



NOAA AND THE CALIFORNIA WATER ACTION PLAN

A partnership for resilience

Seasonal drought outlook

Drought tendency through August 31, 2016



Drought persists or intensifies

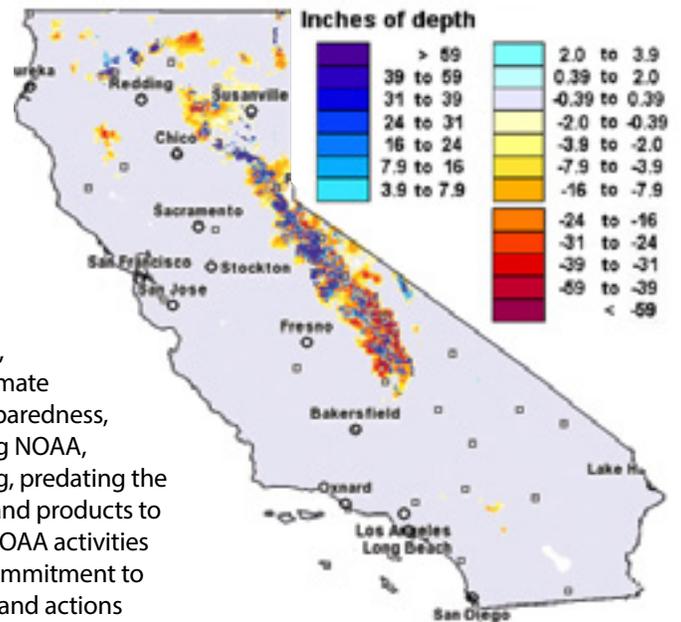
http://www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.php

In response to the ongoing California drought, Gov. Edmund G. Brown Jr. released the California Water Action Plan (CWAP) in 2014, directing the California Natural Resources Agency, the California Environmental Protection Agency, and the California Department of Food and Agriculture to identify key actions for the next one to five years, to (1) address urgent needs and (2) provide the foundation for the sustainable management of California's water resources.

NOAA and its partners have been providing California with research, analyses, publications, forecasts, communications, workshops and climate and drought outlooks to support drought preparedness, mitigation and recovery. Collaborations among NOAA, NIDIS and California partners are long-standing, predating the present drought, focused on linking research and products to support managers and decision makers. The NOAA activities listed below illustrate the agency's ongoing commitment to support the state in addressing specific issues and actions identified in the CWAP.

Snow depth: departure from normal

Map compares normal depth of snow pack to current levels as of May 13, 2016



<http://www.nohrsc.noaa.gov/interactive/html/map.html>

UNCERTAIN WATER SUPPLIES

NOAA actions:

- **Analyze the effects of climate change and climate variability** on water supplies and resources.
- **Develop and distribute public briefing documents** about the most up-to-date science on influences of droughts, atmospheric rivers, and El Niño on water supply variability and reliability.
- **Construct drought scenarios** to assess potential impacts and trajectories, to help regions prepare for the next drought.

RESOURCES AND LINKS

[California Climate Data Archive](#)
[Great Basin Weather and Climate Dashboard](#)
[Will El Niño Make a Difference?](#)
[Our Changing Climate 2012: Vulnerability and Adaptation to the Increasing Risks from Climate Change in California](#)
[California Climate Extremes Workshop Report 2011](#)
[Southwest Climate Assessment Summary for Decision Makers, 2012](#)
[Statistical Downscaling Using Localized Constructed Analogs \(LOCA\)](#)

WATER SCARCITY/DROUGHT

NOAA actions:

- **Document the surprisingly strong role of major storms and floods** in ending previous droughts in California, and the role of the occurrence or absence of any major atmospheric river storms in cycles of plenty and drought.
- **Monitor fallowed land extent** monthly within-season in the Central Valley using satellite imagery. Knowledge of the amount and spatial distribution of fallowing helps agricultural communities and government make informed decisions to reduce the impacts of water shortage and have helped the state locate county food banks. This research is being operationalized into a tool for the California Department of Water Resources.

RESOURCES AND LINKS

[Atmospheric rivers as drought busters on the US west coast](#)
[Drought and the California Delta—A matter of extremes: San Francisco Estuary and Watershed Science](#)
[Flooding on California's Russian River—Role of atmospheric rivers](#)
[National Geographic issue on the 2014 California Drought](#)

POOR WATER QUALITY

NOAA actions:

- **Evaluate the historic roles of major storms on salinity** in the Delta, and how those impacts have changed with modern water management procedures.
- **Map saltwater inundation from sea level rise** in high-resolution.
- **Quantify water lost** during the drought using GPS sensors, in coordination with Scripps Institution of Oceanography.

RESOURCES AND LINKS

[Climate change projections of sea-level extremes along the California coast](#)
[Contemporaneous Subsidence and Levee Overtopping Potential, Sacramento-San Joaquin Delta](#)
[Ongoing drought-induced uplift in the western United States](#)
[Promoting atmospheric-river and snowmelt fueled biogeomorphic processes by restoring river-floodplain connectivity in California's Central Valley](#)

DECLINING GROUNDWATER

NOAA actions:

■ **Develop simulation models** that couple climate change projections directly to and through groundwater flow and storage simulations for the Central Valley.

RESOURCES AND LINKS

[Integrated simulation of consumptive use and land subsidence in the Central Valley, California, for the past and for a future subject to urbanization and climate change](#)

[A method for physically-based model analysis of conjunctive use in response to potential climate changes](#)

DECLINING NATIVE FISH SPECIES AND LOSS OF WILDLIFE

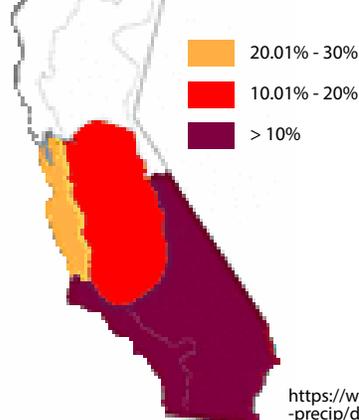
NOAA actions:

■ **Characterize the historic role of major atmospheric-river storms** in initiating ecologically beneficial inundations (Yolo Bypass of the Sacramento River, floodplains along the unregulated Cosumnes River, as proxies for floodplain habitats in the Central Valley).

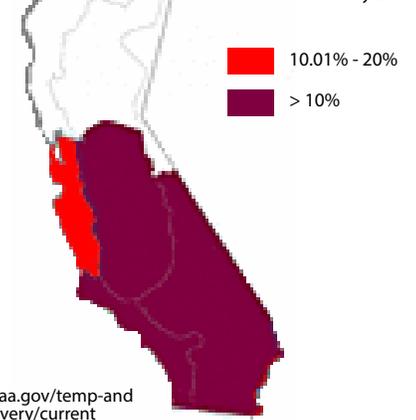
■ **Develop indicators** to protect fish populations in the Russian River through work with stakeholders to study hydrologic extremes.

■ **Monitor water temperature** behind Shasta Dam to help wildlife managers determine how much of the river can be maintained at a low enough temperature for salmon eggs to survive, and how long can they do so before running out of enough cold water.

Probability of precipitation to ameliorate current drought in six months As of May 2016



Probability of precipitation to end current drought in six months As of May 2016



<https://www.ncdc.noaa.gov/temp-and-precip/drought/recovery/current>

FLOODS

NOAA actions:

■ **Research atmospheric rivers** to understand and better predict major flood events in California, and help communities to reduce their vulnerability.

■ **Examine stakeholder perspectives** on vulnerabilities and preparedness for an extreme storm event in the greater Lake Tahoe, Reno, and Carson City region.

■ **Characterize of the historic role of atmospheric-river storms** in causing levee breaks in the Central Valley and Delta, where levees are still the primary defense against salinity intrusions.

RESOURCES AND LINKS

[Flooding on California's Russian River—Role of atmospheric rivers](#)

[Atmospheric rivers, floods, and the water resources of California](#)

[Storms, floods and the science of atmospheric rivers](#)

[Historical and national perspectives on extreme west-coast precipitation associated with atmospheric rivers during December 2010](#)

[The coming megafloods](#)

LOOKING AHEAD: MANAGING AND PREPARING FOR DRY PERIODS

NOAA actions:

■ **Develop and provide drought early warning information** to decision makers throughout California, including leading drought preparedness activities involving more than 100 water agencies, organizations, industries, tribes, and other stakeholders. Partners include the California Rural Water Association, California Department of Water Resources, and California-Nevada Applications Program (CNAP), U.S. Geological Survey and NASA.

■ **Address drought issues and water demands in urban areas** of Southern California, where water supplies are primarily imported and demands heavily residential. NOAA works with stakeholders develop tools for drought assessment and forecasting directly relevant to stakeholders, and to assess drought conditions.

■ **Characterize and understand historic droughts** using stakeholder-informed

indicators. For example, NOAA developed a percentile-based indicator system for assessing present drought in the context of the frequency and severity of historic events. Among the findings: the severity of drought conditions developing in early 2014, based on a 12-month precipitation anomaly, would be expected to occur less than once every 10,000 years.

■ **Develop Forecast-Informed Reservoir Operations (FIRO)** with several partners, a management strategy that uses data from watershed monitoring and weather and water forecasting to help managers selectively retain or release water in a manner that reflects current and forecast conditions.

■ **Develop an integrated water resources monitor and outlook** to represent the current and seasonally forecast state of water resources including precipitation, snow, runoff into reservoirs,

soil moisture, and other variables important to water management (proposal under consideration).

■ **Refine existing drought amelioration tools** to make them more relevant and useful to California's hydrology.

■ **Assess NOAA drought-related services** to improve decision support for decision makers and stakeholders.

■ **Develop tools and estimates** to update the Central Valley Hydrologic Model (CVHM) developed by USGS/California Water Science Center to calculate real-time estimates of groundwater pumping through a collaborative effort between USGS and CNAP.

■ **Develop enhanced visualization and analysis tools** and establish a more direct link between drought early warning and wildfire management and planning within the California-Nevada Drought Early Warning System (CA-NV DEWS).

FIND OUT MORE about NIDIS' California Drought Early Warning System: <https://www.drought.gov/drought/dews/california/about>

