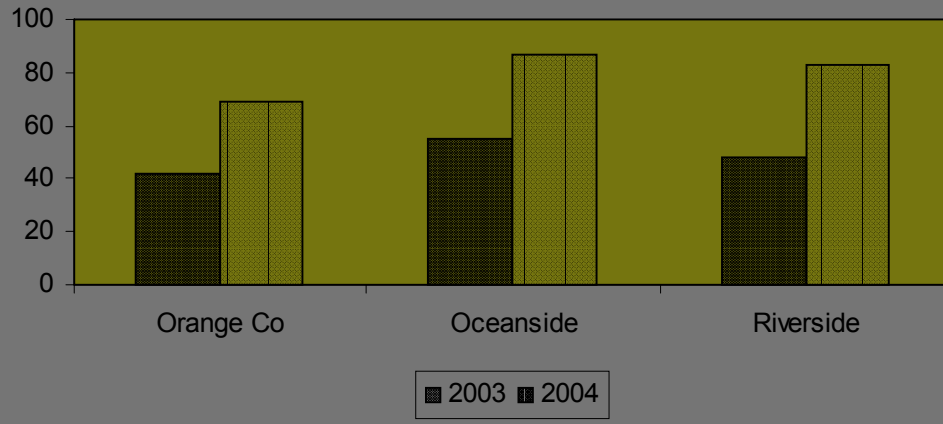


Emergence Story?

- Greater emergence in 2004 may correlate with:
 - Greater carbohydrate reserves in large 2004 rhizomes
 - Cooler soil temperatures in 2004
 - Less competition from resident plant species in 2004
- However, these results are not yet conclusive!!

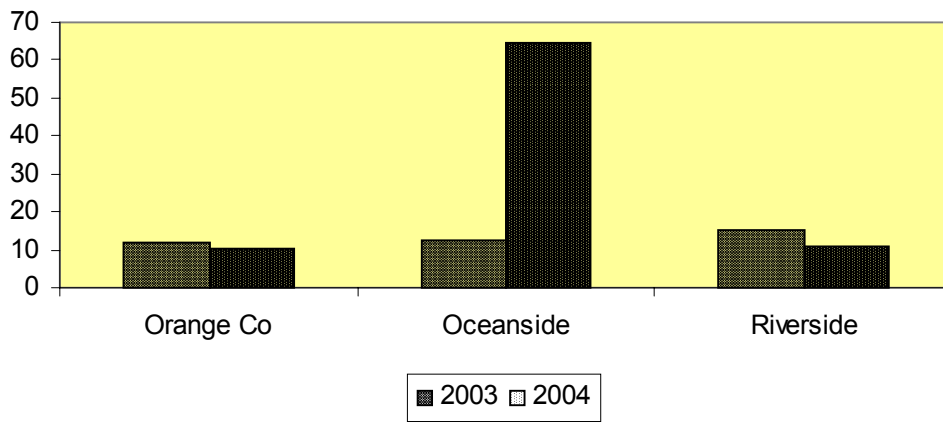
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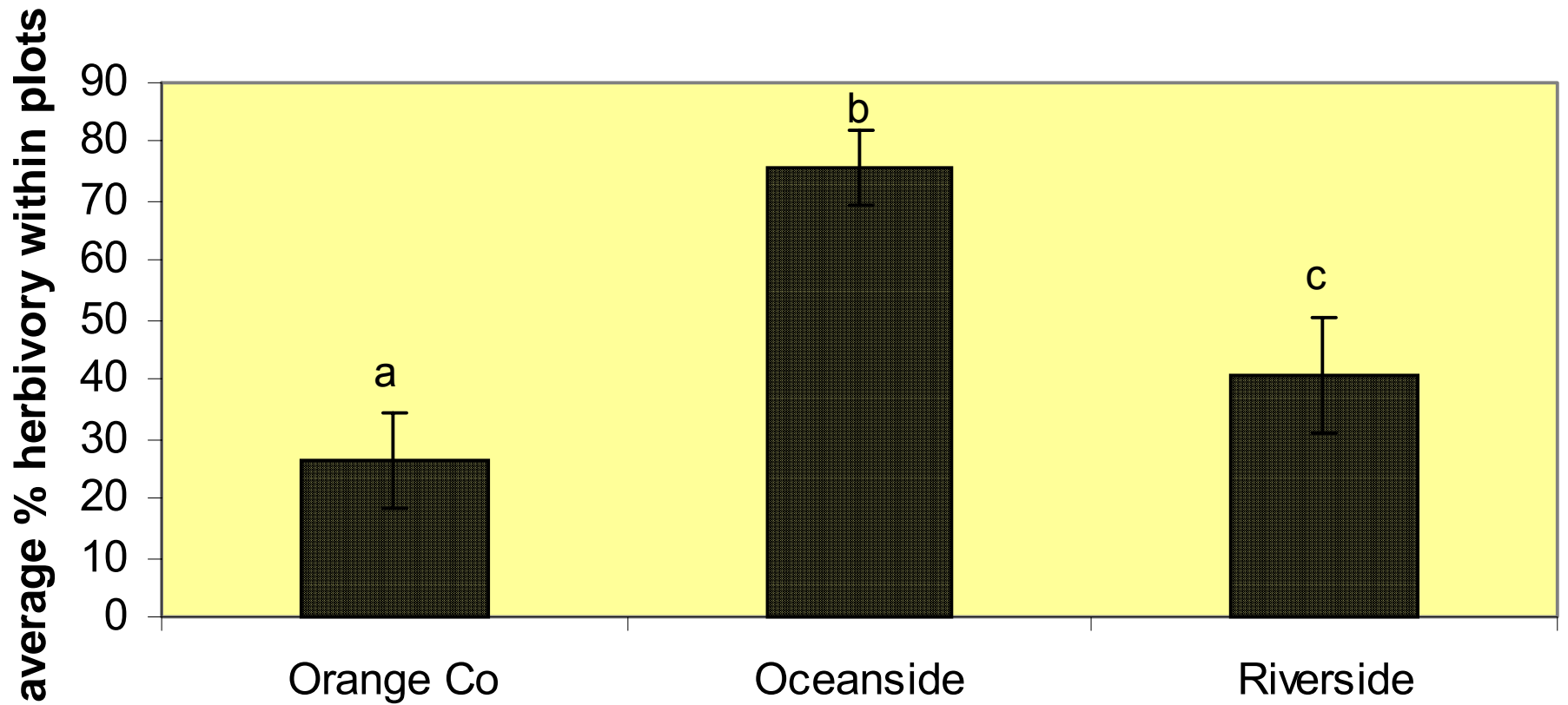


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2003 Survival

Herbivory in 2003

$p \leq 0.001$



Survival Differences Between Sites in 2003

All sites lumped:

$R^2=0.199$

$p=0.07$

Herbivory:

$p=0.05$

coeff= -21.9

Soil temp:

$p=0.04$

coeff= -6.2

Orange Co:

$R^2=0.624$

$p=0.03$

Soil moisture

$p=0.007$

coeff= 1.6

Oceanside:

$R^2=0.526$

$p=0.08$

Herbivory:

$p=0.01$

coeff= -48.1

Overstory cover

$p=0.02$

coeff= -0.9

Riverside:

No significant relationships

Survival Summary

- Survival may have been negatively affected by herbivory in 2003, especially in the Oceanside site
- With exclosures, Oceanside plants are surviving much longer in 2004

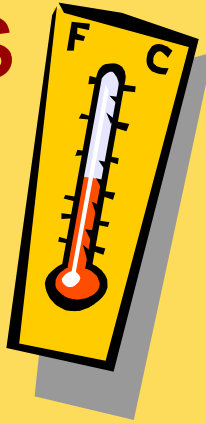


Conclusions and Implications



- Rhizome size matters
 - Heavy rhizomes produce shoots faster than lighter rhizomes (Quinn and Holt, unpublished data)
 - Focus on controlling movement of large rhizomes
 - Remove all rhizome pieces after control efforts

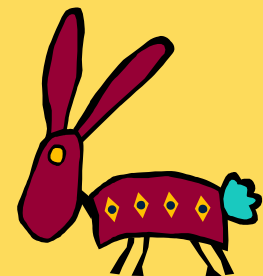
Conclusions and Implications



- Soil temperature matters
 - Rhizomes produce more roots in cold temperatures compared with hot or medium (Quinn and Holt, unpublished data)
 - Cooler soil temperatures in 2004 may have allowed more root production thereby supporting greater shoot production
 - Focus on controlling rhizome movement early in the season, when the soil is still cool

Conclusions and Implications

- Resident plant community matters?
 - In 2003, resident plant communities were more diverse than in 2004
(more data showing the effects of community composition on *Arundo* performance is forthcoming from the Holt lab)
- Herbivory matters!
 - Reassess the importance of biotic controls on the early establishment of *Arundo*



Thank You!

- Jodie S. Holt
- Holt lab members:
 - Rana, Mike, Ginger, Robin, Jenn, Ken, and Jared
- California Dept. of Food and Agriculture
- UCR Botany Dept.

