

Preparing for Water Scarcity: Learning from California's Recent Drought

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Jay Lund, Director of UC Davis Watershed Sciences Center and PPIC Adjunct Fellow

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PPIC

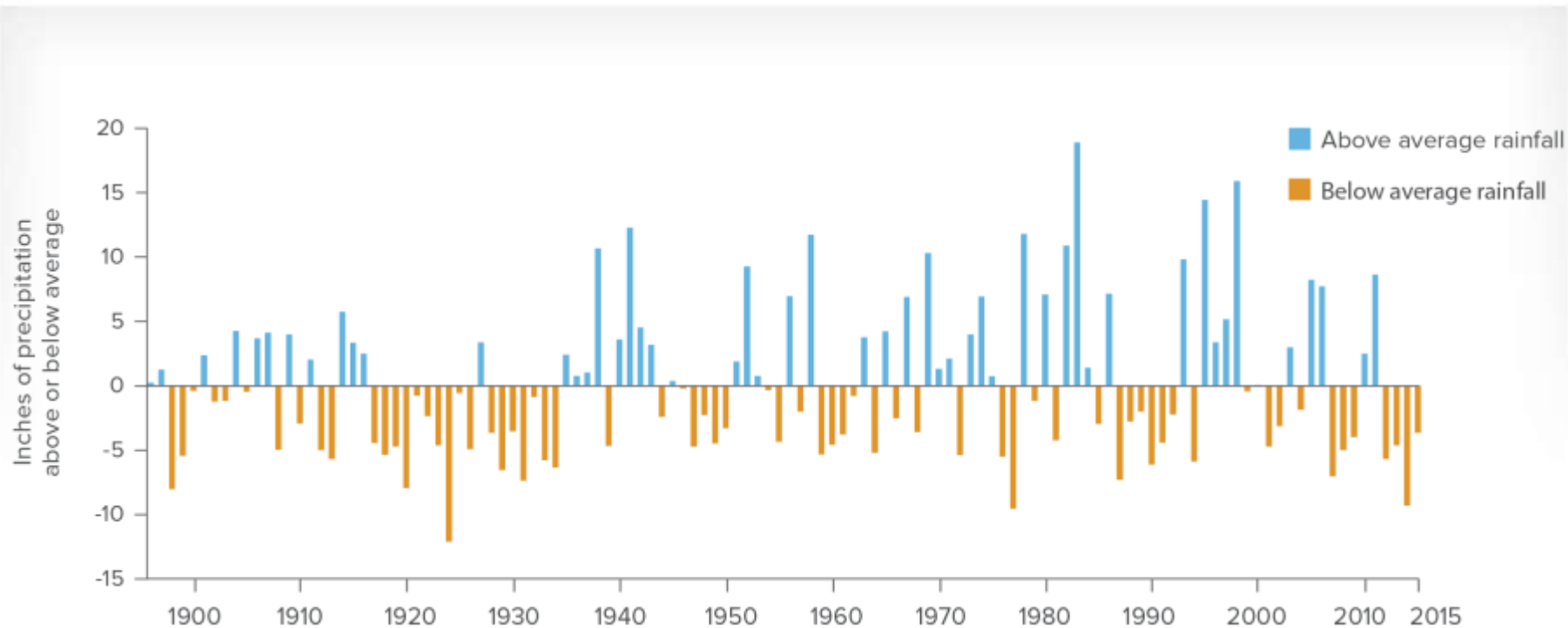
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Outline

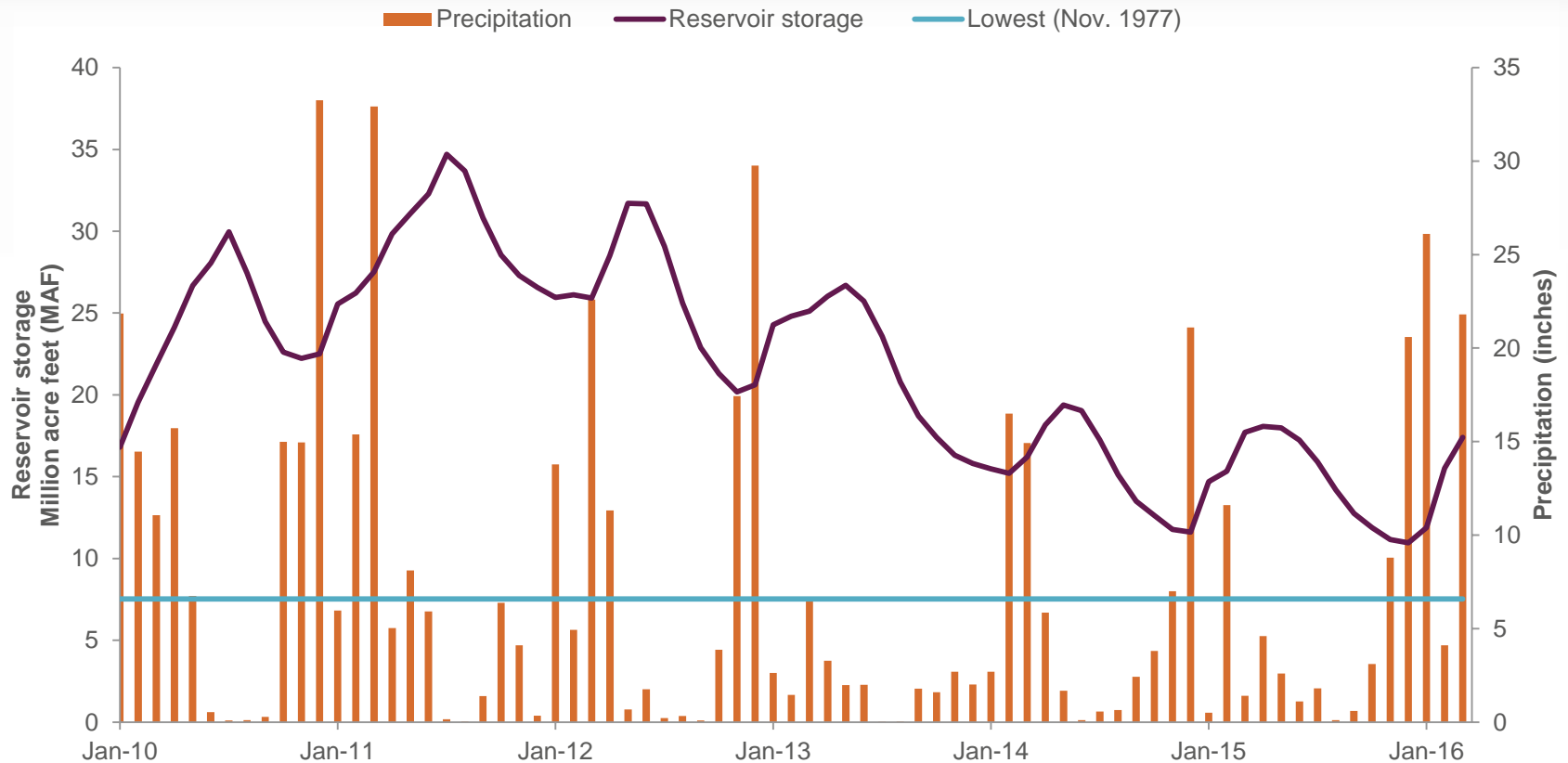
- **California's latest drought**
- Drought impacts and vulnerabilities
- Project scope and timeline
- Progress to date and next steps

Droughts are a recurring feature of California's variable climate



SOURCE: Western Regional Climate Center.

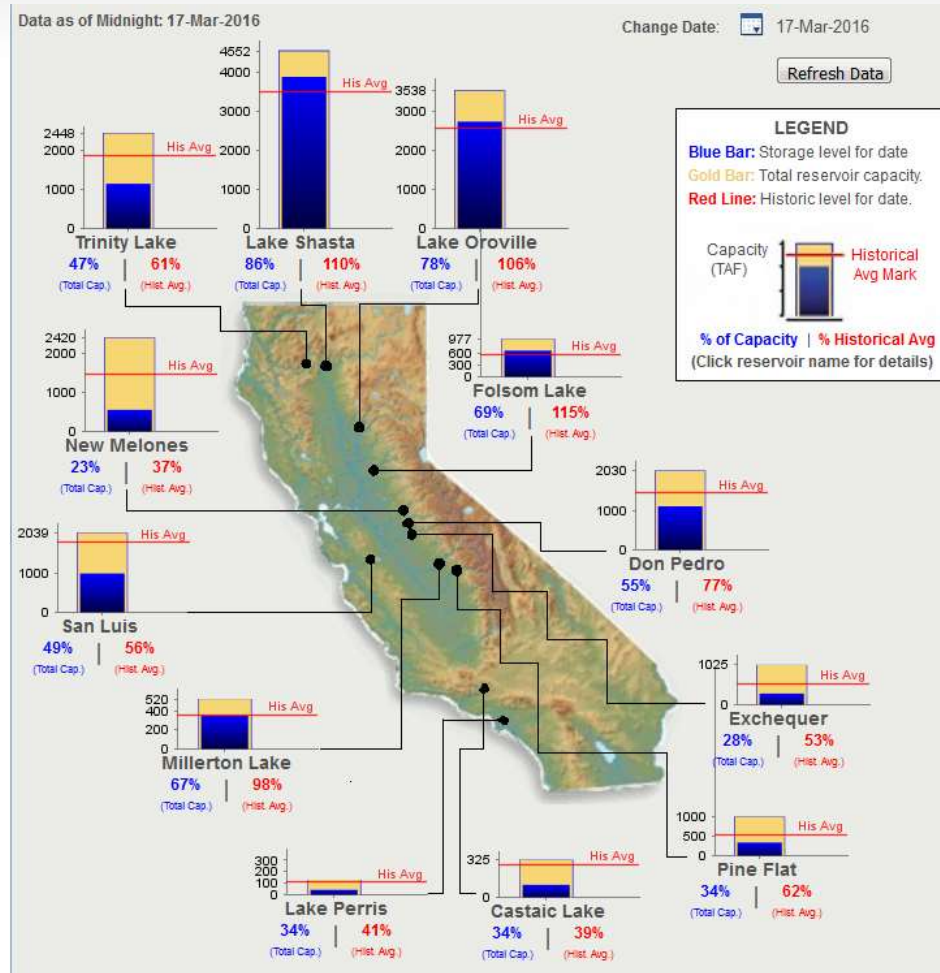
California just experienced four years of a severe drought



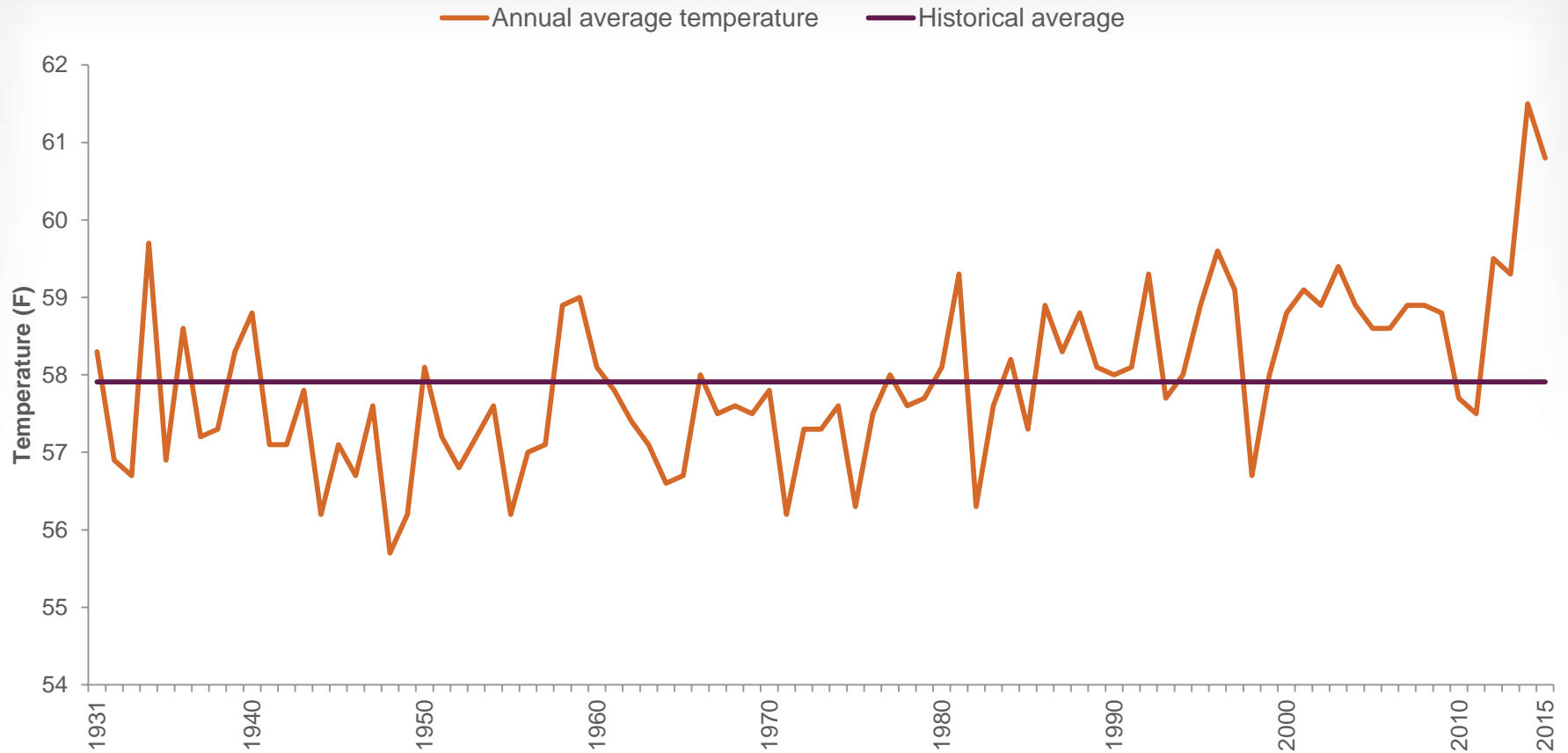
SOURCE: California Department of Water Resources.

NOTE: Precipitation is measured by summing the Northern Sierra 8-station and San Joaquin 5-station precipitation indices. Reservoir storage is the sum of monthly storage in 154 major reservoirs within the state (excluding storage in the Colorado River Basin) on the first day of the month.

Recent rains filled some major reservoirs, but we are not caught up yet



High temps, reduced snowpack, low flows = “drought of the future”



SOURCE: National Oceanic and Atmospheric Administration.

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Cities were better prepared for this drought

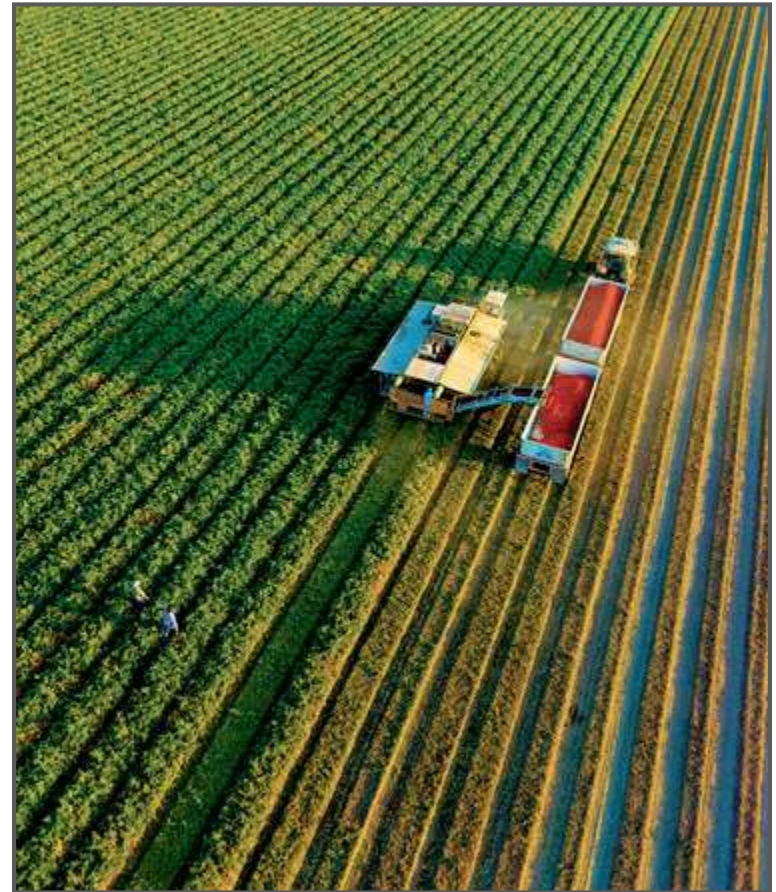
- Major investments since the early 1990s helped:
 - Conservation (esp. indoors)
 - Diversified water portfolios
 - Regional infrastructure development
- 2014: handful of isolated cities (e.g., Santa Cruz) in crisis
- 2015: 25% avg. conservation mandated statewide
 - Successful, but fiscal fallout



California Journal, 1991

Farms have been coping with large (~50%) surface water cutbacks

- Net water reductions ~10%
 - Groundwater pumping +70%
 - Some trading (~5%)
 - Some fallowing (~550K acres, 6%)
- Economic losses moderate:
 - Ag costs (4% of revenues)
 - Farm jobs (5%)
 - State GDP (<0.1%)
- Unmitigated damages
 - Subsidence (infrastructure)
 - Well impacts (incl. drinking water for rural residents)



Source: NYT

Rural communities have been hit hard

- So far...
 - ~3,000 dry domestic wells, 100+ small systems in trouble
 - Strong emergency response
 - But time lags still too long
- Continued vulnerabilities...
 - Increase in dry wells
 - Worsening air quality
 - Economic hardship

Reported dry wells



SOURCE: CA Office of Planning and Research
NOTE: Map from Feb 2016

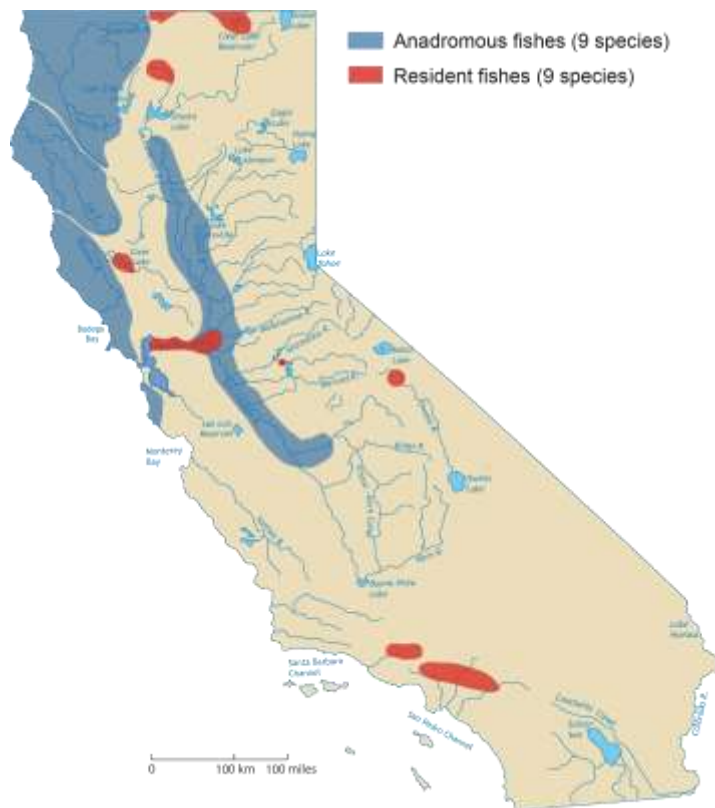
Ecosystems are most vulnerable: rivers, wetlands, forests

- So far...
 - Dramatic reduction in flows and habitat
 - Major forest die-offs
 - Increased wildfire risk
 - Rescues and monitoring
 - Some innovations in waterbird management



Dry, hot conditions pose enduring ecosystem risks

Native fish at near-term risk of extinction from dry, hot conditions



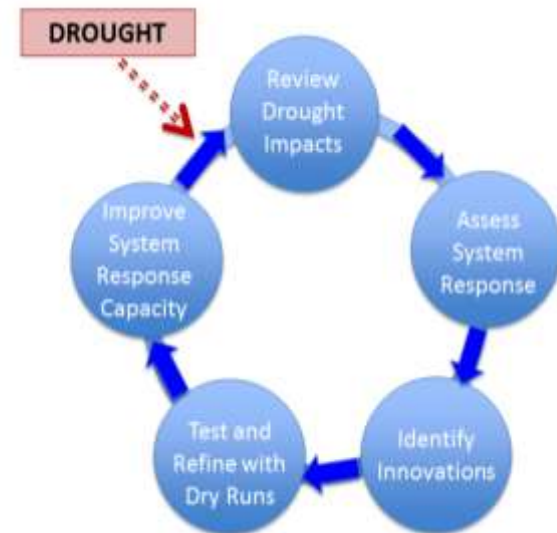
- 18 fish at risk of extinction
 - Need for strategic flows, conservation hatcheries
- High risks of waterbird mortality
 - Need for strategic flows to maintain wetlands
 - Severe wildfire risk, with some permanent losses of conifer forests

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Project objectives

- Seeks to improve drought planning and emergency response in California and the West
- Four interrelated objectives:
 - Review drought impacts
 - Assess systems response
 - Identify innovations
 - Test and refine with dry runs



Basic project structure

Research team:

- Core team + 8 area teams: seeking cross-fertilization
 - Over 25 researchers from 8 institutions

Research approach:

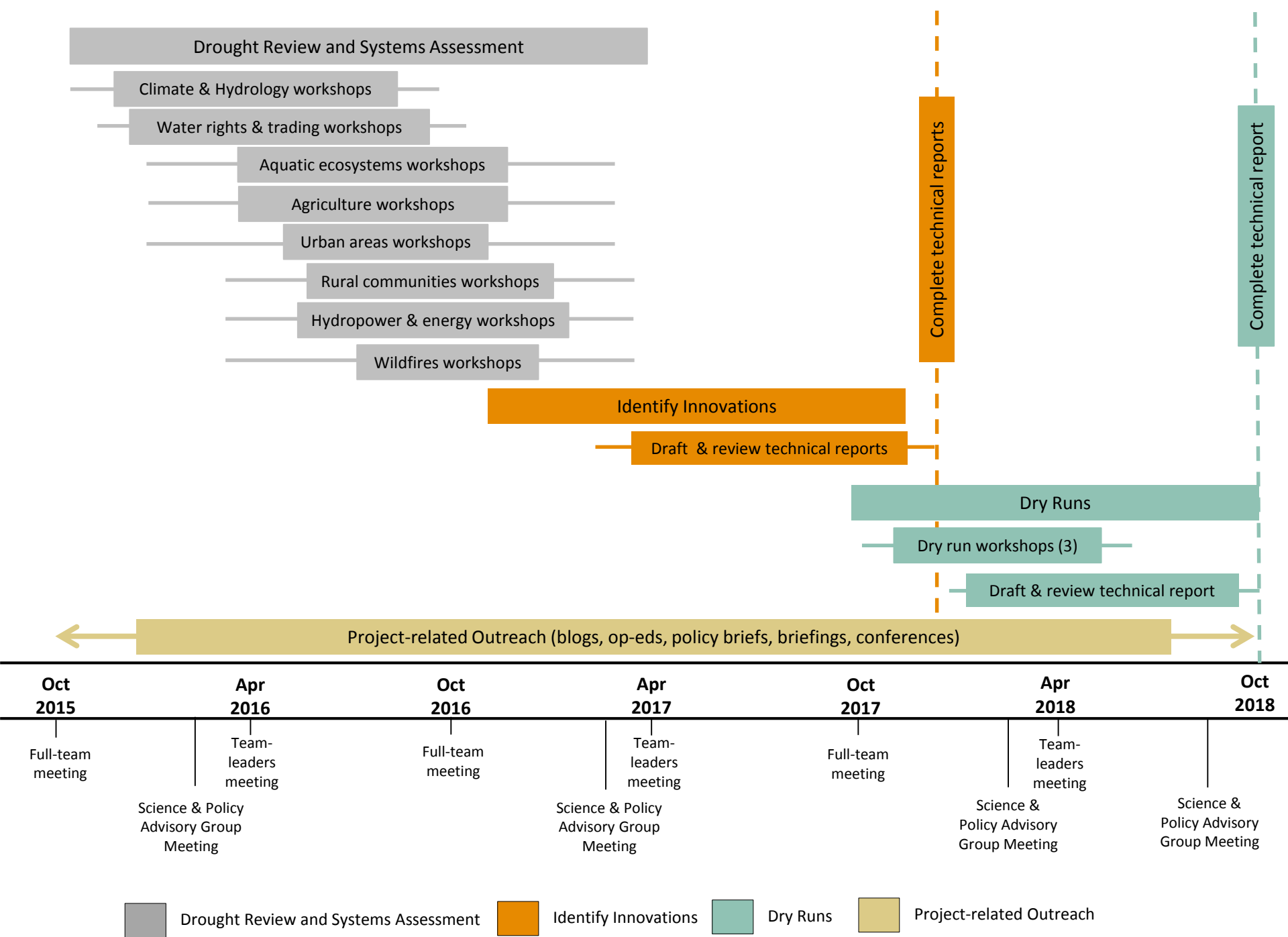
- “Synthesis-plus” to inform policy
 - Data analysis, modeling
 - Policy workshops for two-way insights

Timeline, outputs:

- 3-year timeline with range of products (fact sheets, technical reports, etc.) and outreach (blogs, events)

Topic areas

- Hydrology and climatology
 - Causes of this drought
 - Implications of current drought for future droughts
- Managing supply and quality
 - Water rights, trading, and quality: law, institutions, accounting
 - Urban response
 - Agricultural response
 - Rural issues
 - Energy sector response
- Managing ecosystems
 - Aquatic ecosystems (rivers and wetlands)
 - Forests and wildfires



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Hydrology and climate

- Research in progress:
 - Characterize latest drought along different dimensions (precipitation, snowpack, temperature)
 - Assess likely conditions of future droughts, informed by climate models
- Next steps:
 - Hold workshop on drought characteristics for future planning
 - Develop scenarios of future droughts for use in dry runs

**2070-2099, Medium Warming Scenario
25% snowpack remaining**

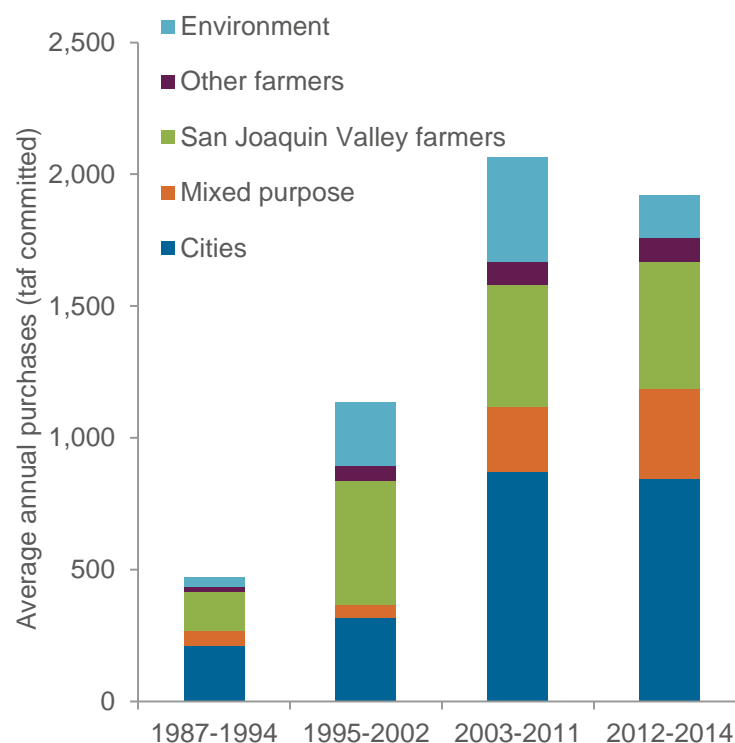


SOURCE: Cayan, Dan et al. (2009), CA Climate Adaptation Strategy

Water rights, markets, and quality

- Research in progress:
 - Assess drought lessons for water allocation institutions
 - Identify best practices in water accounting for managing scarce supplies
- Next steps:
 - Hold event on water accounting recommendations

Water purchases by user group



Agricultural, rural issues

- Research in progress:
 - Focus on the San Joaquin Valley
 - Outline regional challenges
 - Provide solution context (e.g., 2014 Sustainable Groundwater Management Act)
 - Lay out alternative paths
- Next steps:
 - Hold regional workshops
 - Initiate more in-depth analysis on solution paths



Urban water use

- Research in progress:
 - Survey California's 400+ urban water agencies to understand drought impacts and responses
 - Supplement with urban data (finance, water use, plans)
- Next steps:
 - Hold regional workshops
 - Report on state, local policy and management lessons



Aquatic ecosystems (rivers and wetlands)

- Research in progress:
 - Examine environmental water regulations during drought in three watersheds
 - Assess lessons from Victoria, Australia, for environmental management in CA
- Next steps:
 - Hold workshops on planning for droughts and allocating water for the environment



Forest and wildfires

- Research in progress:
 - Draw lessons from the latest drought for moving from fire suppression to forest management & fire prevention
- Next steps
 - Hold workshop w/ state, federal, private forest managers, NGOs, and researchers
 - Focus on reducing barriers, raising incentives for forest management



Some reflections on drought

- Droughts test water systems, and catalyze innovations and adaptations. Every drought is different. It has always been so.
- Statewide economic impacts of drought have been far less than one would have expected.
- Ecosystem impacts of drought were often greater, and less well prepared for.
- Problems and successes suggest directions for improvement across all levels of government.

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:

Jay Lund (jrlund@ucdavis.edu)

Thank you for your interest in this work.