

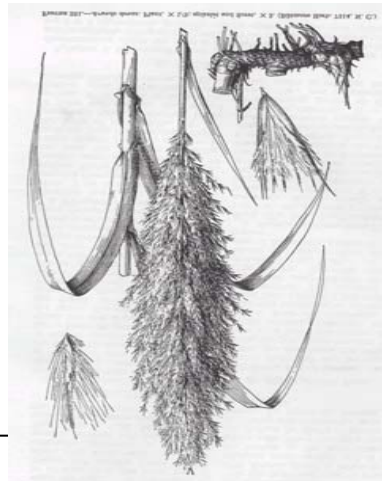


**Are we creating the ideal
conditions for *Arundo donax*
invasion in California?**

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UCLA**

Arundo (*Arundo donax*)

- Indigenous to northern India and southern Nepal, a Wet-Dry Tropical Climate
- Bamboo-like member of Grass family
- 8-10 meters tall
- Spreads via massive rhizomes



PROBLEM

- Introduced globally for use in erosion control, ceilings, roofs, fences, baskets, and around hot springs
- Successful invader in river systems of Southern CA in past 35 years

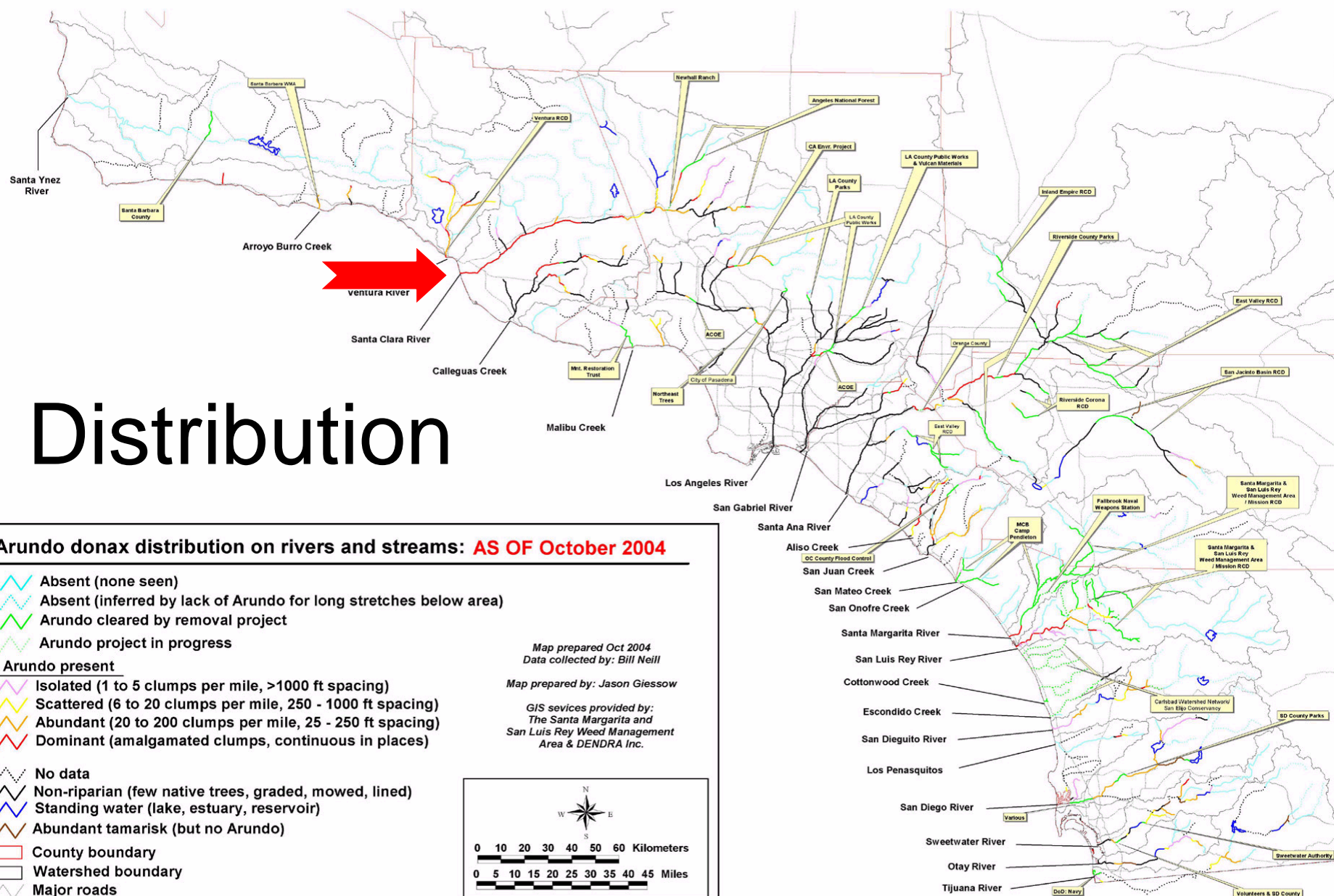


DISTRIBUTION OF ARUNDO DONAX IN COASTAL WATERSHEDS OF SOUTHERN CALIFORNIA: **AS OF October 2004**

This map and accompanying text descriptions of distribution data are available at: <http://smslrwma.org>

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Distribution

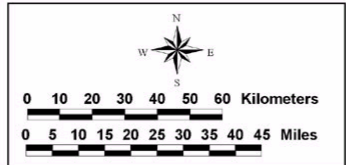
Arundo donax distribution on rivers and streams: **AS OF October 2004**

- Absent (none seen)
- Absent (inferred by lack of Arundo for long stretches below area)
- Arundo cleared by removal project
- Arundo project in progress
- Arundo present**
- Isolated (1 to 5 clumps per mile, >1000 ft spacing)
- Scattered (6 to 20 clumps per mile, 250 - 1000 ft spacing)
- Abundant (20 to 200 clumps per mile, 25 - 250 ft spacing)
- Dominant (amalgamated clumps, continuous in places)
- No data
- Non-riparian (few native trees, graded, mowed, lined)
- Standing water (lake, estuary, reservoir)
- Abundant tamarisk (but no Arundo)
- County boundary
- Watershed boundary
- Major roads

Map prepared Oct 2004
Data collected by: Bill Neill

Map prepared by: Jason Giessow

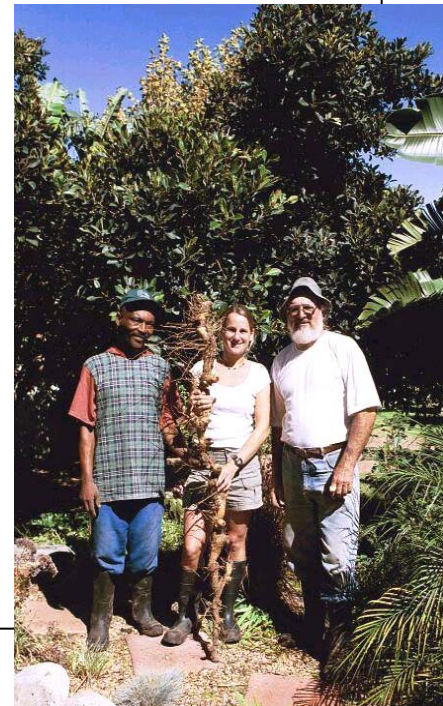
GIS services provided by:
The Santa Margarita and
San Luis Rey Weed Management
Area & DENDRA Inc.



Why is Arundo So Successful?

- Easily dispersed via rhizomes
- Disturbance colonizer
- Successful in Mediterranean-type climate
 - fast growing (up to 7 cm per day)
 - reaches >8 m in height after only a few months
 - grows 3-4 times faster than native plants
- **Outcompetes indigenous plant species for resources**

Bell 1994



Factors Thought to Contribute to Invasion

- Water
- Nutrients
- Light
- Fire



IMPORT AND EXPORT OF WATER



NUTRIENT INPUTS



LOTS OF LIGHT...





FIRE !!!

October 2003

Invasion Hypothesis

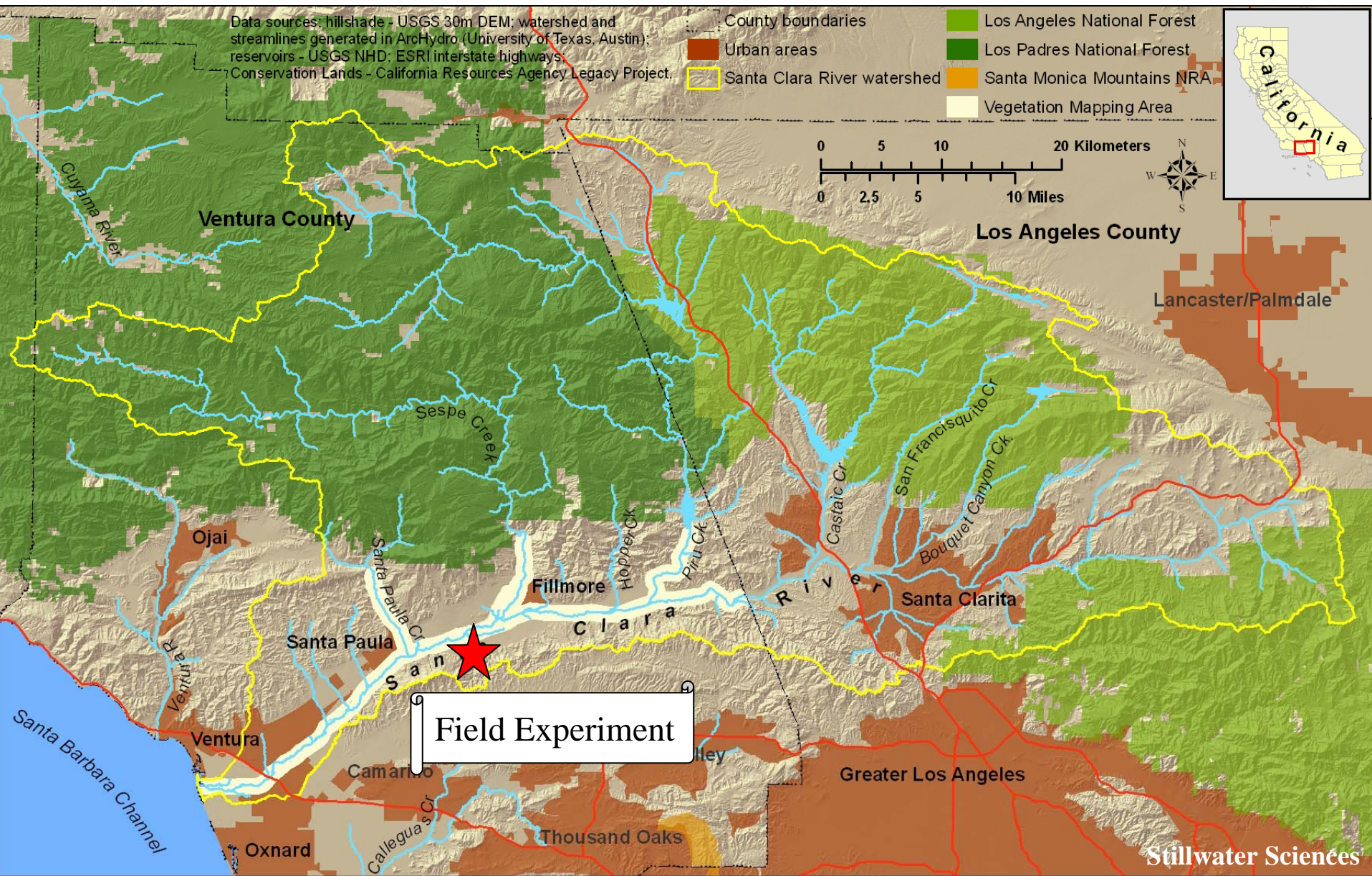
Increased water, nutrients, light, and fire in riparian ecosystems have made a significant contribution to the successful invasion of *Arundo* (*Arundo donax*) throughout river systems in Mediterranean-type climates like California

Study Approaches

- Experimental study -
 - large-scale field experiment (2002-5)
- Correlational field study -
 - opportunistic fire study (2003-4)

Study Area

Santa Clara River Watershed



Santa Clara River

HRNA

Field Experiment

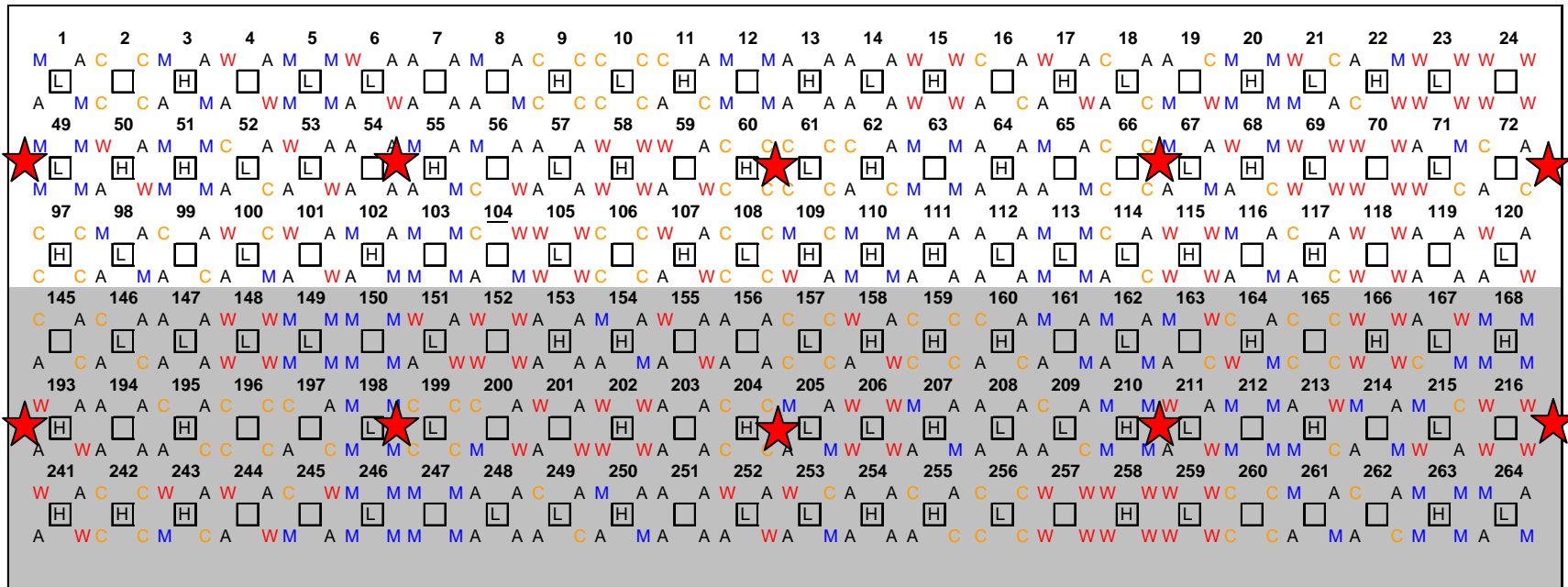
South Mountain Road



Riparian Field Experiment





- Large-scale field experiment (0.4 ha)
 - 1,152 plants
 - 8 competition treatments (4 species)
 - 3 nutrient treatments
 - 2 water treatments
 - 2 light treatments

Study Design



LEGEND:

- A = *Arundo donax* (Giant Reed)
- C = Black Cottonwood (*Populus balsamifera* ssp. *trichocarpa*)
- M = Mule Fat (*Baccharis salicifolia*)
- W = Red Willow (*Salix laevigata*)
- H = High N fertilizer treatment
- L = Low N fertilizer treatment

-  = Open treatment
-  = Shade treatment (80%)
-  = Plant grouping number
-  = Plant grouping

 Groundwater wells
and soil moisture sensors

Measurements

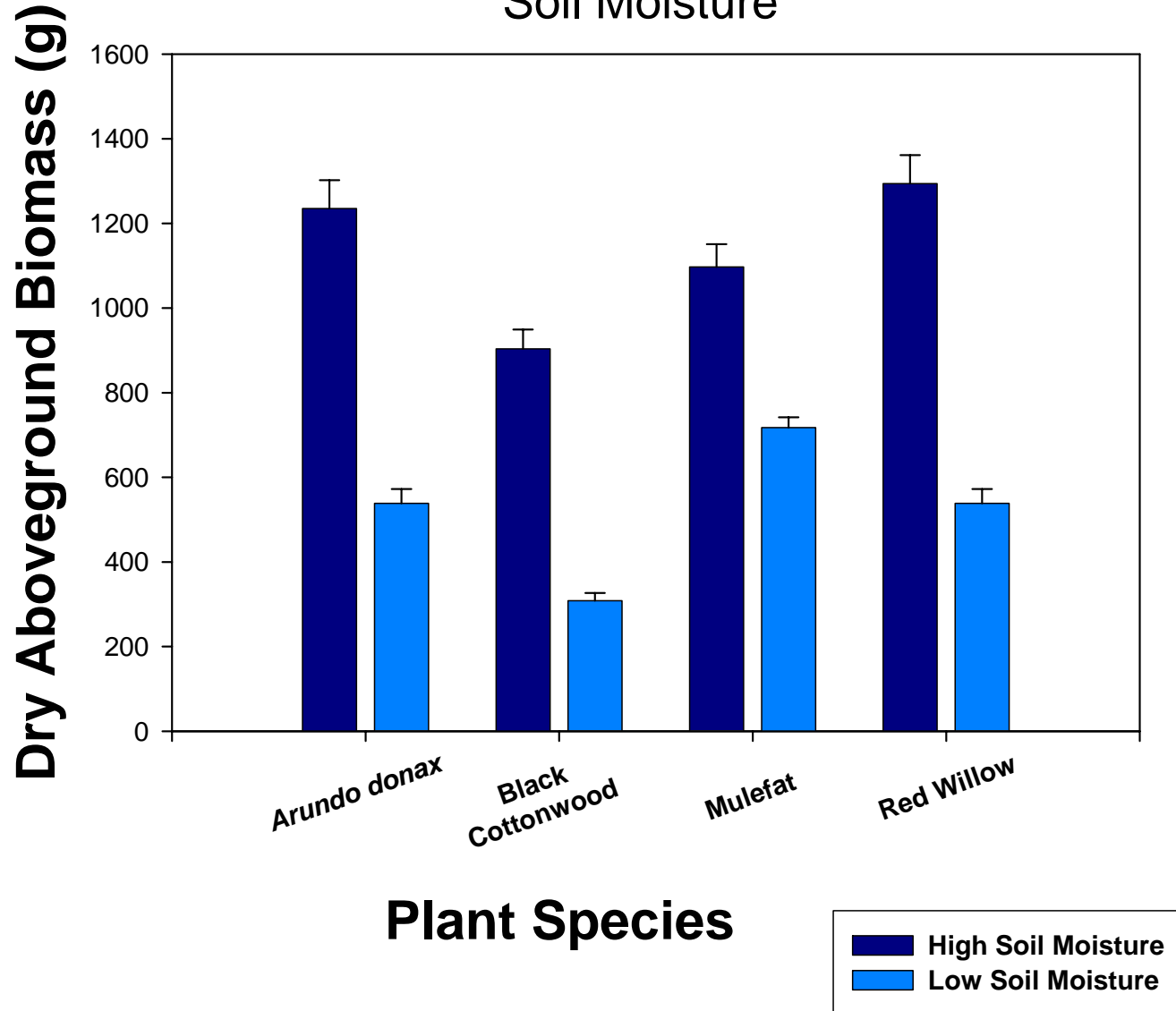
- **Biomass**
- Growth
- Soil moisture
- Groundwater levels
- Soil grain size
- Leaf area
- Leaf nutrient content
- Water potential



Results

Water Availability

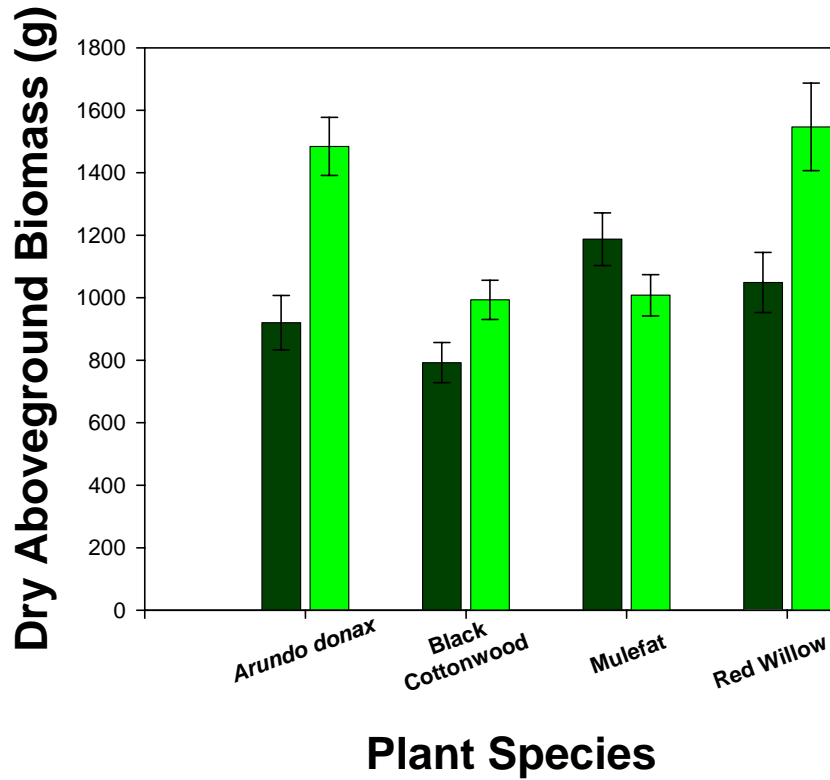
Soil Moisture



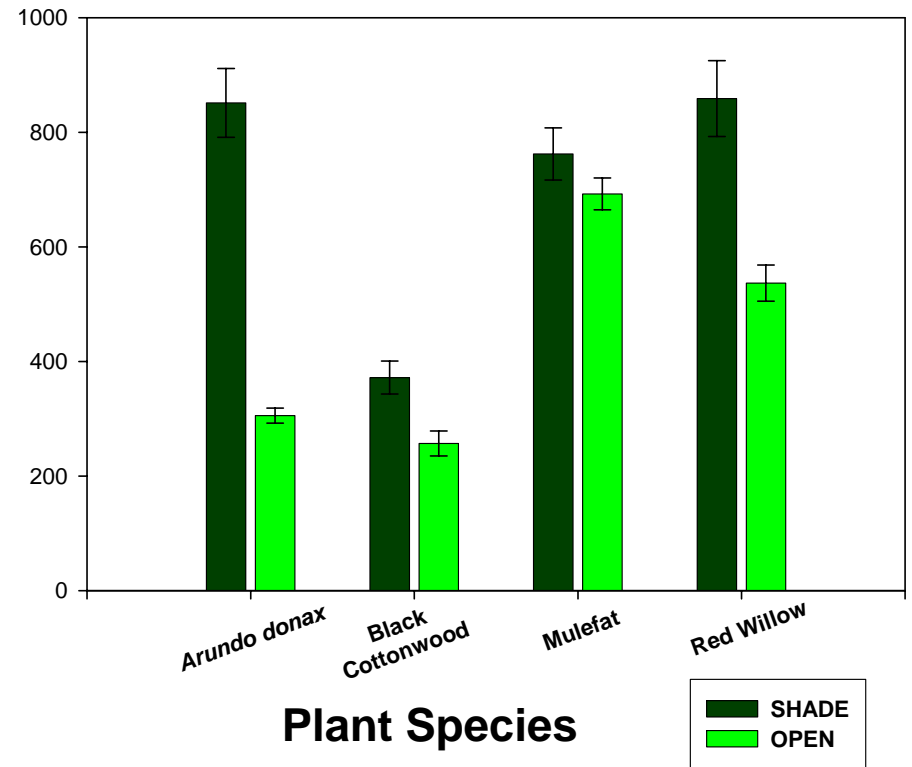
Light Availability

Summer 2003

High Soil Moisture



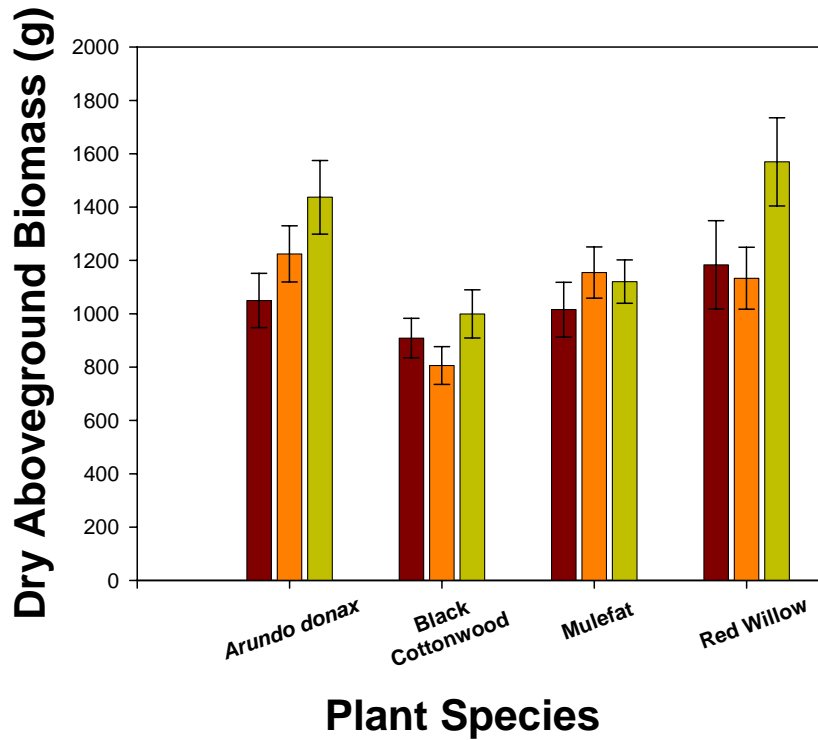
Low Soil Moisture



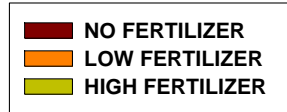
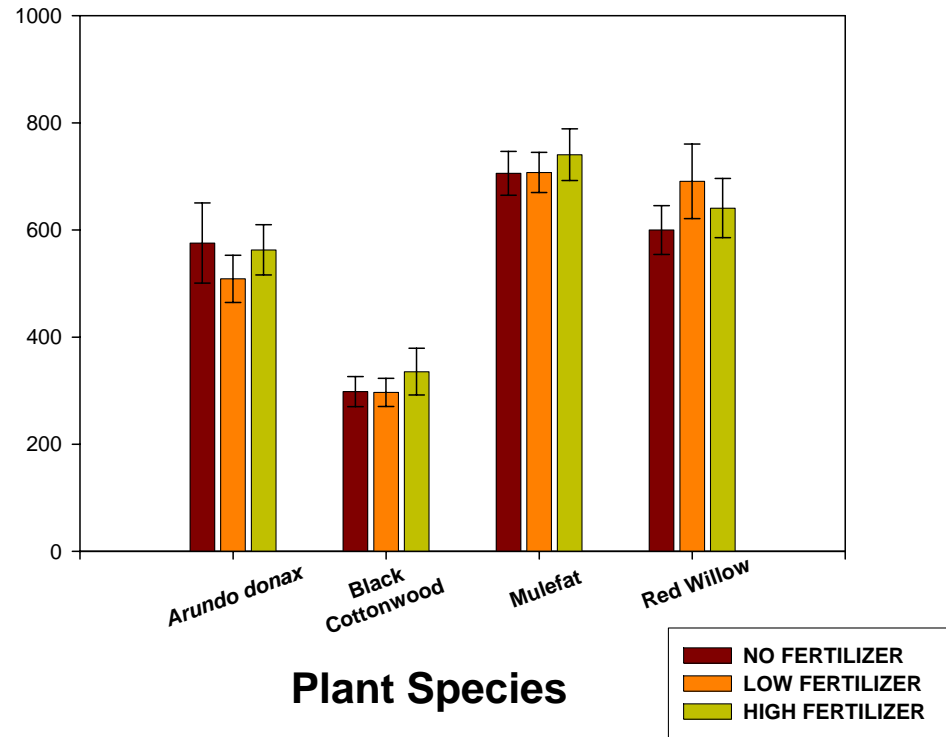
Nutrient Availability

Summer 2003

High Soil Moisture

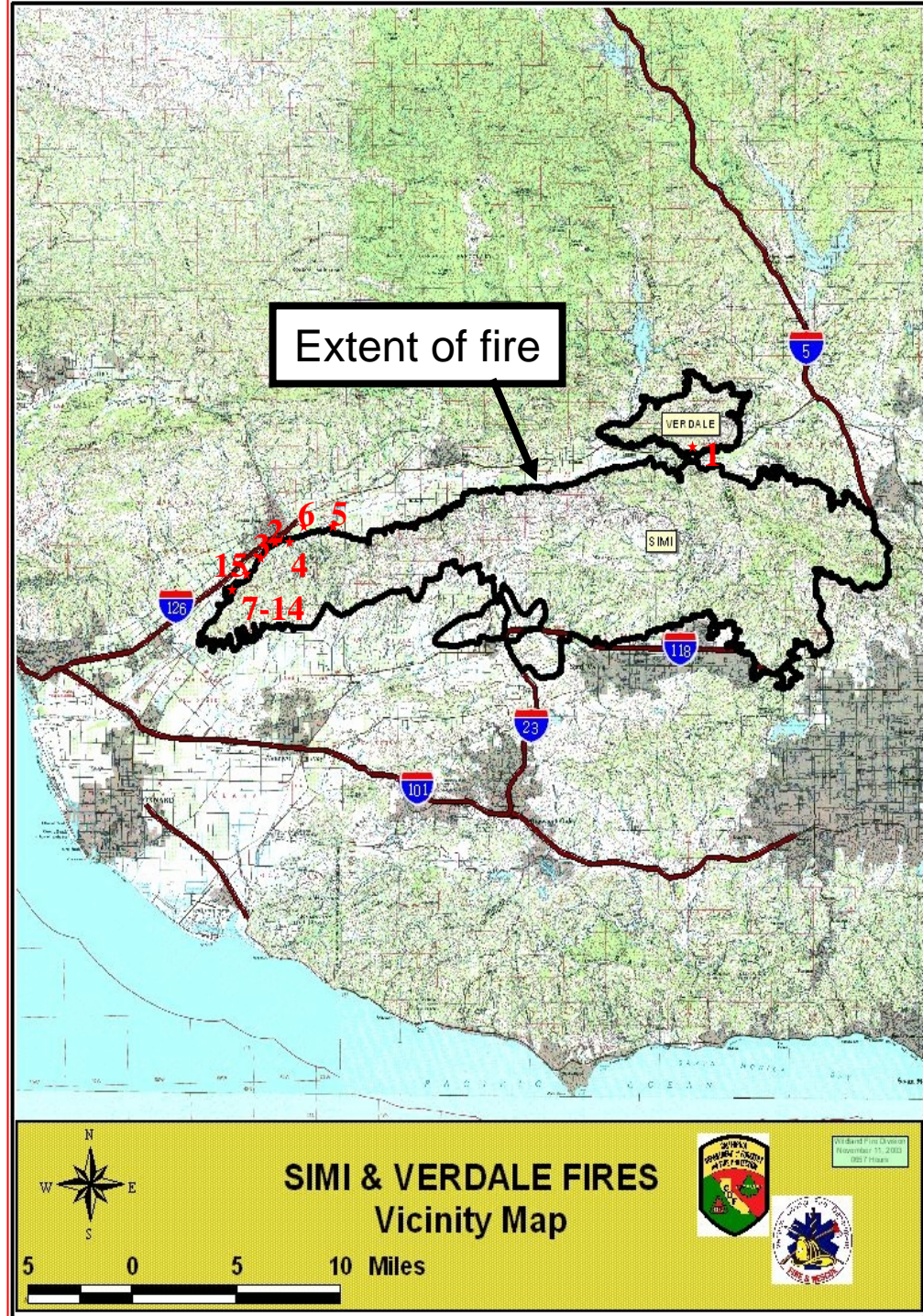


Low Soil Moisture



Fire Studies

- Documented historical spread of fire through Arundo in 9 rivers in Southern CA
- Measured growth, density and % cover of Arundo vs. natives after fire



Rapid *Arundo* growth after fire

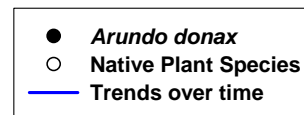
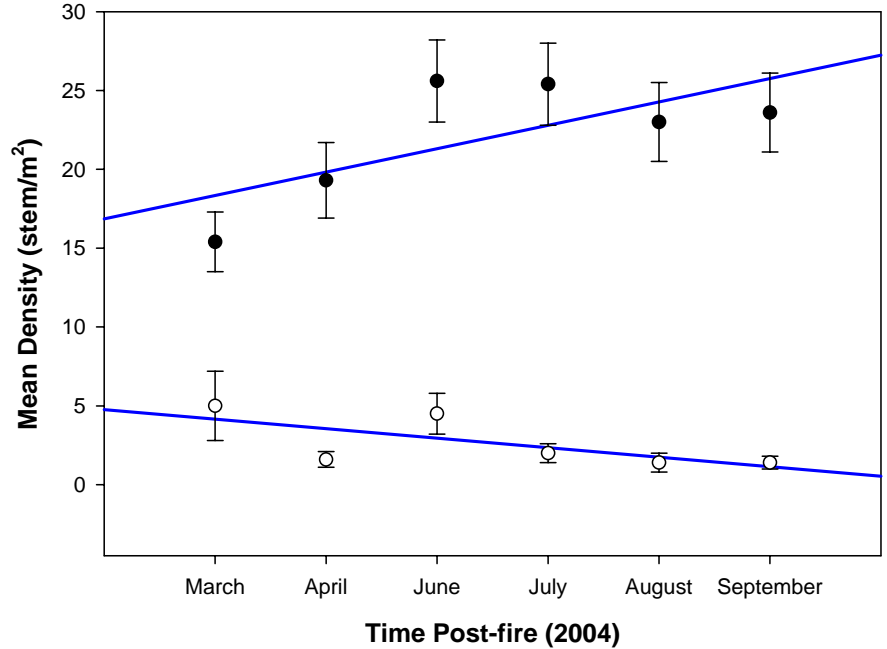
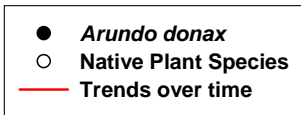
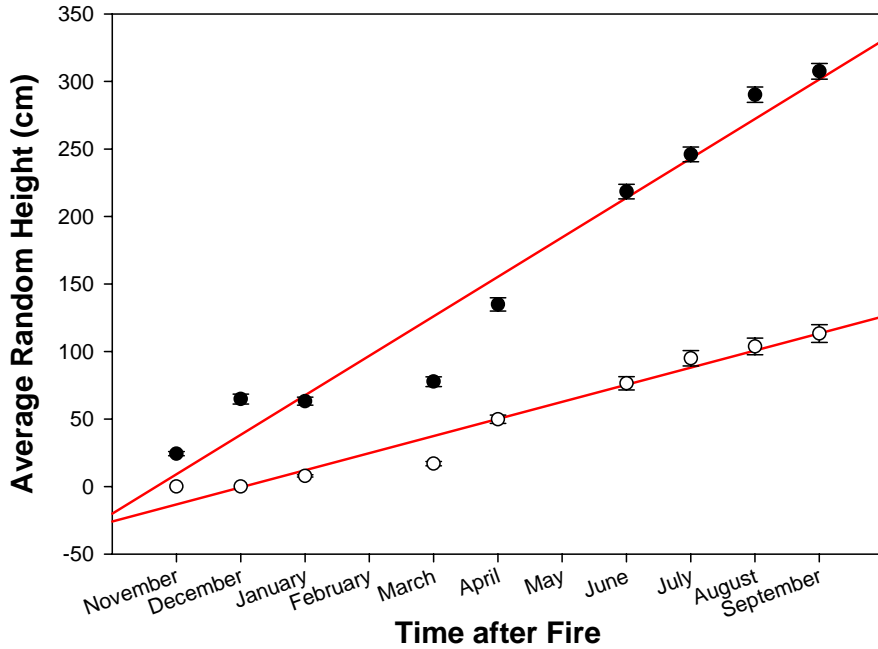


8 weeks

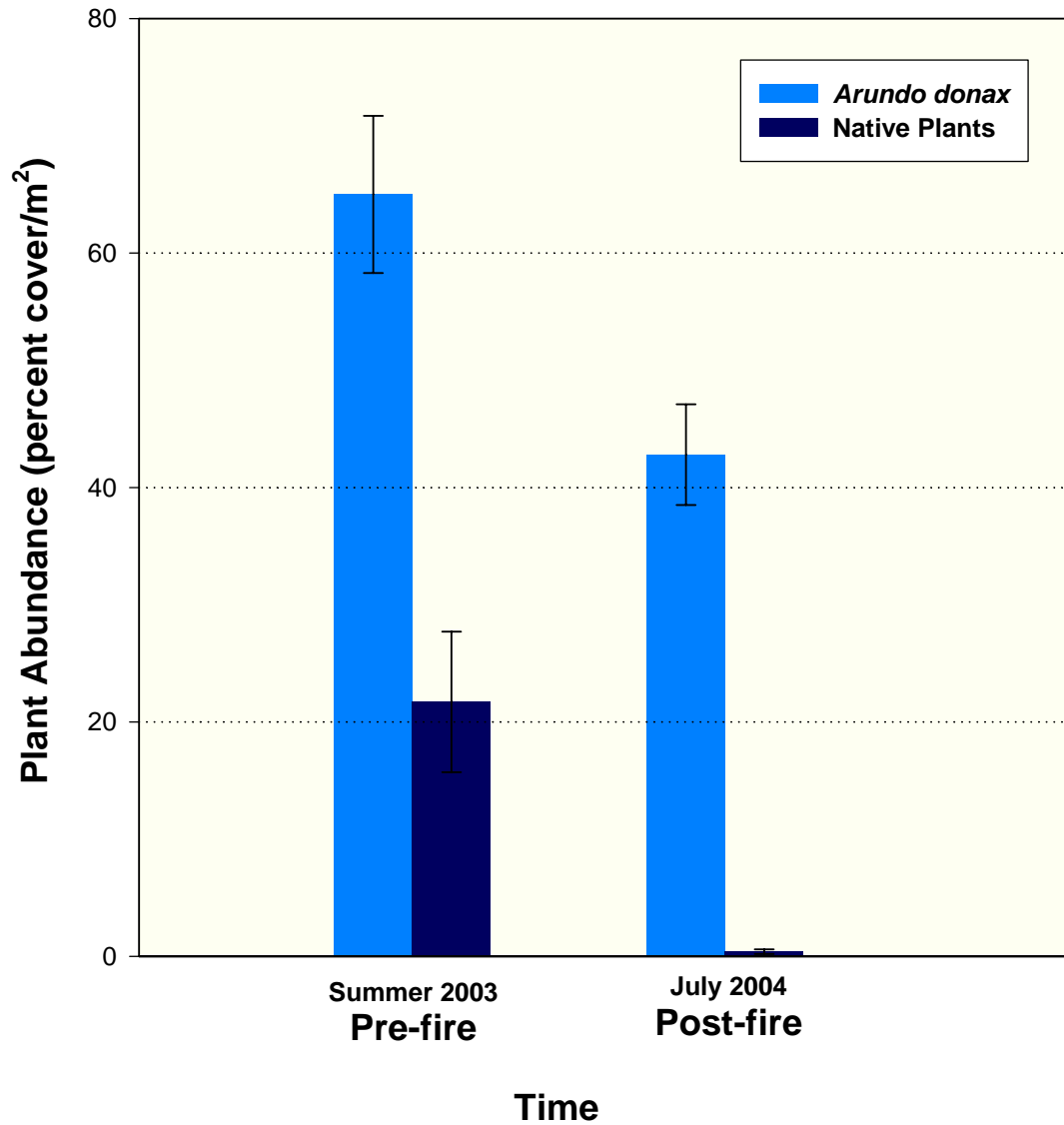


6 months

Post-Fire Growth



Plant Abundance



Summary



Water Import/Export



Nutrient Inputs




Removal of Mature
Riparian Forest



Fire

Acknowledgements

- Funding:
 - UC Water Resources Center
 - State Coastal Conservancy
 - Santa Clara River Trustee Council
 - The Nature Conservancy
 - University Research Expedition Program
 - Rico International
 - UCLA/UCSB
 - Thanks to my many field assistants and volunteers in the Western Cape, South Africa and Southern California who made this research possible!
- 
- A photograph of three people with large backpacks crossing a shallow river. The person in the foreground is a woman in a white long-sleeved shirt and dark pants, carrying a blue and black backpack. The person in the middle is a man in a red shirt and khaki pants, carrying a black backpack and a long wooden pole. The person in the background is a man in a blue shirt and khaki pants, also carrying a backpack. They are in a mountainous area with green vegetation and a blue sky with white clouds.