

# Water in California

Dr. Samuel Sandoval Solis

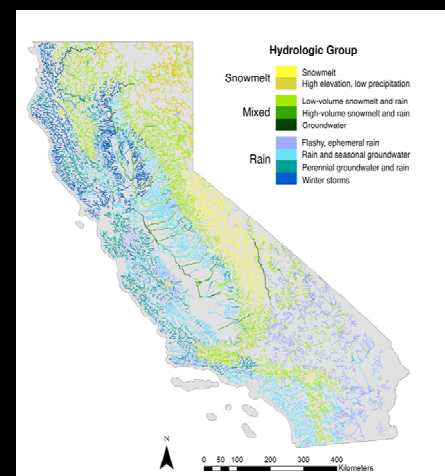
Professor and Specialist in Water Resources Management

University of California  
Agriculture and Natural Resources



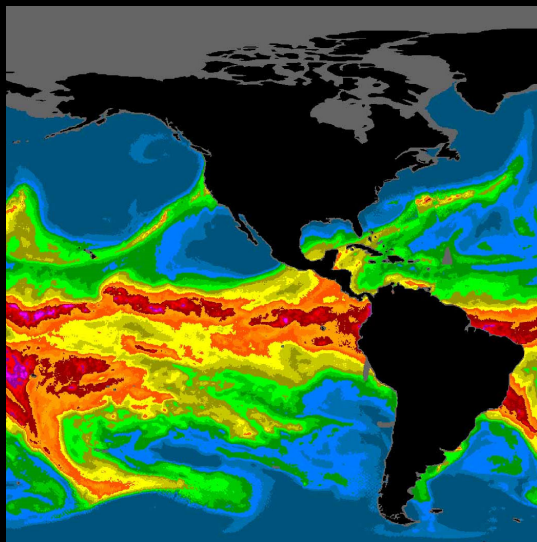
## Outline

- Climate
- Water Conditions
- Basins
- Natural Hydrology
- Supply and demand



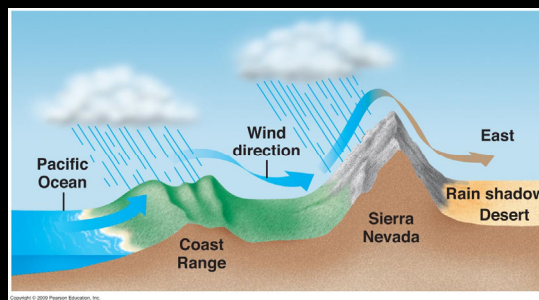
# Climate

## Atmospheric Rivers



### Mediterranean Climate

- Dry Summers
- Wet Winters



## The science behind atmospheric rivers

An atmospheric river (AR) is a flowing column of condensed water vapor in the atmosphere responsible for producing significant levels of rain and snow, especially in the Western United States. When ARs move inland and sweep over the mountains, the water vapor rises and cools to create heavy precipitation. Though many ARs are weak systems that simply provide beneficial rain or snow, some of the larger, more powerful ARs can create extreme rainfall and floods capable of disrupting travel, inducing mudslides and causing catastrophic damage to life and property. Visit [www.research.noaa.gov](http://www.research.noaa.gov) to learn more.

A strong AR transports an amount of water vapor roughly equivalent to 7.5–15 times the average flow of water at the mouth of the Mississippi River.

ARs are a primary feature in the entire global water cycle and are tied closely to both water supply and flood risks, particularly in the Western U.S.

On average, about 30–50% of annual precipitation on the West Coast occurs in just a few AR events and contributes to the water supply — and flooding risk.

ARs move with the weather and are present somewhere on Earth at any given time.

ARs are approximately 250–375 miles wide on average.

Scientists' improved understanding of ARs has come from roughly a decade of scientific studies that use observations from satellites, radar and aircraft as well as the latest numerical weather models. More studies are underway, including a 2015 scientific mission that added data from instruments aboard a NOAA ship.

3/2015  
NOAA

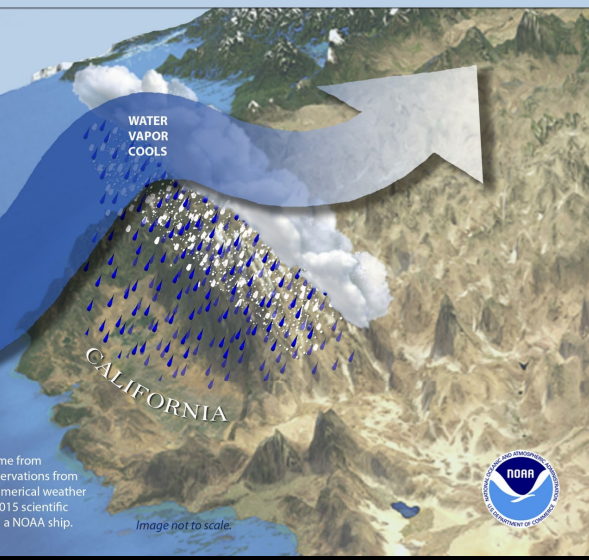
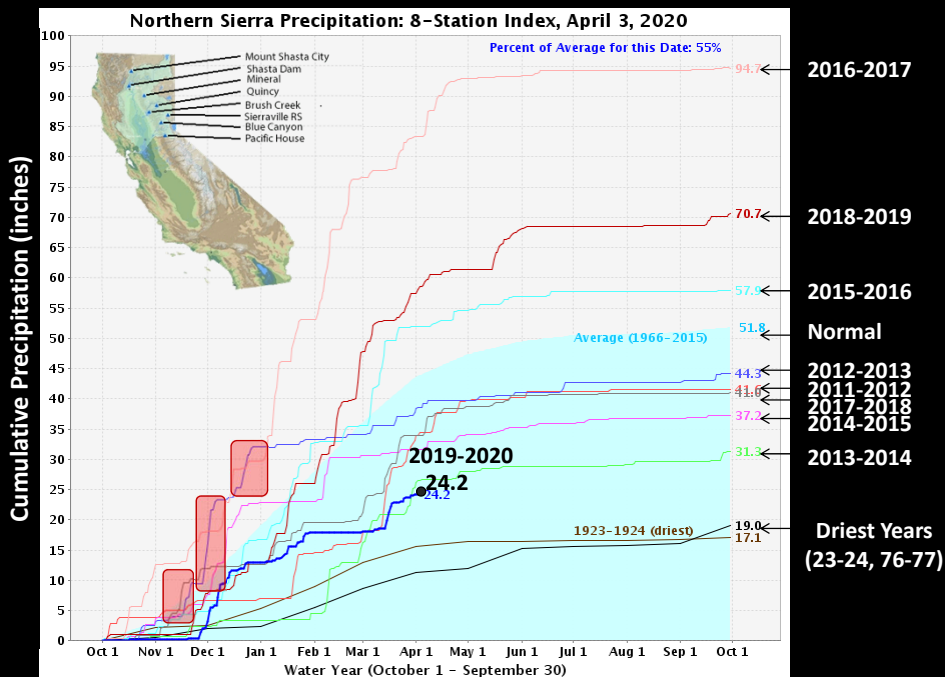
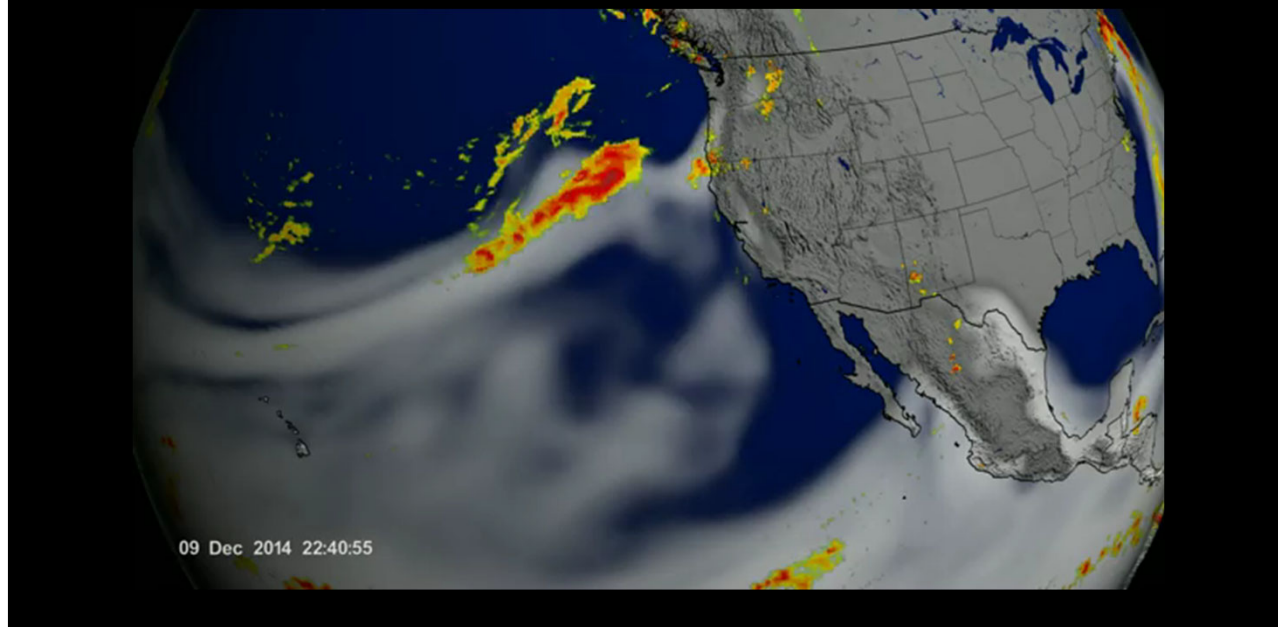


Image not to scale.

# California full of extremes



# Snowpack

APRIL: 2011

Drought

- 2012
- 2013
- 2014
- 2015
- 2016

Wettest

2017

Dry

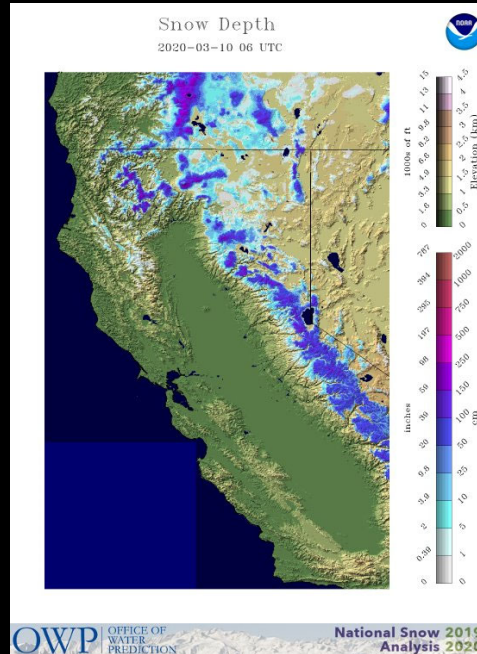
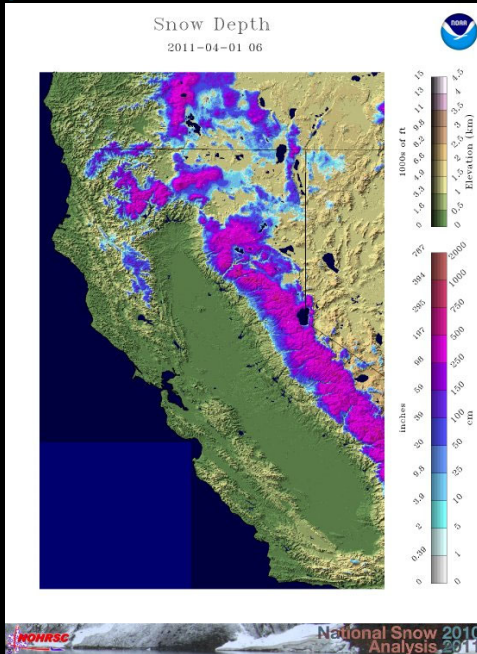
2018

Wet

2019

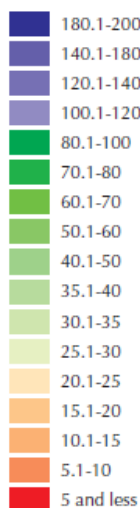
Dry

2020



# Rainfall and snow

Average Annual Precipitation (in inches)  
1961-1990





## River Basins

- Sacramento
- San Joaquin
- Tulare Lake
- Klamath
- North Coast
- Central Coast
- South Coast
- Colorado
- Lake Tahoe
- East Sierras

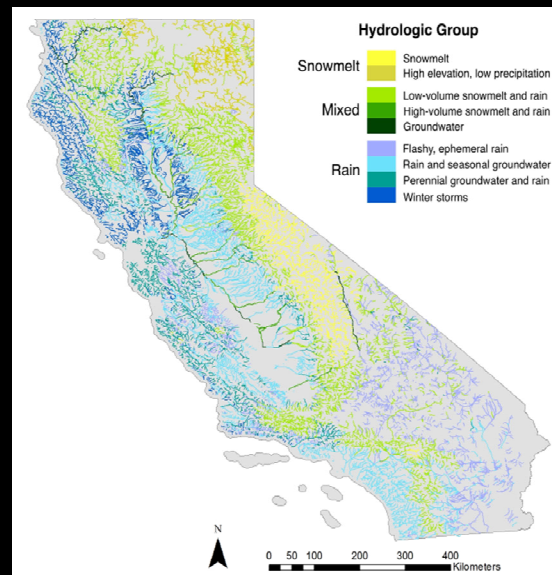


## Natural Streamflow Classification

Catchment Properties

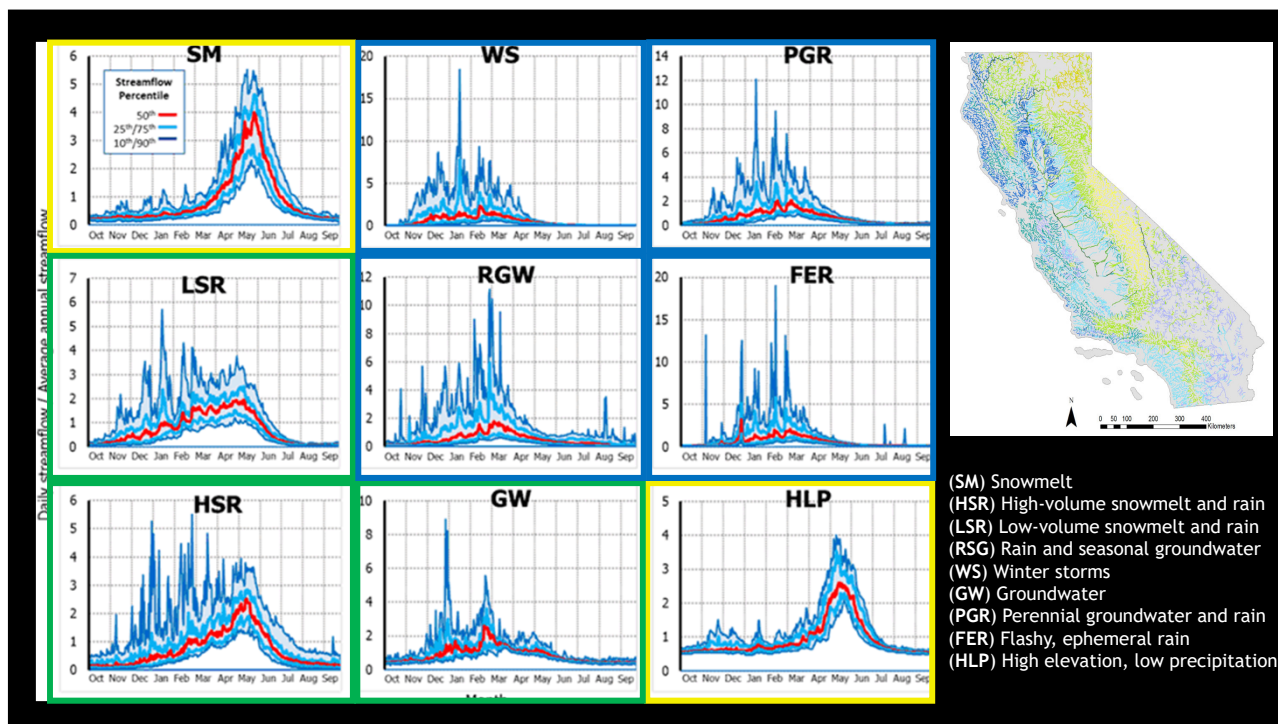
Climate Patterns

Geology and Soils

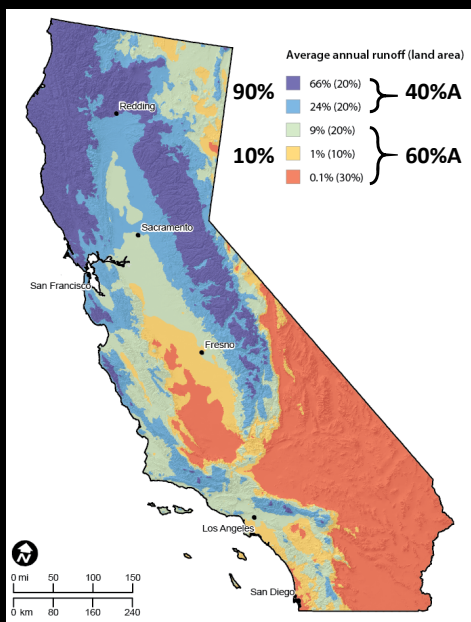


[eflows.ucdavis.edu](http://eflows.ucdavis.edu)

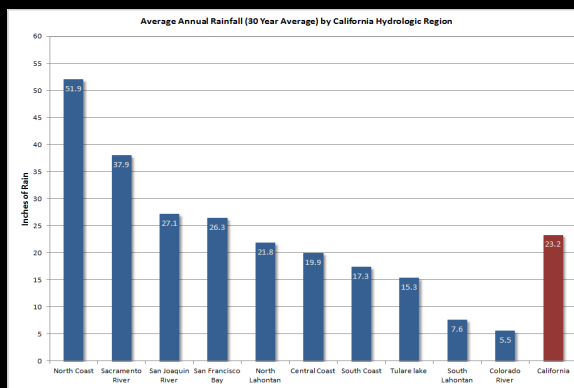
Lane, B.A., Sandoval-Solis, S., Stein, E.D., Yarnell, S.H., Pasternack, G.B. and Dahlke, H.E. (2018). Beyond metrics? The role of hydrologic baseline archetypes in environmental water management. *Journal of Environmental Management*.



# Rainfall and snow

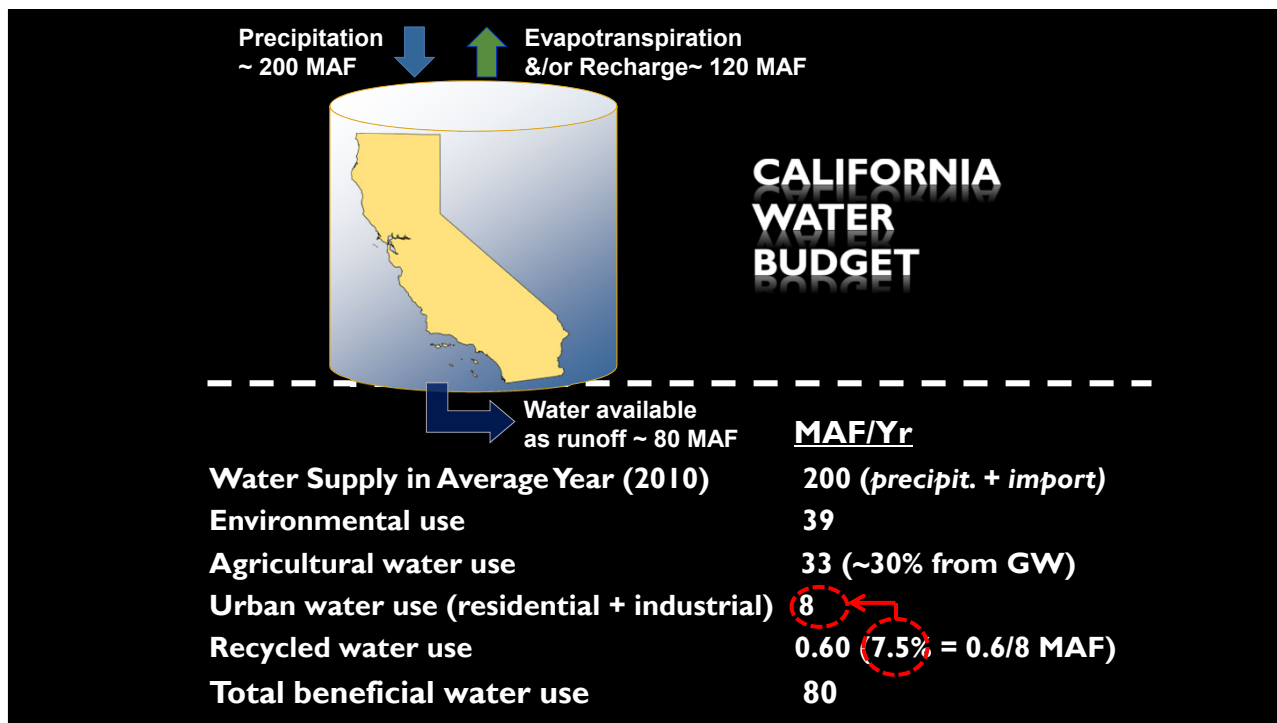
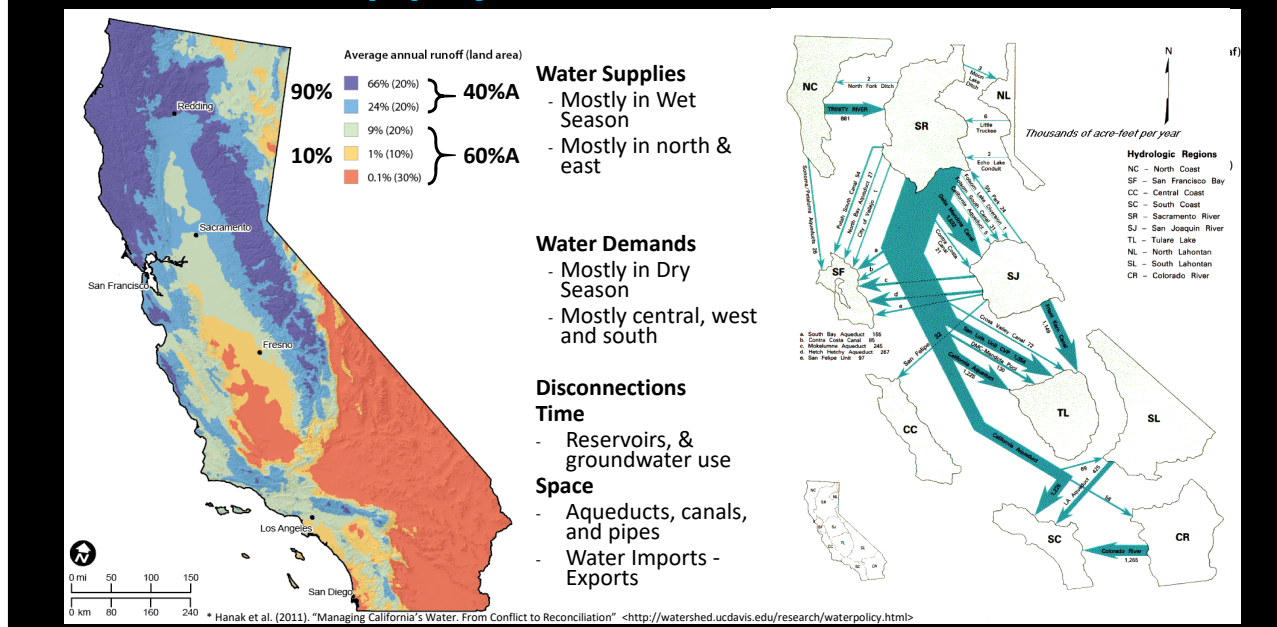


75% of California's precipitation occurs east and north and 75% of its water demand lies west and south

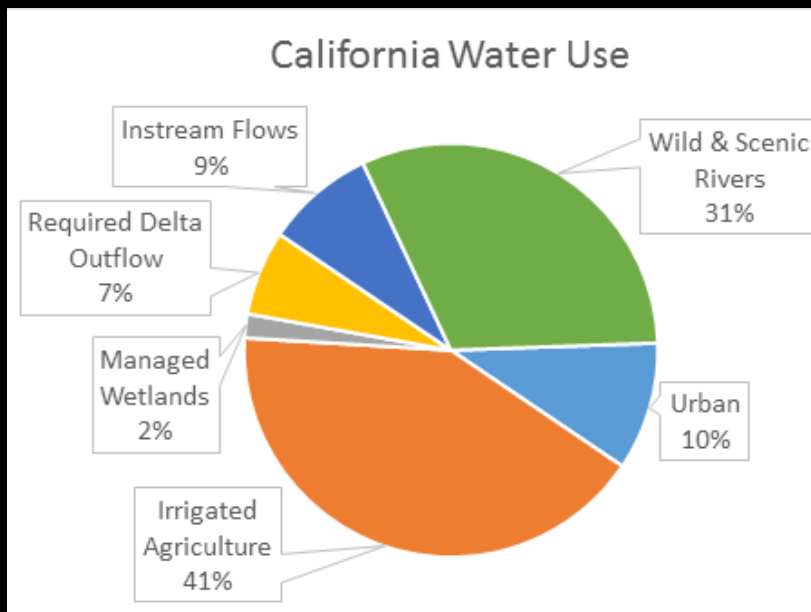


\* Hanak et al. (2011). "Managing California's Water. From Conflict to Reconciliation" <<http://watershed.ucdavis.edu/research/waterpolicy.html>>

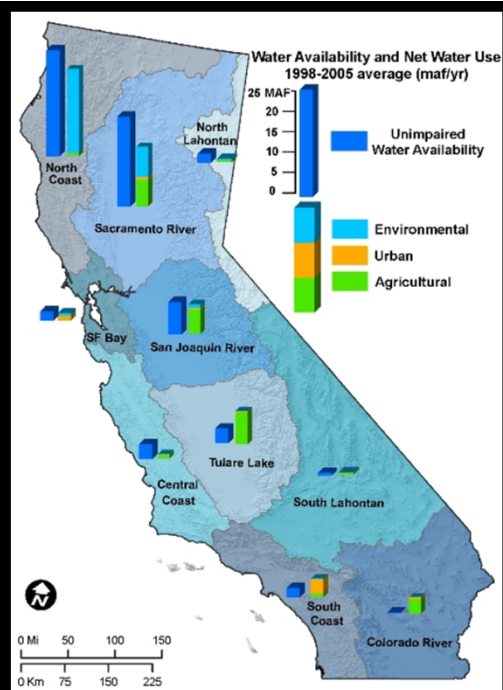
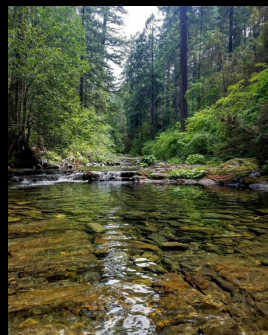
# Water Supply and Water Demand



# Beneficial Water Use



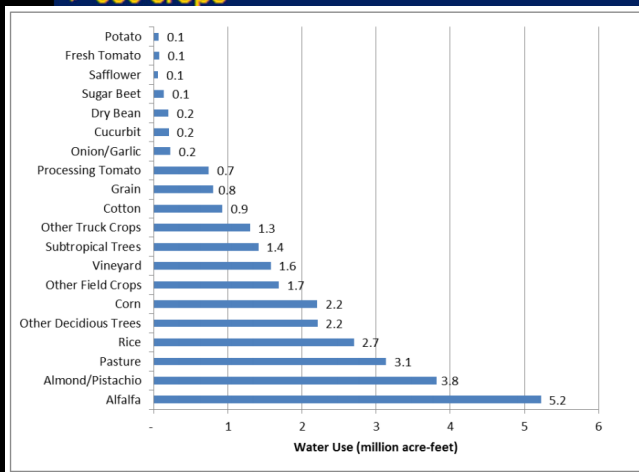
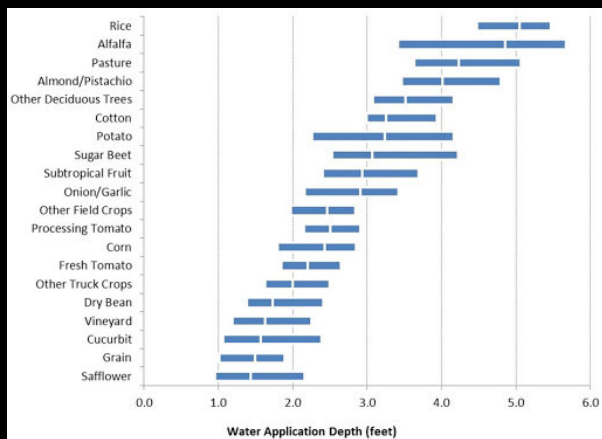
# Beneficial Water Use



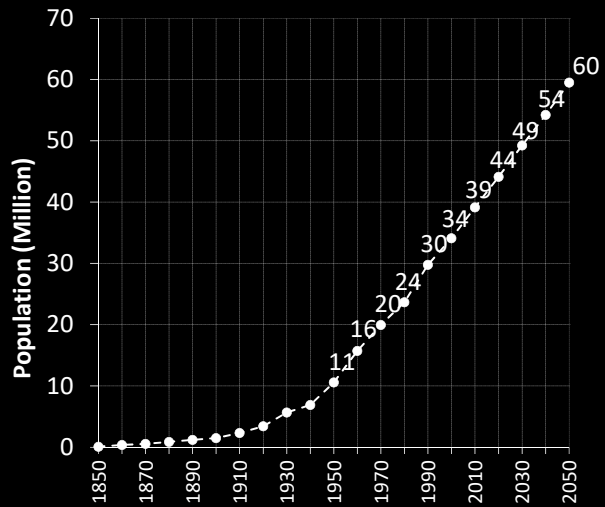
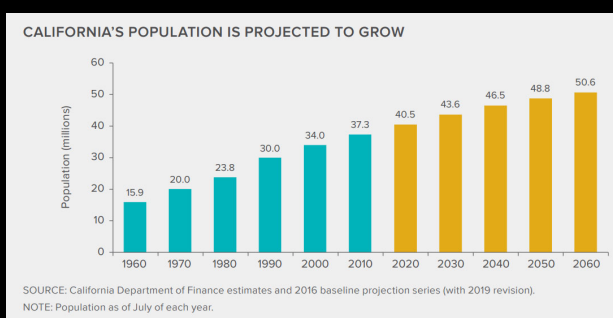


# Agriculture Facts

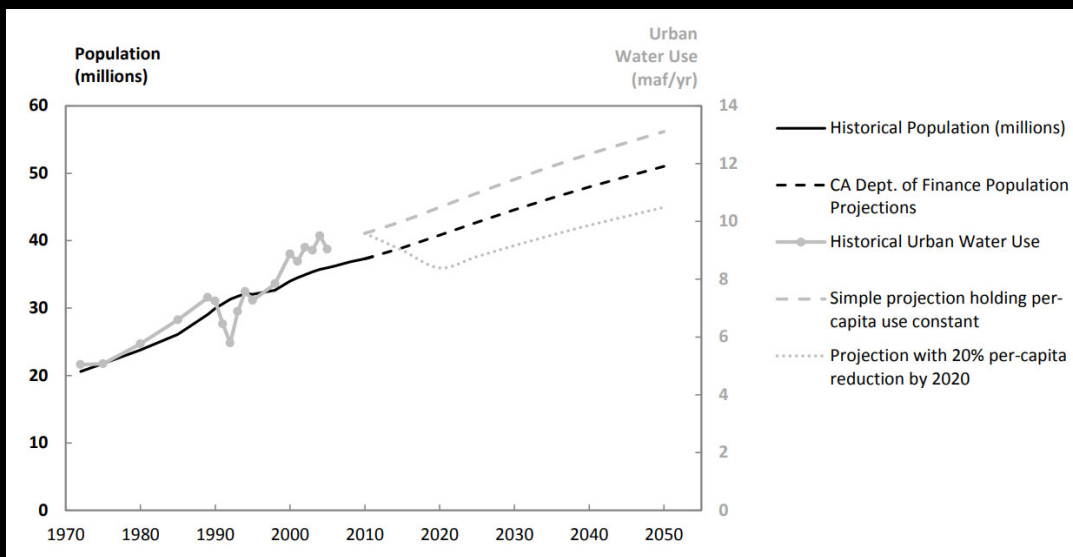
> 80,000 Farms => \$45 Billion Industry (< 5% GIR)  
 26 Million Acres of Agricultural Lands  
 13 Million Acres of Pasture and Rangeland  
 9.5 Million Acres of Irrigated Cropland  
 6.2 Million Acres Annuals  
 3.3 Million Acres Orchards/Vineyards  
 > 350 crops



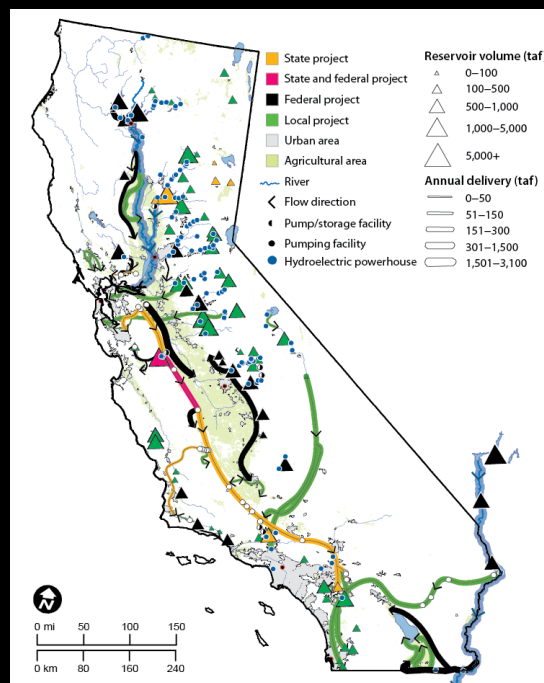
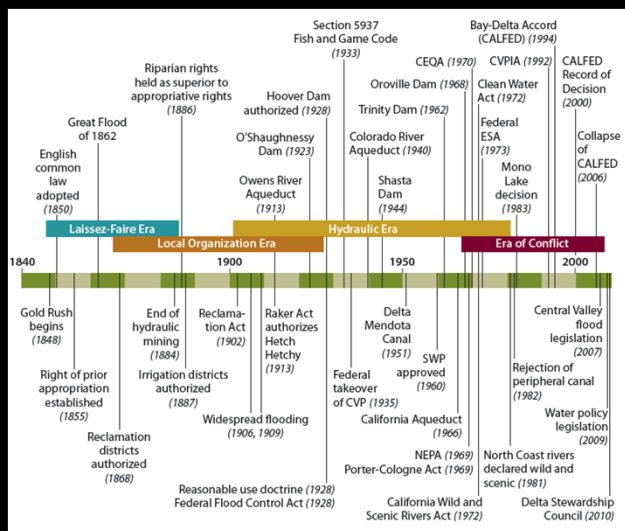
# Population



# Beneficial Water Use



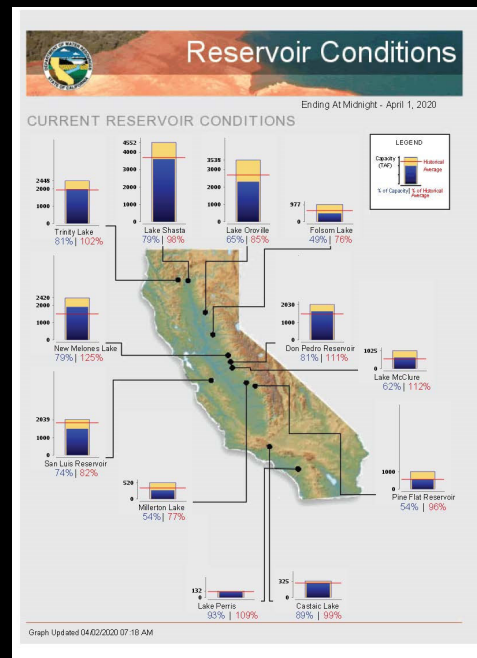
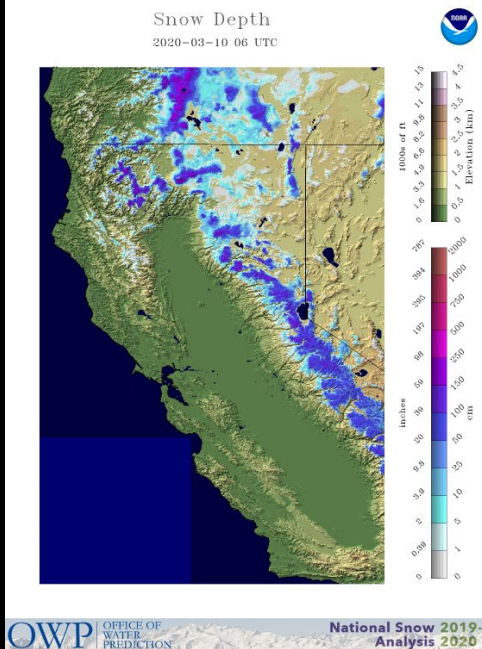
# Infrastructure



\* Hanak et al. (2011). "Managing California's Water. From Conflict to Reconciliation" <<http://watershed.ucdavis.edu/research/waterpolicy.html>>

# Snowpack

APRIL: 2020



Thank you  
[samsandoval@ucdavis.edu](mailto:samsandoval@ucdavis.edu)  
[watermanagement.ucdavis.edu](http://watermanagement.ucdavis.edu)  
[eflows.ucdavis.edu](http://eflows.ucdavis.edu)

University of California  
 Agriculture and Natural Resources

