

Before and after photo of Lake Folsom comparing 2011 to 2014. (Photo credit: California Department of Water Resources)



## ASSESSMENT REPORT

# Causes and Predictability of the 2011 to 2014 California Drought

## How severe has the California Drought been?

California statewide precipitation during the last three winters (November-April 2011/2012 through 2013/2014) ranked the second lowest since official measurements began in 1895. Only the consecutive three-year period of 1974/1975 through 1976/1977 was drier. As one critical indication of the cumulative and growing impact of this drought, the September 2014 assessment of statewide water storage was only about 50% of average for this time of year, according to the California Department of Water Resources. Water supply depletion has not resulted from the lack of precipitation alone, but also from very high temperatures with the 2013/2014 winter being the state's warmest on record.

As the new 2014/2015 wet season commences, the current state of drought as assessed by the US Drought Monitor indicates almost all of California to be experiencing extreme to exceptional drought severity. The situation deteriorated greatly during the past year – the third consecutive year of low precipitation and the driest of the three. Exceptional drought conditions cover over half of the state as of December 4, 2014, whereas one year earlier no regions in the state were considered to be under exceptional drought conditions.

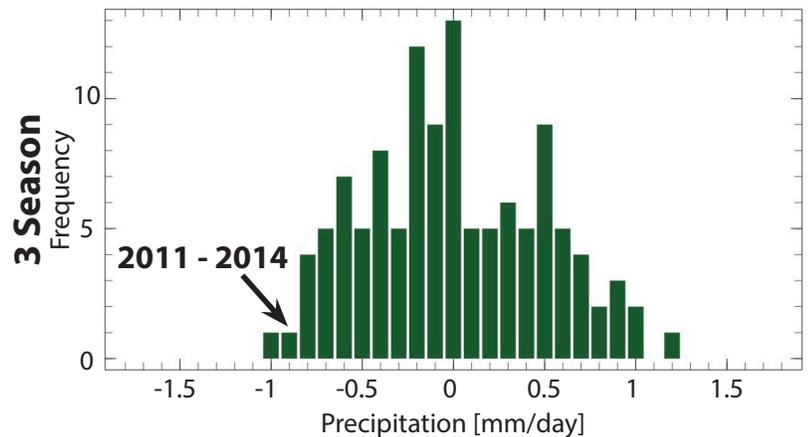
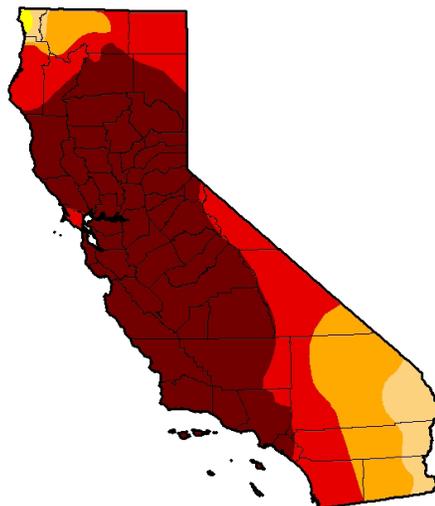


FIGURE 1

Three year average winter all-California precipitation for 1895/1896 to 2013/2014 from NOAA Climate Division Data.

### U.S. Drought Monitor California



December 2, 2014  
(Released Thursday, Dec. 4, 2014)  
Valid 7 a.m. EST

#### Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	99.72	94.42	79.69	55.08
Last Week 11/25/2014	0.00	100.00	99.72	94.42	79.69	55.08
3 Months Ago 09/29/14	0.00	100.00	100.00	95.42	81.92	58.41
Start of Calendar Year 12/01/2013	2.61	97.39	94.25	87.53	27.59	0.00
Start of Water Year 09/01/14	0.00	100.00	100.00	95.04	81.92	58.41
One Year Ago 12/02/13	2.61	97.39	94.15	82.53	27.59	0.00

#### Intensity

D0 Abnormally Dry D3 Extreme Drought  
D1 Moderate Drought D4 Exceptional Drought  
D2 Severe Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:  
Anthony Artusa  
NOAA/NWS/NCEP/CPC



FIGURE 2

Source: United States Drought Monitor: <http://droughtmonitor.unl.edu>

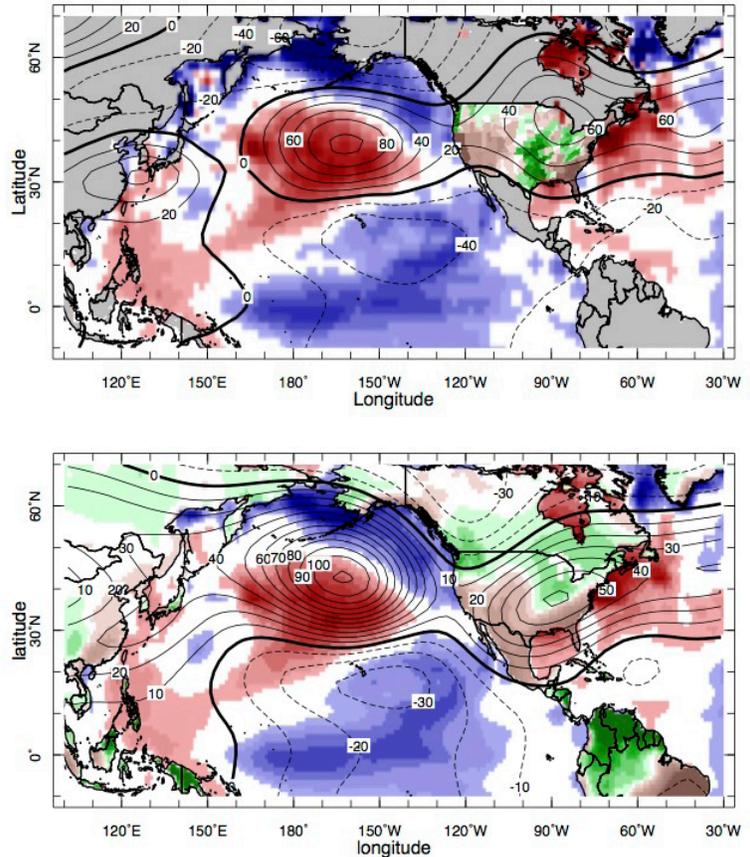
## What factors caused the California Drought?

- Weather conditions were key to explaining the event – a high pressure ridge off the West Coast diverted the track of storms during all three winters, typical of historical droughts.
- West Coast high pressure was rendered more likely during 2011-14 by effects of sea surface temperature patterns over the world oceans.
- The drought's first year (2011/2012) was likely the most predictable, when La Niña effects largely explained high pressure off the West Coast, though simulations indicate that high pressure continued to be favored due to ocean effects in 2012-14.

## Is the California Drought a symptom of long term climate change?

The current drought is not part of a long-term change in California precipitation, which exhibits no appreciable trend since 1895. Key oceanic features that caused precipitation inhibiting atmospheric ridging off the West Coast during 2011-14 were symptomatic of natural internal atmosphere-ocean variability.

Model simulations indicate that human-induced climate change increases California precipitation in mid-winter, with a low-pressure circulation anomaly over the North Pacific, opposite to conditions of the last 3 winters. The same model simulations indicate a decrease in spring precipitation over California. However, precipitation deficits observed during the past three years are an order of magnitude greater than the model simulated changes related to human-induced forcing. Nonetheless, record setting high temperature that accompanied this recent drought was likely made more extreme due to human-induced global warming.

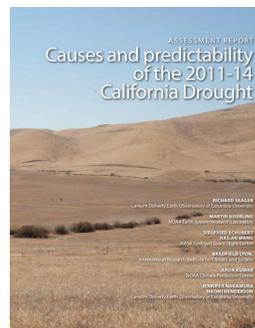


**FIGURE 3**

The 200mb height (contours), sea surface temperature (color, ocean), and U.S. precipitation (color, land) anomalies for November 2011-April 2012 observed (top) and average of 150 climate simulations (bottom). Red (blue) denotes warm (cold), and brown (green) denotes dry (wet).

## Assessment Report Details

### Causes and Predictability of the 2011 to 2014 California Drought



December 2014

Composed by the Narrative Team of the NOAA Drought Task Force

Lead Author: R. Seager

Co-Authors: M. Hoerling, S. Schubert, H. Wang, B. Lyon, A. Kumar, J. Nakamura, N. Henderson

The NOAA Drought Task Force is organized by the Modeling, Analysis, Predictions and Projections (MAPP) Program of the NOAA/OAR Climate Program Office

