

# Health and Economic Impacts of the 2012-2014 California Drought: Lessons Learned

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Drought and Public Health Symposium

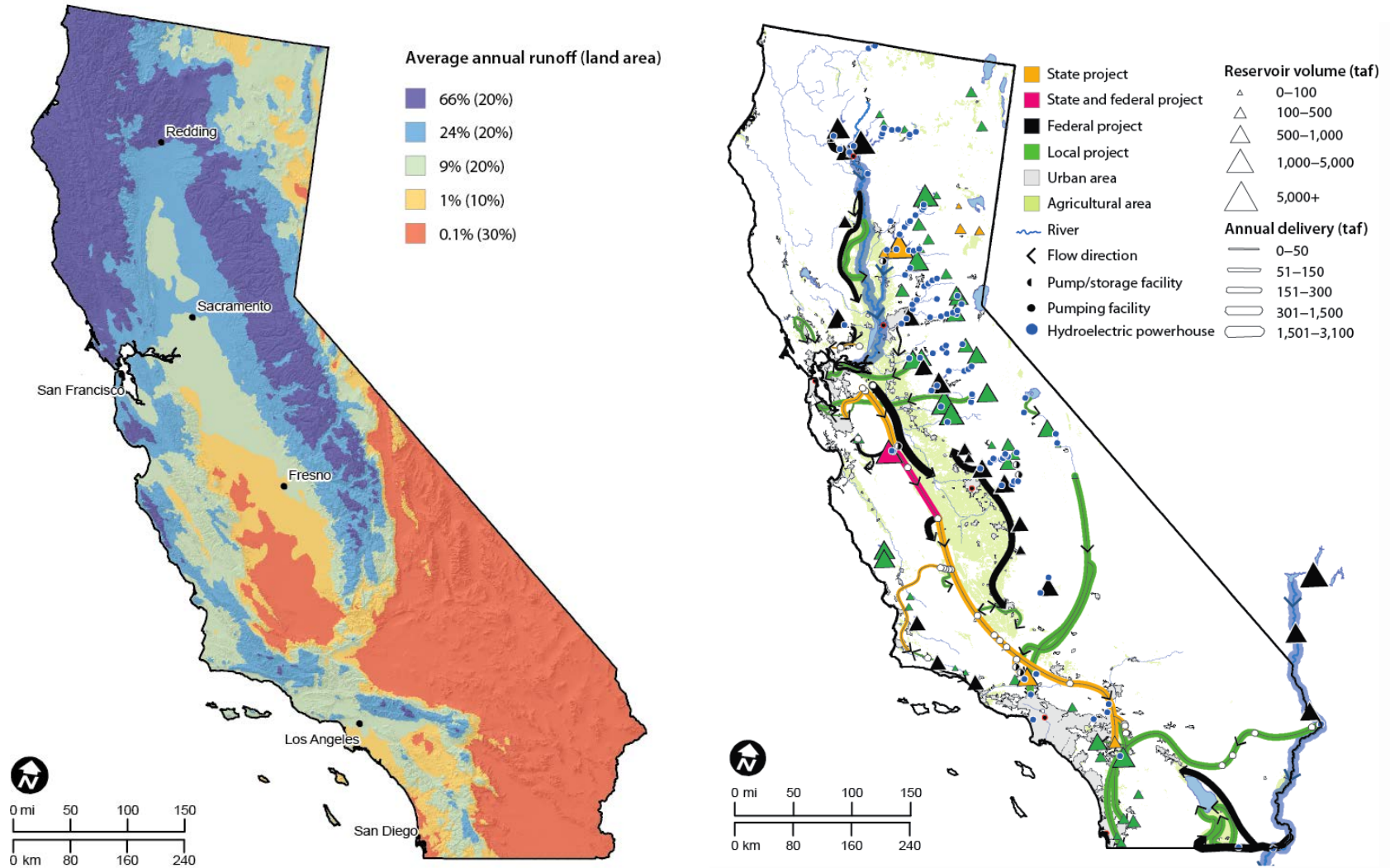
Sacramento, California, February 4, 2019



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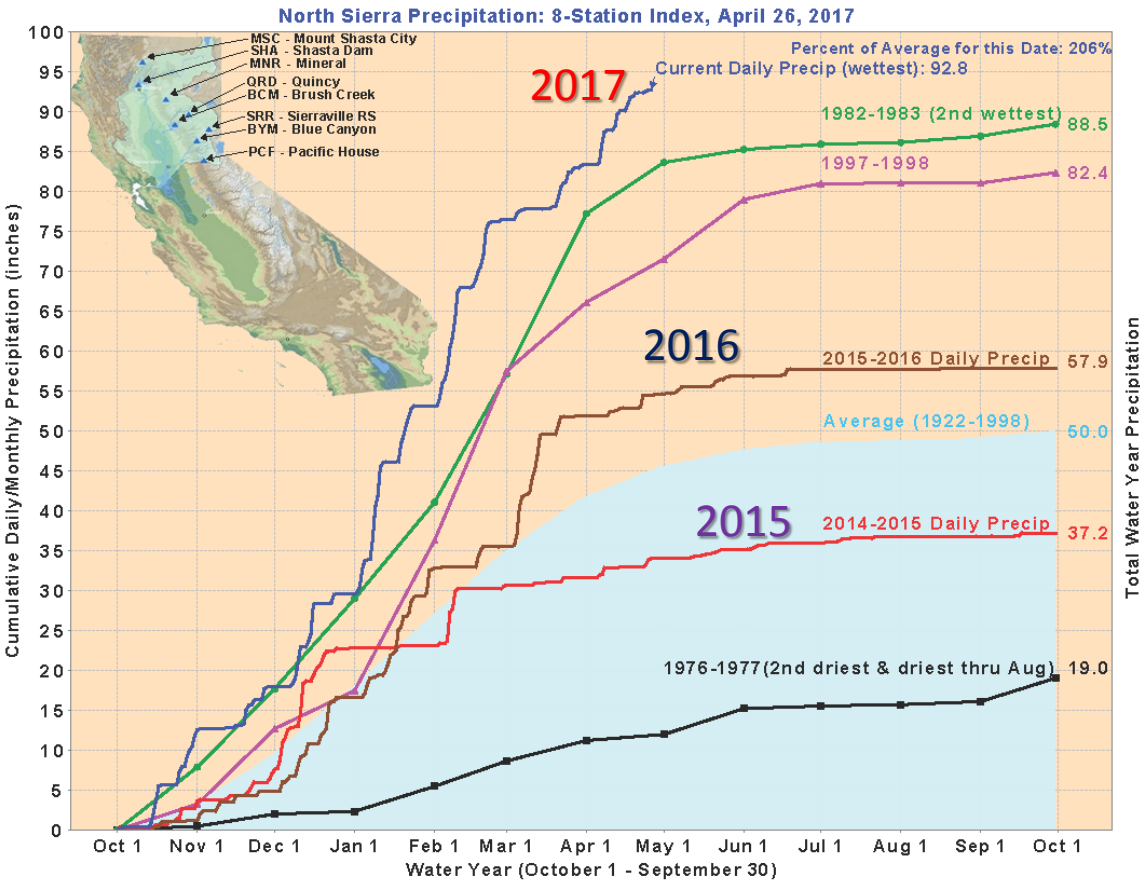


# Water Resources in California



Hanak et al. (2011) *Managing California's Water*

# California is a land of climate extremes that change quickly



Oroville dam spillway



Monticello dam spillway



# The 2012-2016 drought

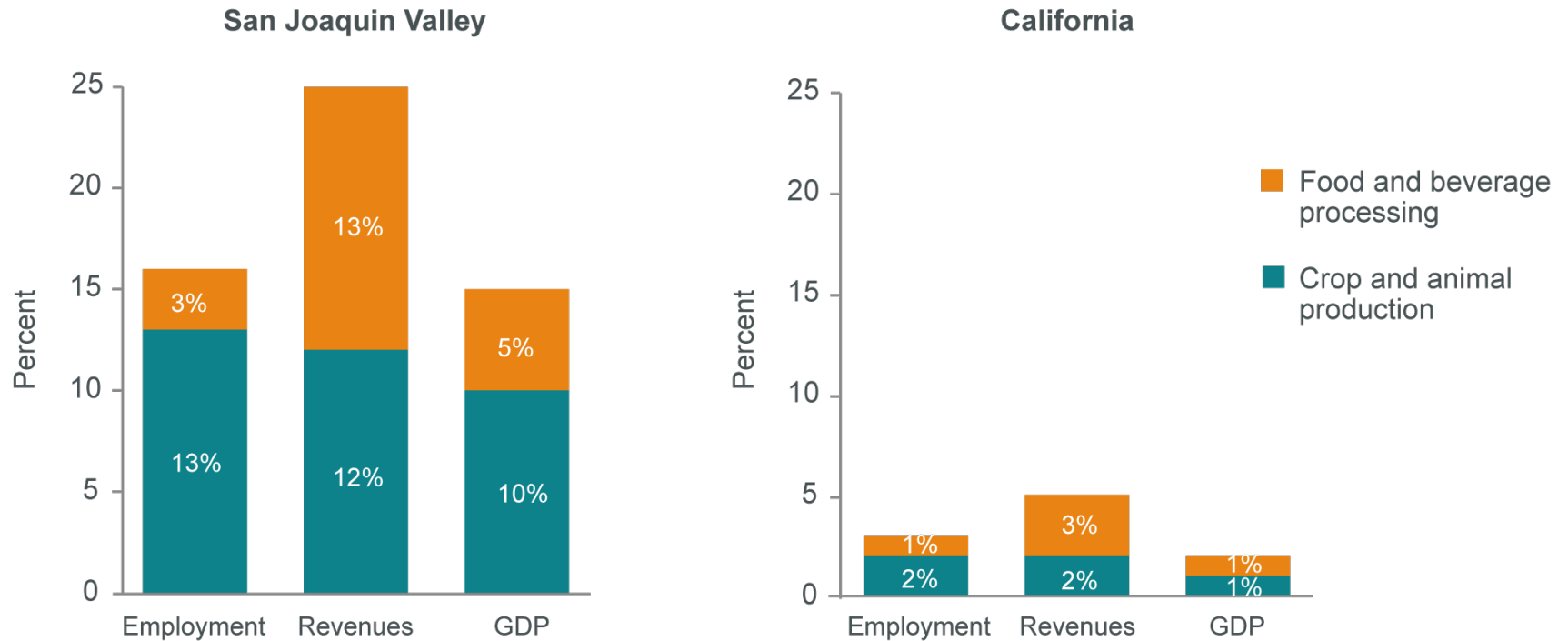
## **Some Sectors affected**

- Agriculture
- Urban water use
- Ecosystems
- Small rural water systems
- Recreation
- Forests
- Hydropower

## **Some Health and Employment Implications**

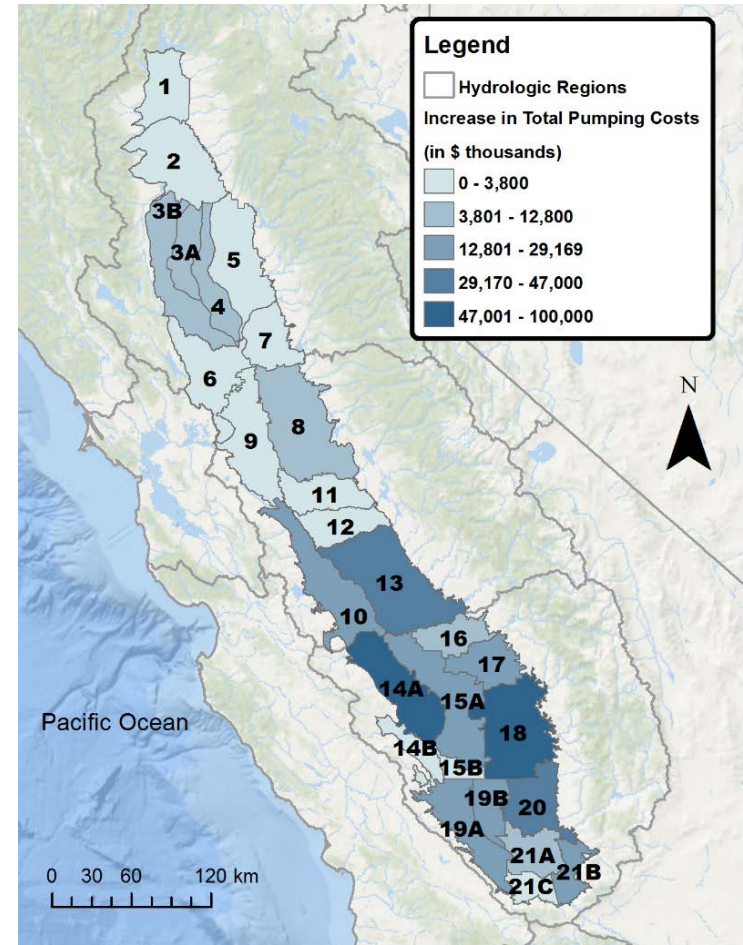
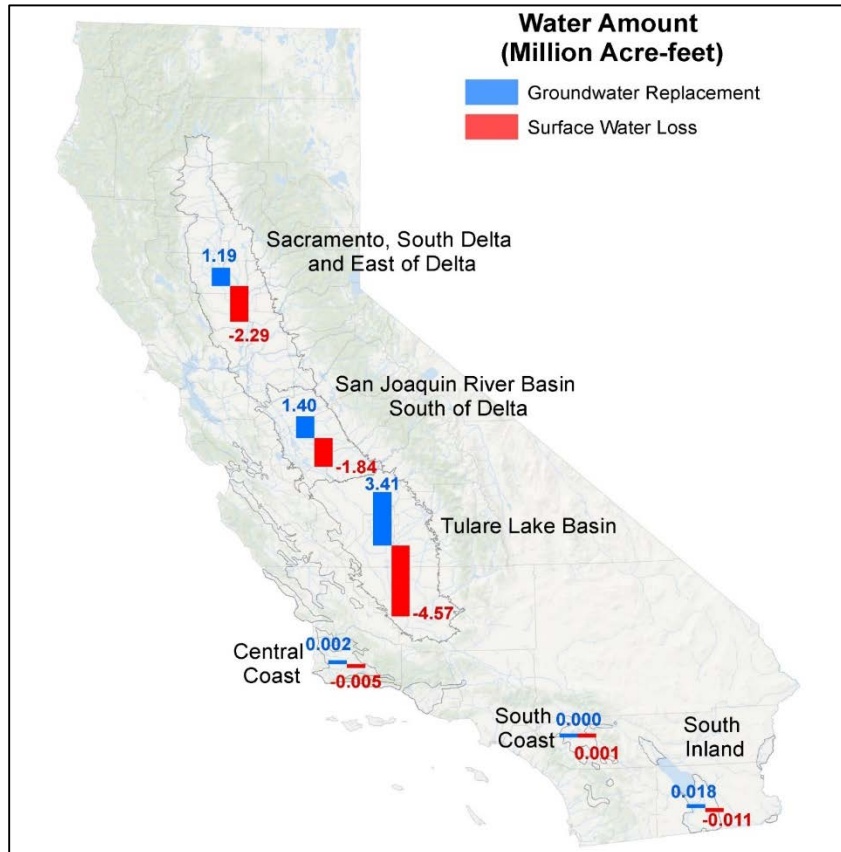
- Stress due to insecure employment and Income
- Relocation and childcare
- Air quality effects
- Dry wells
- Concentration of contamination in wells

# Agriculture is the main economic driver in the San Joaquin Valley



Hanak et al. 2017 Water stress and a changing San Joaquin Valley

# Recent droughts highlight the role of groundwater in agriculture



<http://droughtimpacts.ucdavis.edu>

[Also see: Why California needs better groundwater management](#)

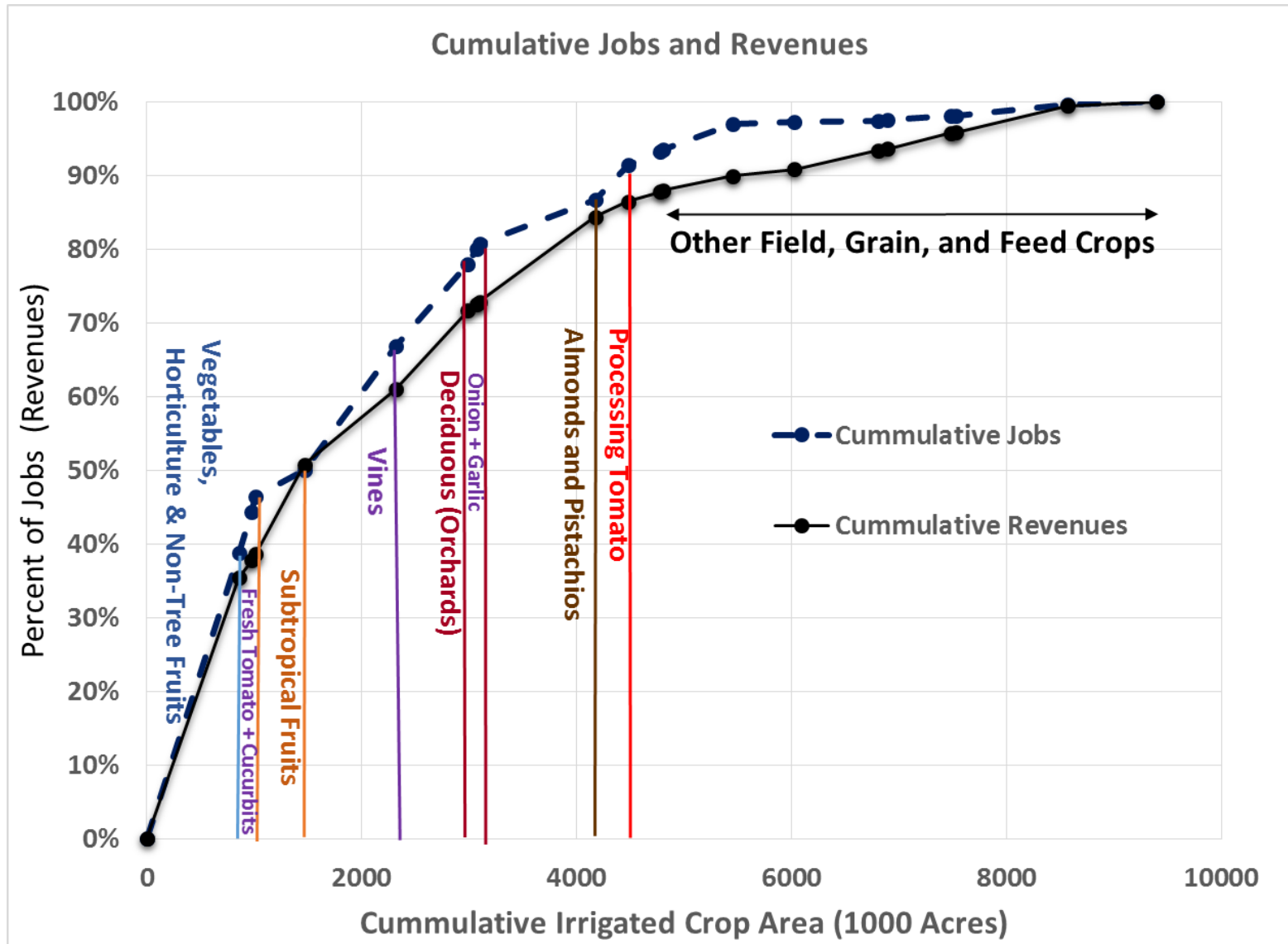
# 2015 Estimated Agricultural Drought Impacts

| Description                               | Impact               | Base year            | Percent |
|---|----------------------|----------------------|---------|
| Drought water shortage (million acre-ft)  | 8.7                  | 26.4                 | 33%     |
| Groundwater replacement (million acre-ft) | 6.0                  | 8.4                  | 72%     |
| Net water shortage (million acre-ft)      | 2.7                  | 26.4                 | 10%     |
| Drought-related idle land (acres)         | 540,000              | 9 million*           | 6%      |
| Crop revenue losses (\$)                  | \$900 million        | \$40 billion         | 2.3%    |
| Dairy and livestock revenue losses (\$)   | \$350 million        | \$13 billion         | 2.7%    |
| Costs of additional pumping (\$)          | \$590 million        | \$780 million        | 75.5%   |
| Net revenue losses (\$)                   | \$1.8 billion        | 54 billion rev.      | 3.3%    |
| <b>Total economic impact (\$)</b>         | <b>\$2.7 billion</b> | NA                   | NA      |
| Direct job losses (farm seasonal)         | 10,100               | 200,000 <sup>#</sup> | 5.1%    |
| <b>Total job losses</b>                   | <b>21,000</b>        | NA                   | NA      |

\* NASA-ARC estimate of normal Central Valley idle land is 1.2 million acres.

<sup>#</sup> Total agriculture employment is about 412,000, of which 200,000 is farm production.

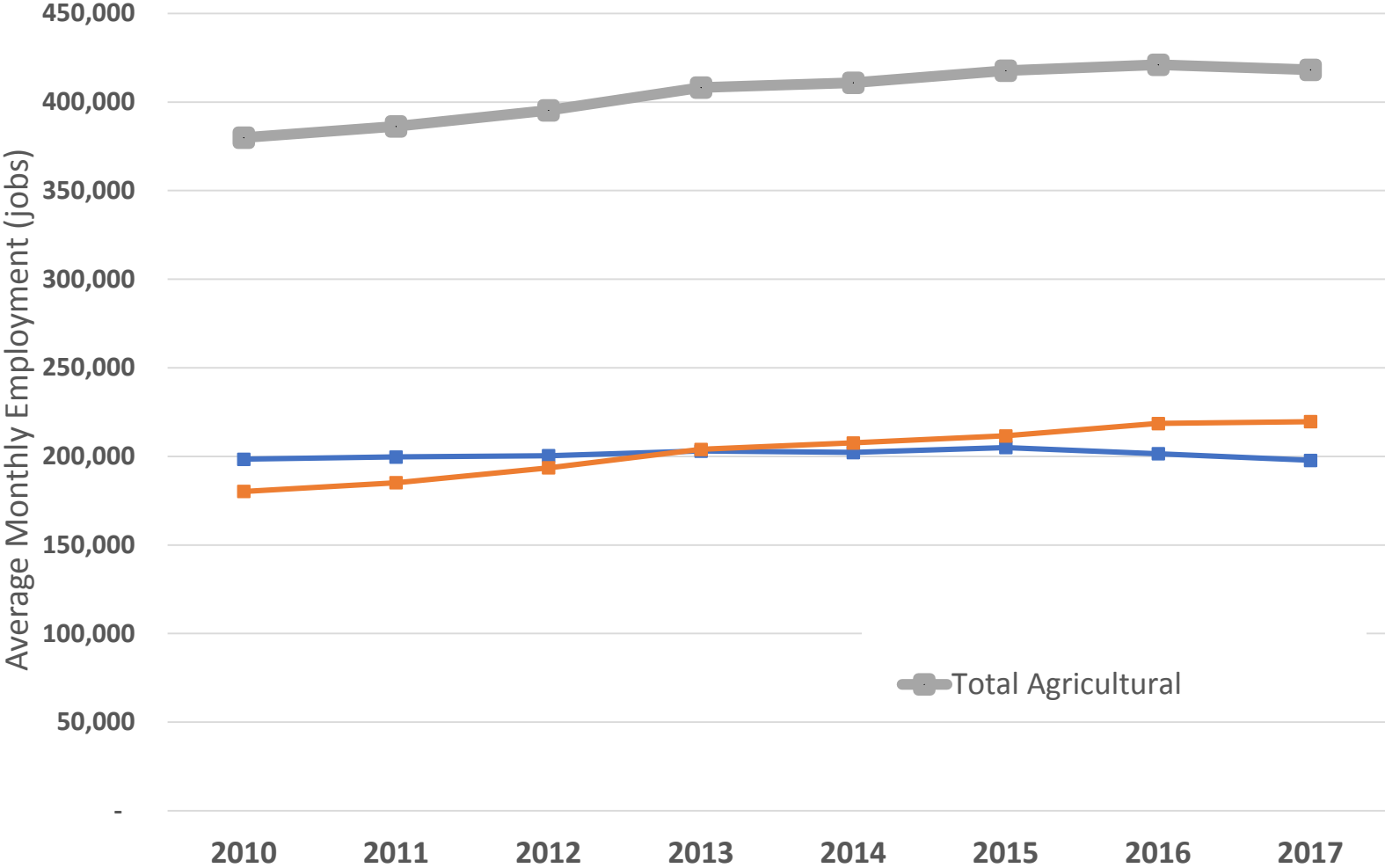
# Most agricultural income and employment is in fruits, nuts and vegetables





# Agricultural employment mostly growing, especially for contract labor

Agricultural Employment in California



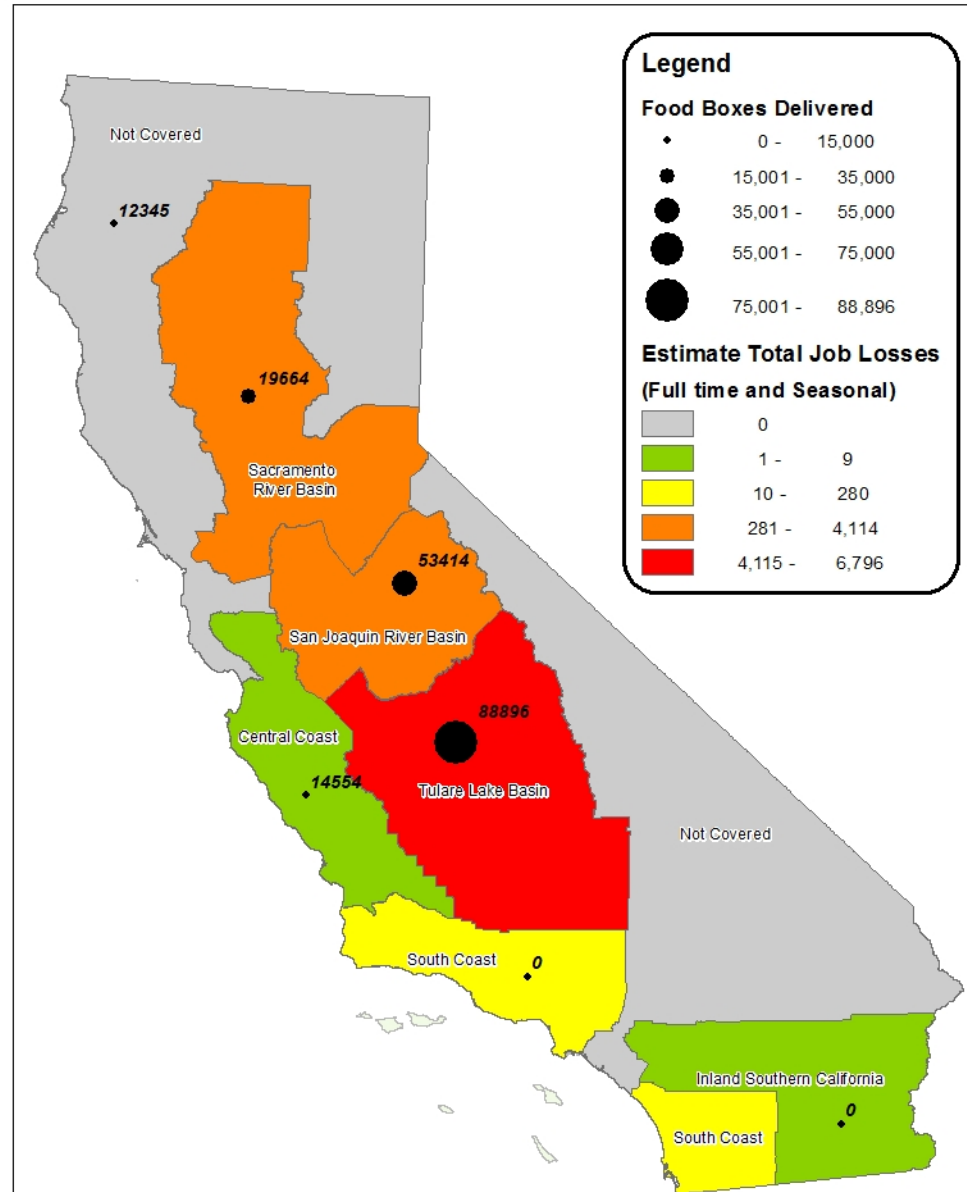
Source: Author calculations with data from the Employment and Development Department

# Job Losses and Boxes Delivered by Emergency Services

- Food boxes were delivered to regions with job losses
- Tulare Lake Basin is the most seriously affected

## Migrant & Seasonal Farm Worker Emergency Drought Relief Needs Assessment Report

Prepared for: California Department of Community Services & Development  
Prepared by: La Cooperativa de Campesina, Profile Research & Marketing, Inc.  
Date: November, 2015



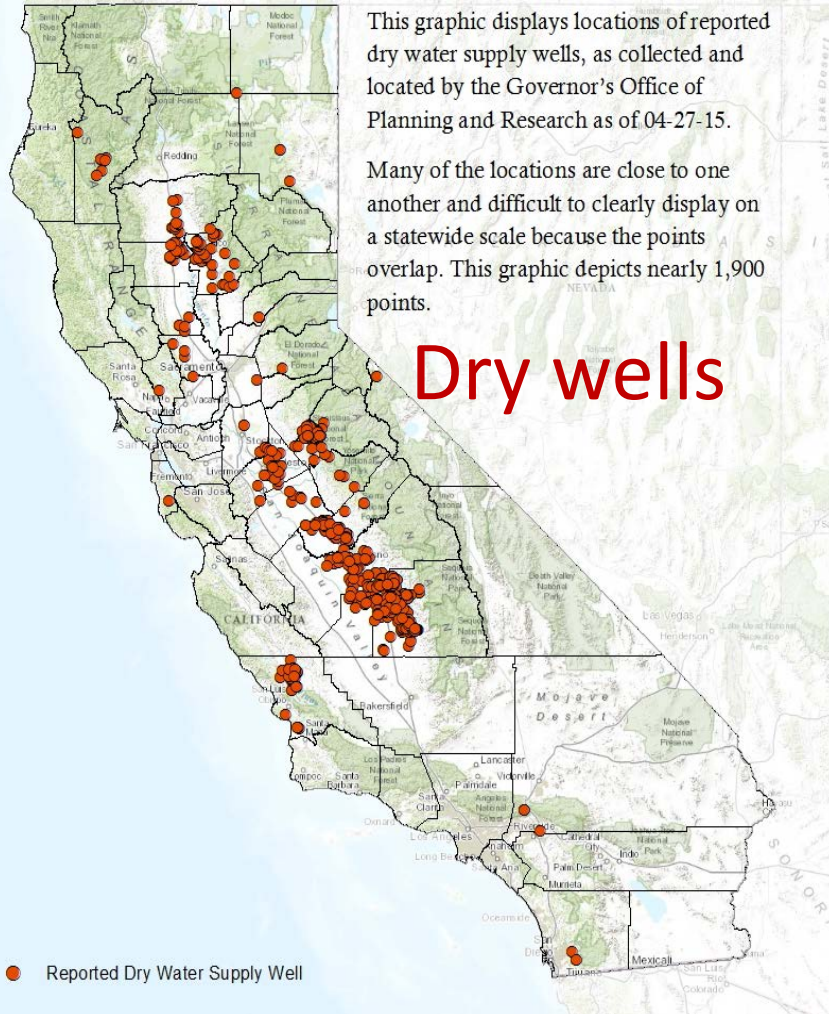
# Water Quantity and Quality Issues in Small Water Systems



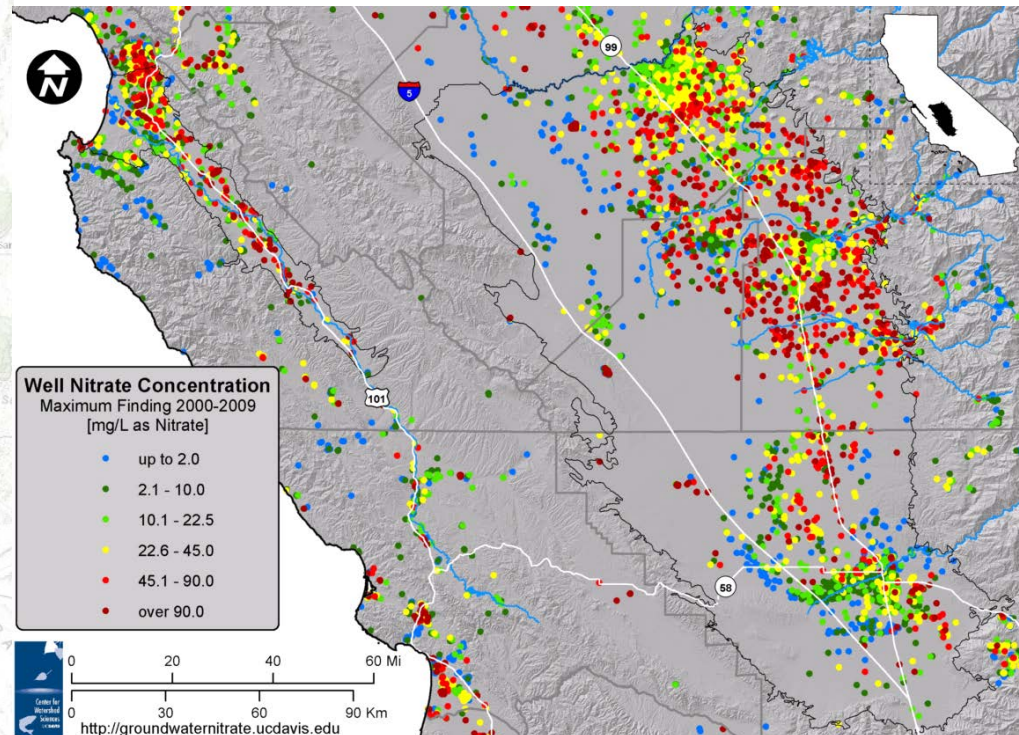
This graphic displays locations of reported dry water supply wells, as collected and located by the Governor's Office of Planning and Research as of 04-27-15.

Many of the locations are close to one another and difficult to clearly display on a statewide scale because the points overlap. This graphic depicts nearly 1,900 points.

## Dry wells

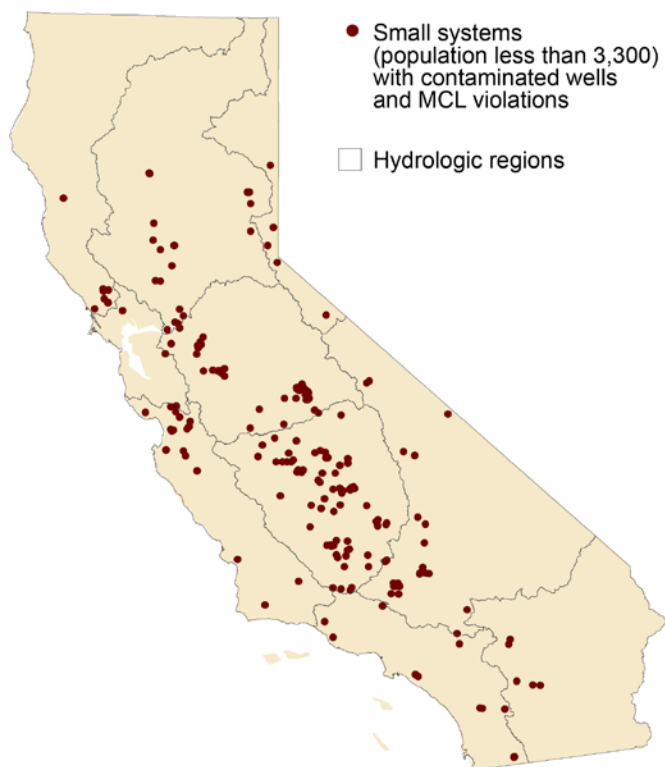


## Concentration of Pollutants



# Solutions for nitrate in groundwater

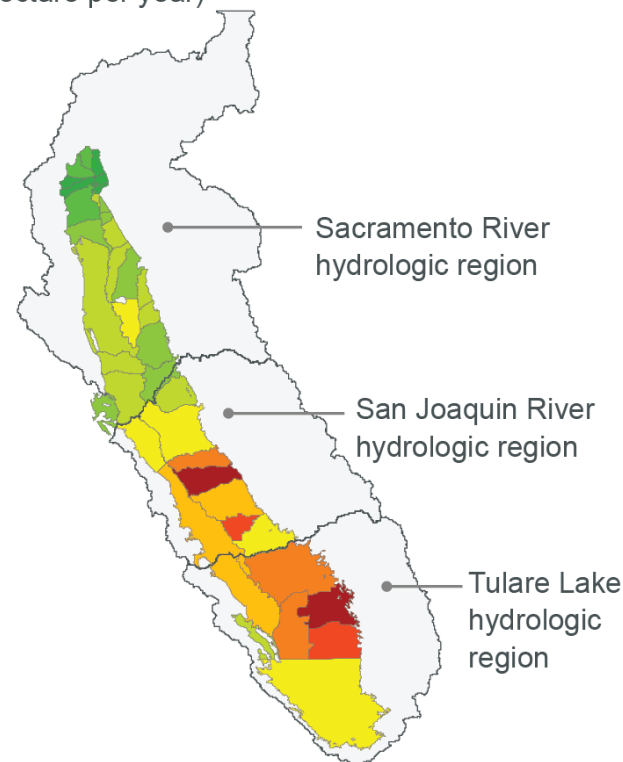
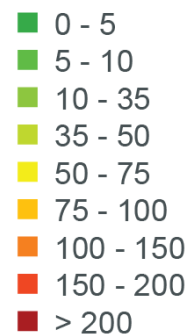
## Safe drinking water programs



## Farm programs to reduce nitrogen loading

### Nitrogen loading to groundwater

(kilogram per hectare per year)

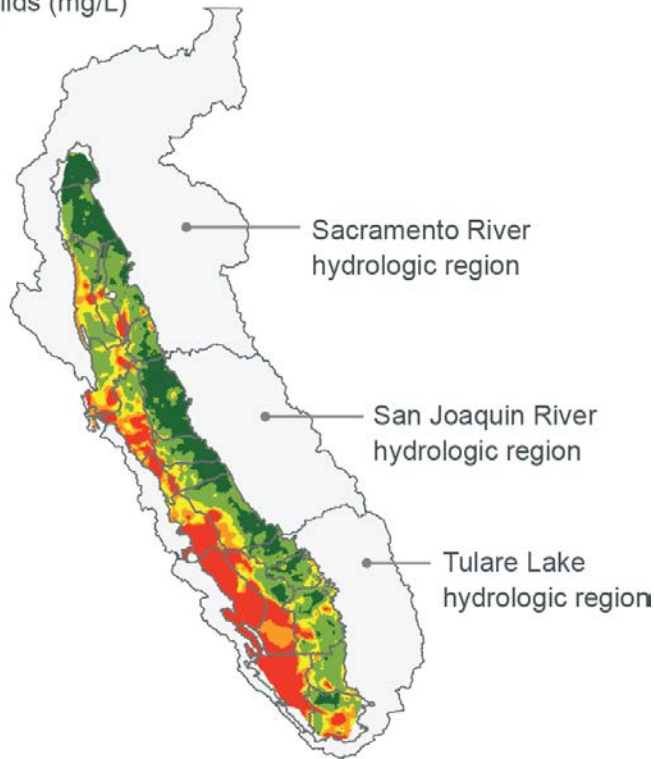


# Range of approaches for salinity, dust management

## Shallow groundwater salinity

Total dissolved solids (mg/L)

- 1 - 250
- 251 - 500
- 501 - 750
- 751 - 1,000
- > 1,000



- Salts
  - Major infrastructure (desalinate, “brine line”)
  - Crop choices, irrigation management
- Dust from idled fields
  - Cover crops
  - Solar
  - Habitat

*Hanak et al. 2017 Water stress and a changing San Joaquin Valley*

# Conclusions Drought Impacts

- Some health impacts: income and employment stress, air quality, access to safe drinking water
- Droughts help focus attention and encourage improvements in water management.
- A diversified economy with deep global connection buffered economic effects of drought.
- Major droughts have less impact under diversified water sources
- Small rural water systems are specially vulnerable to drought both in water quality and quantity
- Every drought is different



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# Thank you!

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