Predicting the Spread of Invasive Plants in California

Elizabeth Brusati[1], Doug Johnson[1], and Joseph DiTomaso[2]

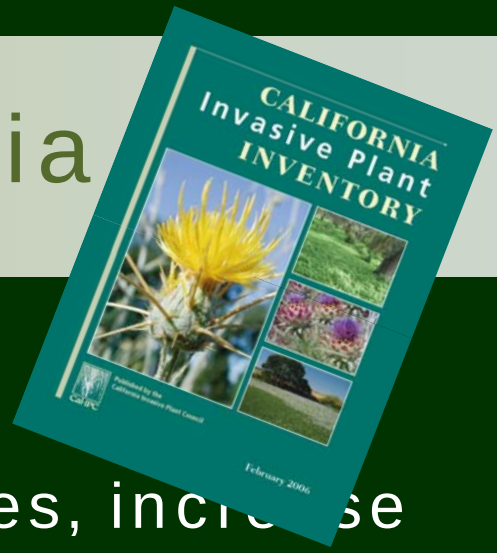
[1]California Invasive Plant Council

[2] UC Davis Weed Science Program

Cal-IPC

Photo: Carolyn Martus

Invasive Plants in California



200+ plants invade wildlands

- Impacts: displace native species, increase fire, block waterways, decrease recreational opportunities...
- Predicting future spread complicated by diverse geography
- Predictive models help early detection and rapid response programs

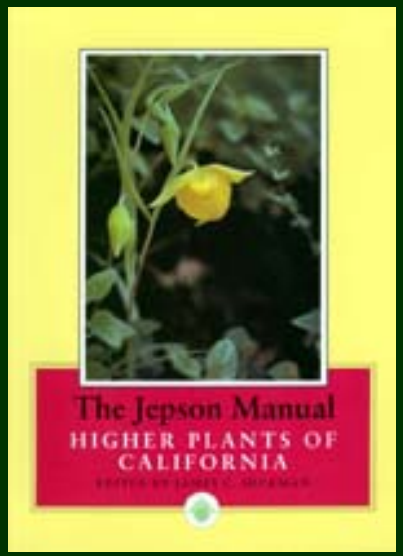
Climate change and weeds

- Distributions shift to higher elevations and higher latitudes
- Increased CO_2 → increased growth
- Increased fire → habitat type conversion
- 66% of native CA plants could lose >80% of their range (Loarie et al. 2008)

Predicting weeds' spread

1. Where are weeds now?
   Survey data from Weed Management Areas
2. Where could they spread?
   Models with climate change
3. What else could invade?
   Weeds from other Mediterranean-type regions
   - not discussed here

Data based on counties and floristic regions



Map: UC Berkeley Jepson Herbarium

Where are weeds now?

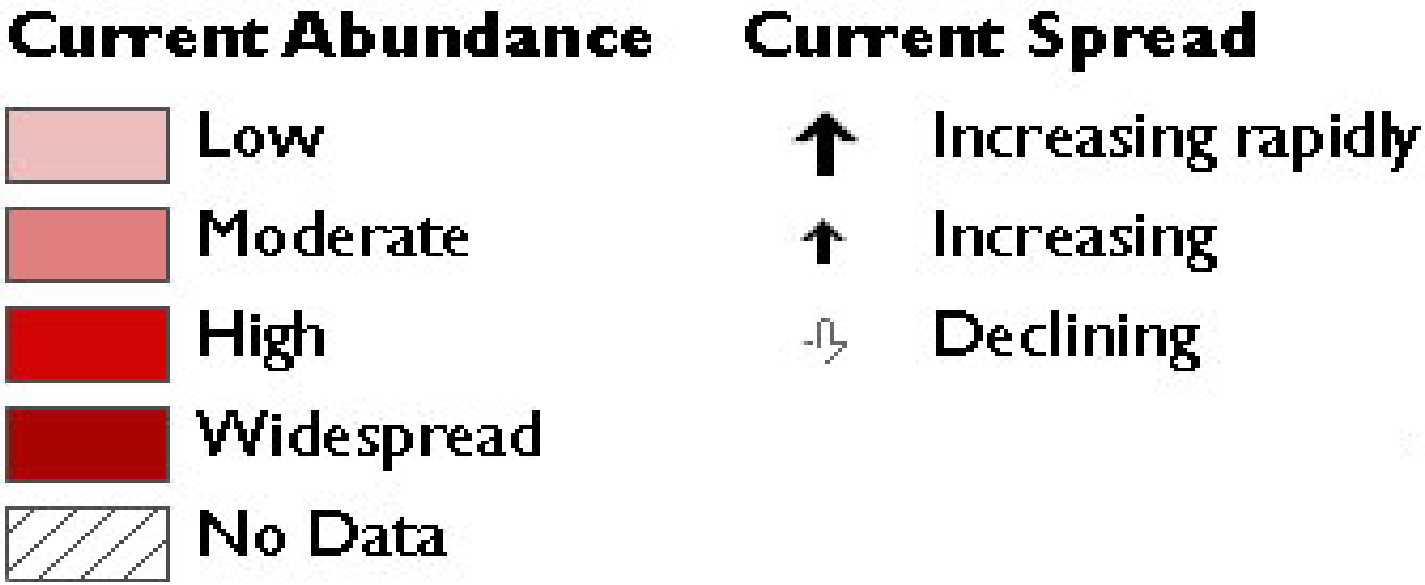
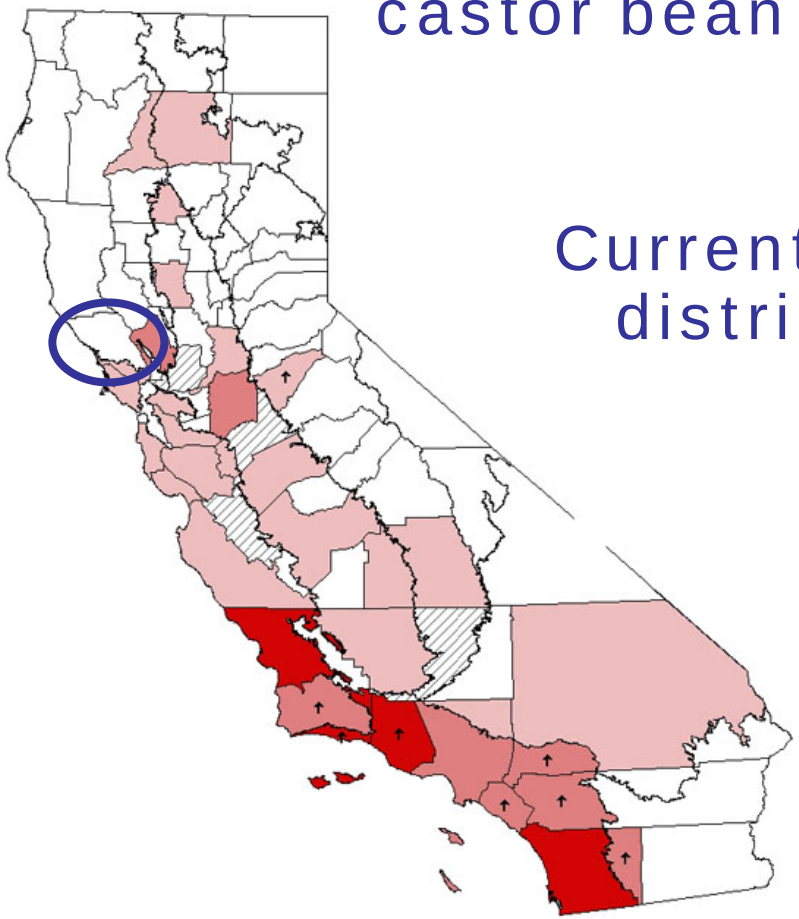


Photo: Carolyn Martus

Ricinus communis

castor bean



Current distribution

Photo: P. Roullard

Where could weeds spread?

Climate is most basic determinant of where a plant can grow

Models predict where plants can spread based on where they already grow

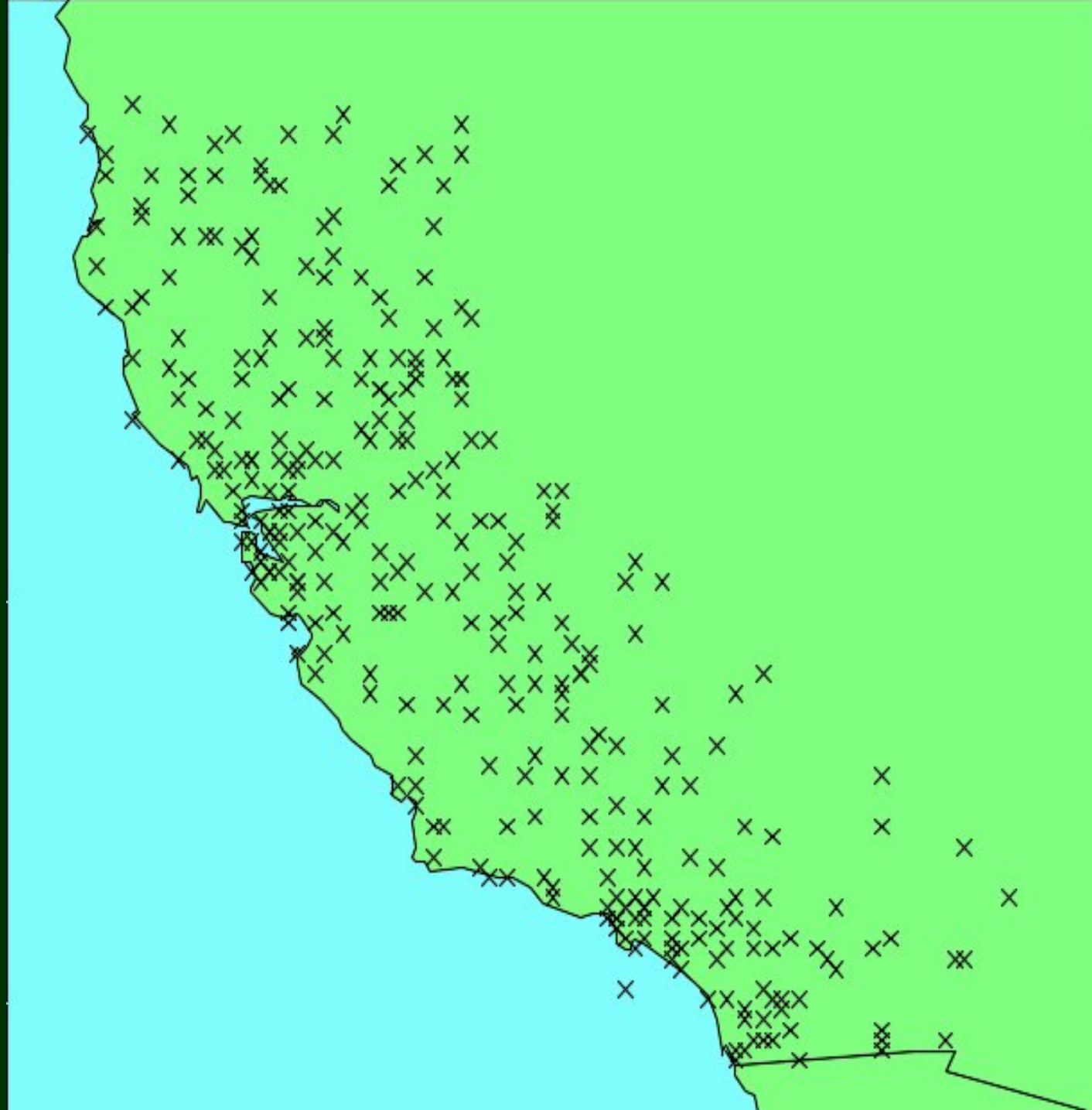
- Compare native and introduced ranges
- Calculate temp. and moisture tolerance

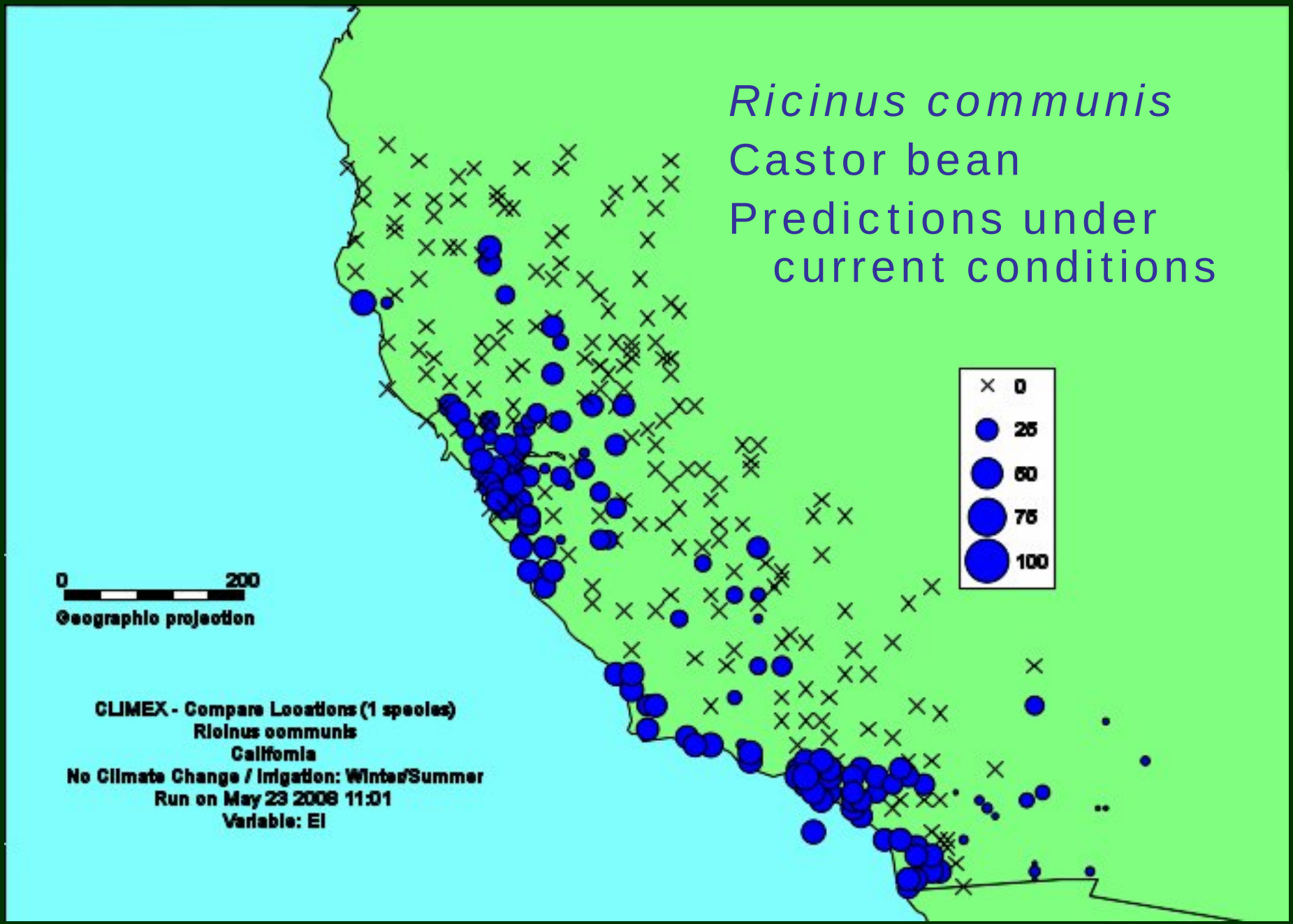
Photo: Carolyn Martus

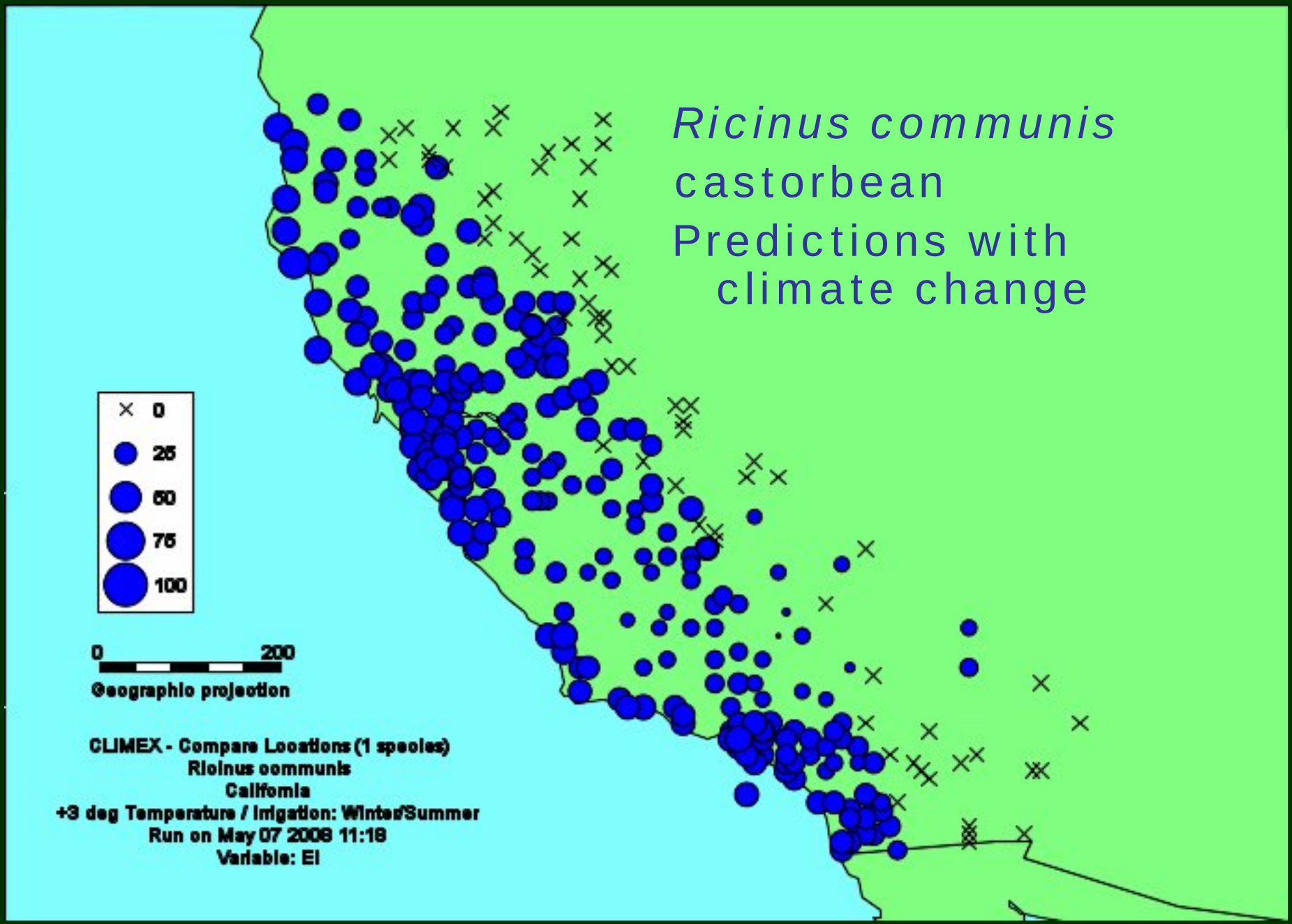
Modeling plants' spread

- 36 plants from Cal-IPC Inventory
  - **Researched native and intro ranges**
- California weather station data added into Climex software
  - **"Ecoclimatic index" 0 – 100**
- Climate change based on 3° C increase

322
NOAA
weather
stations




Ricinus communis
Castor bean
Predictions under current conditions
0
25
50
75
100
0
200
Geographic projection
CLIMEX - Compare Locations (1 species)
Ricinus communis
California
No Climate Change / Irrigation: Winter/Summer
Run on May 23 2008 11:01
Variable: EI


Ricinus communis
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Predictions with
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0
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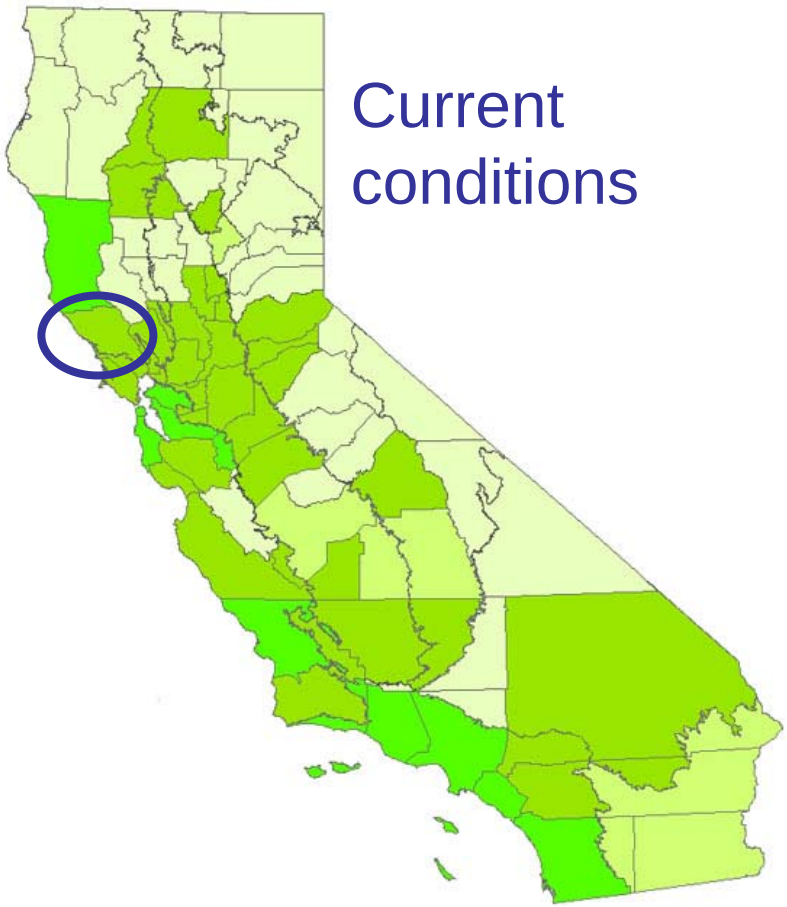
Geographic projection
CLIMEX - Compare Locations (1 species)
Ricinus communis
California
+3 deg Temperature / Irrigation: Winter/Summer
Run on May 07 2008 11:18
Variable: EI

Ricinus communis castor bean



Current conditions

Potential Suitability

- Very low
- Low
- Moderate
- High

Photo: P. Roullard

Ricinus communis castor bean

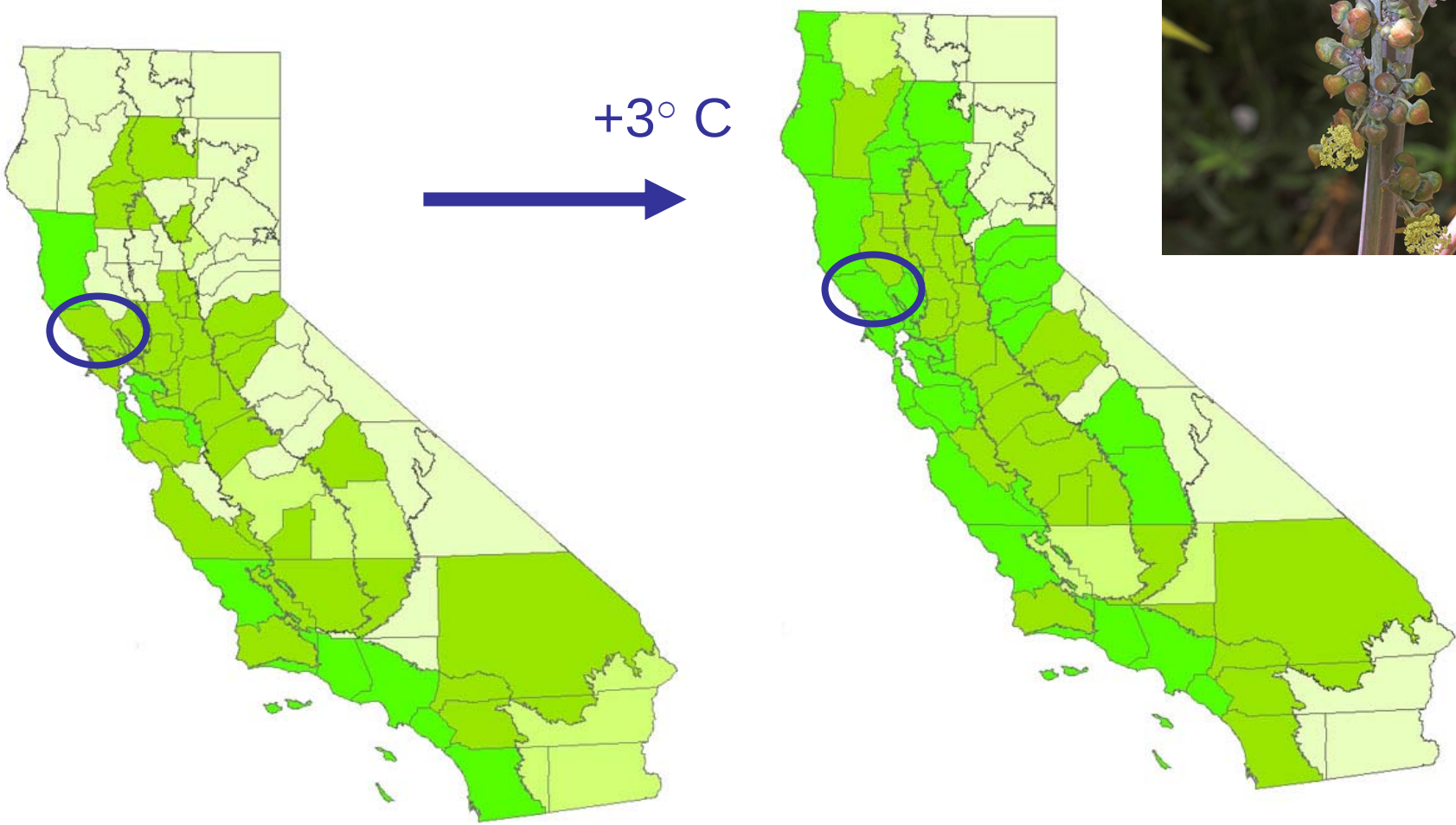
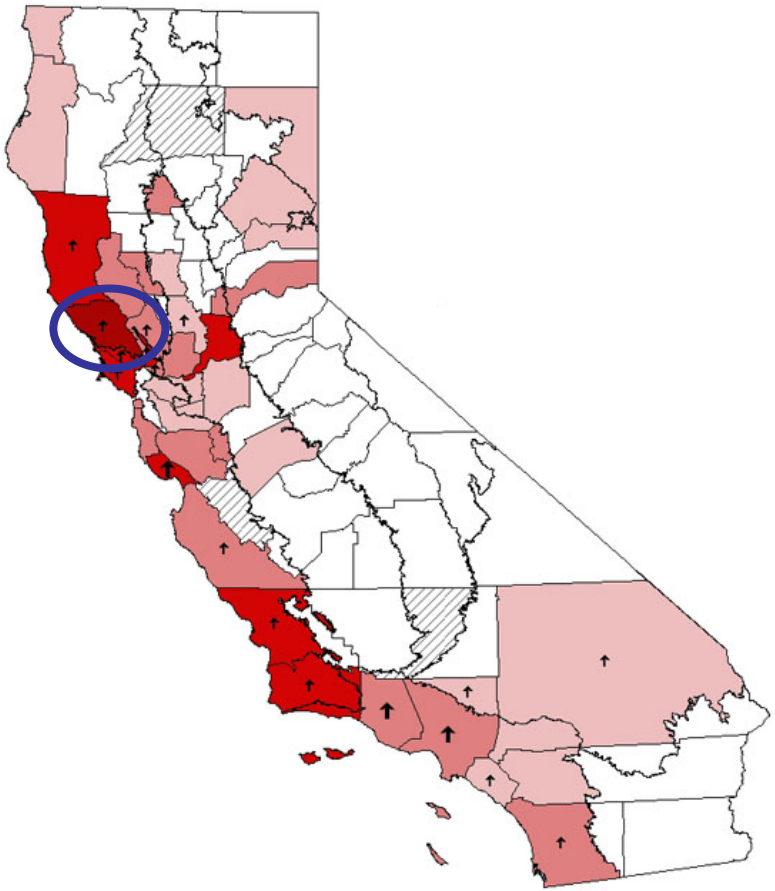


Photo: P. Roullard

Phalaris aquatica Hardinggrass



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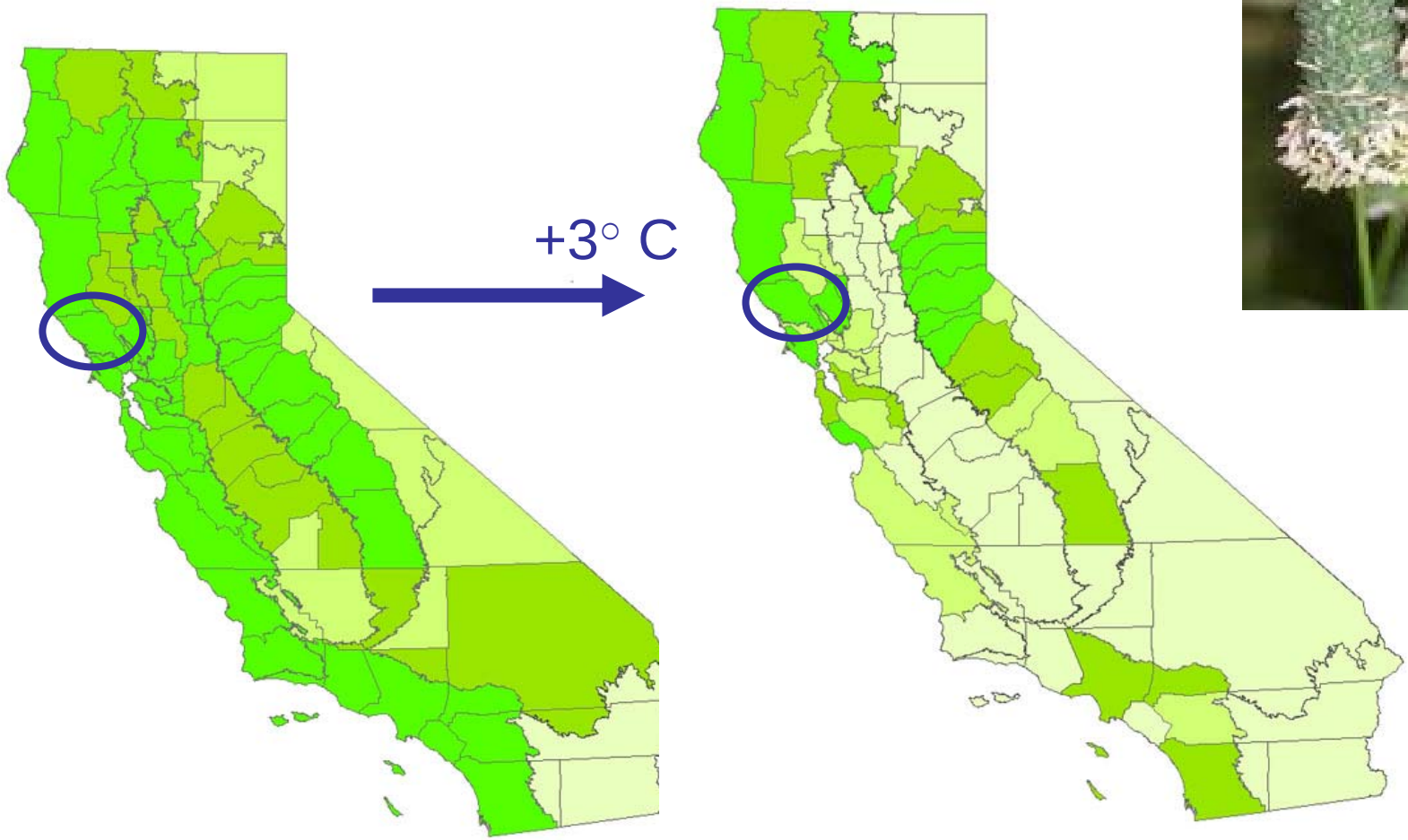


Photo: Joe DiTomaso

Delairea odorata Cape ivy

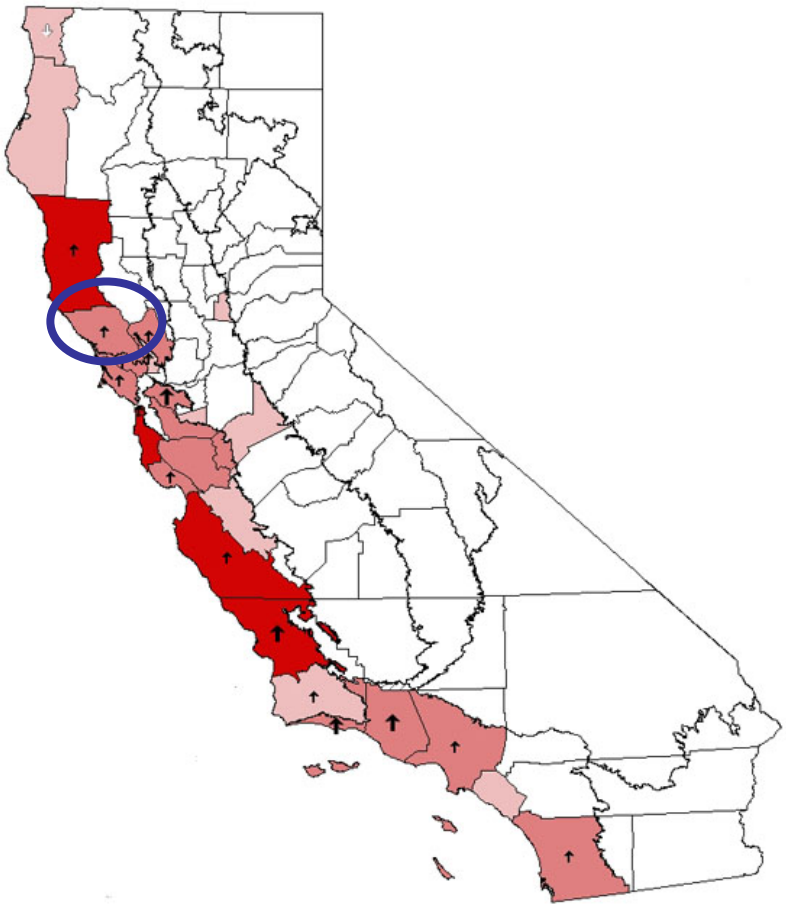
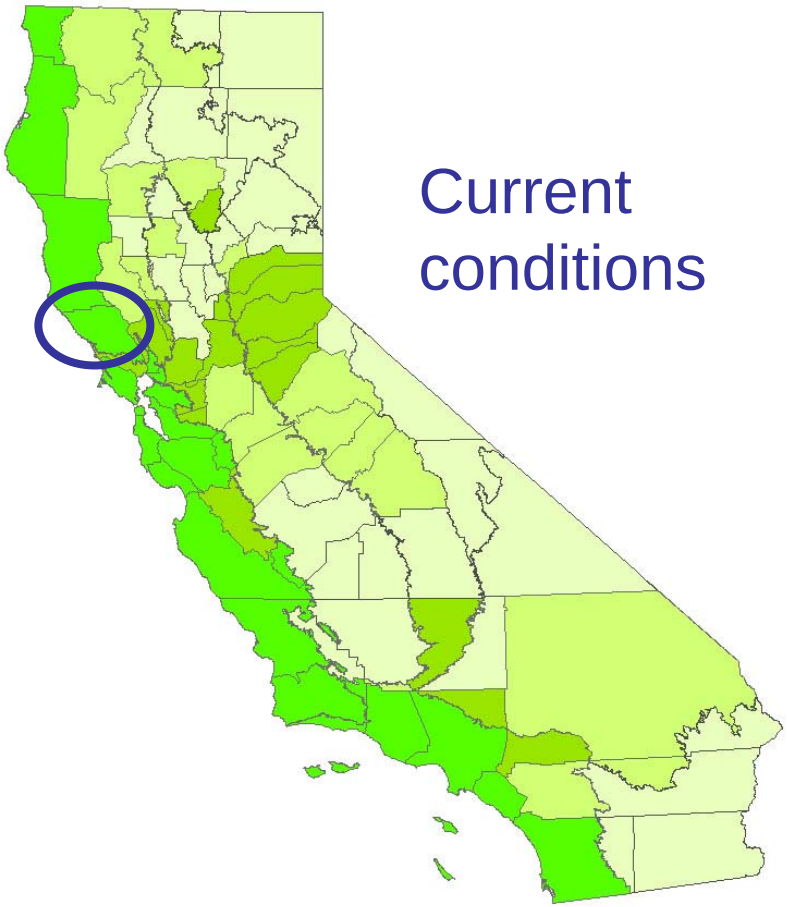


Photo: Jim Bromberg

Delairea odorata Cape ivy



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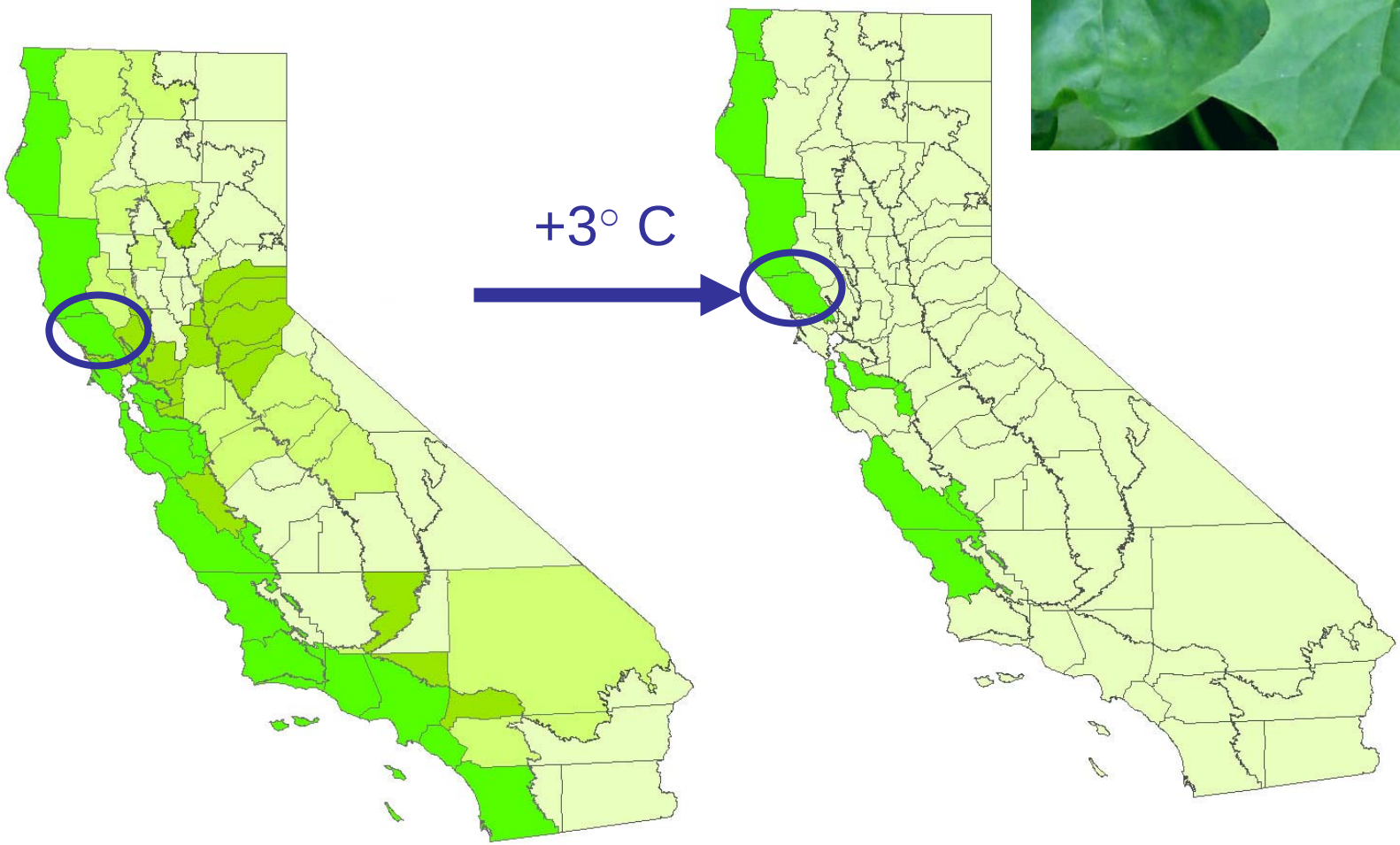

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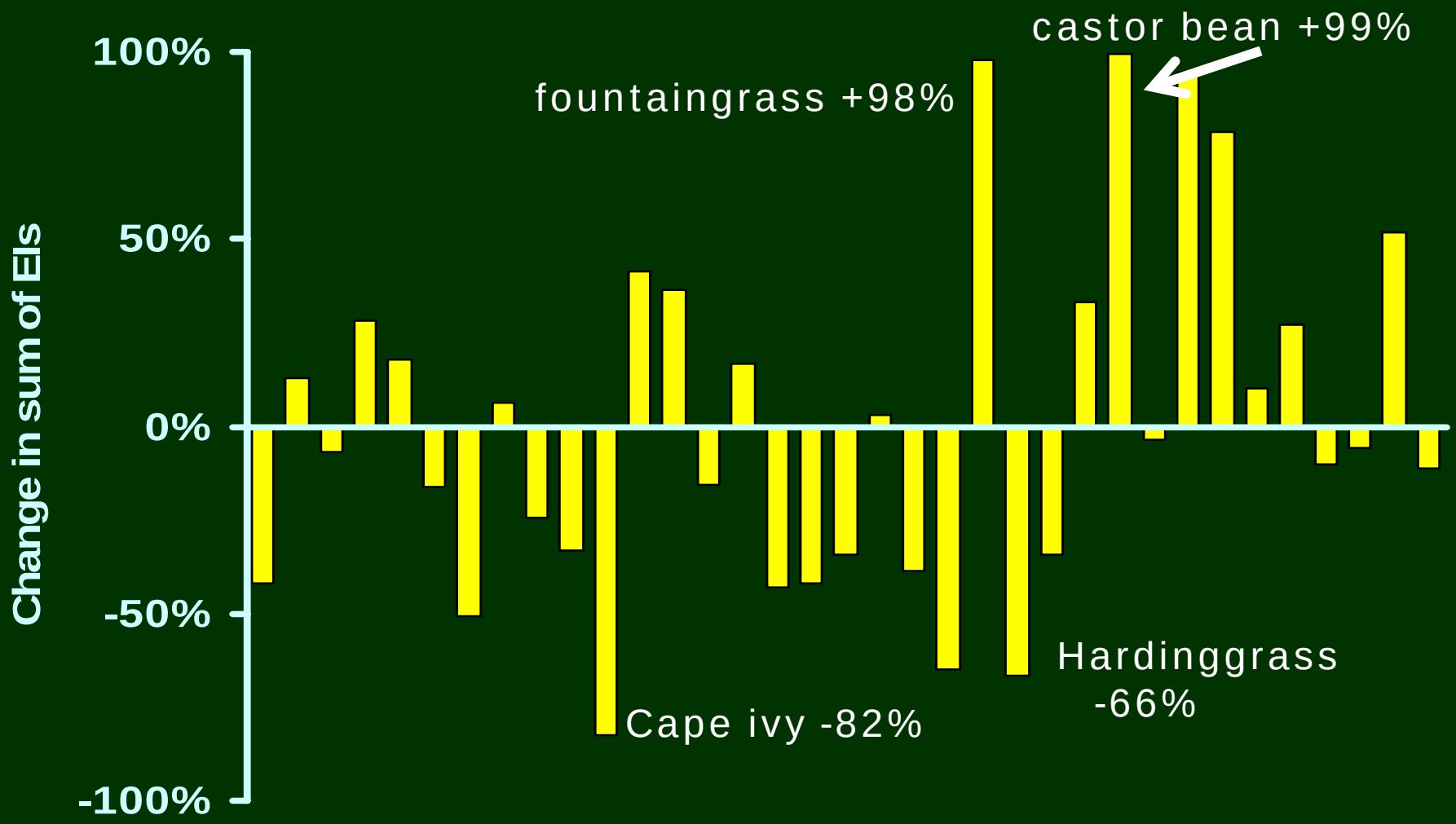
Change in climate suitability



A few cautions

- Weather station data are individual points, while WMA surveys extrapolate to entire county
- Not all predicted spread is due to climate change
- Does not consider other factors
  - **Soils, competition, geographic barriers to dispersal**

Native plant conservation

- Where will a particular invasive plant compete with natives?
- What happens as native species' ranges collapse?
- What are the implications for assisted migration?

Thank you to...

WMAs for survey data

UC Integrated Pest Management (funding)

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Len Liu

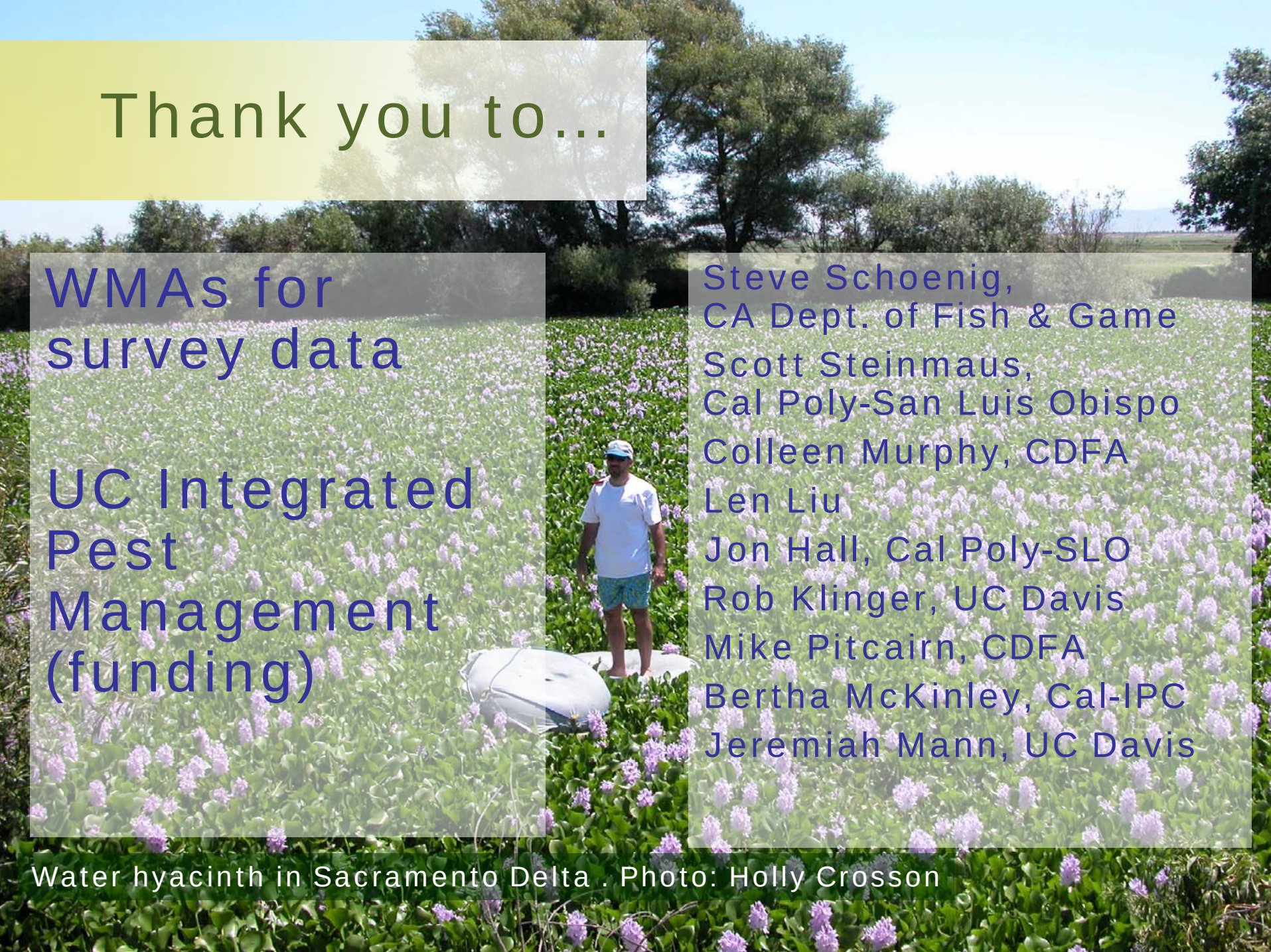
Jon Hall, Cal Poly-SLO

Rob Klinger, UC Davis

Mike Pitcairn, CDFA

Bertha McKinley, Cal-IPC

Jeremiah Mann, UC Davis



Water hyacinth in Sacramento Delta . Photo: Holly Crosson

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Research → Risk Assessment