Response of California Agriculture to Water Reductions

Josué Medellín-Azuara

Richard E. Howitt,

Duncan MacEwan and Jay R. Lund, Daniel Sumner

Workshop on Migration of Agriculture a One Path to Sustainability

Boulder, Colorado

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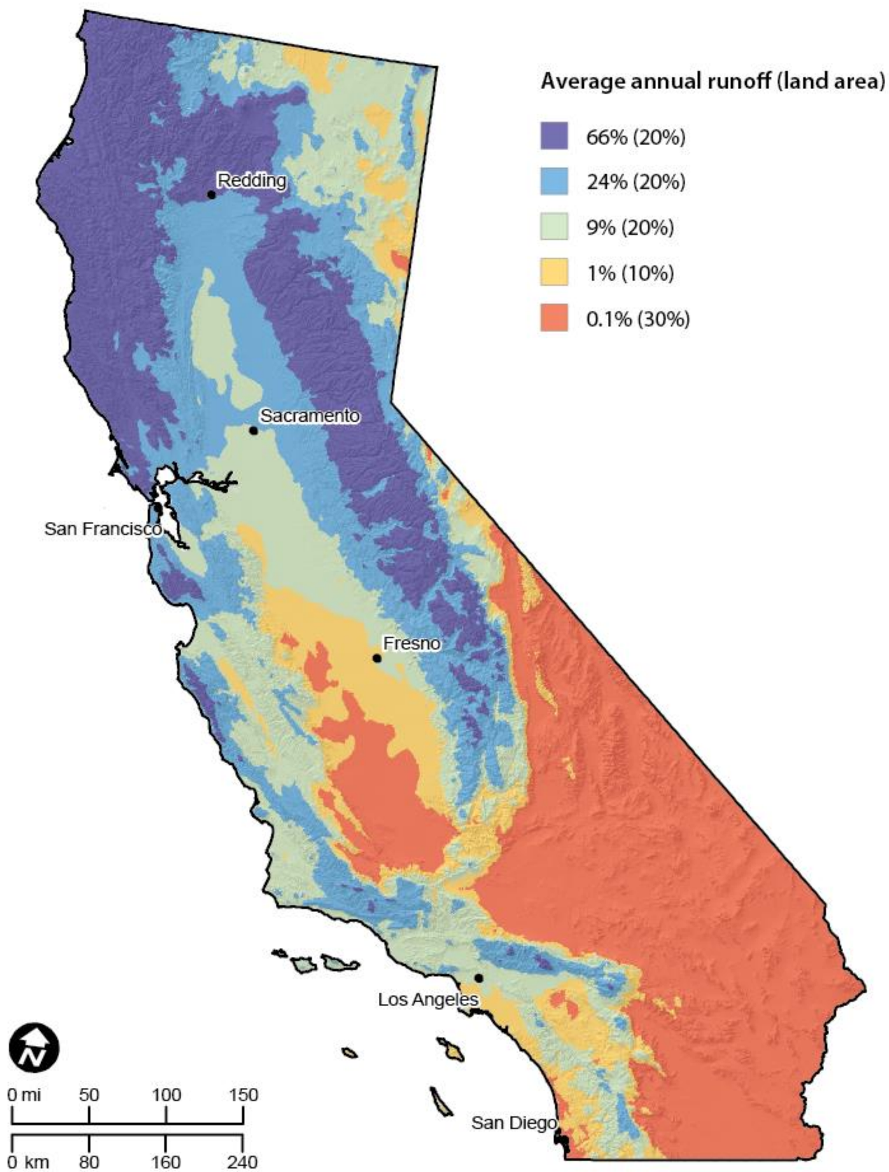
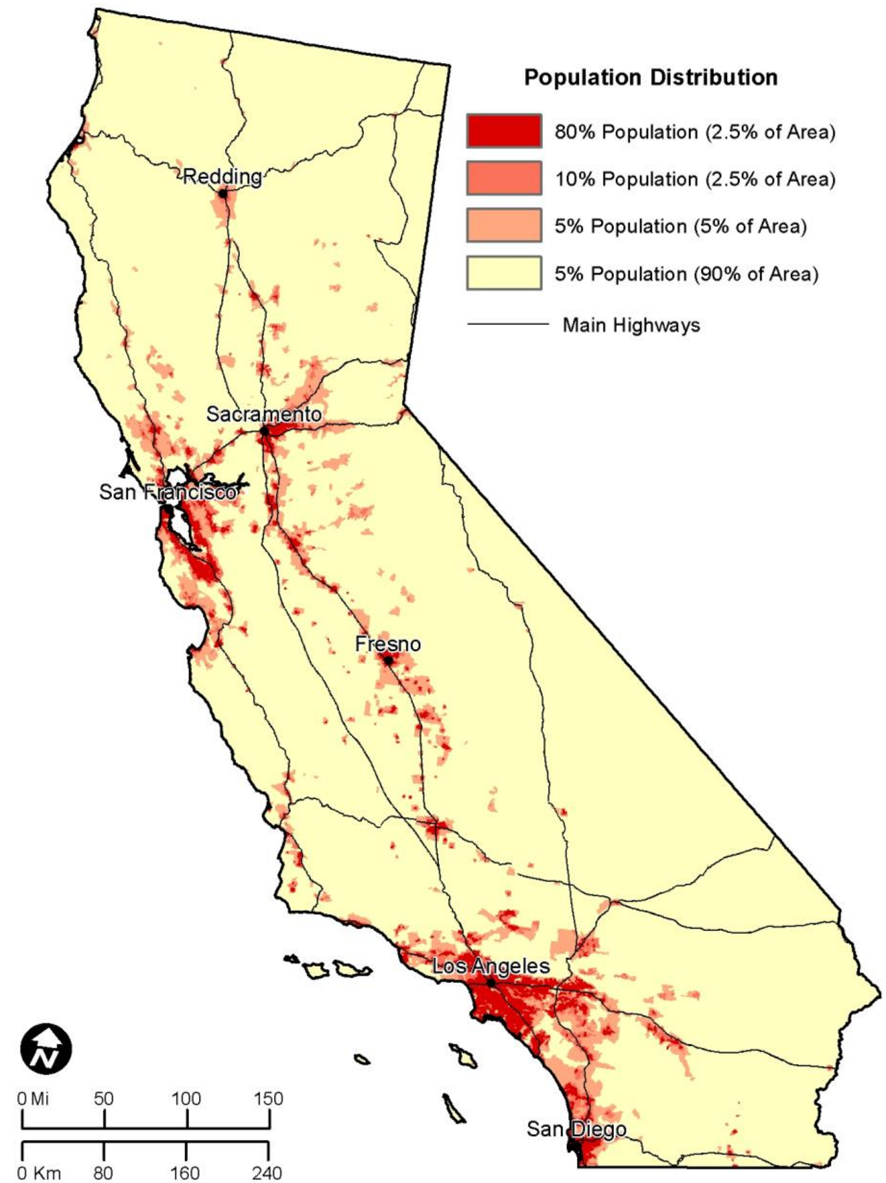
UCDAVIS CENTER FOR WATERSHED SCIENCES

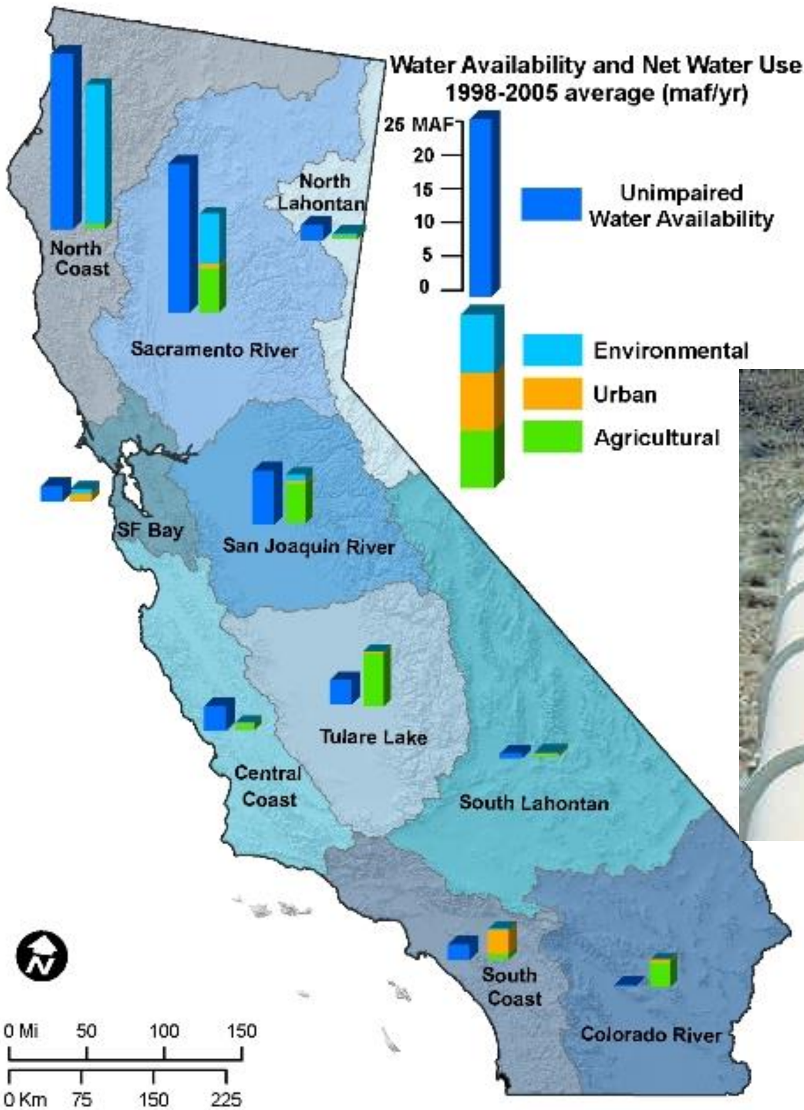
eraeconomics environment • resources • agriculture

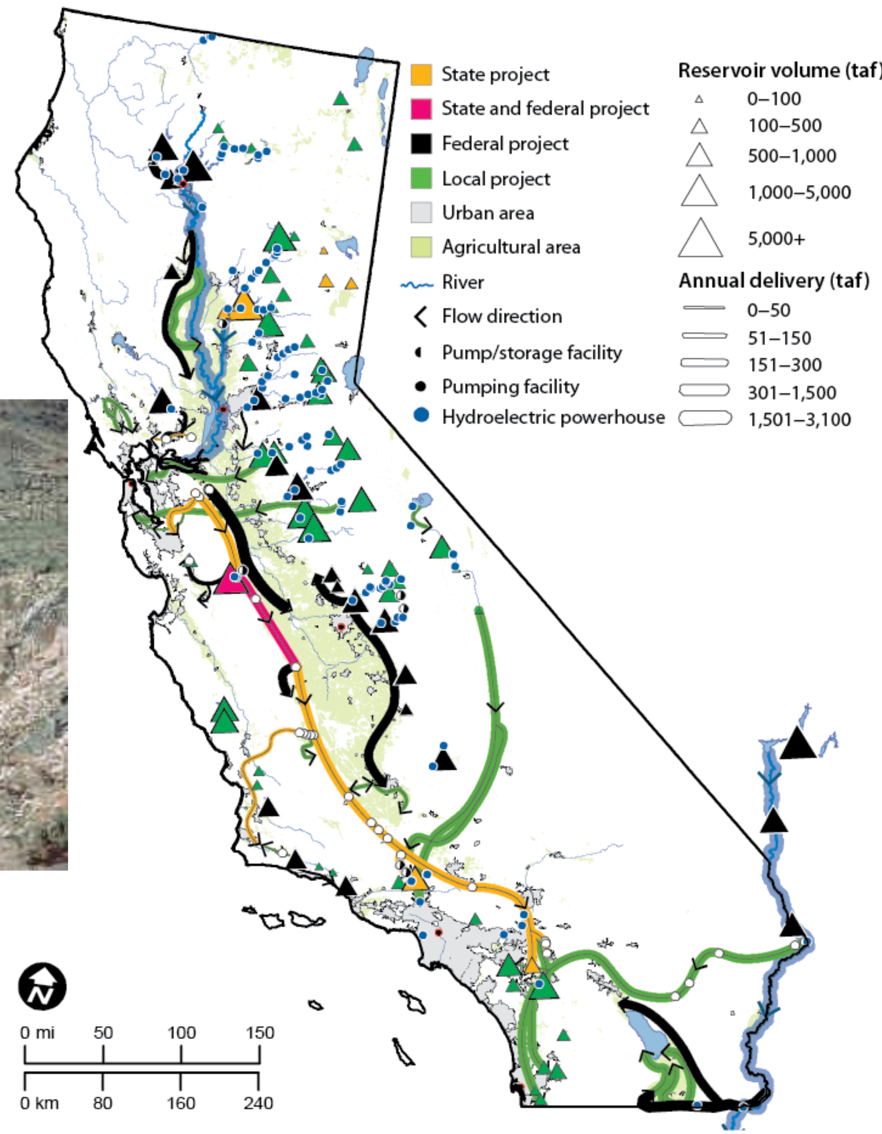
Water and People in California





California depends on an engineered statewide network





Agriculture in California

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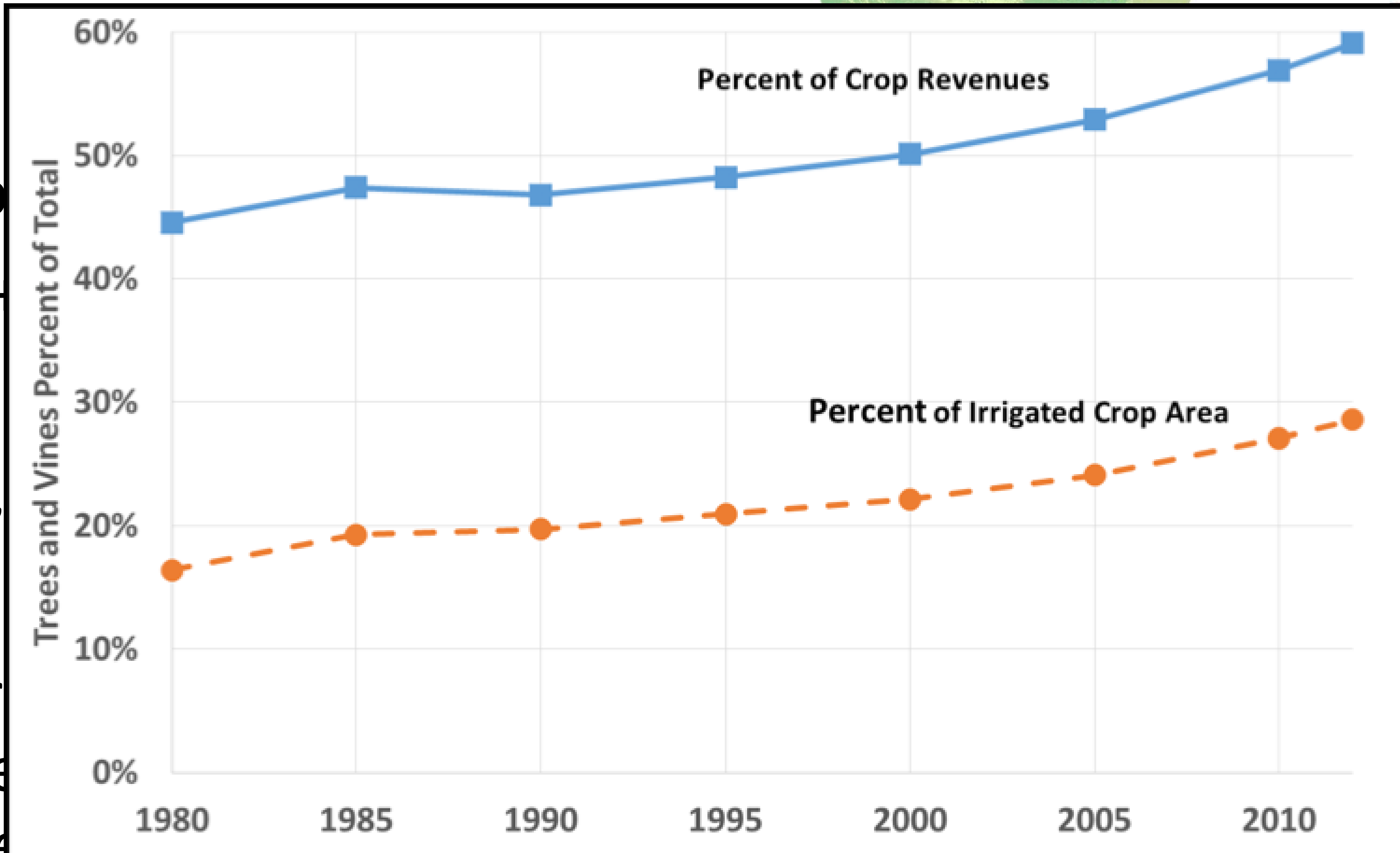
- Trend towards permanent crops

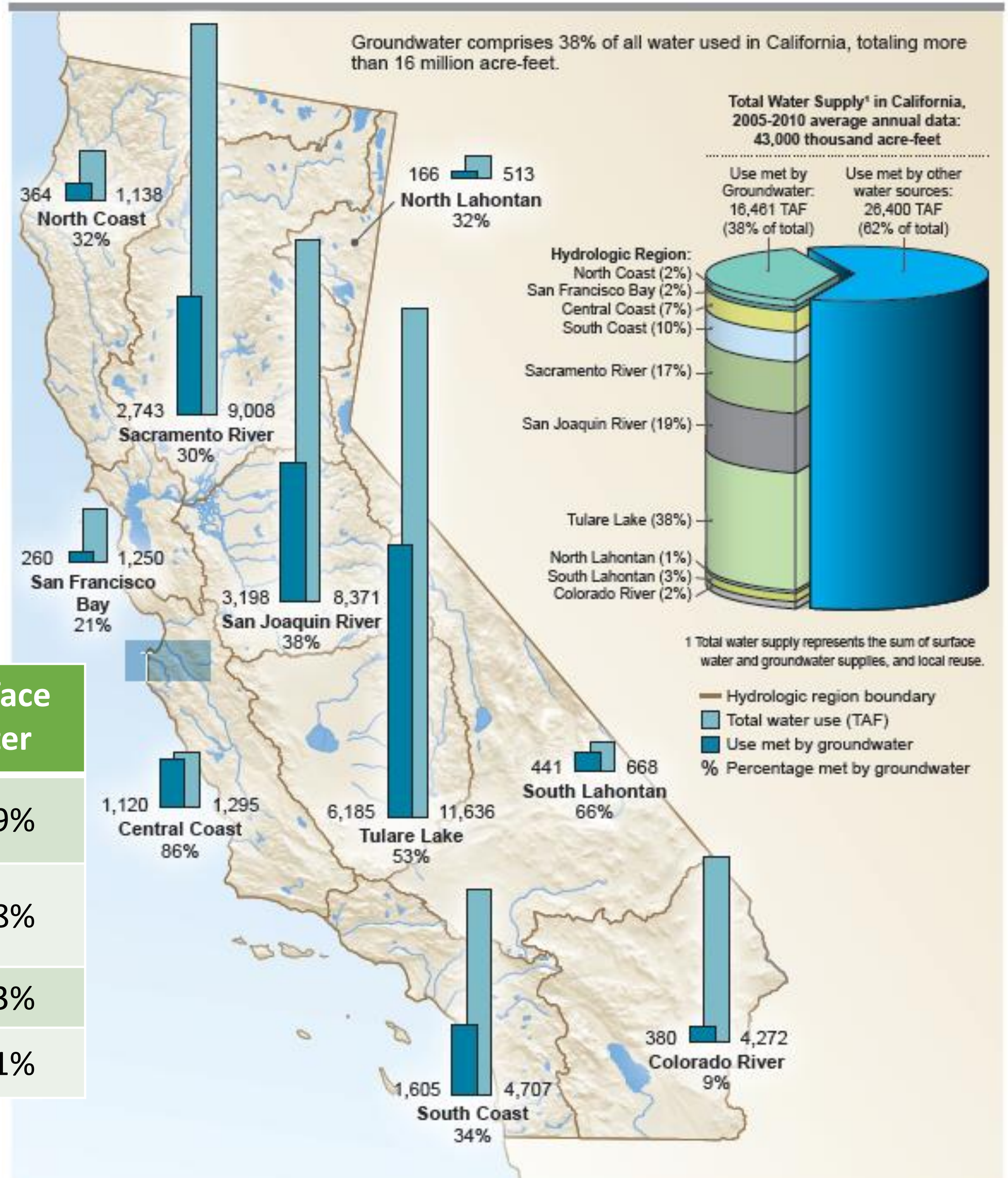


Source NASS CDL 2011

Water Sources in California

Irrigated Agriculture

Basin	Groundwater	Surface Water
Sacramento	31%	69%
San Joaquin & Delta	32%	68%
Tulare Lake	47%	53%
Central Valley	39%	61%



California's highly engineered water supply system is loosing its long-term ability to cope with drought as permanent crops water demand increases, and groundwater overdraft continues

Hydro-economic models

"Hydroeconomic models represent regional scale hydrologic, engineering, environmental and economic aspects of water resources systems within a coherent framework." Harou et al. (2009)

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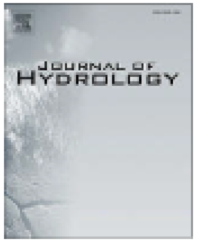


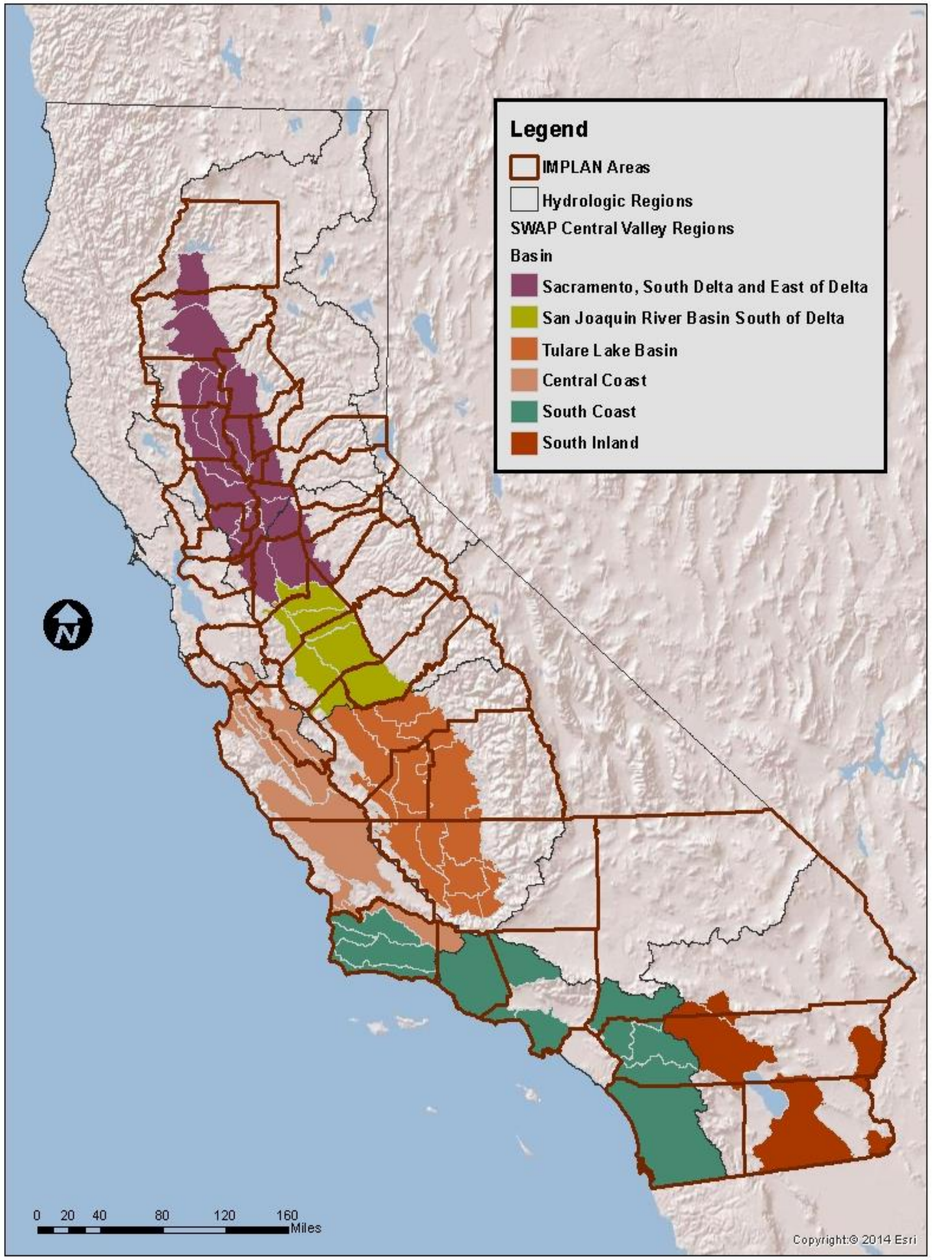
Review

Hydro-economic models: Concepts, design, applications, and future prospects

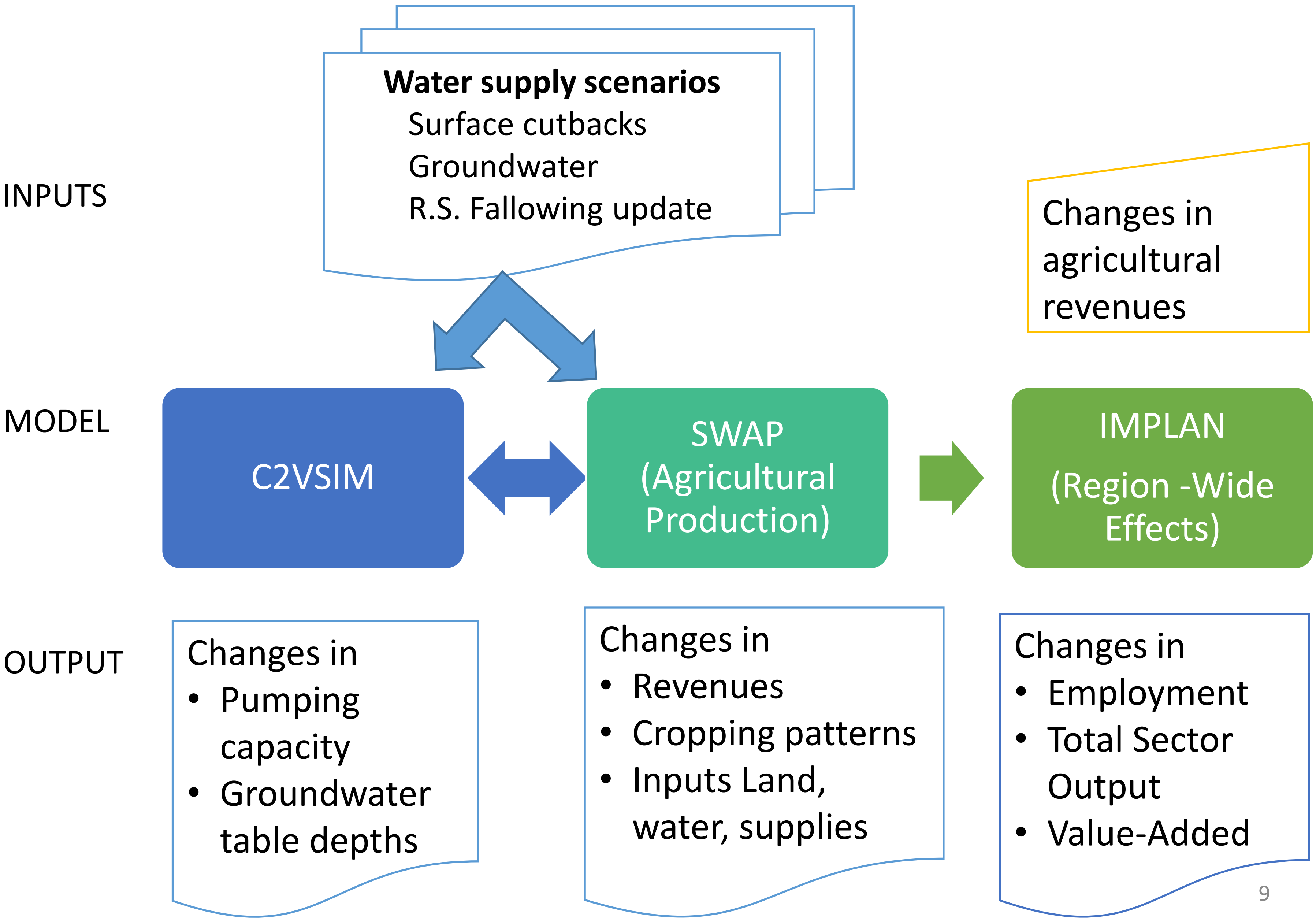
Julien J. Harou [a,*], Manuel Pulido-Velazquez [b], David E. Rosenberg [c], Josué Medellín-Azuara [d], Jay R. Lund [d], Richard E. Howitt [e]

SWAP Model

- More than 90% of the irrigated agriculture
- Positive mathematical programming
- 20 Crop groups
- Maximizes net returns to land and management
- SWAP and C2VSim linked to IMPLAN



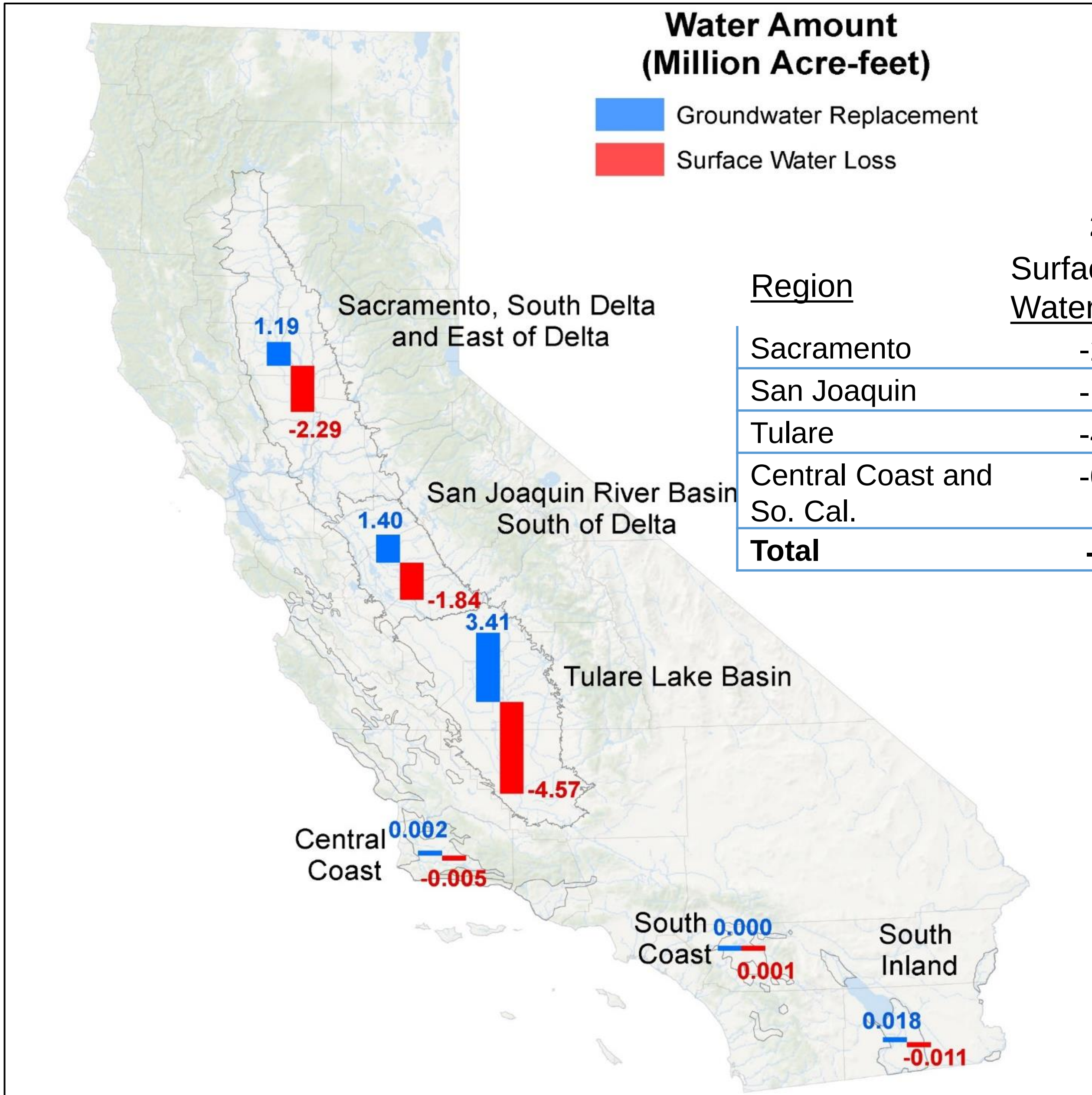
Suite of Models for Studying Drought Impacts



2015 Estimated Changes in Water Availability

Region	Surface Water Change (maf/yr)	Additional Groundwater Use (maf/yr)	Net Change (maf/yr)
Sacramento Valley	-2.2	1.3	-0.9
San Joaquin Valley	-1.9	1.4	-0.5
Tulare Lake Basin	-4.8	3.5	-1.3
Central Valley subtotal	-8.8	6.2	-2.6
Central Coast	-0.0	0.0	-0.0
South Coast	-0.0	0.0	-0.0
Colorado River Region	-0.0	0.0	-0.0
Statewide Total	-8.7	6.0	-2.7

2015 Water Shortage & Changes in Groundwater



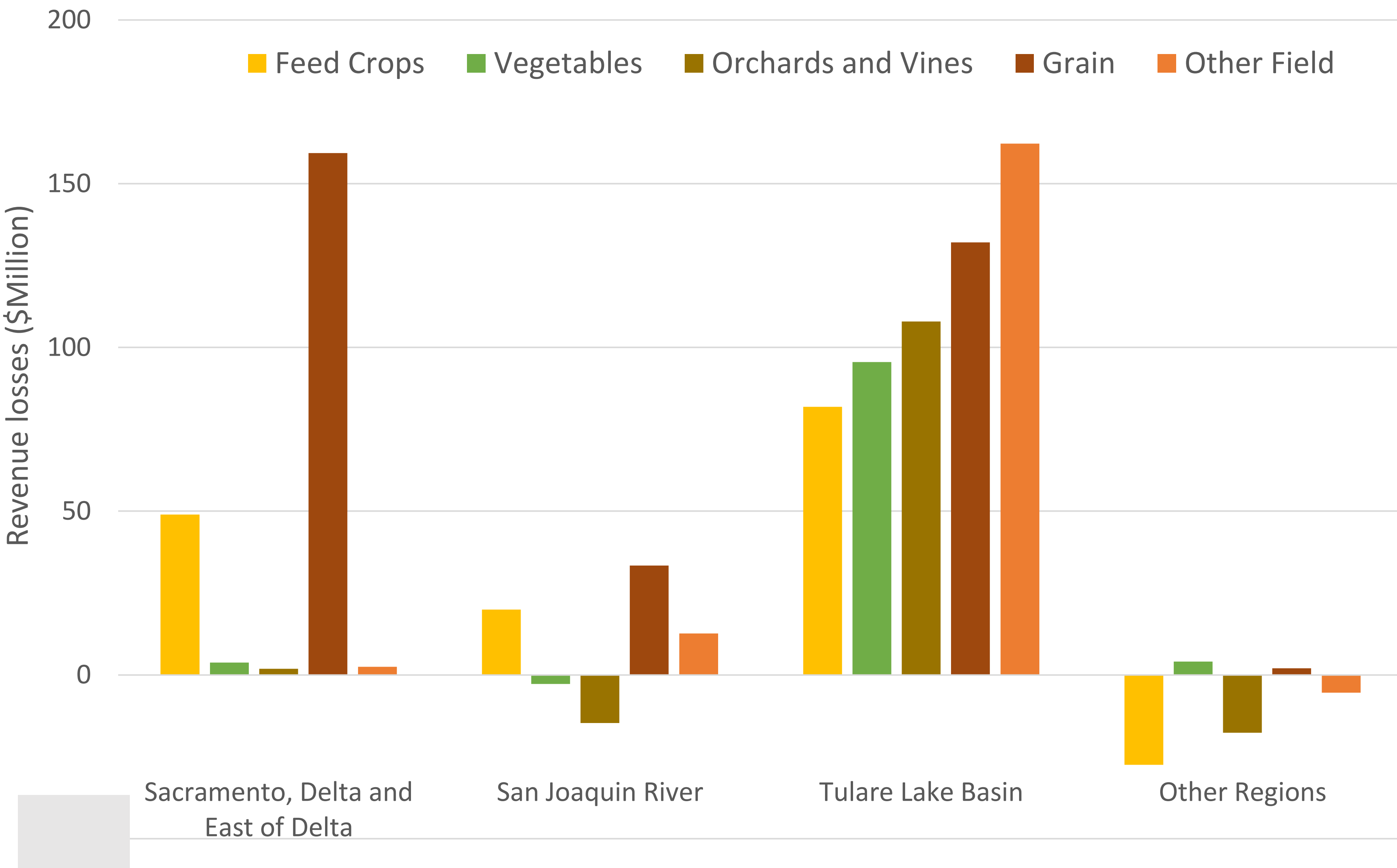
2015 Water use changes (MAF)

Region	Surface Water	Groundwater	Net Delivery Shortage
Sacramento	-2.29	1.19	-1.1
San Joaquin	-1.84	1.40	-0.44
Tulare	-4.57	3.41	-1.16
Central Coast and So. Cal.	-0.02	0.02	0.01
Total	**-8.72**	**6.02**	**-2.7**

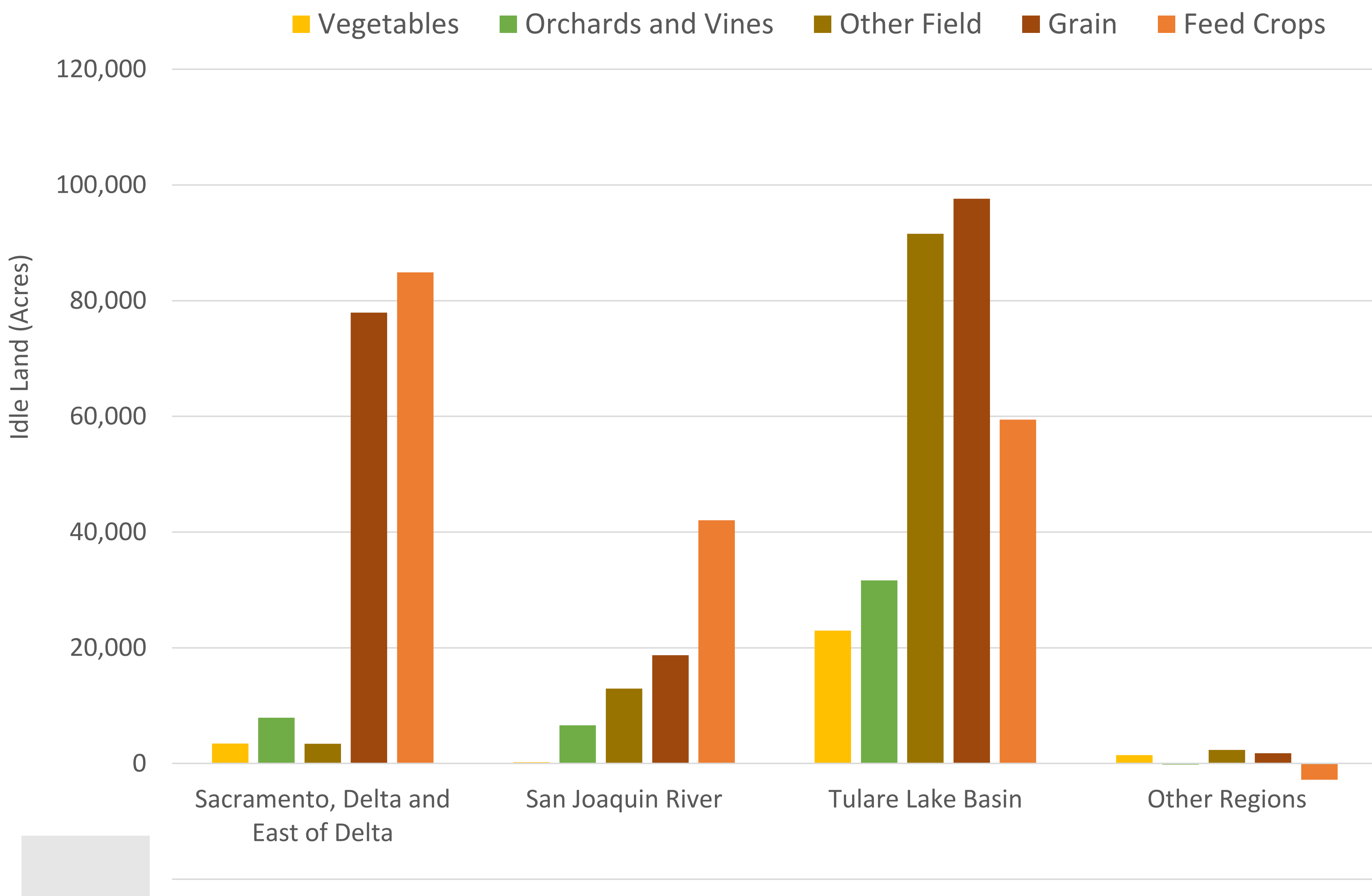
2015 Summary of Drought Impacts

Impact	Quantity
Water supply, 2015 drought	
Surface water reduction	8.7 million acre-feet
Groundwater pumping increase	6.0 million acre-feet
Net water shortage	2.7 million acre-feet
Statewide Agriculture Economic Impacts	
Total fallow	564,000 acres
Crop revenue loss	\$844 million
Additional groundwater pumping cost	\$558 million
Livestock and dairy revenue loss (dairy ~ \$250 mil, livestock ~ \$100 mil)	\$350 million
Total direct costs	\$1.75 billion
Total agriculture economic costs	\$2.7 billion
Direct job losses	8,546
Total job losses	18,600

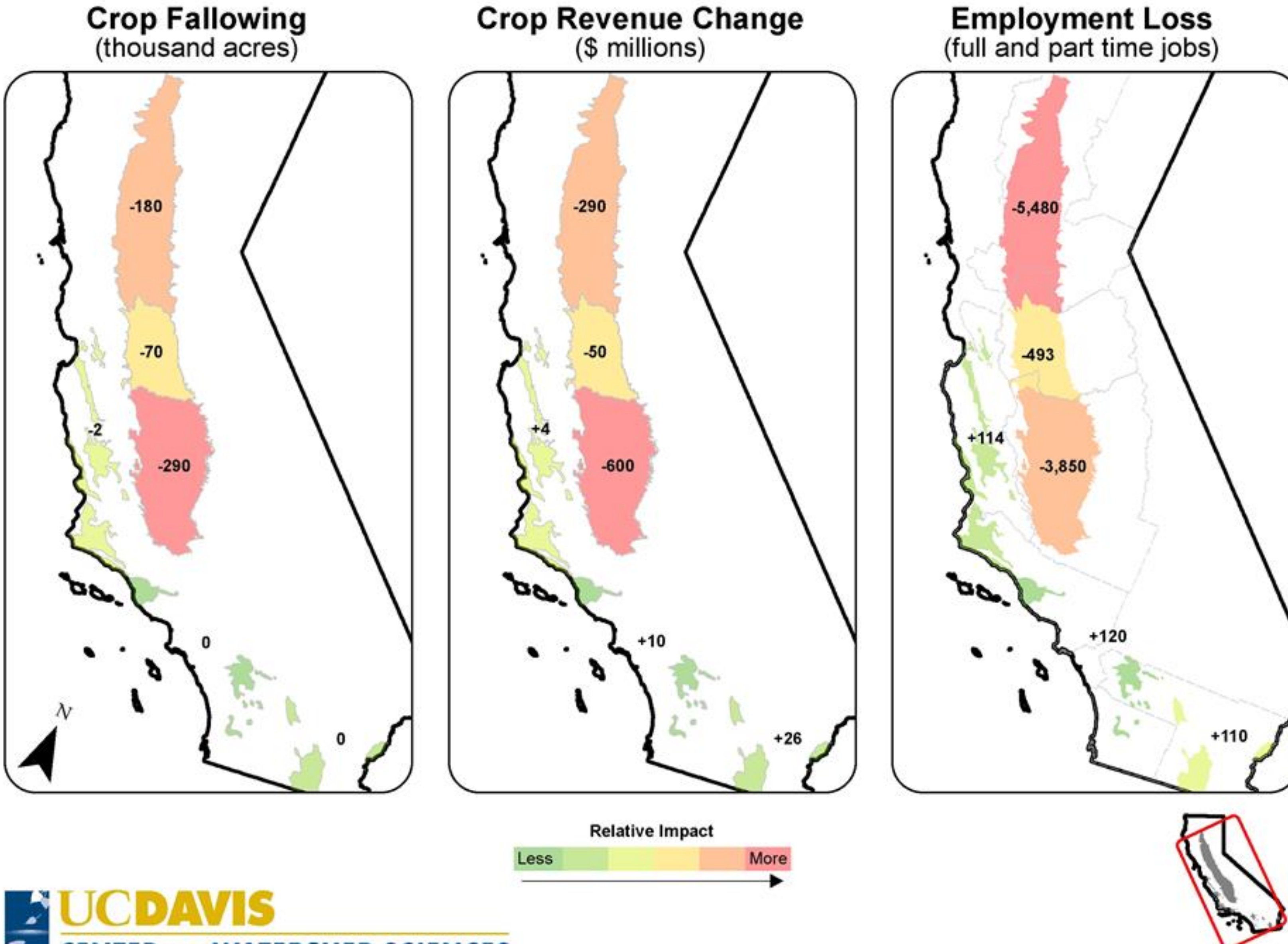
2015 Estimated Gross Revenue Reduction



2015 Estimated Crop Acreage Reductions



2015 Estimated Crop Acreage Reductions



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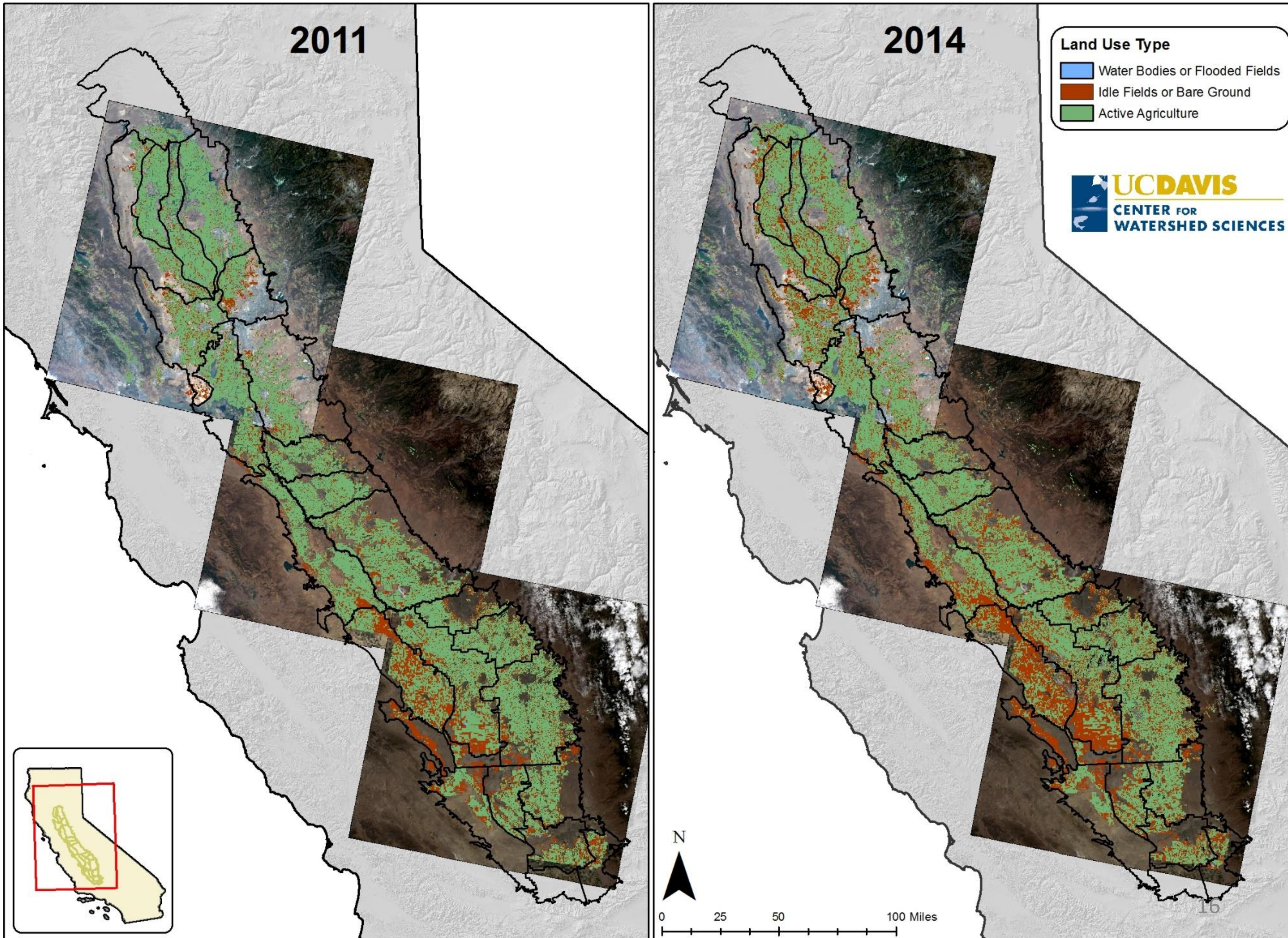
UC Davis estimate Idle Land



Hydro-economic models are useful for improving quantitative understanding of a water system and, assess economic costs, and screening water management alternatives. Remote sensing can be helpful in ground thruting model predictions.

What can we do better?

- Land use information
- Groundwater management
- Water trade environmental impact reports
- Water data and hydro-economics
- Remote sensing efficiency

Conclusions

- California is remarkably drought resilient
- Agriculture relies on groundwater, Urban uses a portfolio approach
- Drought Impacts vary greatly by sector

  from high to low impact:

  Environmental values and fish species

  Rural communities

  Agricultural production

  Urban water use

Further information

Drought Report Website:
https://droughtimpacts.ucdavis.edu

http://californiawaterblog.com/

Josué Medellín jmedellin@ucdavis.edu

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