

California's Future: Climate Change and Water

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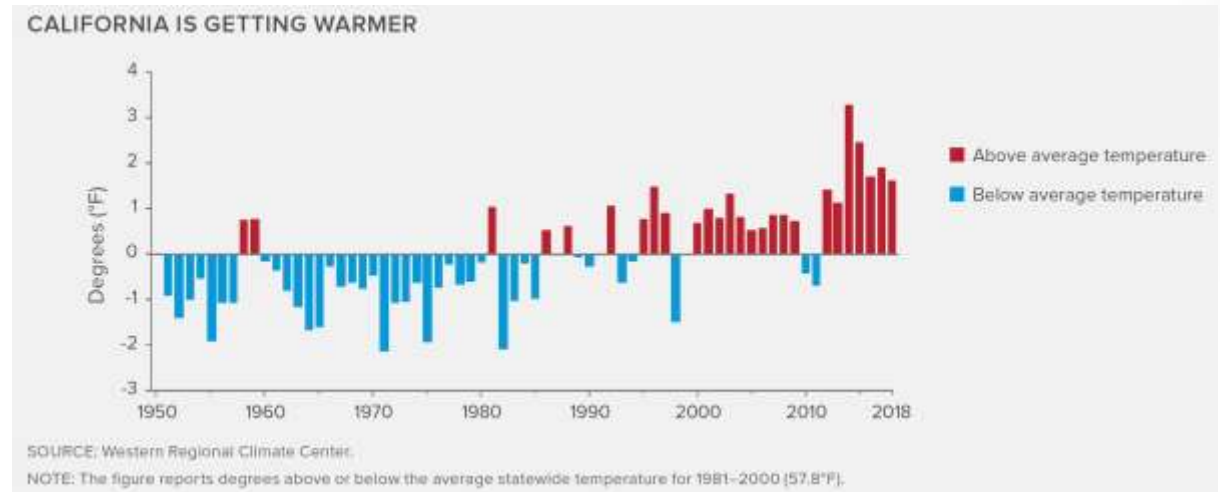
PPIC WATER POLICY CENTER

Outline

- An overview at climate change impacts and policies in California
- California's water: the big picture
- Climate change and water management
- Managing droughts under a changing climate
- Final thoughts

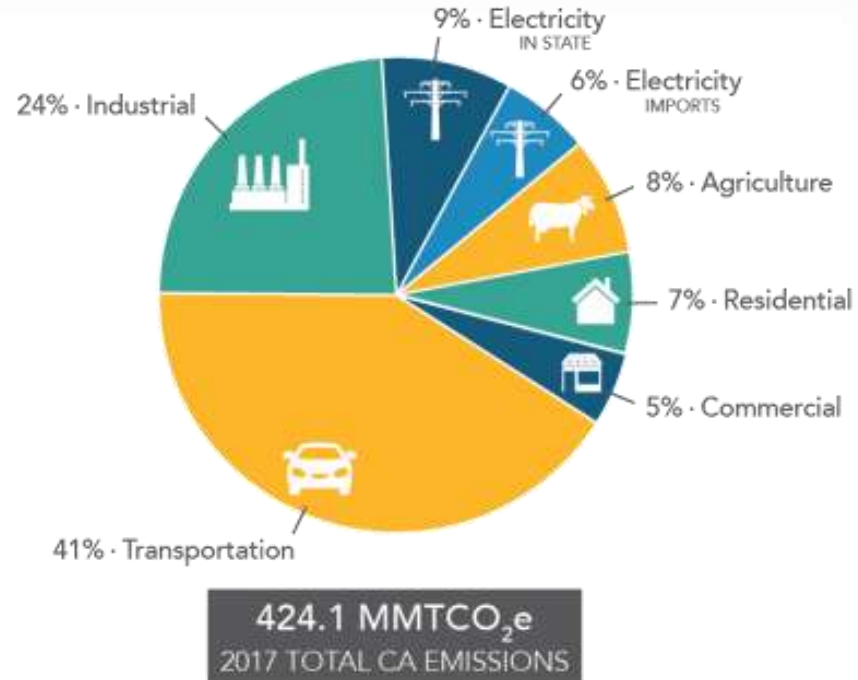
Climate change threatens California's future

- Global emissions are raising
- 7 of 10 warmest years from 2012-2018
- Sea level is predicted to rise 20 to 54 inches by 2100
- Increased frequency of extreme events

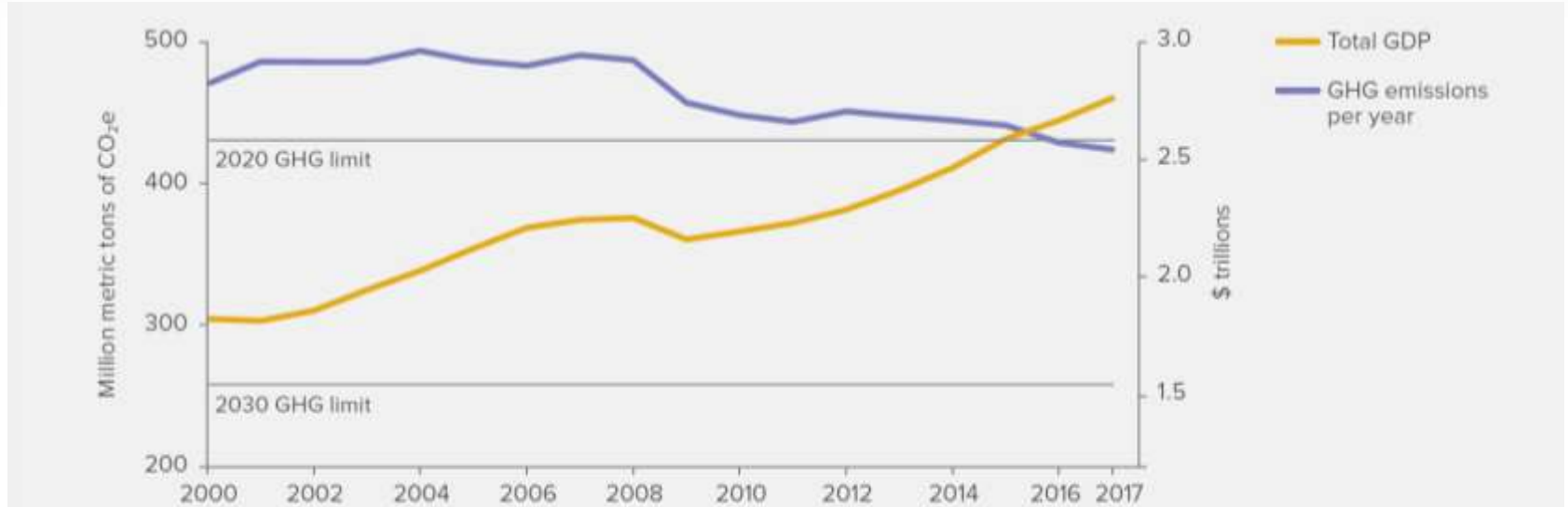


California is using a multifaceted approach to reduce emissions

- Reducing transportation emissions is key
- The state is increasing its reliance on cleaner energy
- A statewide cap-and-trade program brings flexibility to reduce emissions
- New policies target methane and other potent GHGs
- Natural and working lands provide opportunities to capture and store carbon



California's economy is growing despite reductions in GHG emissions

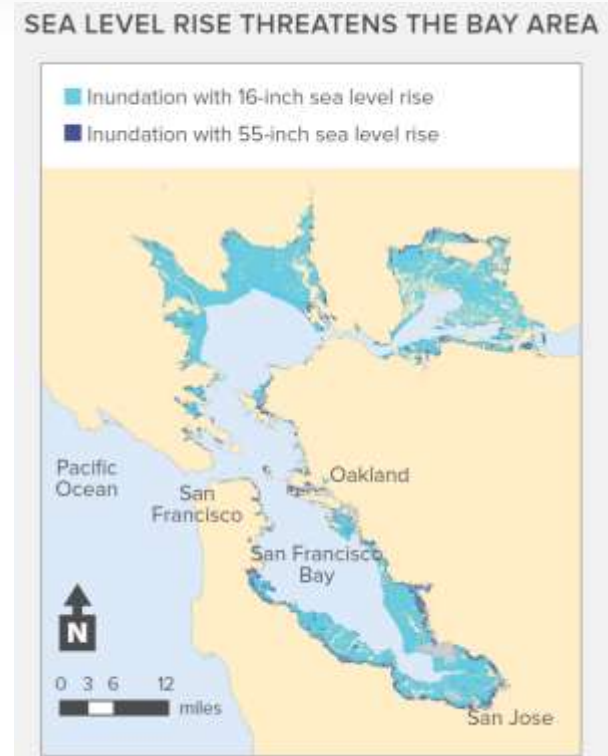


SOURCES: California Air Resources Board (emissions) and US Bureau of Economic Analysis (GDP).

NOTES: Gross domestic product (GDP) is expressed in 2017 dollars. GHG emissions are in millions of metric tons of CO₂ equivalent (CO₂e), a measure used to compare the relative contribution to global warming of various greenhouse gases. The CO₂e of CO₂ is 1, while the CO₂e of methane is 25.

California needs to address the effects of climate change

- Sea level rise threatens coastal infrastructure, homes, and habitat
- Wildfire risks are increasing
- Native biodiversity is under threat
- Public health threats will increase
- Water management faces challenges
- Agriculture will have to adapt to changing conditions
- Readiness to cope is variable



California is at the forefront of innovative climate policies, but there's still more to do

- In the early 2000s California started to address climate change with innovative policies: multiple legislative, regulatory and programmatic actions have been enacted since then
- Needs for the future:
 - Align state actions
 - Achieve near-term greenhouse gas emission reductions
 - Use land-use planning to reduce potential impacts
 - Review adaptation plans for critical infrastructure
 - Continue to play a leadership role

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PPIC Water Policy Center's latest report on droughts under a changing climate

- Managing water is at the forefront of climate change adaptation in California
- Drought reveals strengths and weaknesses in water systems
- To reduce social, economic and environmental effects of future droughts, a suite of reforms will be needed



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Managing Drought in a Changing Climate

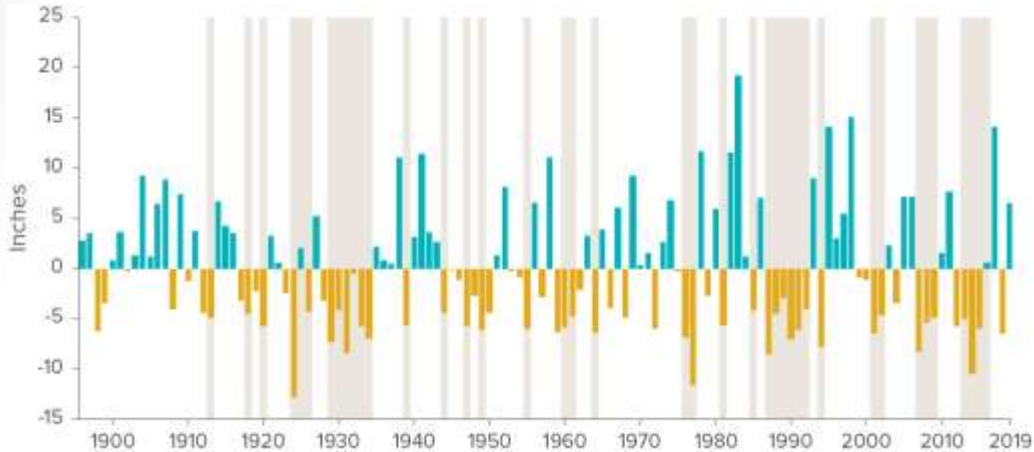
Four Essential Reforms



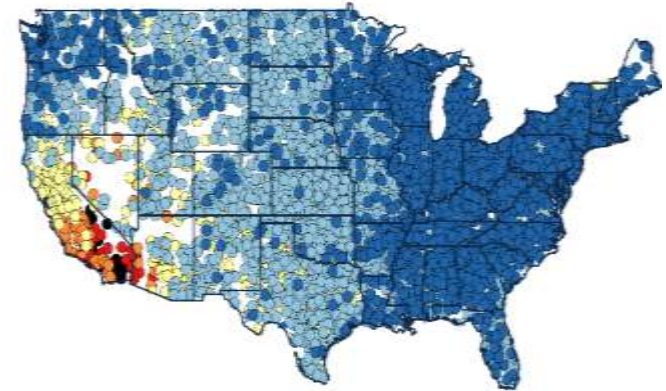
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California's highly variable climate requires preparing for extremes

Annual precipitation in California, deviation from average



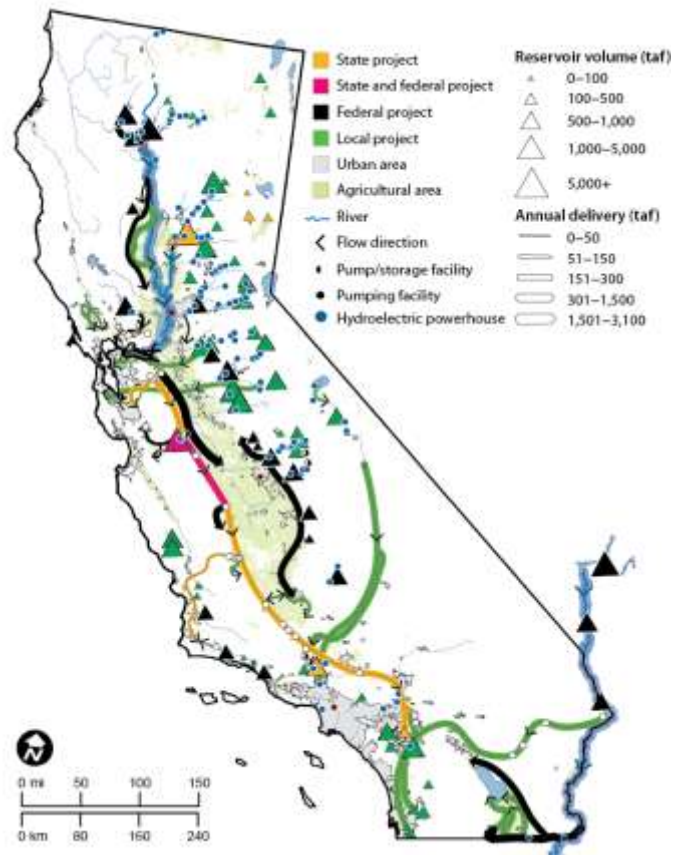
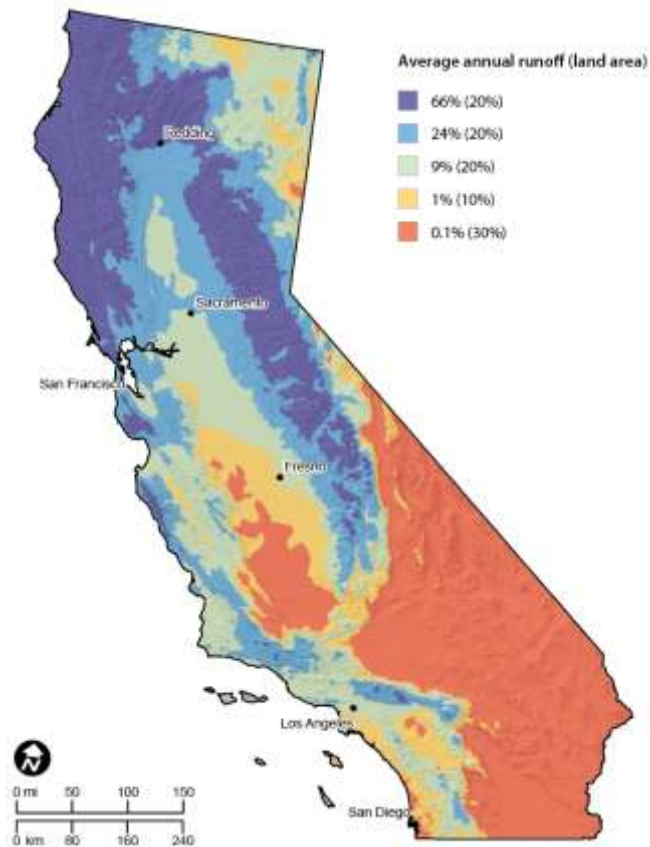
Rainfall Variability



Floods, droughts and lawsuits are catalysts for reform



20th century legacy: a highly engineered water system...



...to supply farms and cities far away from the most abundant water supply sources...

Irrigated agriculture



Urban communities



....and a very complex water rights system

- Century-old water rights system specifically designed for scarcity
 - First in time, first in right
 - No waste or unreasonable use
 - Use it or lose it
 - And a whole lot more...
- The 2014 Sustainable Groundwater Management Act develops a plan to regulate aquifer management
- Water trading

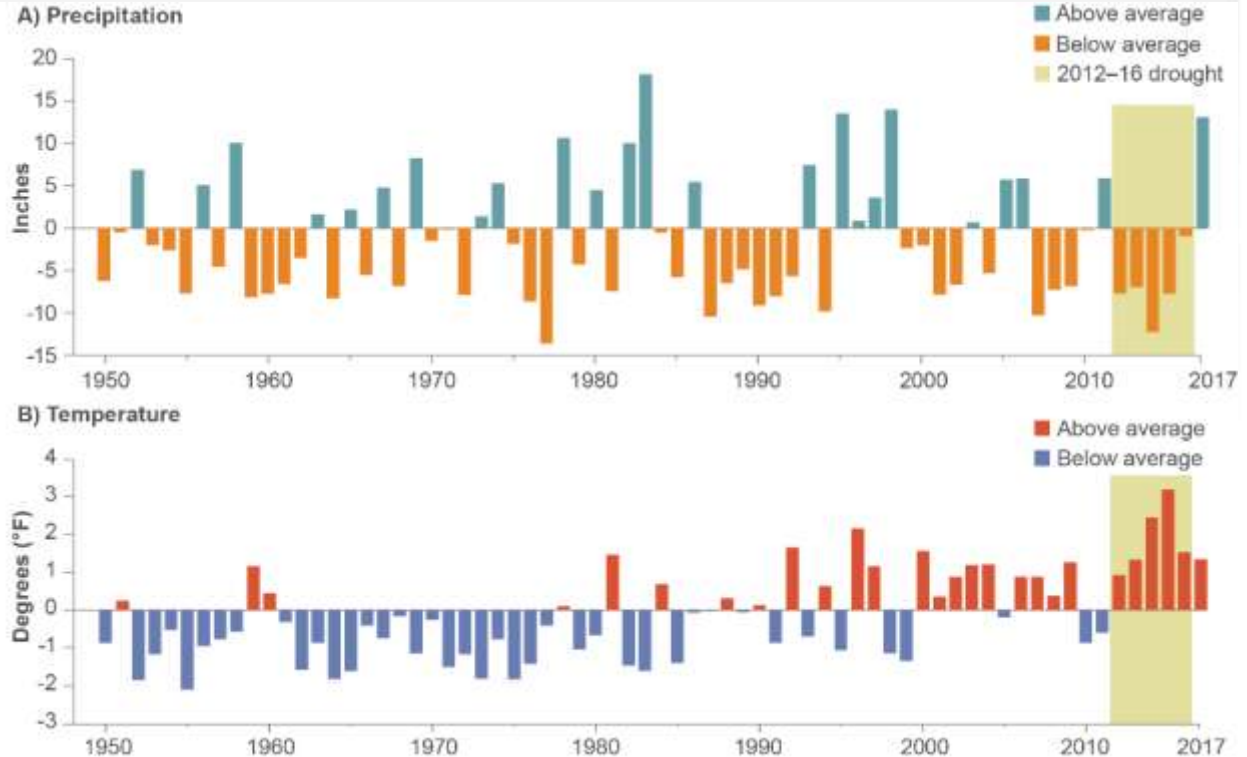


Outline

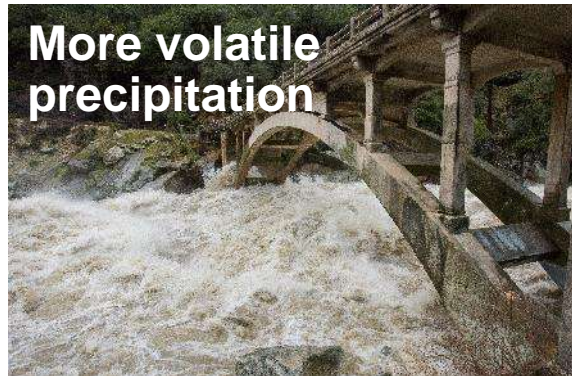
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The unusually warm drought of 2012–16 was a window into the future

- Driest 4-year period on record
- Warmest single year and warmest overall drought
- Record low flows on rivers across CA
- Near record lows on reservoir storage



Five climate pressures are impacting water management



California is warming



Temperature change
by mid-century (degrees °F)



- Temperature impacts:
 - Evaporative loss
 - Soil moisture deficits
 - Urban and agricultural irrigation demand
 - Surface water quality
 - Increasing demand for wetlands and instream flows (cold water)

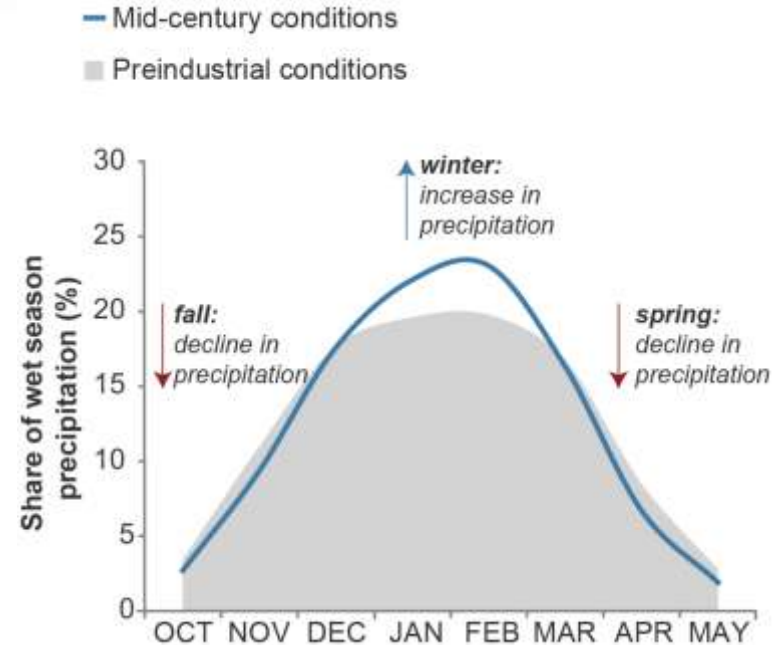
Snowpack is shrinking, “snow droughts” common

- Snowpack impacts:
 - Montane groundwater recharge
 - Total water budget and timing
 - Water available for recharge
 - Water quality
 - Reservoir temperatures



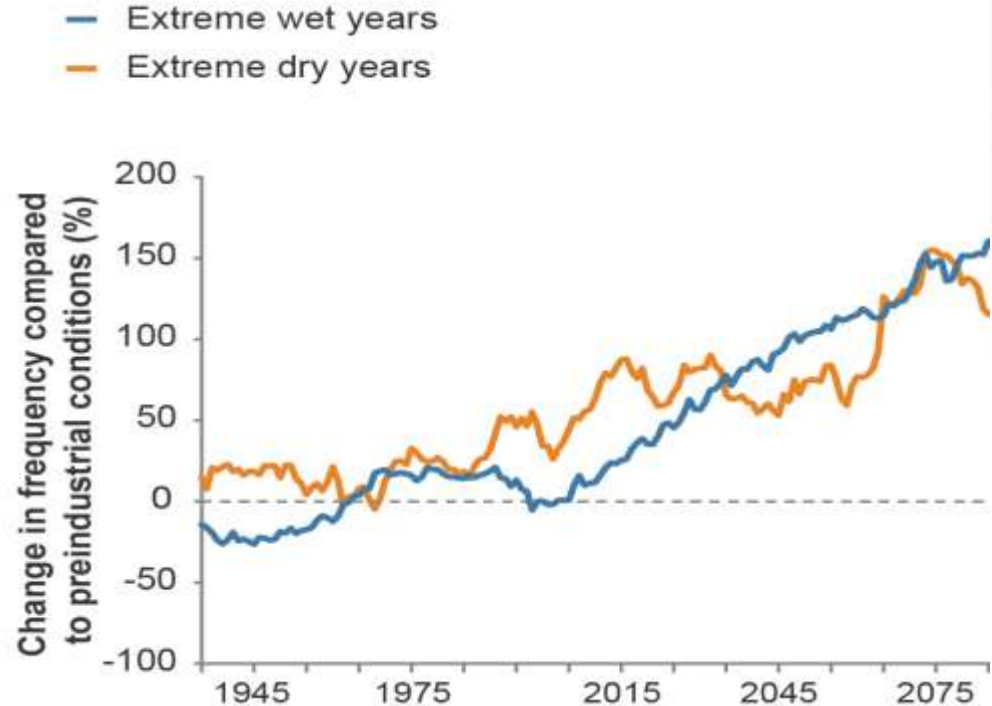
“Seasonality” is increasing

- Seasonality impacts:
 - Early and late season irrigation demands
 - Increased demand for spring and fall wetland and river ecosystem water
 - Reduced spring inflow to reservoirs and irrigation systems
 - Opportunities for managed recharge



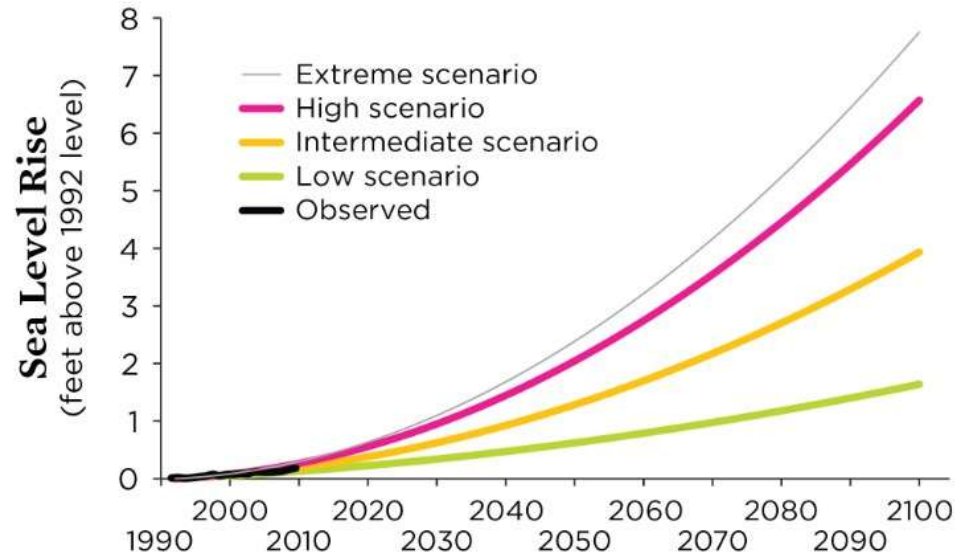
Precipitation is becoming more volatile

- Increased pressure to expand flood reserve in multipurpose reservoirs
- Increased pressure to maintain carryover storage in reservoirs
- Increased uncertainty about flood recharge opportunities
- Increased demand for aquifer storage and pumping



Accelerated sea level rise

- Sea level rise impacts:
 - Challenges to manage salinity in coastal aquifers
 - Threats to water quality and levee stability in the Sacramento-San Joaquin Delta (15% of statewide supply, 25% of SJV)



UNION OF CONCERNED SCIENTISTS

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Reducing vulnerability requires concerted action

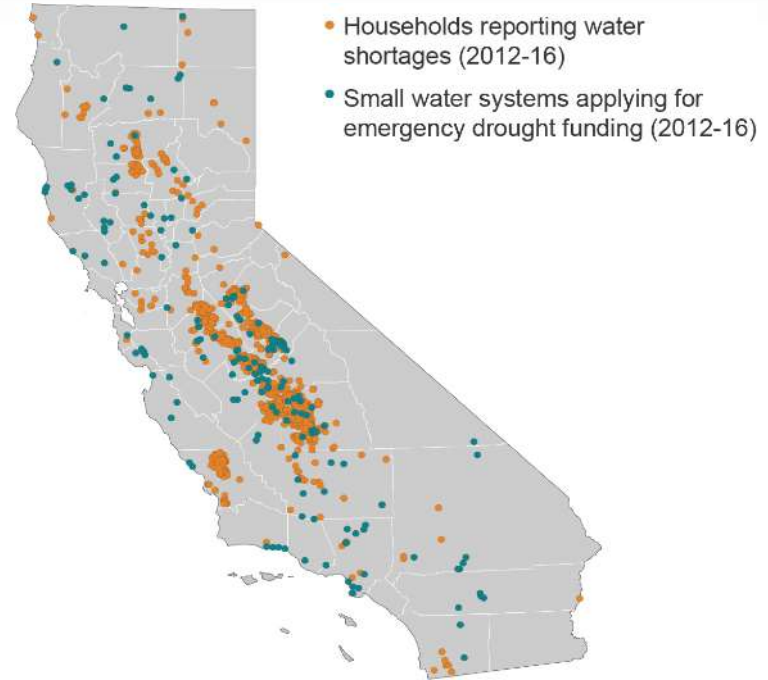
Four essential policy reforms:

1. Plan ahead
2. Upgrade the water grid
3. Update water allocation rules
4. Find the money



Reform 1: Plan ahead

- Successful adaptation requires advance planning at both local and regional scales.
- Top priorities:
 - Strengthen urban water management plans
 - Ensure effective groundwater sustainability plans
 - Develop drinking water plans for rural communities
 - Prepare ecosystem drought plans



Reform 2: Upgrade the water grid

- Modernizing California's "water grid" can help reduce costs of future droughts
- Top priorities:
 - Improve conveyance and storage capacity
 - Rethink operations



Reform 3: Update water allocation rules

- Facilitate equitable and efficient allocation during dry times.
- Promote capture and storage during wet times



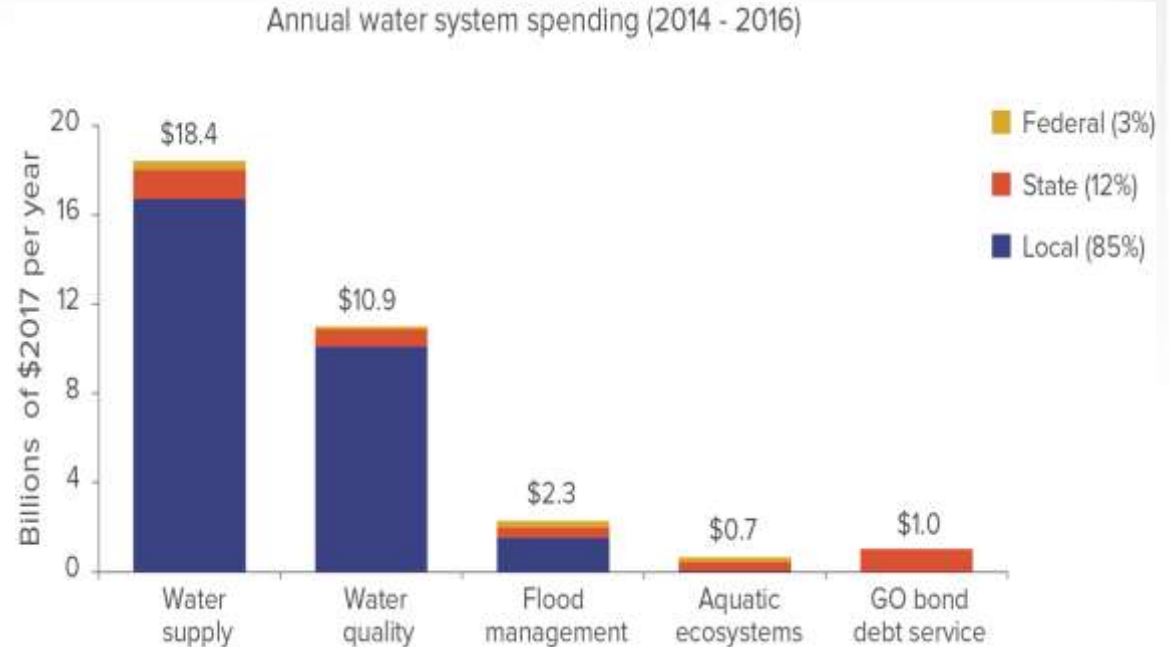
Reform 3: Update water allocation rules

- Top priorities:
 - Promote groundwater recharge
 - Streamline trading and banking
 - Give the environment a water budget
 - Improve water rights administration



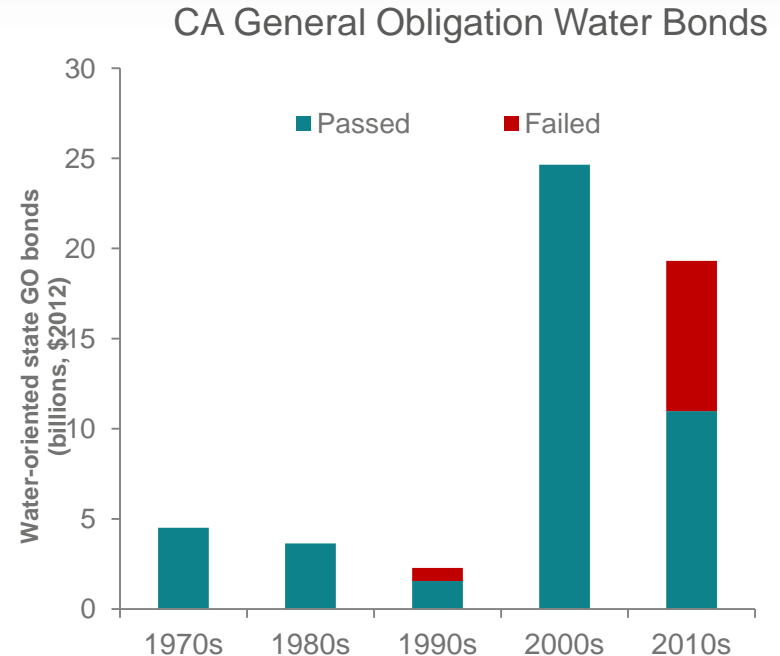
Reform 4: Find the money

- Reliable sources of funding are crucial
- Ratepayers the most abundant source
- But there are many fiscal orphans



Reform 4: Find the money

- Top priorities:
 - Use general obligation bonds for public benefit
 - Fill the \$2-3 billion gap for fiscal orphans
 - Reform water pricing law



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Reasons for optimism

- Urban sector has been adapting and investing in groundwater
- Agriculture has been innovating, improving efficiency, and working toward groundwater sustainability
- Progress is under way on safe drinking water supplies in rural communities



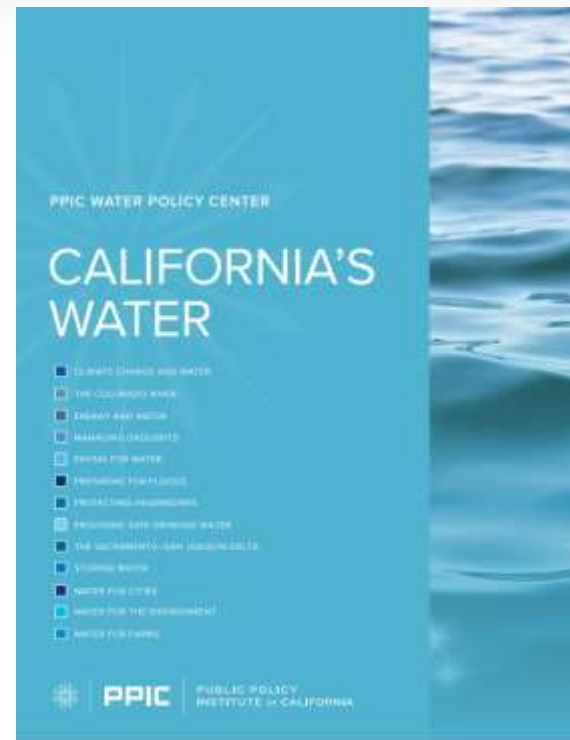
But difficult work lies ahead

- Efforts to date haven't stopped species decline
- Need a new approach to environmental management
- Also need to improve water rights administration
- And make some tough decisions about funding



If you want to know more...

- Mount et al. 2018. [Managing Drought in a Changing Climate: Four Essential Reforms](#). Public Policy Institute of California.
- Hanak et al. 2019. [Water and the Future of the San Joaquin Valley](#). Public Policy Institute of California.
- Mitchell et al. 2017. [Building Drought Resilience in California Cities and Suburbs](#). Public Policy Institute of California.
- Escriva-Bou et al. 2016. [Accounting for California's Water](#). Public Policy Institute of California.
- Hanak et al. 2018. [Replenishing groundwater in the San Joaquin Valley](#). Public Policy Institute of California.
- Hanak et al. 2014. [Paying for Water in California](#). Public Policy Institute of California.
- Mount et al. 2017. [Managing California's Freshwater Ecosystems: Lessons from the 2012-16 Drought](#). Public Policy Institute of California.
- Van Butsic et al. 2017. [Improving the Health of California's Headwater Forests](#). Public Policy Institute of California.
- ...



Thank you



Notes on the use of these slides

These slides were created to accompany a presentation. They do not include full documentation of sources, data samples, methods, and interpretations. To avoid misinterpretations, please contact:

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Thank you for your interest in this work.