



# Drought Update

Jeanine Jones



Department of Water Resources

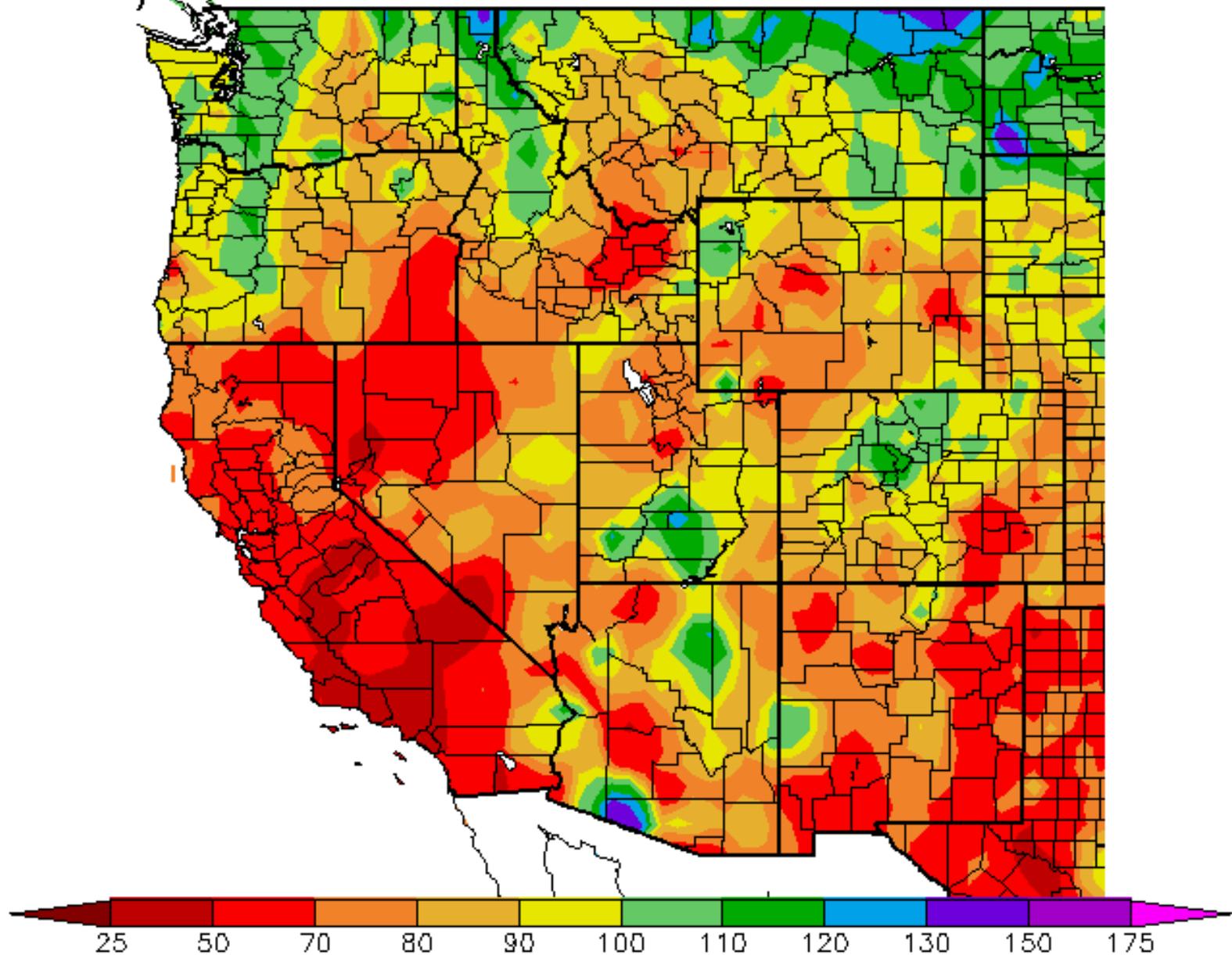
June 2014

# Outline

- This year's hydrology in perspective
- Recent drought activities
- What about 2015?

# Percent of Average Precipitation (%)

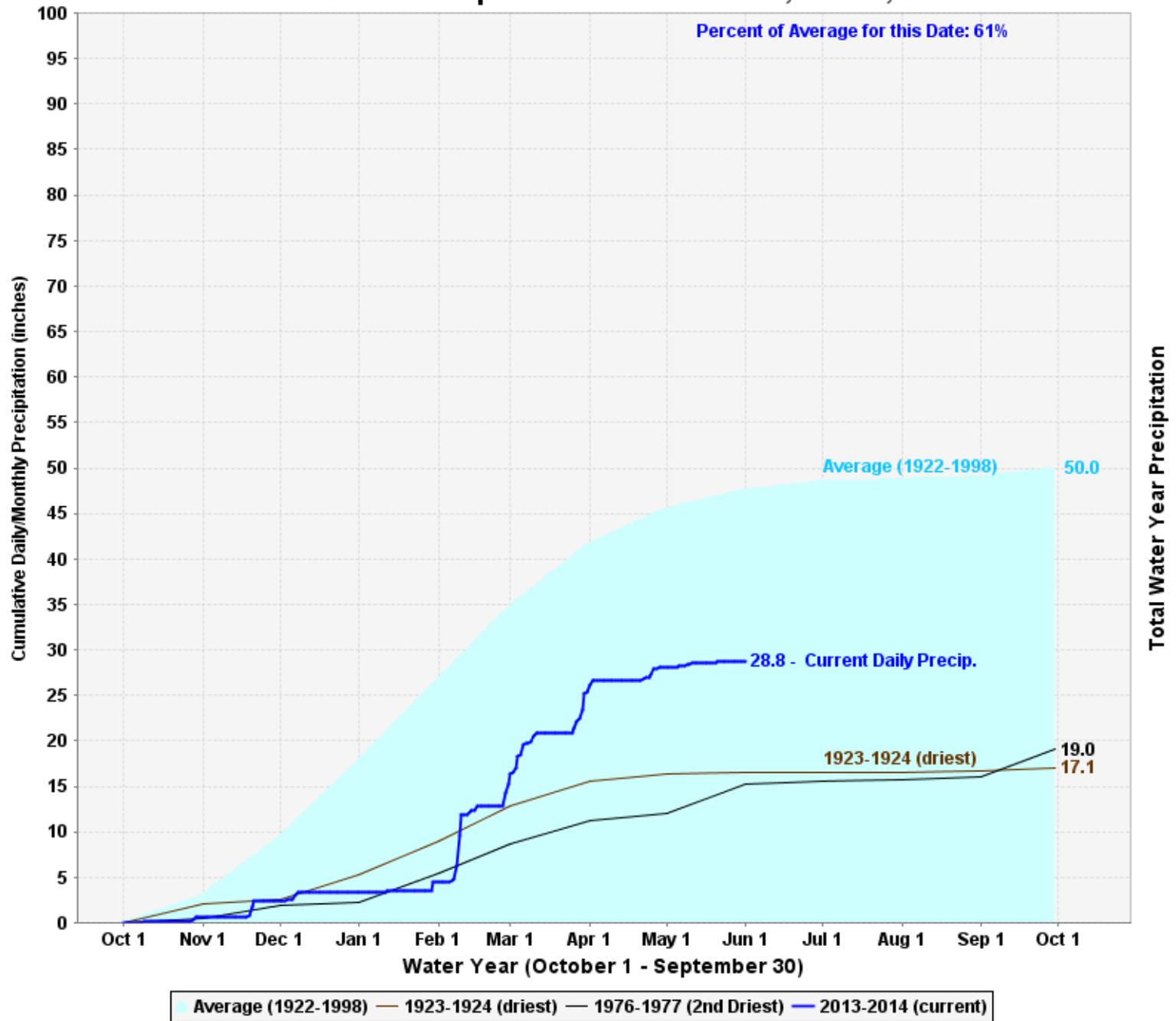
6/17/2011 - 6/16/2014



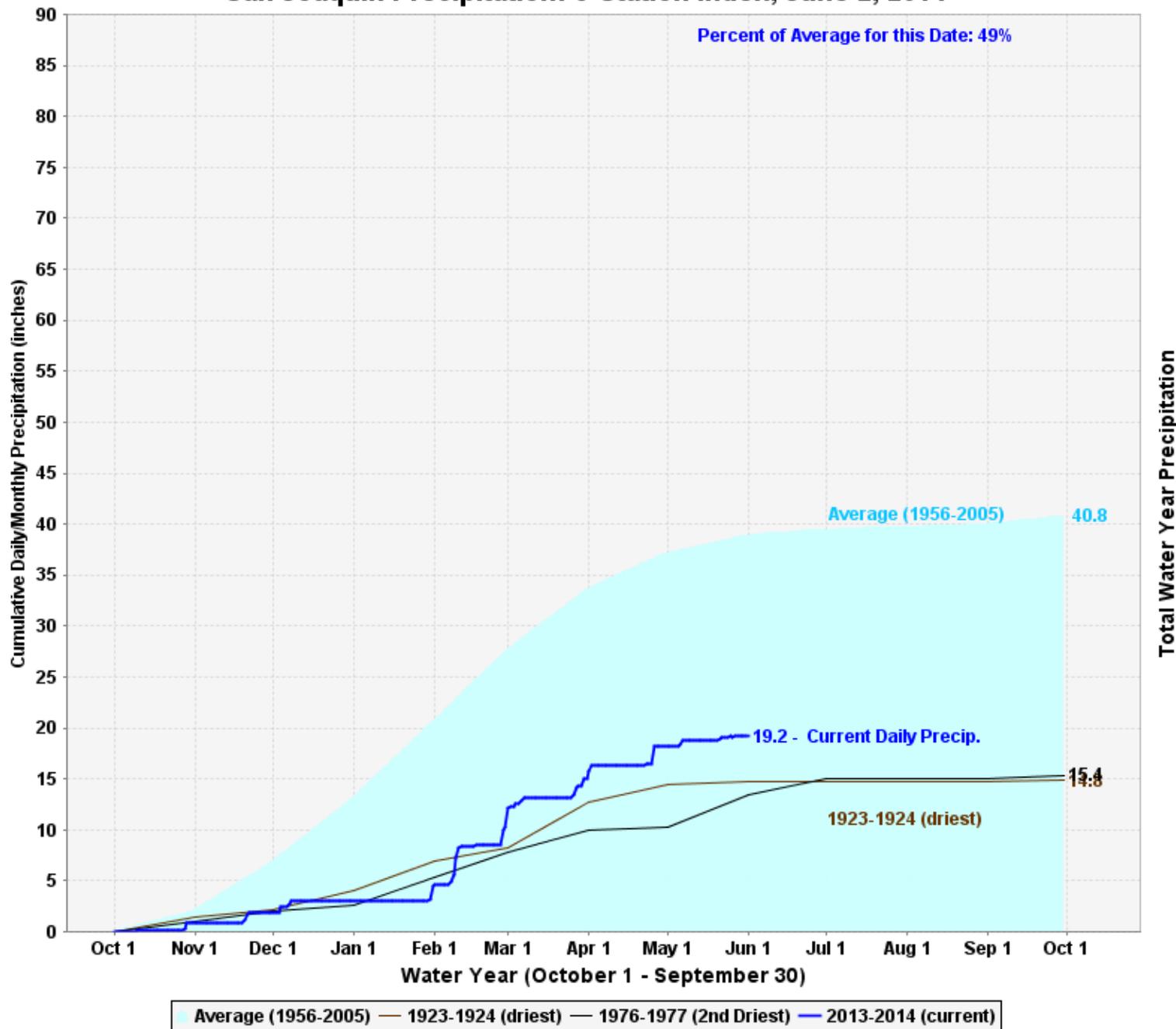
Generated 5/17/2014 at WRCC using provisional data.

NOAA Regional Climate Centers

# Northern Sierra Precipitation: 8-Station Index, June 2, 2014



# San Joaquin Precipitation: 5-Station Index, June 2, 2014



# USGS Computed CA WY Runoff

## Dozen Driest years -- (rank out of 113)

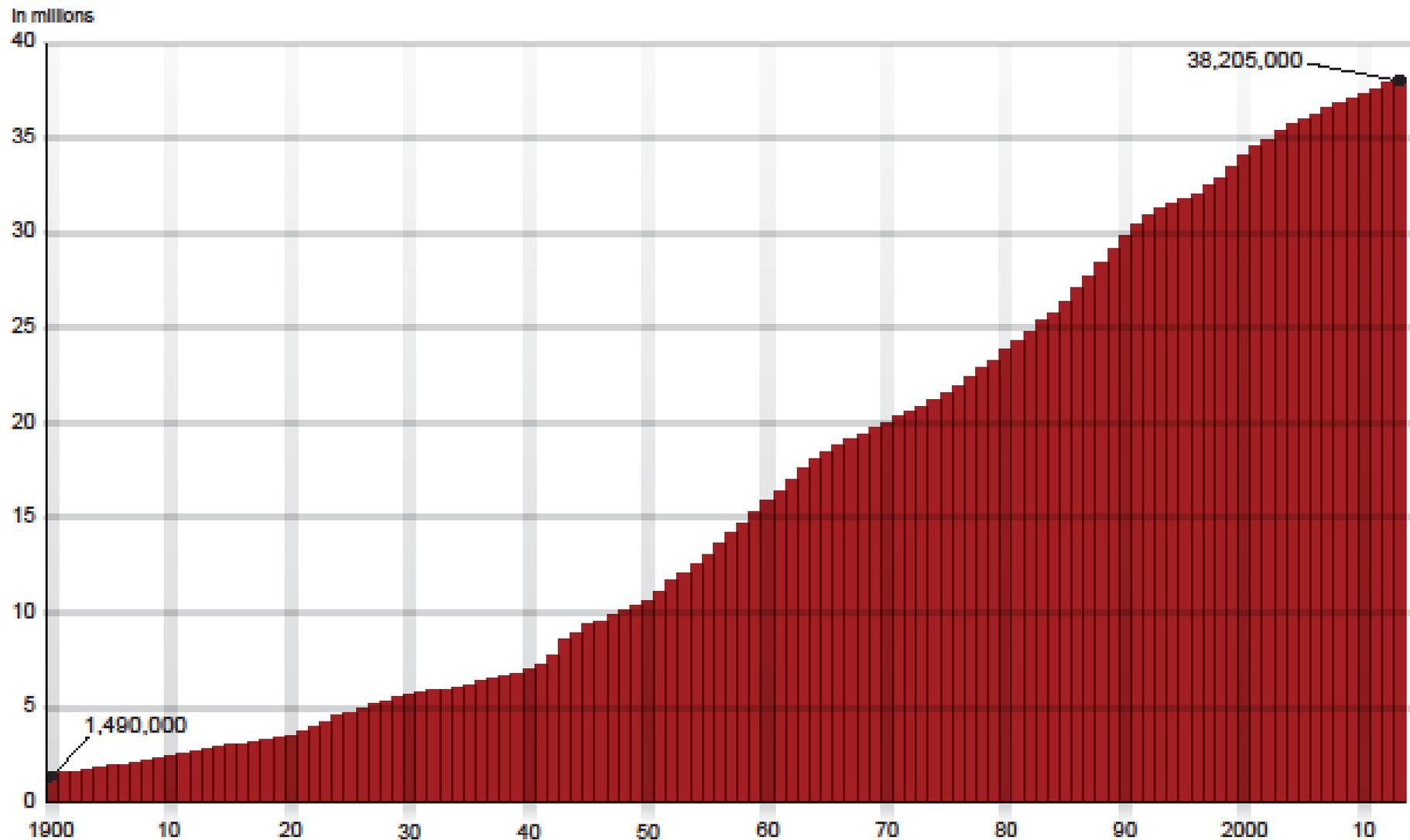
1. 1977	113 <sup>th</sup>	7. 2001	107 <sup>th</sup>
2. 1931	112 <sup>th</sup>	8. 1934	106 <sup>th</sup>
3. 1924	111 <sup>th</sup>	9. 1992	105 <sup>th</sup>
4. 1991	110 <sup>th</sup>	10. 1976	104 <sup>th</sup>
5. 1994	109 <sup>th</sup>	11. 1929	103 <sup>rd</sup>
6. 1990	108 <sup>th</sup>	12. 1998	102 <sup>nd</sup>

# California's 20<sup>th</sup> & 21<sup>st</sup> Century Statewide Droughts

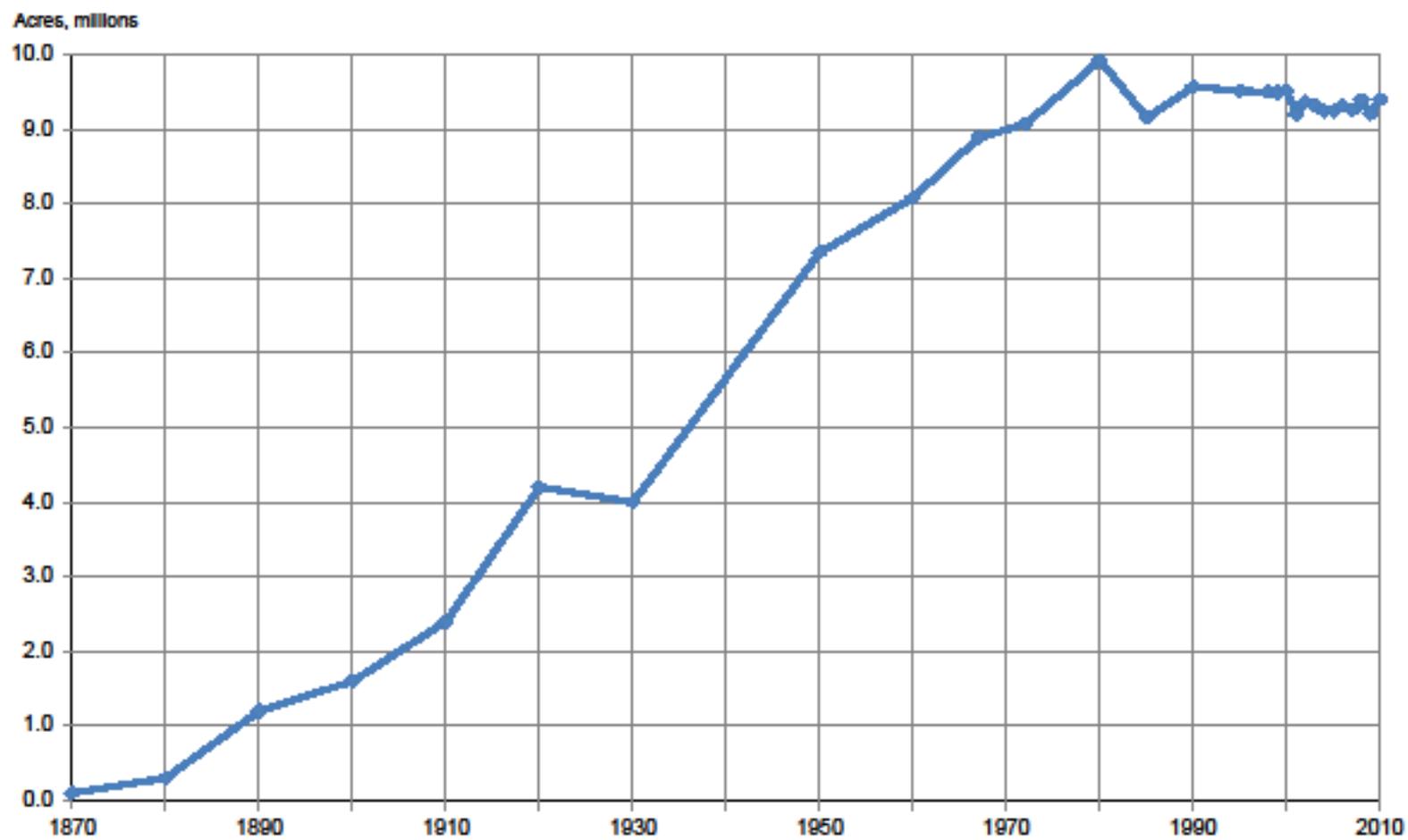
- 1918-20
- 1922-24
- 1929-34
- 1947-50

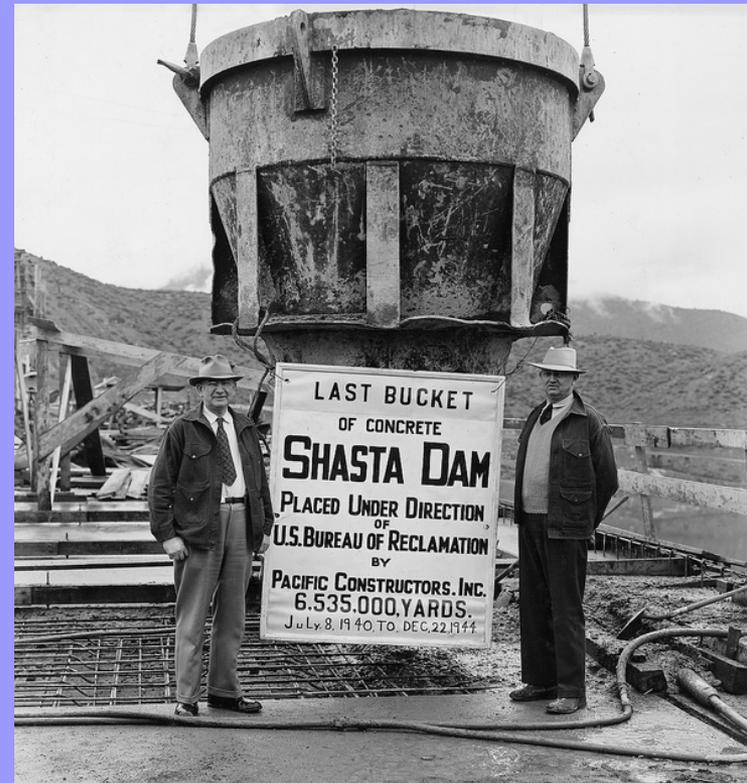
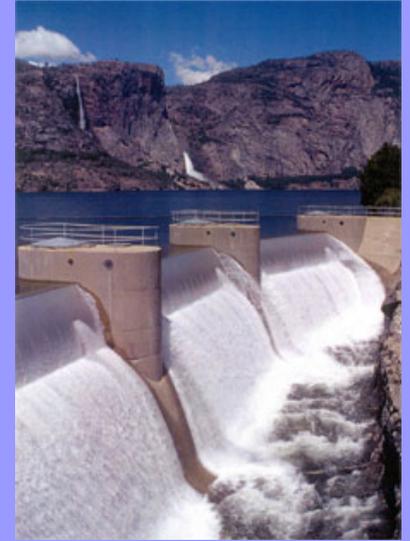
- 1959-61
- 1976-77
- 1987-92
- 2007-09

California Population Estimates, with Components of Change and Crude Rates, July 1, 1900-2013



California Irrigated Crop Acreage, 1870-2010



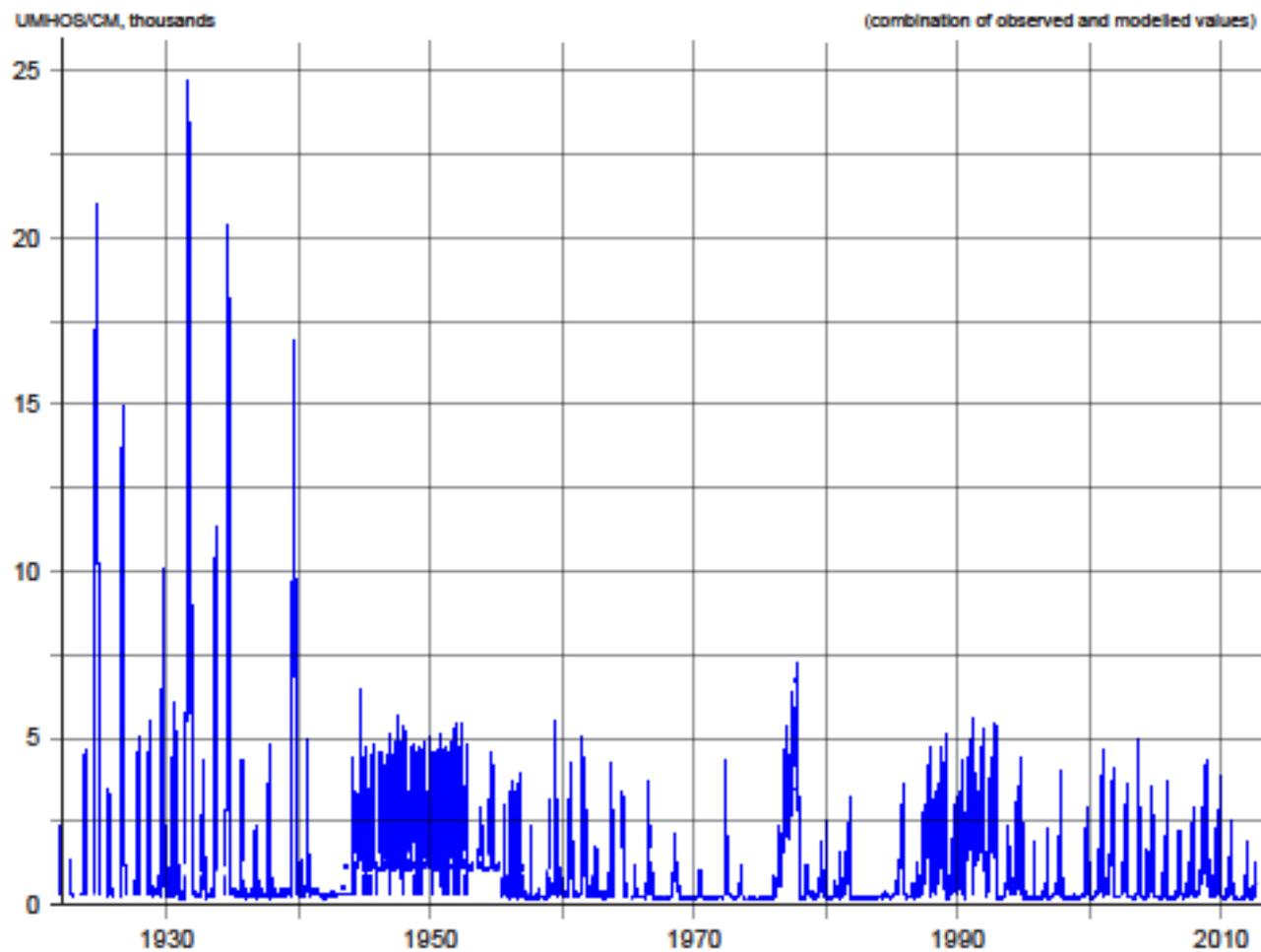




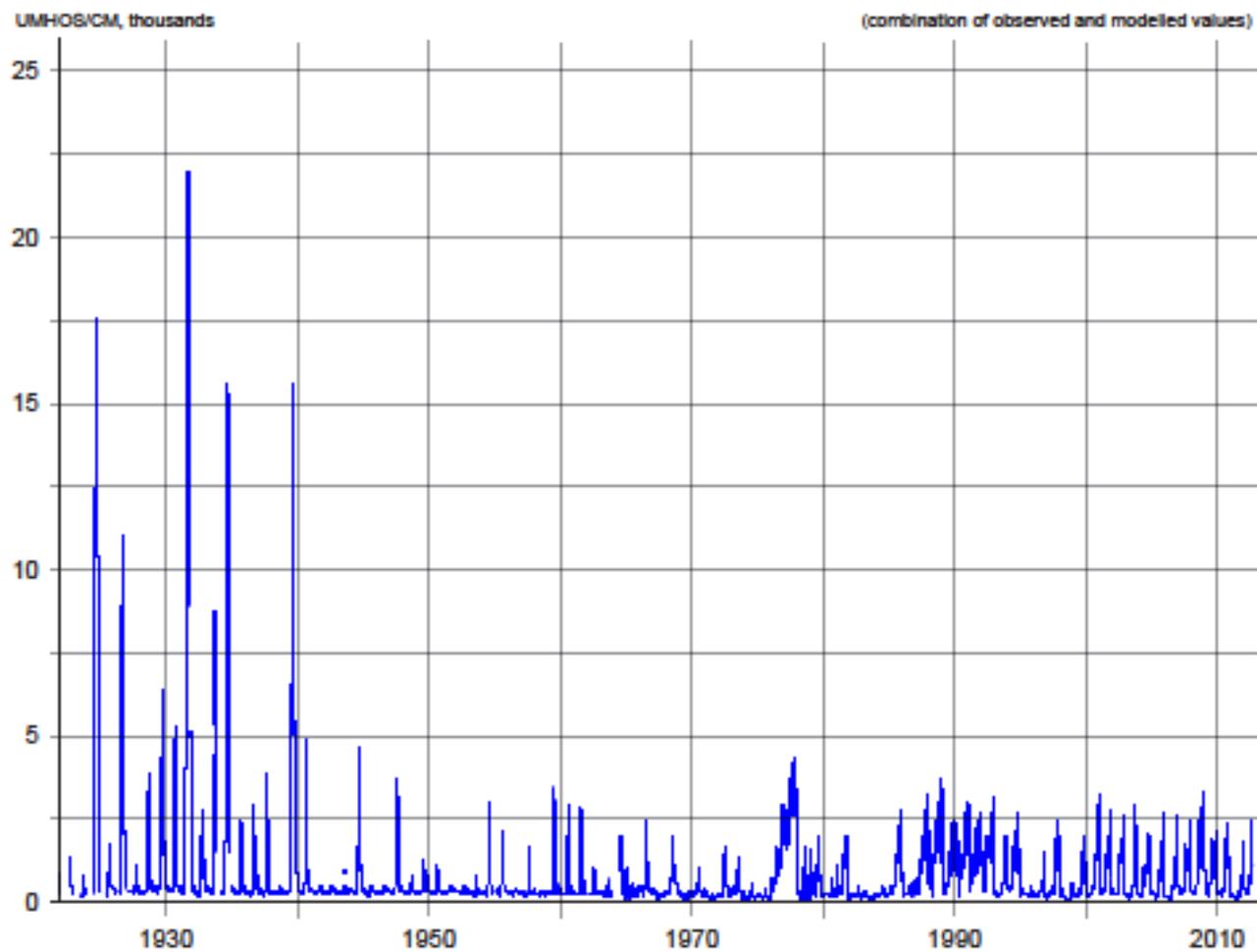




### Estimated Salinity at Emmanton, 1920-2013



## Estimated Salinity at Jersey Point, 1920-2013



# Comparison of Water Project Allocations in Dry Years

	1991	2009	2014
SWP	30% / 0%	40%	5%
SWP water rts	50%	100%	100%
CVP N of Delta Ag	25%	40%	0
CVP S of Delta Ag	25%	10%	0
Friant	100%	100%	0
CVP Sac water rts	75%	100%	75%
CVP SJ water rts	75%	100%	65%

# State Response Actions to Current Drought

# Drought Response Actions

- May 2013 Executive Order on water transfers
- Dec 2013 formation of Drought Task Force
- Jan 2014 Governor's emergency proclamation
- March 2014 drought relief proclamation
- April 2014 proclamation of emergency



# March Emergency Drought Relief Funding Highlights

\$549 million from the accelerated expenditure of voter-approved bonds, Proposition 84 and Proposition 1E, in the form of infrastructure grants for local and regional projects that are already planned or partially completed to increase local reliability, including recapturing of storm water, expanding the use and distribution of recycled water, enhancing the management and recharging of groundwater storage and strengthening water conservation.

\$30 million from the Greenhouse Gas Reduction Fund to the Department of Water Resources (DWR) for direct expenditures and grants to state and local agencies to improve water use efficiency, save energy and reduce greenhouse gas emissions from state and local water transportation and management systems.

\$14 million for groundwater management across the state, including assistance to disadvantaged communities with groundwater contamination exacerbated by the drought.

\$10 million from the Greenhouse Gas Emissions Fund for the California Department of Food and Agriculture to invest in irrigation and water pumping systems that reduce water use, energy use and greenhouse gas emissions.

\$15 million from the General Fund for Emergency Drinking Water Fund to address emergency water shortages due to drought.

\$13 million from the General Fund to augment the California Conservation Corps and local community conservation corps to expand water use efficiency and conservation activities and to reduce fuel loads to prevent catastrophic fires.

\$25.3 million from the General Fund for food assistance, which will be structured to maximize the potential federal drought assistance that can be provided to provide food assistance to those impacted by the drought.

\$21 million from the General Fund and federal funds for housing related assistance for individuals impacted by the drought.

# April 2014 Proclamation

- 1. The orders and provisions contained in Proclamation No. 1-17-2014, dated January 17, 2014, remain in full force and effect except as modified herein.
- 2. The Department of Water Resources and the State Water Resources Control Board (Water Board) will immediately and expeditiously process requests to move water to areas of need, including requests involving voluntary water transfers, forbearance agreements, water exchanges, or other means. If necessary, the Department will request that the Water Board consider changes to water right permits to enable such voluntary movements of water.
- 3. Recognizing the tremendous importance of conserving water during this drought, all California residents should refrain from wasting water:
  - a. Avoid using water to clean sidewalks, driveways, parking lots and other hardscapes.
  - b. Turn off fountains and other decorative water features unless recycled or grey water is available.
  - c. Limit vehicle washing at home by patronizing local carwashes that use recycled water.
  - d. Limit outdoor watering of lawns and landscaping to no more than two times a week.
- Recreational facilities, such as city parks and golf courses, and large institutional complexes, such as schools, business parks and campuses, should immediately implement water reduction plans to reduce the use of potable water for outdoor irrigation.
- Commercial establishments such as hotel and restaurants should take steps to reduce water usage and increase public awareness of the drought through measures such as offering drinking water only upon request and providing customers with options to avoid daily washing of towels or sheets.
- Professional sports facilities, such as basketball arenas, football, soccer, and baseball stadiums, and hockey rinks should reduce water usage and increase public awareness of the drought by reducing the use of potable water for outdoor irrigation and encouraging conservation by spectators.
- The Water Board shall direct urban water suppliers that are not already implementing drought response plans to limit outdoor irrigation and other wasteful water practices such as those identified in this Executive Order. The Water Board will request by June 15 an update from urban water agencies on their actions to reduce water usage and the effectiveness of these efforts. The Water Board is directed to adopt emergency regulations as it deems necessary, pursuant to Water Code section 1058.5, to implement this directive. Californians can learn more about conserving water from the Save Our Water campaign ([SaveOurH2O.org](http://SaveOurH2O.org)).
- 4. Homeowners Associations (commonly known as HOAs) have reportedly fined or threatened to fine homeowners who comply with water conservation measures adopted by a public agency or private water company. To prevent this practice, pursuant to Government Code section 8567, I order that any provision of the governing document, architectural or landscaping guidelines, or policies of a common interest development will be void and unenforceable to the extent it has the effect of prohibiting compliance with the water-saving measures contained in this directive, or any conservation measure adopted by a public agency or private water company, any provision of Division 4, Part 5 (commencing with section 4000) of the Civil Code notwithstanding.
- 5. All state agencies that distribute funding for projects that impact water resources, including groundwater resources, will require recipients of future financial assistance to have appropriate conservation and efficiency programs in place.
- 6. The Department of Fish and Wildlife will immediately implement monitoring of winter-run Chinook salmon in the Sacramento River and its tributaries, as well as several runs of salmon and species of smelt in the Delta as described in the April 8, 2014 Drought Operations Plan.
- 7. The Department of Fish and Wildlife will implement projects that respond to drought conditions through habitat restoration and through water infrastructure projects on property owned or managed by the Department of Fish and Wildlife or the Department of Water Resources for the benefit of fish and wildlife impacted by the drought.
- 8. The Department of Fish and Wildlife will work with other state and federal agencies and with landowners in priority watersheds to protect threatened and endangered species and species of special concern and maximize the beneficial uses of scarce water supplies, including employment of voluntary agreements to secure instream flows, relocation of members of those species, or through other measures..

# April Proclamation, con't.

- 9. The Department of Water Resources will expedite the consideration and, where appropriate, the implementation, of pump-back delivery of water through the State Water Project on behalf of water districts.
- 10. The Water Board will adopt statewide general waste discharge requirements to facilitate the use of treated wastewater that meets standards set by the Department of Public Health, in order to reduce demand on potable water supplies.
- 11. The Department of Water Resources will conduct intensive outreach and provide technical assistance to local agencies in order to increase groundwater monitoring in areas where the drought has significant impacts, and develop updated contour maps where new data becomes available in order to more accurately capture changing groundwater levels. The Department will provide a public update by November 30 that identifies groundwater basins with water shortages, details remaining gaps in groundwater monitoring, and updates its monitoring of land subsidence and agricultural land following.
- 12. The California Department of Public Health, the Office of Emergency Services, and the Office of Planning and Research will assist local agencies that the Department of Public Health has identified as vulnerable to acute drinking water shortages in implementing solutions to those water shortages.
- 13. The Department of Water Resources and the Water Board, in coordination with other state agencies, will provide appropriate assistance to public agencies or private water companies in establishing temporary water supply connections to mitigate effects of the drought.
- 14. For the protection of health, safety, and the environment, CAL FIRE, the Office of Emergency Services, the Department of Water Resources, and the Department of Public Health, where appropriate, may enter into contracts and arrangements for the procurement of materials, goods, and services necessary to quickly mitigate the effects of the drought.
- 15. Pursuant to the drought legislation I signed into law on March 1, 2014, by July 1, 2014, the California Department of Food and Agriculture, in consultation with the Department of Water Resources and Water Board, will establish and implement a program to provide financial incentives to agricultural operations to invest in water irrigation treatment and distribution systems that reduce water and energy use, augment supply, and increase water and energy efficiency in agricultural applications.
- 16. To assist landowners meet their responsibilities for removing dead, dying and diseased trees and to help landowners clear other trees and plants close to structures that increase fire danger, certain noticing requirements are suspended for these activities. Specifically, the requirement that any person who conducts timber operations pursuant to the exemptions in Title 14, California Code of Regulations sections 1038 (b) and (c) submit notices to CAL FIRE under the provisions of Title 14, California Code of Regulations, section 1038.2 is hereby suspended. Timber operations pursuant to sections 1038(b) and (c) may immediately commence operations upon submission of the required notice to CAL FIRE and without a copy of the Director's notice of acceptance at the operating site. All other provisions of these regulations will remain in effect.
- 17. The Water Board will adopt and implement emergency regulations pursuant to Water Code section 1058.5, as it deems necessary to prevent the waste, unreasonable use, unreasonable method of use, or unreasonable method of diversion of water, to promote water recycling or water conservation, and to require curtailment of diversions when water is not available under the diverter's priority of right.
- 18. In order to ensure that equipment and services necessary for drought response can be procured quickly, the provisions of the Government Code and the Public Contract Code applicable to state contracts, including, but not limited to, advertising and competitive bidding requirements, are hereby suspended for directives 7 and 14. Approval by the Department of Finance is required prior to the execution of any contract entered into pursuant to these directives.
- 19. For several actions called for in this proclamation, environmental review required by the California Environmental Quality Act is suspended to allow these actions to take place as quickly as possible. Specifically, for actions taken by state agencies pursuant to directives 2, 3, 6--10, 13, 15, and 17, for all actions taken pursuant to directive 12 when the Office of Planning and Research concurs that local action is required, and for all necessary permits needed to implement these respective actions, Division 13 (commencing with section 21000) of the Public Resources Code and regulations adopted pursuant to that Division are hereby suspended. The entities implementing these directives will maintain on their websites a list of the activities or approvals for which these provisions are suspended. This suspension and that provided in paragraph 9 of the January 17, 2014 Proclamation will expire on December 31, 2014, except that actions started prior to that date shall not be subject to Division 13 for the time required to complete them.
- 20. For several actions called for in this proclamation, certain regulatory requirements of the Water Code are suspended to allow these actions to take place as quickly as possible. Specifically, for actions taken pursuant to directive 2, section 13247 of the Water Code is suspended. The 30-day comment period provided in section 1726(f) of the Water Code is also suspended for actions taken pursuant to directive 2, but the Water Board will provide for a 15-day comment period. For actions taken by state agencies pursuant to directives 6 and 7, Chapter 3 of Part 3 (commencing with section 85225) of the Water Code is suspended. The entities implementing these directives will maintain on their websites a list of the activities or approvals for which these provisions are suspended.

# More Details

- Coordinating operations of SWP and CVP to meet the severe hydrologic conditions
  - Delta export levels
  - ESA BiOps, Water Quality Control Plan
  - Carry-over for 2015
- Planning for emergency temporary Delta barriers, if needed in 2015
- DWR-ACWA Save Our Water program
- Facilitating water transfers
- Administering local assistance funding
- Drought-focused contracts/studies, for example:
  - Water use efficiency (many projects)
  - Improving seasonal forecasting
  - Tracking land subsidence (NASA contract)
  - Tracking Central Valley ag land fallowing (NASA/NIDIS project)

State of California The Resources

Agency Department of Water

Resources

**Public Update for Drought Response Groundwater Basins  
with Potential Water Shortages and Gaps in  
Groundwater Monitoring**



**April 2014**

Edmund Brown Jr.  
Governor  
State of California

John Laird  
Secretary for Resources  
The Resources Agency

Mark W. Cowin  
Director  
Department of Water  
Resources

# A Few Report Highlights

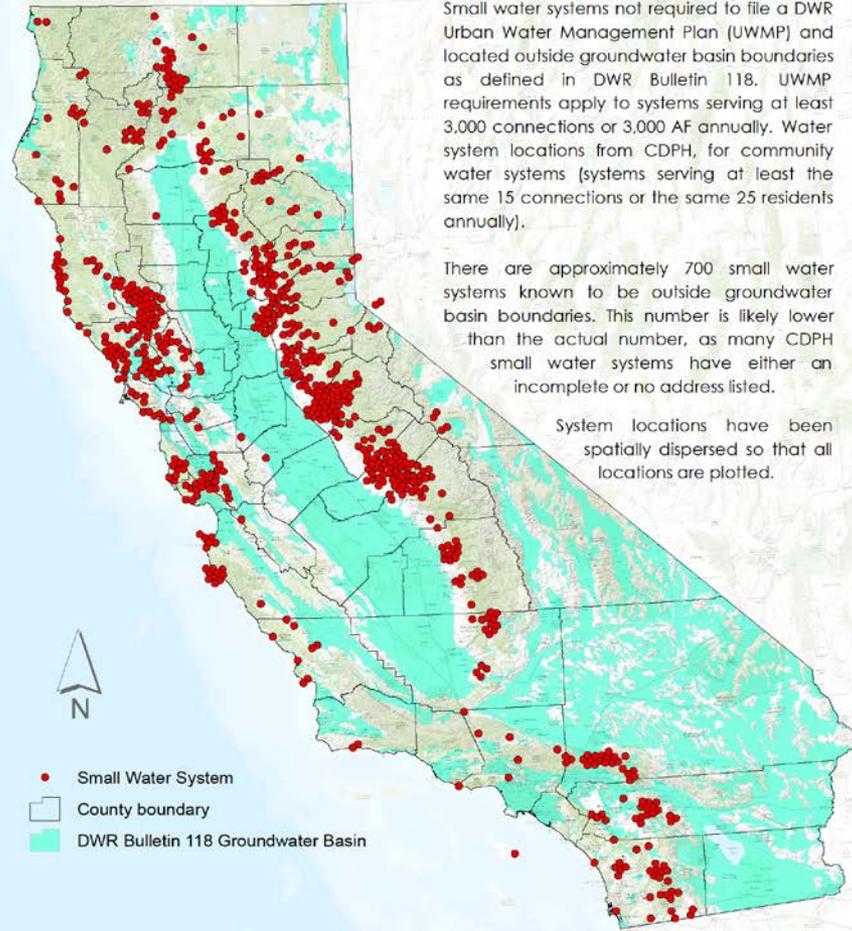
- Since spring 2008, groundwater levels have experienced all-time historical lows in most areas of the state
- In many areas of the SJV, groundwater levels are more than 100 feet below previous historical lows
- Of California's 515 alluvial groundwater basins, 169 are fully or partly monitored under CASGEM; 40 of the 126 high and medium priority basins are not monitored
- The greatest concentration of recently deepened wells is the fractured rock foothill areas of Nevada, Placer, & El Dorado Counties

# One of DWR's Taskings in April 2014 Proclamation

- 11. The Department of Water Resources will conduct intensive outreach and provide technical assistance to local agencies in order to increase groundwater monitoring in areas where the drought has significant impacts, and develop updated contour maps where new data becomes available in order to more accurately capture changing groundwater levels. The Department will provide a public update by November 30 that identifies groundwater basins with water shortages, details remaining gaps in groundwater monitoring, and updates its monitoring of land subsidence and agricultural land following.
  - CASGEM groundwater level monitoring
  - NASA land subsidence contract
  - NASA land following monitoring

# Small Water Systems Outside Groundwater Basins

As of February 21, 2014



1:1,542,907  
Coordinate System: NAD 1983 UTM Zone 10N  
Projection: Transverse Mercator

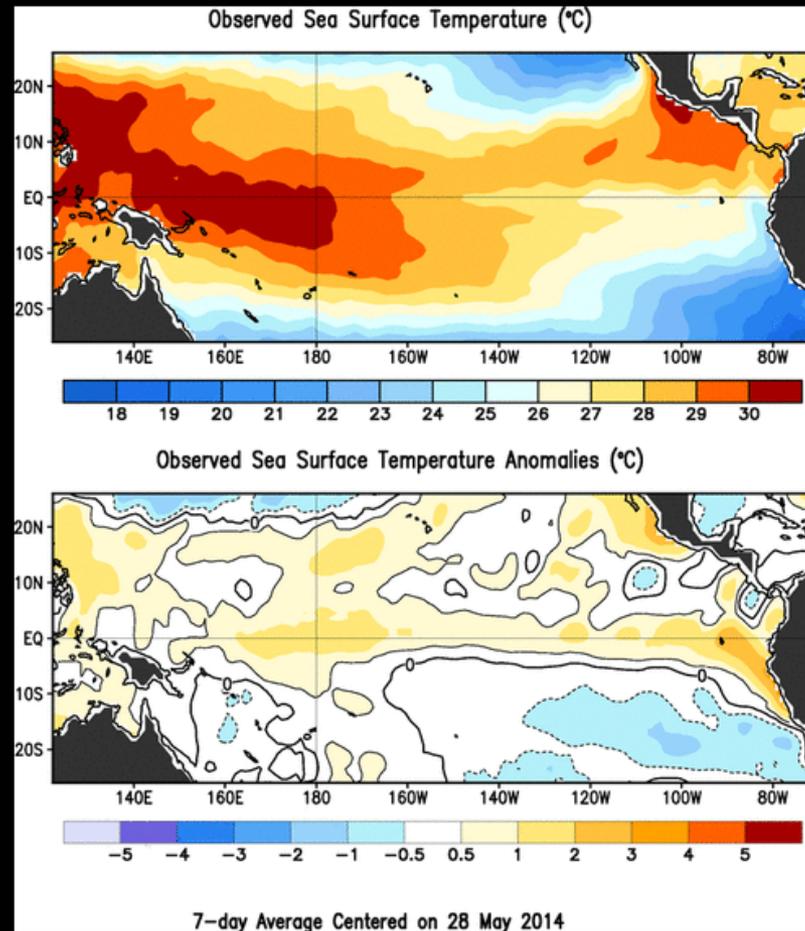






Do past big droughts share common climate characteristics?

(And can we infer anything about WY 2015 prospects?)



# Improved Climate Forecasting

- Intraseasonal to interannual forecasting is scientifically difficult...
- National Weather Service operational weather forecasts – out to about 10 days
- NOAA Climate Prediction Center outlooks for temperature & precipitation (30 days – 1 year)

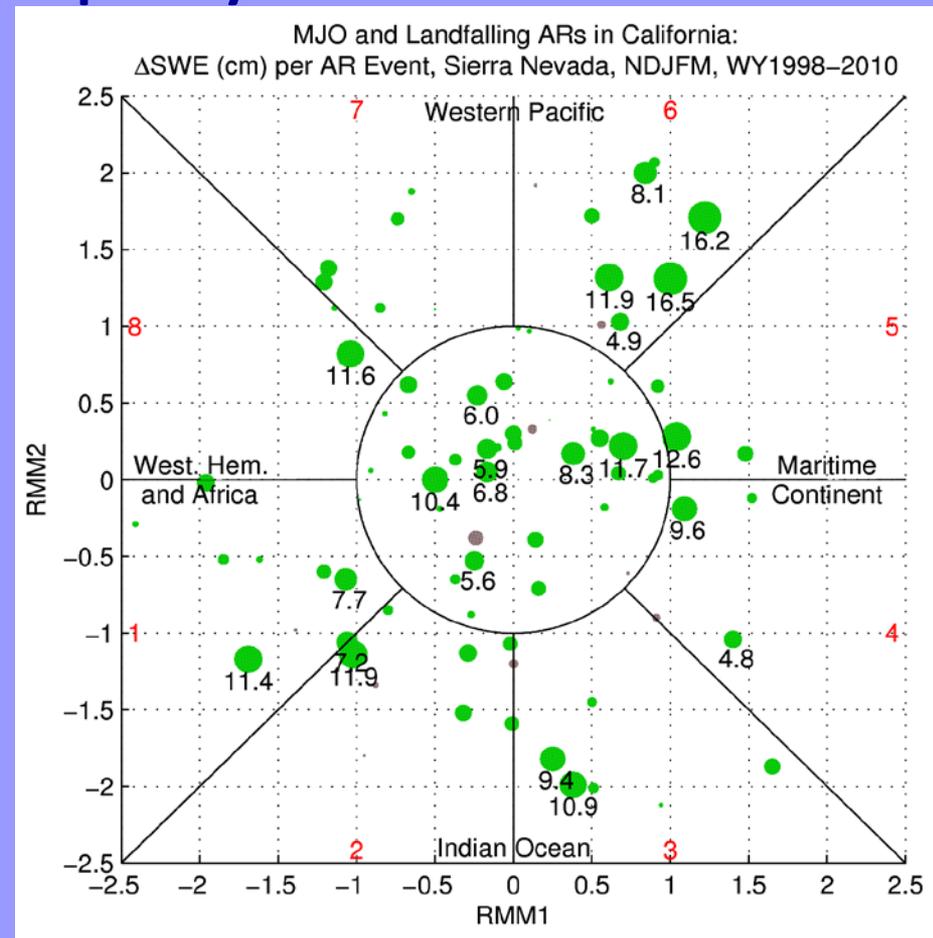
# So Where Do We Go From Here?

- DWR Winter Outlook Workshops held in each of the last 6 years
  - (Statistical forecast experimental seasonal forecast)
- Using the past to inform the future
  - Paleoclimate information, e.g. quasi-decadal oscillation
  - Analog years
- Forecasts of opportunity, emerging info

# Seasonal Forecasting Example: Does the MJO Influence Atmospheric Rivers Timing or Frequency?

AR events during WY 1998-2010 are plotted in relation to the phase and amplitude of the MJO. The amplitude of the AR is shown in terms of  $\Delta$ SWE as size of green circles. AR dots/events inside the unit circle occur during weak/no MJO. AR dots/events outside unit circle occur during strong MJO events in the given phase of the MJO life-cycle.

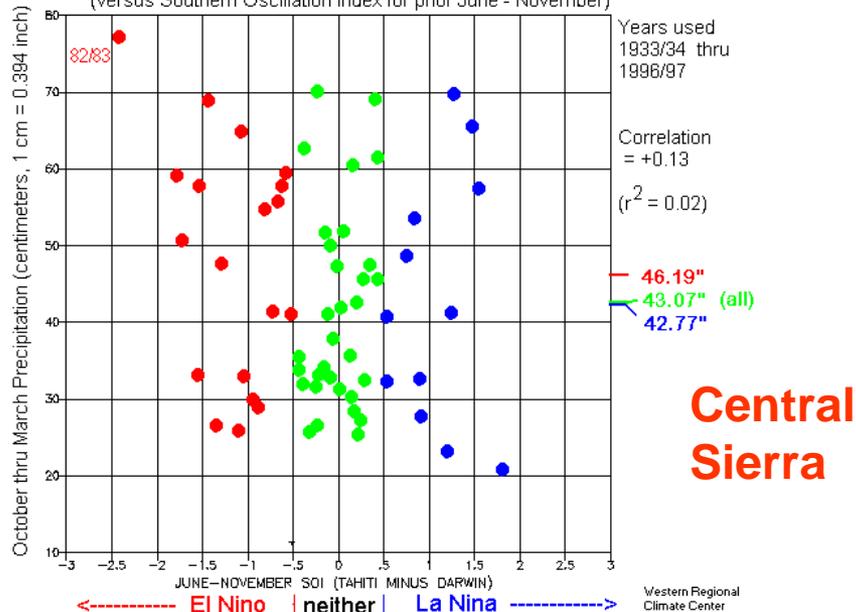
More high-impact ARs are observed during **MJO phase 6 – convection in the W. Pacific Ocean**, including the top two events during WY1998-2010



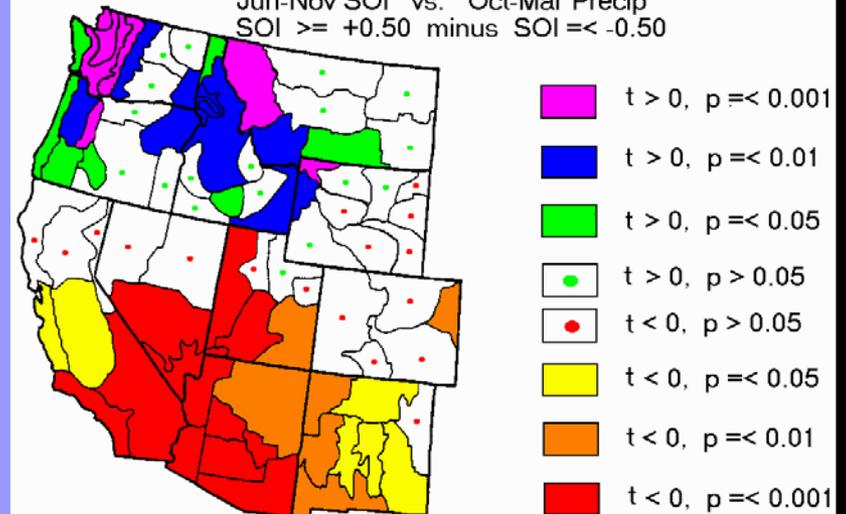
Guan, B., D. E. Waliser, N. Molotch, E. Fetzer, P. Neiman, 2012: Does the Madden-Julian Oscillation Influence Wintertime Atmospheric Rivers and Snowpack in the Sierra Nevada?, *Mon. Wea. Rev.*, 140, 325–342,

# ENSO & Precipitation Correlation (courtesy of Kelly Redmond, DRI)

**California 8-Station Index October thru March Precipitation**  
(versus Southern Oscillation Index for prior June - November)



**Split Samples:**  
Jun-Nov SOI vs. Oct-Mar Precip  
SOI  $\geq +0.50$  minus SOI  $\leq -0.50$



Updated from Redmond and Koch (1991). Winters of 1933/34 - 1994/95.  
Reddish: Composite El Nino winters are wet, La Nina winters are dry.  
Bluish/greenish: Composite El Nino winters are dry, La Nina winters are wet.

**Redmond & Koch,  
1991, updated.**

Redmond, K.T., and R.W. Koch, 1991. Surface climate and streamflow variability in the western United States and their relationship to large-scale circulation indices. *Water Resources Research*, 27(9), 2381-2399.

# What Does it Take to End a Drought?

