Spatio-Temporal Patterns of Open Surface Water in the Central Valley of California: Drought, Land Cover, and Waterbirds

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Conservation science
for a healthy planet.

The Nature Conservancy

Everything originated in water
Everything is sustained by water

J.W. von Goethe

Water and the Central Valley

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Water and Waterbirds

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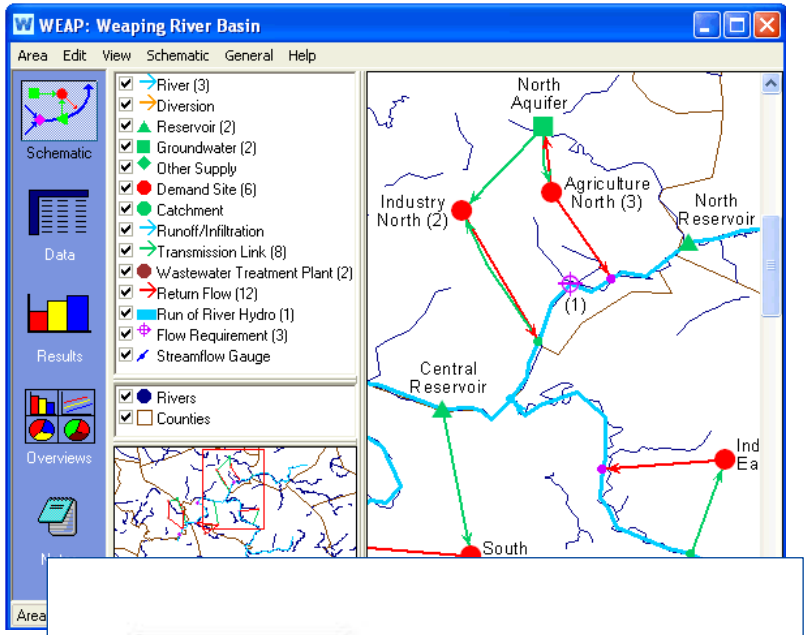
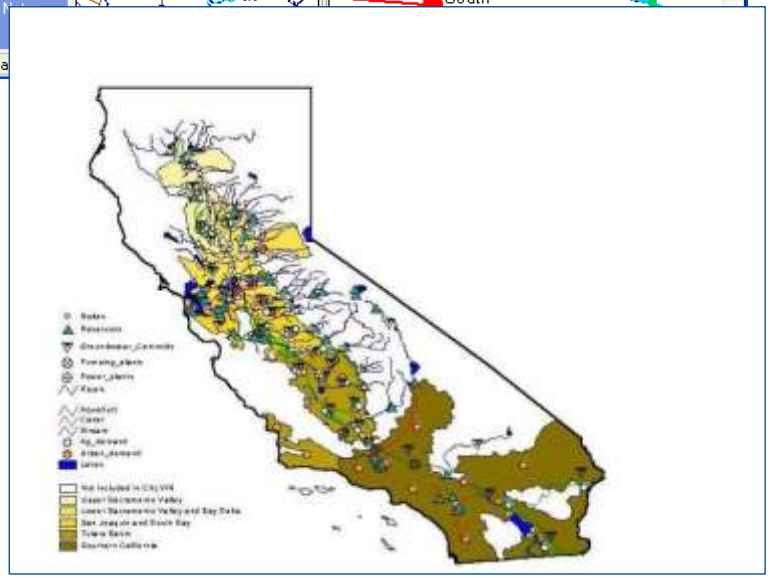
Water Management

- Optimization models
  (CALVIN; WEAP)

- Landsat mission and remote sensing





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Objectives

1. Quantify spatial and temporal variability of water in dry season

2. Identify hotspots of change in water distribution over time

3. Assess factors that influence this variability particularly cover type and drought

4. Apply to inform waterbird conservation and management

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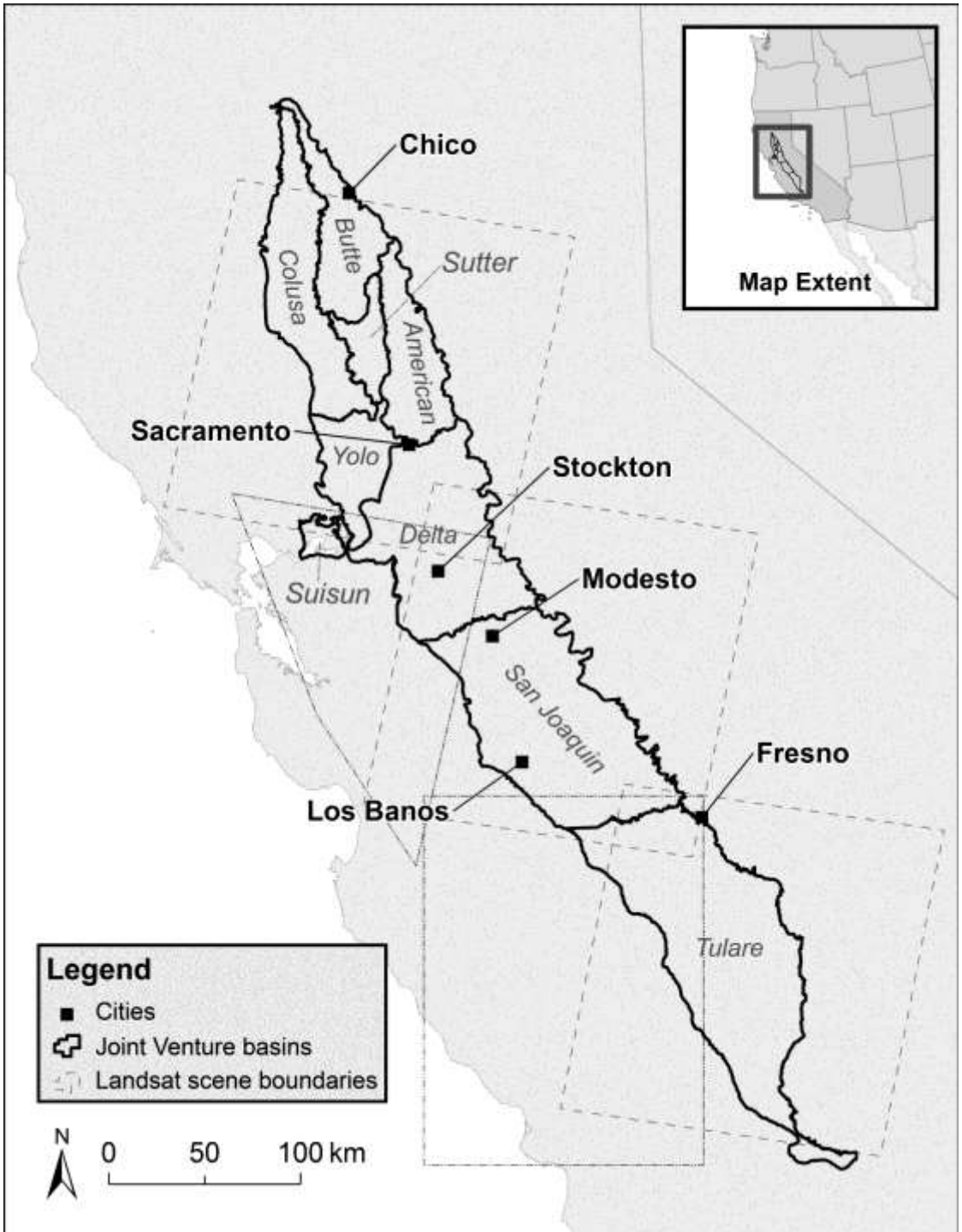
Study Area



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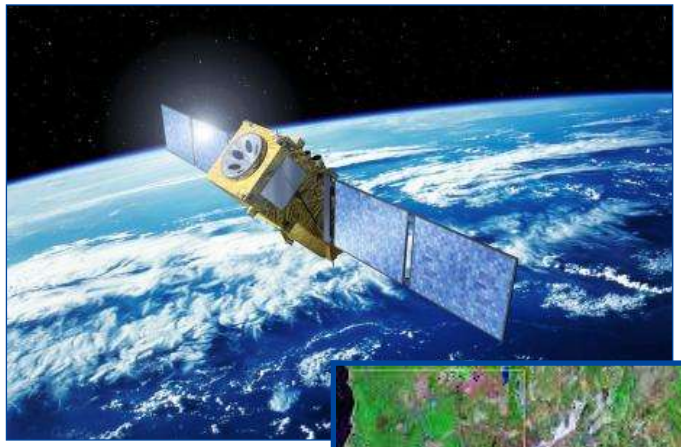
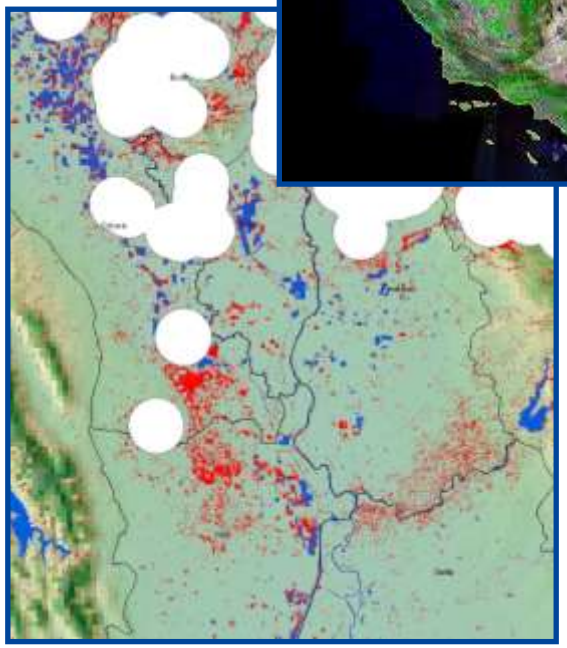
Methods

- Supervised classification Landsat 5
- July – December 2000 – 2011
- >11,000 ground truth observations
- Flood (1,0) ~ reflectance of each Landsat band
- Predict the probability of flooding for each pixel of each image





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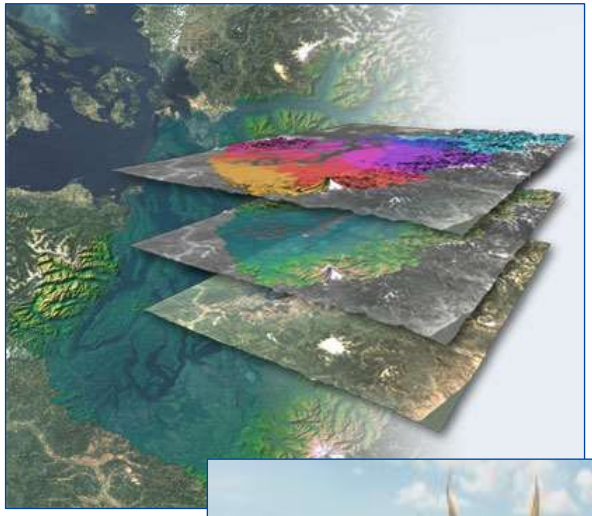
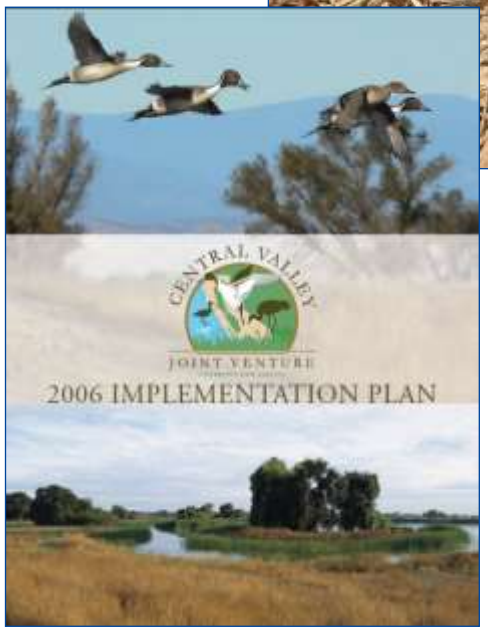
Analyses

- Open water hectares by year, hydrological basin, and cover type

- Modeled trend and the effect of drought years by month and hydrological basin

- Compared flooding schedule with CVJV (2006) – Rice, Corn, and Field Crops





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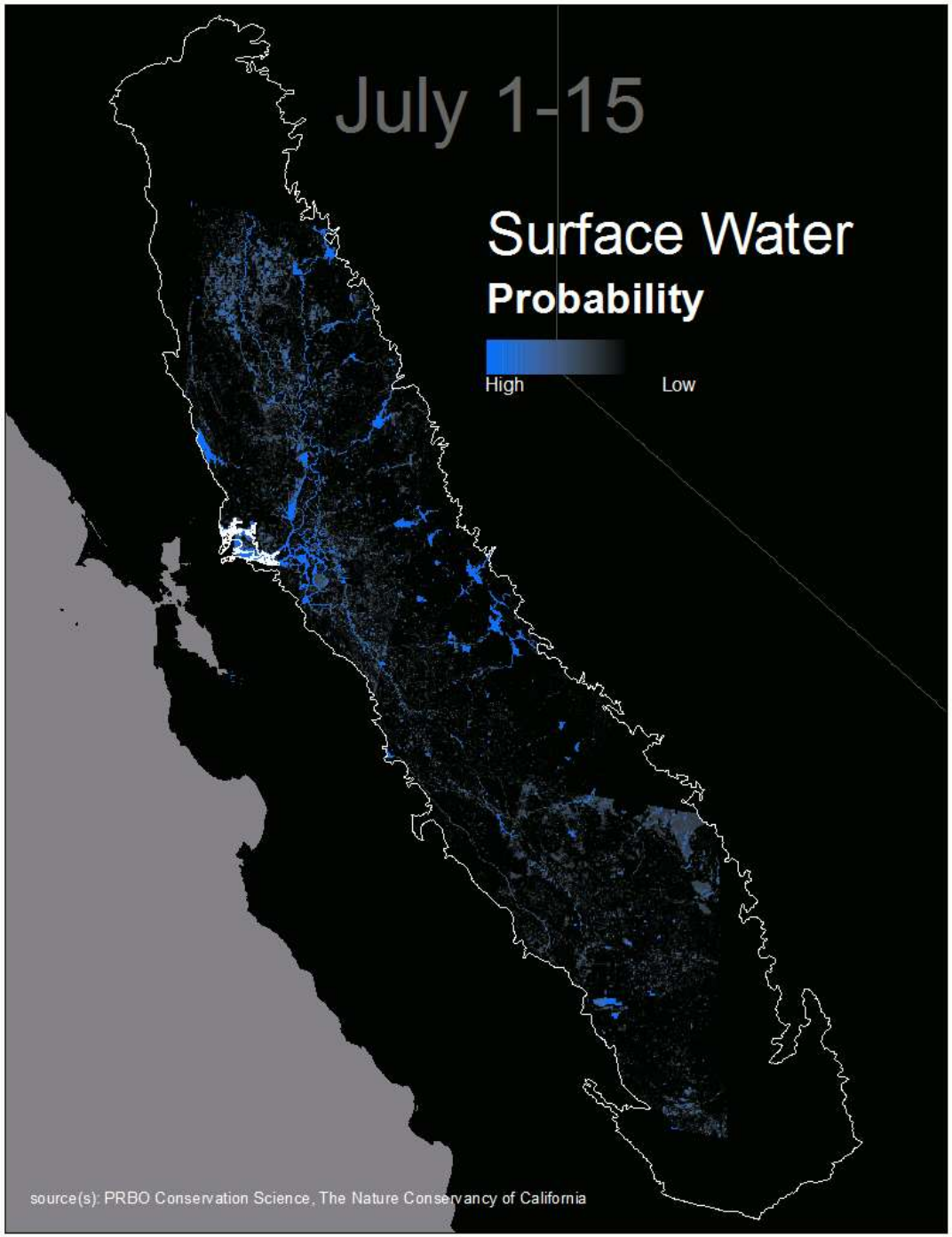
Results

600+ Landsat images classified: water and non-water



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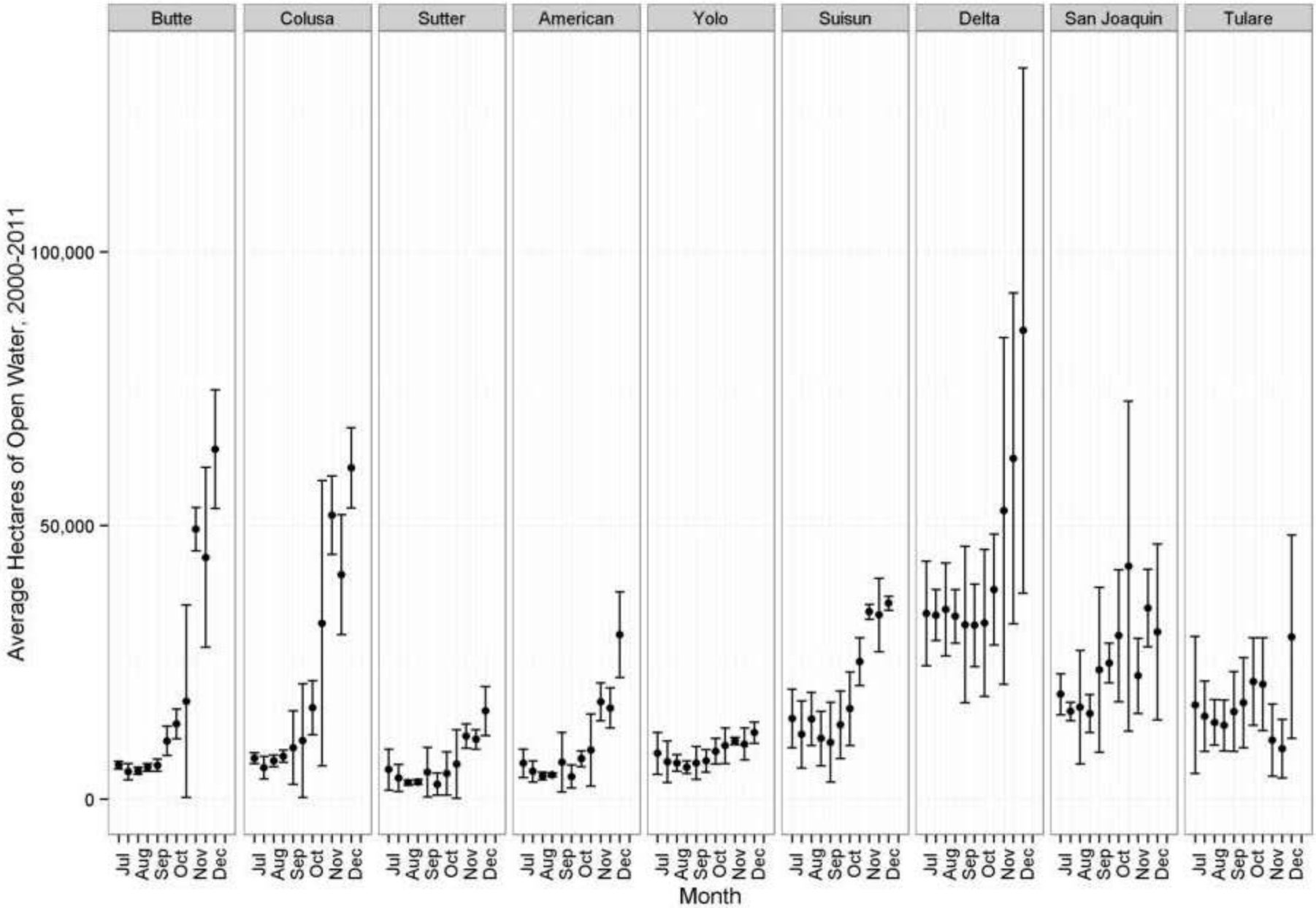
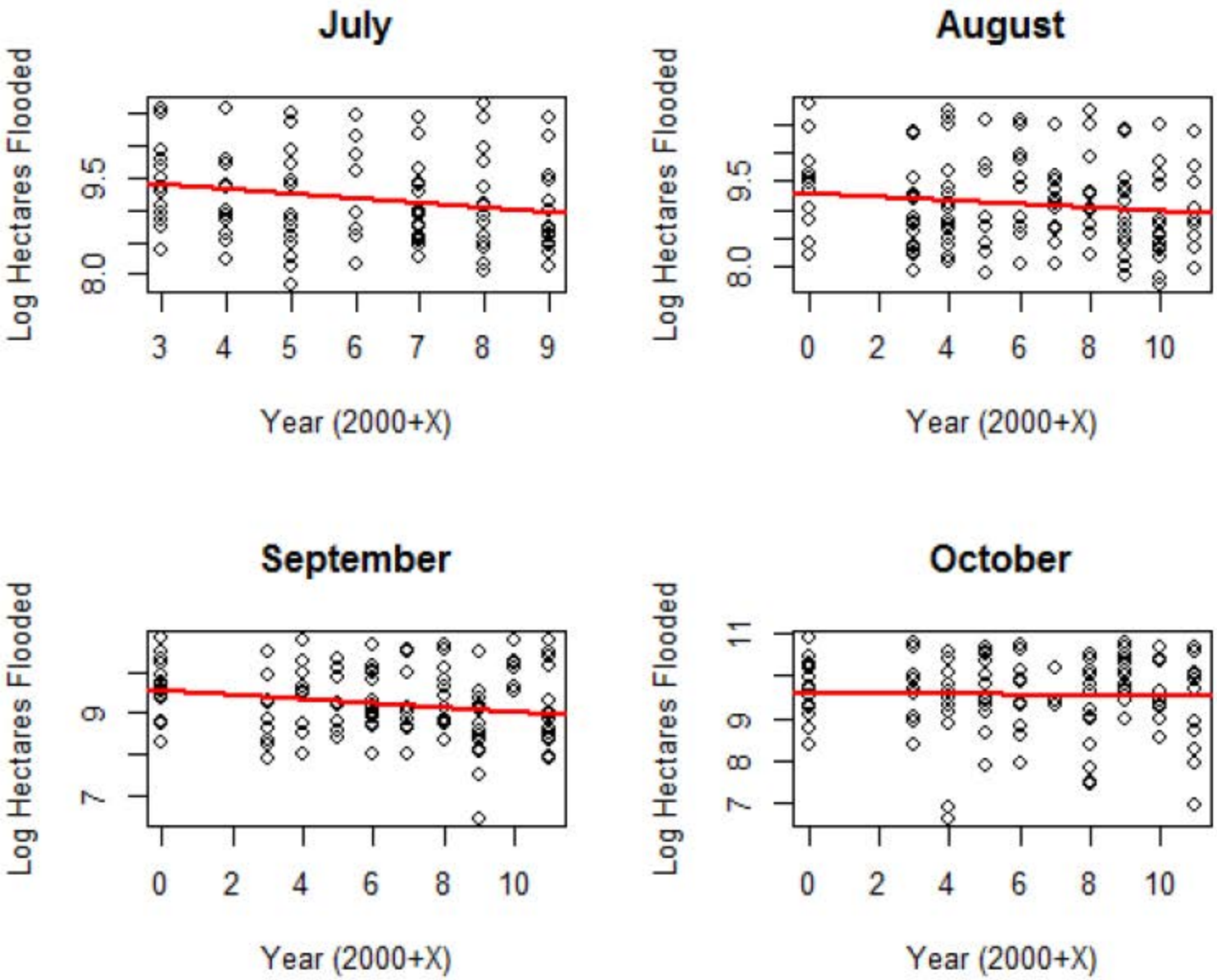
15-day water availability




July
August
September
October
Log Hectares Flooded
Year (2000+X)
8.0
9.5
7
9
11
3
4
5
6
7
8
9
0
2
4
6
8
10

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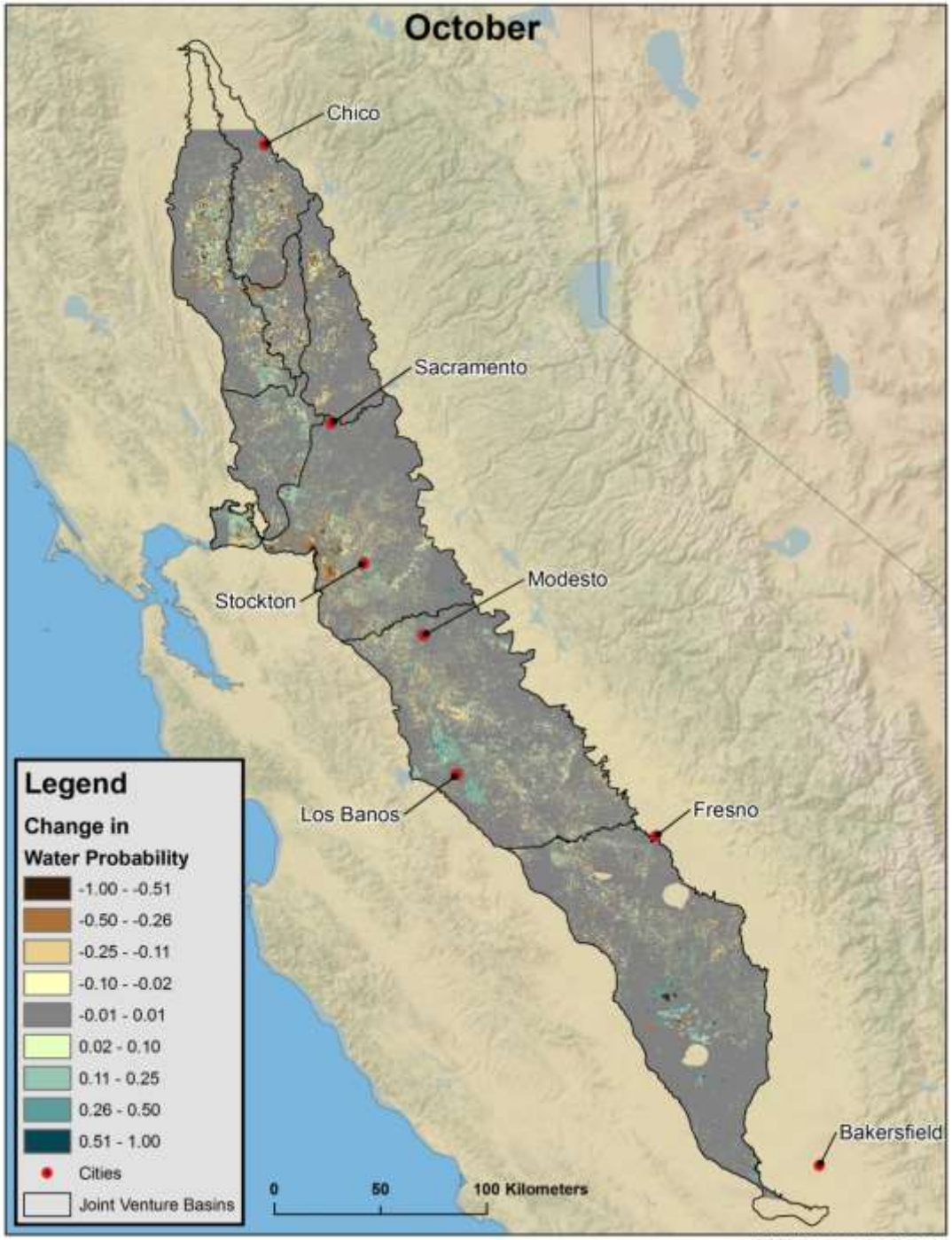
Temporal Change

1 – 3 % decline per year

Spatial variation



PRBO Conservation Science

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Effect of Drought

	Month	Estimate	Lower 95% CI	Upper 95% CI
DI[4]	July	-0.03	-0.04	-0.03
	August	-0.01	-0.02	-0.01
	September	-0.23	-0.24	-0.22

1 – 23% per year decline due to prolonged drought

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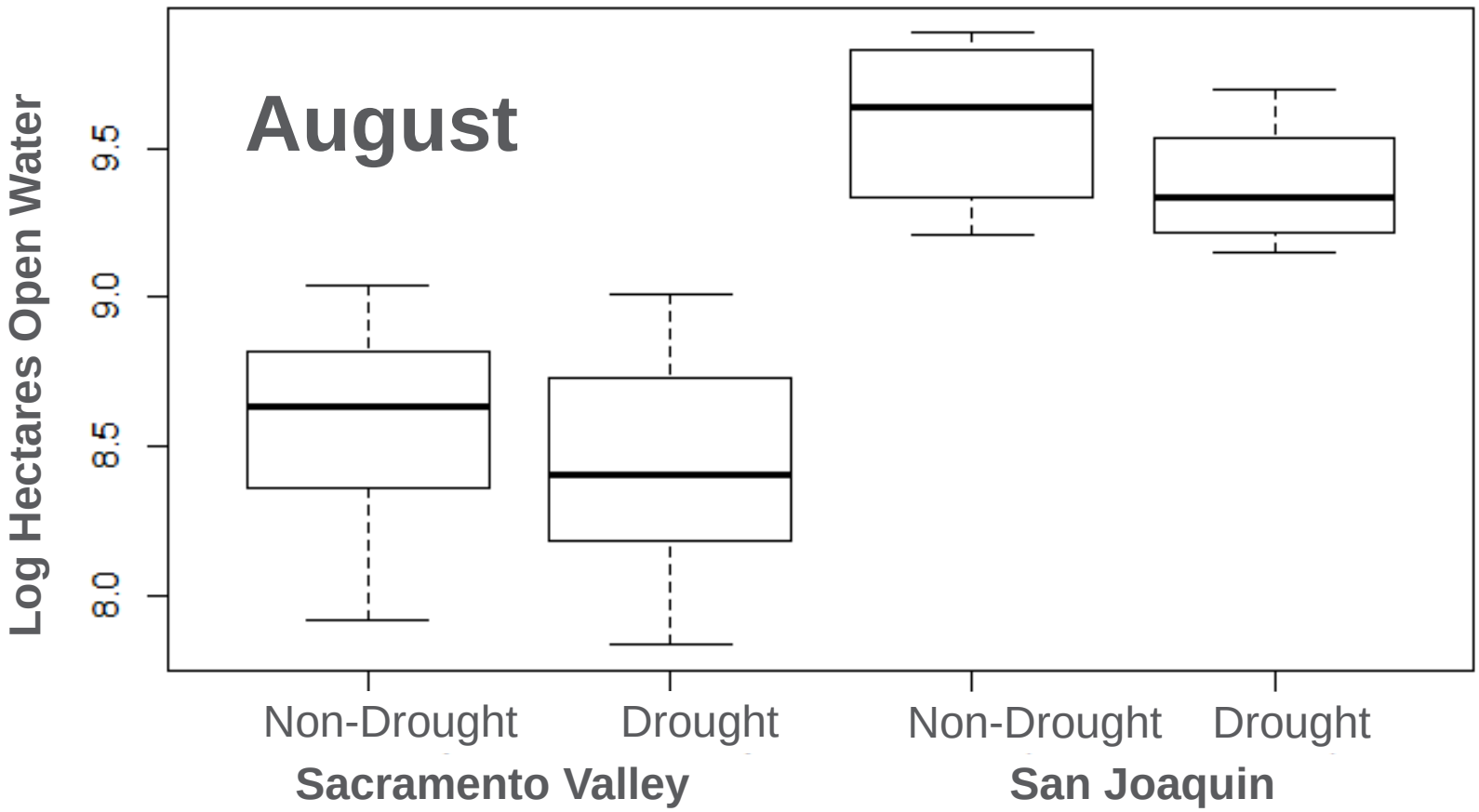
Effect of Drought



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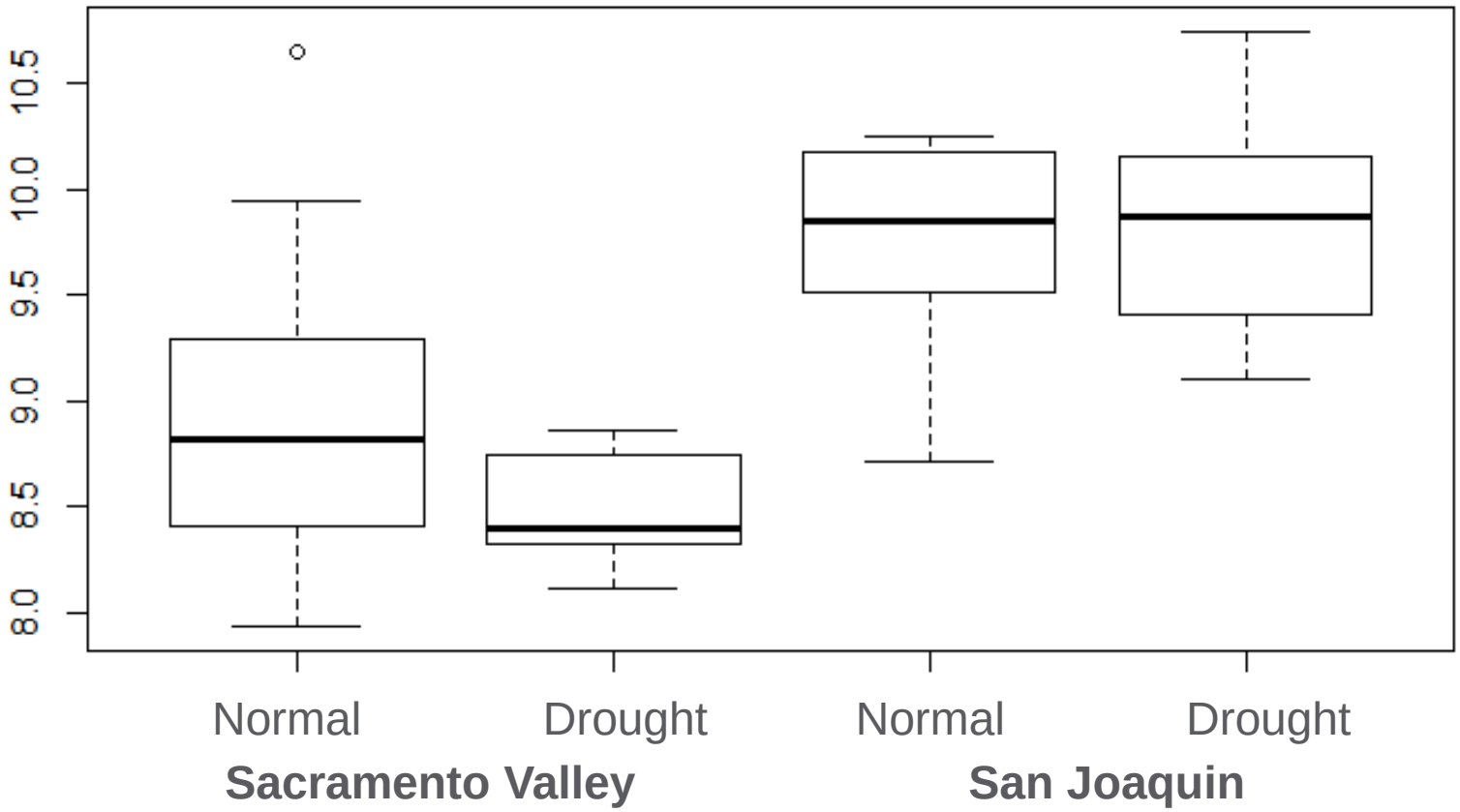
Effect of Drought: 1-year lag

September



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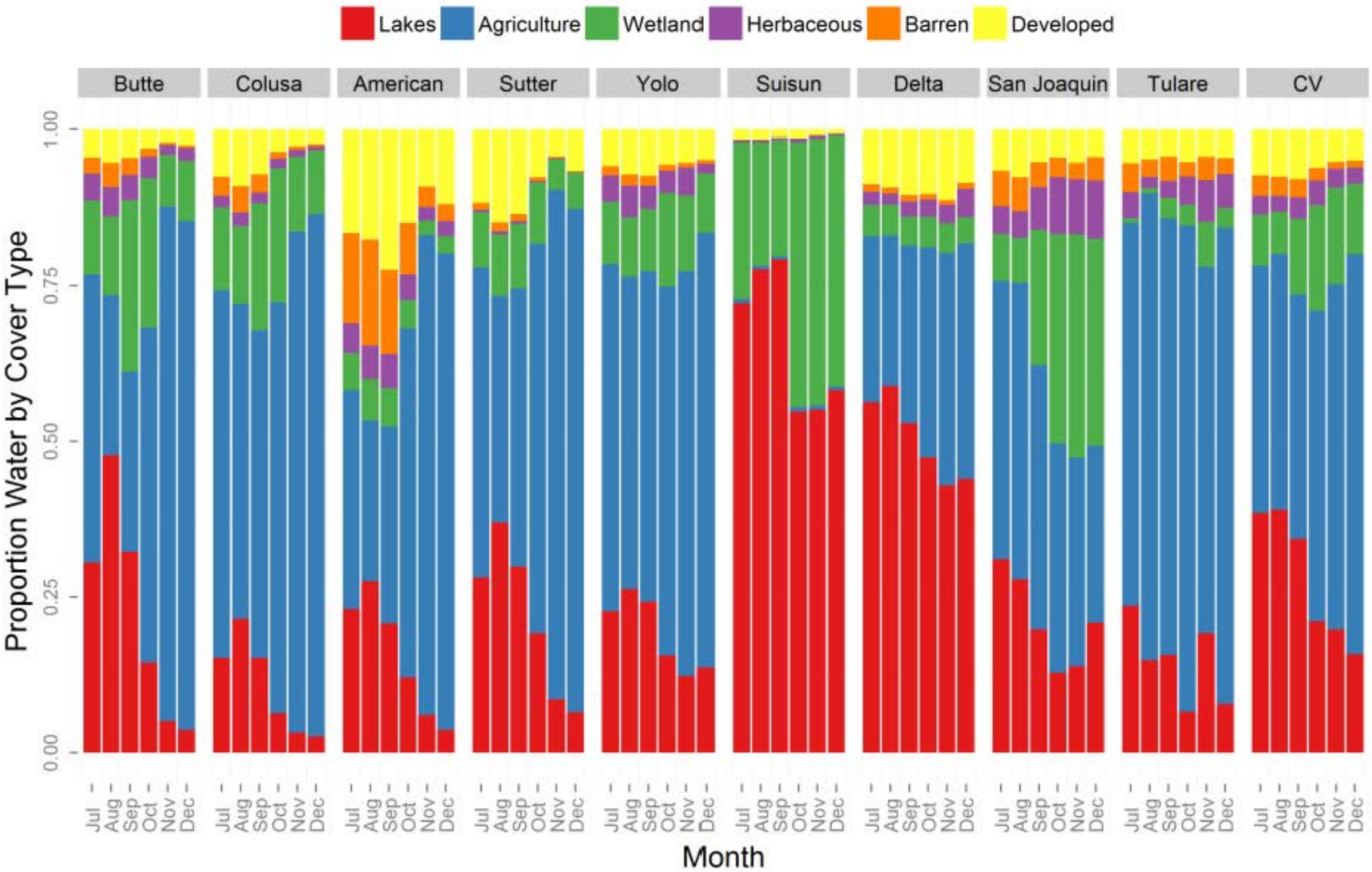
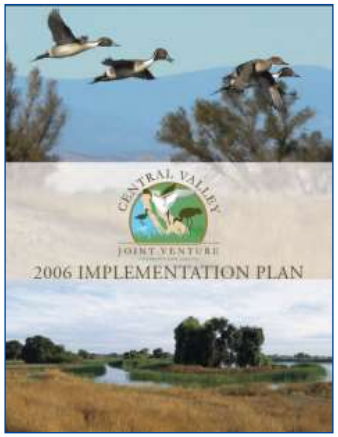
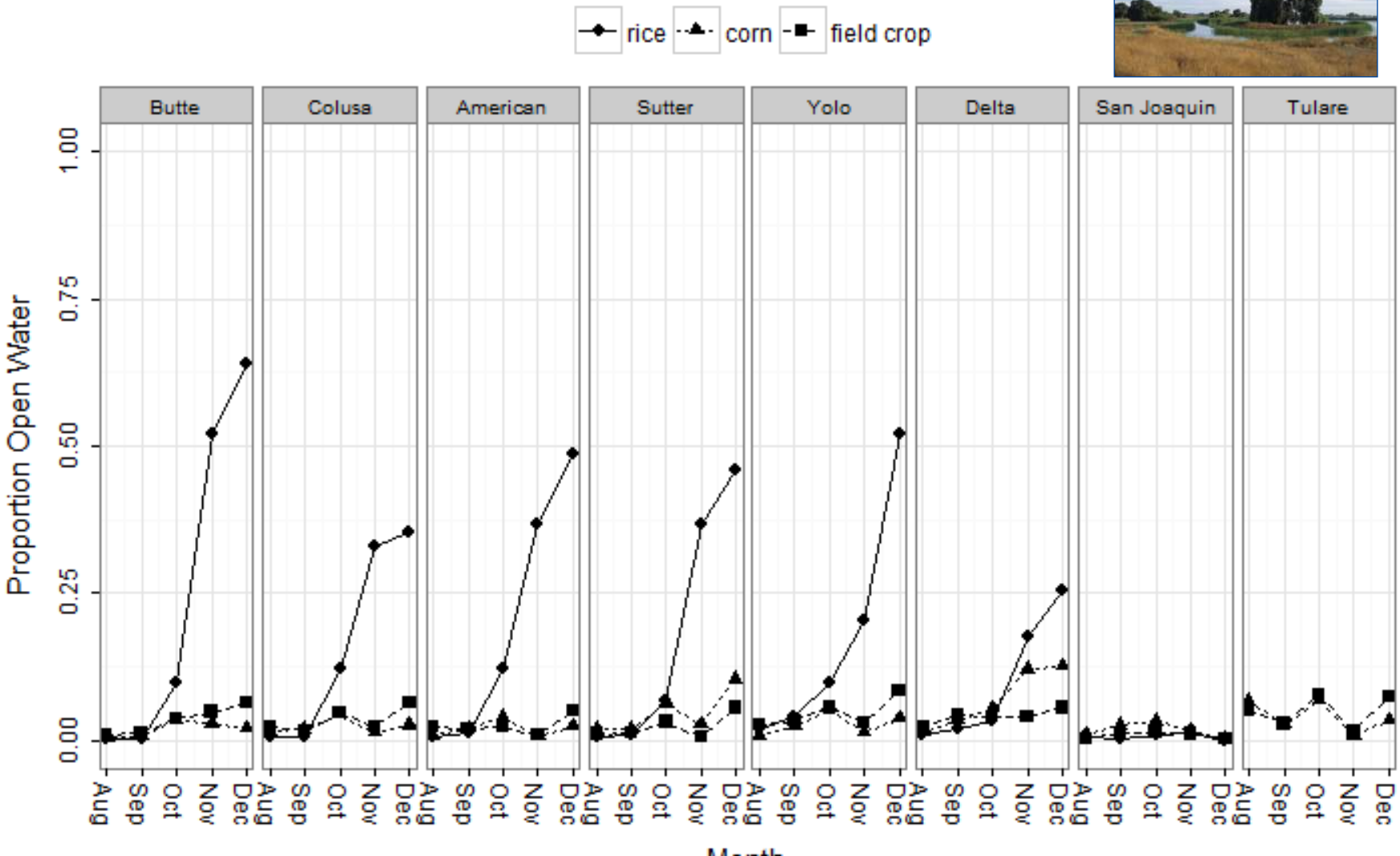
Cover Type and Water



Conservation Planning

53% rice flooded by mid-December (CVJV 2006)





Summary

- Spatial and temporal variability in water
- Surface water extent declining 1- 3 % per year (largely July – October)
- Drought reduces water!
- Water largely in lakes / rivers / streams and flooded agriculture
- Flood-up schedule in rice consistent with CVJV (2006)

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Acknowledgments

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Thank you!