Contributors

Ben McMahan
SWCO Editor; Research, Outreach & Assessment Specialist (CLIMAS)

Mike Crimmins
UA Extension Specialist

Dave Dubois
New Mexico State Climatologist

Gregg Garfin
Founding Editor and Deputy Director of Outreach, Institute of the Environment

Nancy J. Selover
Arizona State Climatologist

Betsy Woodhouse
Institute of the Environment

Published by the Climate Assessment for the Southwest (CLIMAS), with support from University of Arizona Cooperative Extension, the Arizona State Climate Office, and the New Mexico State Climate office.

February Southwest Climate Outlook

Precipitation & Temperature: January precipitation totals were above average in Arizona, and in New Mexico they ranged from much-above average to record wettest (Fig. 1a). January temperatures were average to above average in Arizona, and above average in New Mexico (Fig. 1b). February precipitation to date has been variable across the West. In Arizona, it has been mostly below average; in New Mexico, a few large pockets have received impressive precipitation; and widespread activity has occurred across Northern California and the upper Great Basin (Fig. 2a). February temperatures have been well-above average across the southern two-thirds of the western U.S., with particularly warm temperatures in parts of Utah and Colorado (Fig. 2b). Water-year precipitation is average to above average across most of the Southwest except for southern Arizona and much of southeastern New Mexico (Fig. 3).

Snowpack & Water Supply: Over the past 30 days, numerous storm events brought substantial precipitation to much of the West, particularly northern California and the upper Colorado River Basin, contributing to large increases in snowpack across much of the West. This welcome precipitation was accompanied by increased temperatures, leading to serious reservoir management issues in California (i.e. the Oroville dam spillway concerns) and necessitating small mid-winter releases in the Verde River system in Arizona. Current snow water equivalent (SWE) is well-above average across much of the Intermountain West, but the extent to which above-average temperatures will affect water storage dynamics across the West (e.g., rain vs. snow, storage, evaporation, runoff, infiltration, etc.) remains to be seen. SWE is average to above average across the higher elevation areas of central and northern Arizona and New Mexico, but below average in southern portions of both states (Fig. 4). Spring and summer streamflow forecasts for Arizona and New Mexico reflect the abundant snowpack, ranging from 90 to 180 percent of average.

Drought: Long-term drought conditions remain across much of the Southwest (Fig. 5), although the recent run of moisture in the West has diminished drought in regions of northern California and parts of the Intermountain West. According to the February 16 U.S. Drought Monitor, much of Arizona is designated as abnormally dry (D0) or experiencing moderate drought (D1). The far southwestern corner of the state is still designated as experiencing severe drought (D2), reflecting the persistent multi-year drought conditions extending from central and Southern California. Recent storm events have reduced drought conditions in parts of New Mexico, but the Drought Monitor still identifies a small pocket in eastern New Mexico as abnormally dry (D0) or in moderate drought (D1).

El Niño Southern Oscillation: The La Niña event of 2016-2017 is officially over, but as a weak event that quickly faded to neutral conditions, it may be difficult to distinguish La Niña's influence from the already dry signal of southwestern winters. Neutral conditions are expected to remain for at least the next few months, with a longer-term view suggesting a possible return of El Niño conditions.

Precipitation & Temperature Forecasts: The February 16 NOAA Climate Prediction Center's outlook for March calls for increased chances of below-average precipitation and above-average temperatures across the region. The three-month outlook for March through May also calls for increased chances of below-average precipitation (Fig. 6, top) and above-average temperatures (Fig. 6, bottom).

Tweet Feb SW Climate Outlook

CLICK TO TWEET

FEB2017 @CLIMAS_UA SW Climate Outlook & Summary, ENSO Tracker, Reservoir Volumes -- http://bit.ly/2lZ6I8T #SWclimate #AZWX #NMWX #SWCO

ARIZONA

CLIMAS Climate Assessment for the Southwest A NOAA RISA TEAM

THE UNIVERSITY OF ARIZONA College of Agriculture & Life Sciences Cooperative Extension

NM STATE UNIVERSITY

NIDIS

February Southwest Climate Outlook

Online Resources

Figure 1
National Center for Environmental Information
http://www.ncdc.noaa.gov

Figure 2
High Plains Regional Climate Center
http://www.hprcc.unl.edu/

Figures 3-4
Western Regional Climate Center
http://www.wrcc.dri.edu/

Figure 5
U.S. Drought Monitor
http://droughtmonitor.unl.edu/

Figure 6
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

CLIMAS YouTube Channel

Visit our YouTube channel for videos of content pulled from the podcast.

www.youtube.com/user/UACLIMAS/

Podcasts

Visit our website or iTunes to subscribe to our podcast feed.

www.climas.arizona.edu/media/podcasts

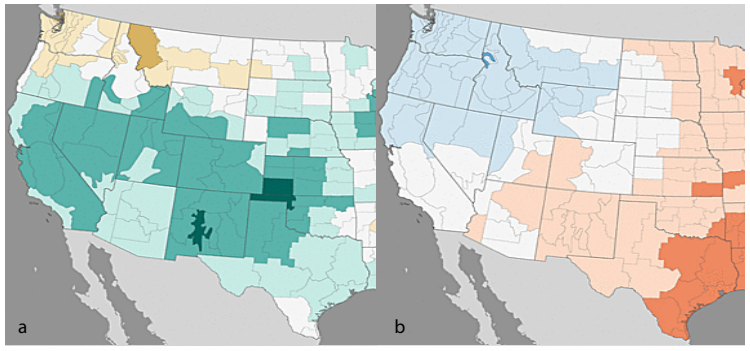


Figure 1: Jan 2017 Precipitation (a) & Temperature Ranks (b)

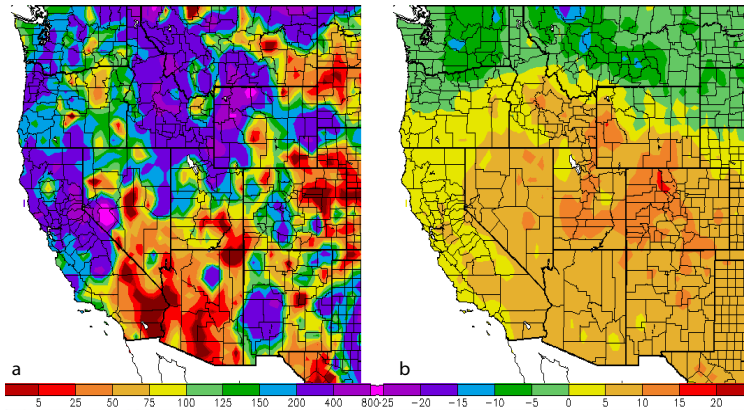


Figure 2: Feb 2017 Pct. of Ave. Precip. (a) & Temp. Departure from Ave. (b)

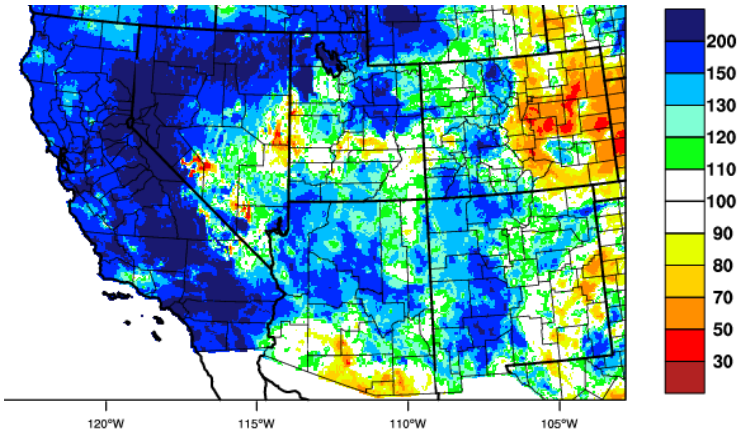


Figure 3: Water Year (Oct 2016-Jan2017) Pct. of Normal Precipitation

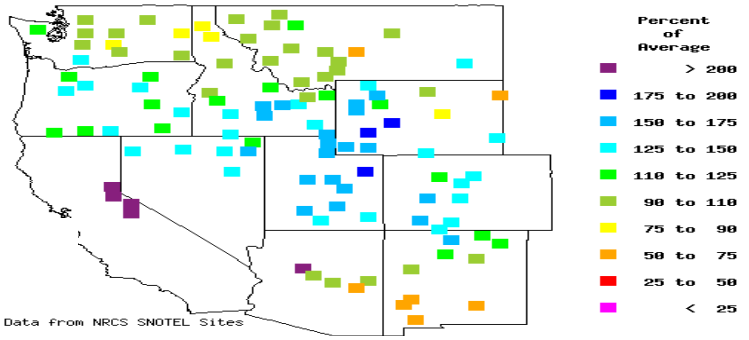


Figure 4: Basin Percent of Average Snow Water Equivalent (Feb 15, 2017)

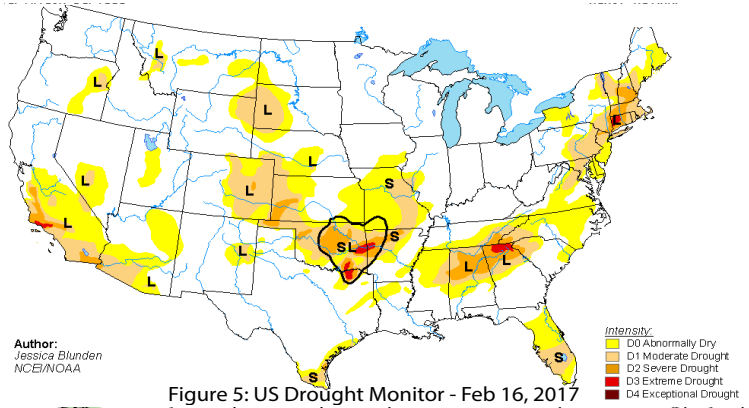


Figure 5: US Drought Monitor - Feb 16, 2017

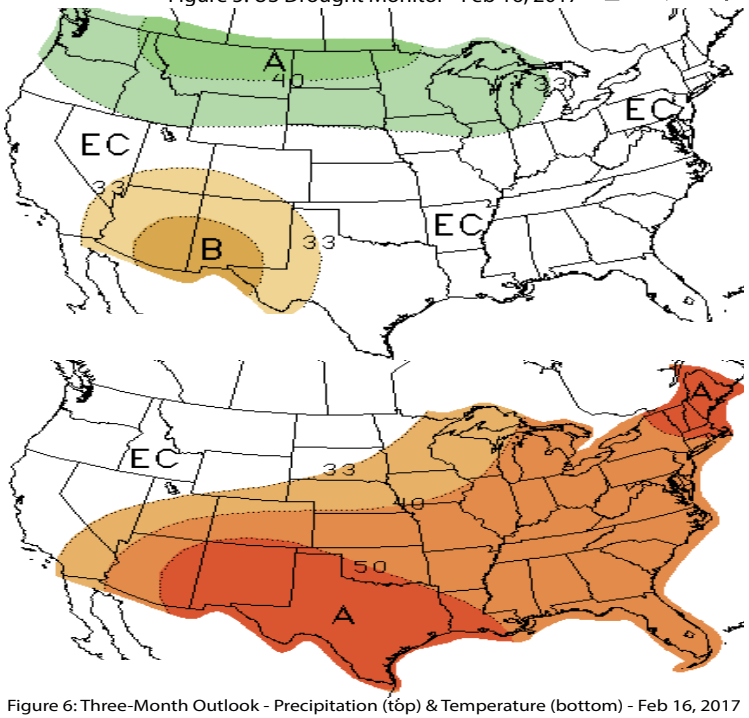


Figure 6: Three-Month Outlook - Precipitation (top) & Temperature (bottom) - Feb 16, 2017

Online Resources

Figure 1
Australian Bureau of Meteorology
http://www.bom.gov.au/climate/enso/index.shtml

Figure 2
NOAA - National Climatic Data Center
http://www.ncdc.noaa.gov/teleconnections/enso/

Figure 3
International Research Institute for Climate and Society
http://iri.columbia.edu/our-expertise/climate/forecasts/enso/

Figure 4
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

El Niño / La Niña

Information on this page is also found on the CLIMAS website:

www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation

ENSO Tracker

The La Niña event of 2016-2017 is officially over, with oceanic and atmospheric indicators of the El Niño-Southern Oscillation (ENSO) having returned to neutral conditions (Figs. 1-2). Neutral conditions are expected to remain in place for the next few months, but the usual difficulty in accurate forecasting that occurs in the spring means the current ENSO forecast includes a wide range of timing and uncertain outcomes. Most forecast agencies are predicting that ENSO-neutral conditions will remain in place through at least spring 2017, with a possible return of El Niño conditions sometime in mid-to-late 2017.

This forecast reflects the current understanding of ENSO patterns based on statistical models using data from past events, but until dynamical models (based on observations and conditions) are available later this spring and summer, these forecasts should be taken with a grain of salt. That said, a closer look at the forecasts and seasonal outlooks provides insight into the range of predictions for the rest of winter and the ENSO signal for the rest of 2017. On Feb. 9, the NOAA Climate Prediction Center (CPC) gave its final La Niña advisory, indicating oceanic and atmospheric conditions had returned to ENSO-neutral conditions. They forecast a 60-percent chance of ENSO-neutral conditions through summer 2017, and a 50-percent chance of El Niño conditions in the second half of 2017. On Feb. 10, the Japanese Meteorological Agency (JMA) declared that observed conditions, while generally indicative of a weak La Niña event, did not meet the JMA definition for a La Niña event. They forecast a 60-percent probability of ENSO-neutral conditions lasting through summer 2017. On Feb. 14, the Australian Bureau of Meteorology maintained an inactive status for its ENSO outlook, with "virtually all indicators close to average values," and with warming oceanic conditions indicating neutral or El Niño conditions as the most likely outcome for 2017. On Feb. 16, the International Research Institute for Climate and Society (IRI) and CPC declared the La Niña over and "squarely in neutral," and their forecast was split between dynamical models pointing towards El Niño and statistical models pointing towards neutral (Fig. 3). The North American Multi-Model Ensemble (NMME) characterizes the current model spread and highlights the variability looking forward to 2017. The NMME mean is forecast to remain ENSO-neutral through spring, but reaches the threshold of weak El Niño by summer (Fig. 4).

(continued on next page)

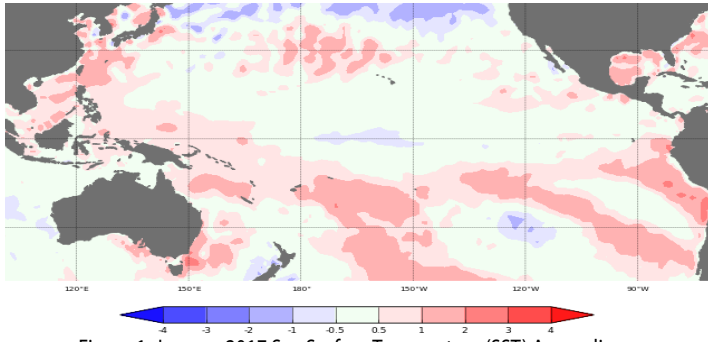


Figure 1: January 2017 Sea Surface Temperature (SST) Anomalies

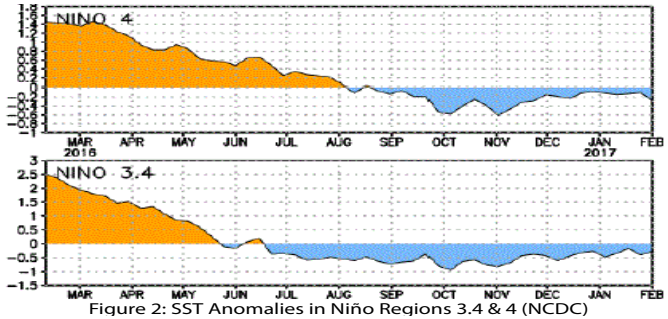


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

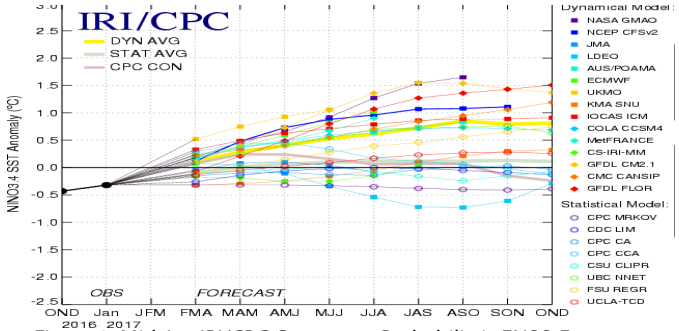


Figure 3: Mid-Jan IRI/CPC Consensus Probabilistic ENSO Forecast

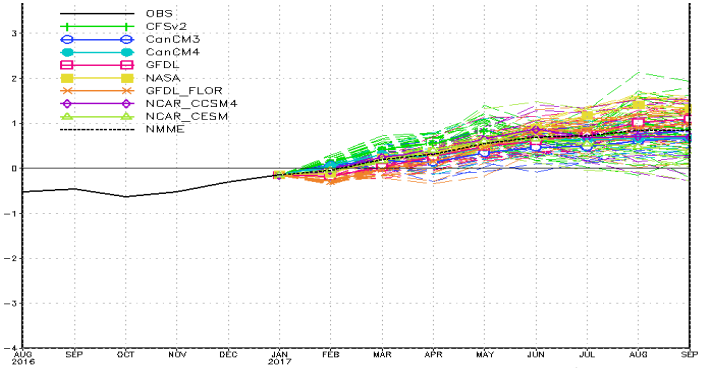


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figure 5
Climate Science Applications Program
http://cals.arizona.edu/climate

Figures 6
Natural Resources Conservation Service
http://www.wcc.nrcs.usda.gov/

El Niño / La Niña

Information on this page is also found on the CLIMAS website:

www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation

ENSO Tracker - continued

Last month's joke about La Niña doing a great El Niño impersonation is still relevant, particularly as northern California and the Intermountain West have recorded heavy rain and snow, and portions of the Southwest are wetter than normal. While January in particular was wet, the cumulative cool season (Oct-Mar) precipitation totals will reveal the overall effects (if any) of the La Niña. Furthermore, the precipitation totals must be evaluated against the effects of elevated temperatures, given their impact on snowpack and water storage over winter, and on altered timing of streamflow during spring and summer. Thus, both factors are key to assessing downstream impacts on water resource management over the coming months and years, with both short-term (as evidenced by the Oroville Dam spillway damage) and long-term (i.e. water levels in Lake Mead) issues to consider.

Next month's Southwest Climate Outlook will have a detailed recap of La Niña, but based on most criteria, it began in fall 2016 and ended in early February 2017. This event straddled the distinction between weak La Niña and ENSO-neutral conditions, highlighting the difficulty in classifying borderline conditions by categorical designation. This ambiguity was further demonstrated by the lack of complete agreement as to the existence or timing of the event by different agencies using different categorical thresholds.

In the Southwest, a La Niña event is more likely than not to bring warmer- and drier-than-average conditions over the cool season, and La Niña years cluster on the dry end of seasonal precipitation distributions (Fig. 5), but weak La Niña events have a less pronounced relationship to reduced seasonal precipitation than stronger events. In fact, a weak La Niña event might not even stand out from the normal seasonal variation of typically dry southwestern winters. Nevertheless, the potential for impacts on regional streamflow and reservoir storage from *any* reduction in regional and western snowpack raised concerns about La Niña exacerbating drought in 2016-2017. Fortunately, La Niña's tendencies have not come to pass, at least so far. Current snowpack, streamflow forecasts, and water resource management projections are optimistic (Fig. 6), with hope that this pattern lasts through winter and spring, and that elevated temperatures do not substantially affect snowpack or the timing of streamflow.

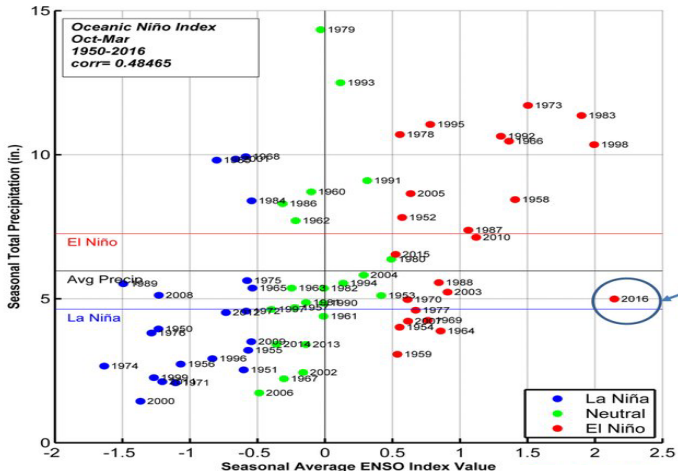


Figure 5: Arizona Climate Division 7 - ENSO vs. Precipitation

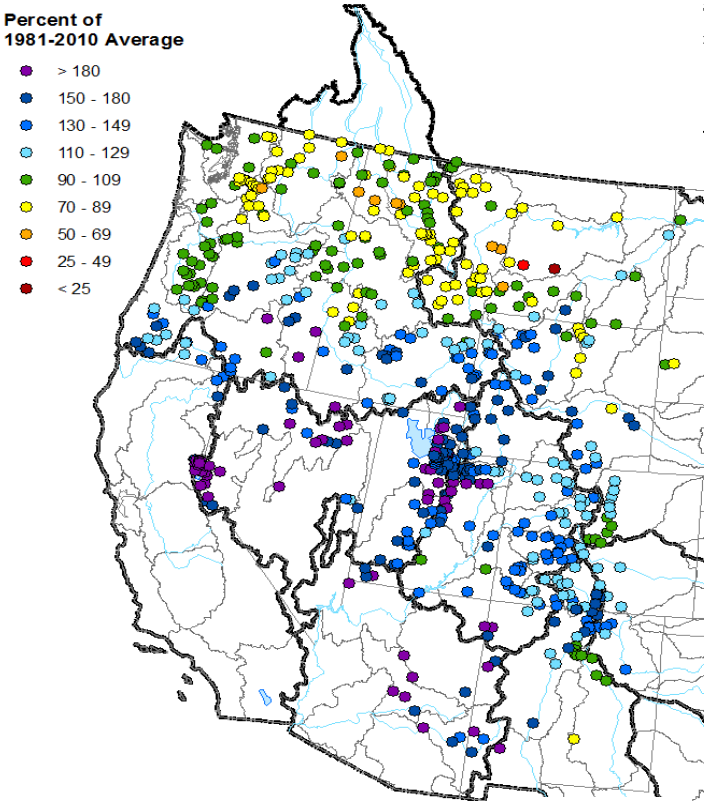


Figure 6: USDA NRCS Spring & Summer Streamflow Forecast - Feb 1, 2017

Online Resources

Portions of the information provided in this figure can be accessed at the Natural Resources Conservation Service

Arizona: http://1.usa.gov/19e2BdJ

New Mexico: http://www.wcc.nrcs.usda.gov/cgibin/resv_rpt.pl?state=new_mexico

Contact Ben McMahan with any questions or comments about these or any other suggested revisions.

Notes

The map gives a representation of current storage for reservoirs in Arizona and New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage (dotted line) and the 1981–2010 reservoir average (red line).

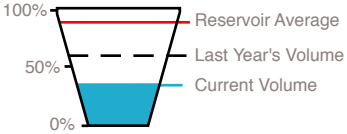
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of four people for a year. The last column of the table lists an increase or decrease in storage since last month. A line indicates no change.

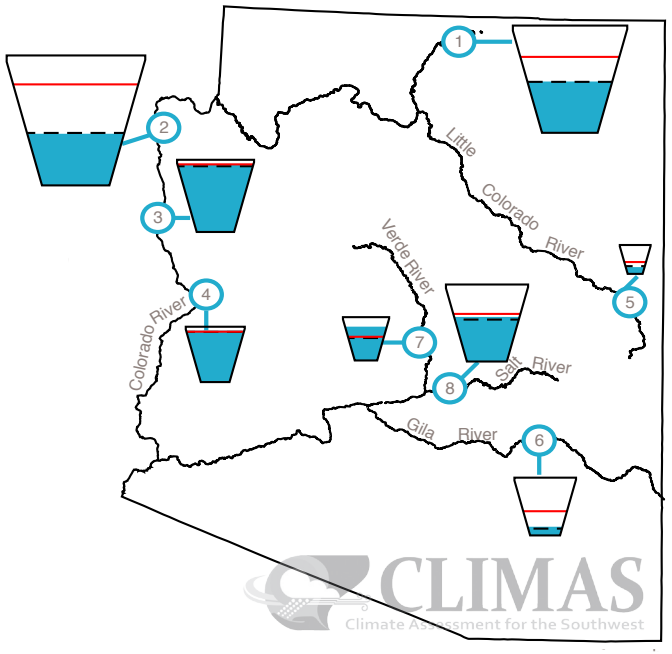
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

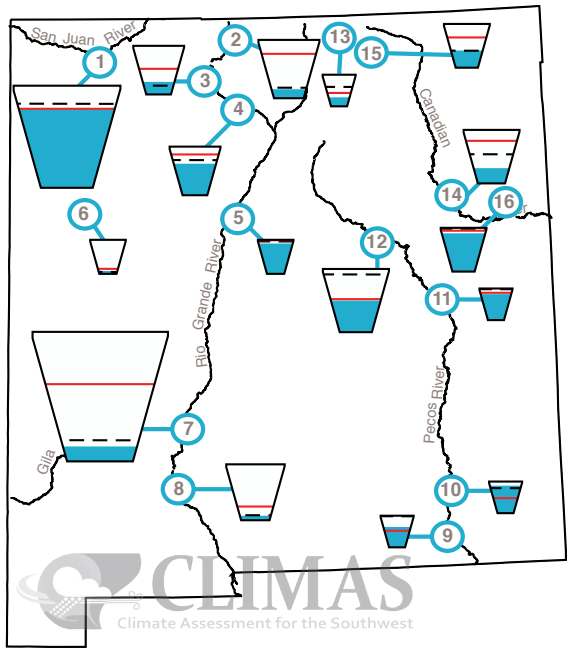
Reservoir Volumes

DATA THROUGH JAN 31, 2017

Data Source: National Water and Climate Center, Natural Resources Conservation Service







Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	47%	11,390.2	24,322.0	-392.4
2. Lake Mead	40%	10,531.0	26,159.0	438.0
3. Lake Mohave	94%	1,710.0	1,810.0	60.0
4. Lake Havasu	92%	569.4	619.0	-5.5
5. Lyman	23%	7.0	30.0	0.8
6. San Carlos	15%	134.5	875.0	88.5
7. Verde River System	78%	225.3	287.4	101.7
8. Salt River System	58%	1173.7	2,025.8	208.0

*KAF: thousands of acre-feet

* in KAF = thousands of acre-feet
**Reservoirs with updated "Max Storage"
***The last available reading for Costilla reservoir is Jan 5, 2017

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	77%	1,305.8	1,696.0	9.0
2. Heron	16%	65.4	400.0	1.0
3. El Vado	26%	50.4	190.3	-1.5
4. Abiquiu	65%	120.7	186.8**	2.2
5. Cochiti	89%	44.7	50.0**	0.3
6. Bluewater	8%	2.9	38.5	1.3
7. Elephant Butte	11%	252.2	2,195.0	48.2
8. Caballo	8%	25.7	332.0	4.7
9. Lake Avalon	64%	2.9	4.5**	0.6
10. Brantley	87%	36.9	42.2**	2.1
11. Sumner	82%	29.6	102.0**	2.9
12. Santa Rosa	49%	51.5	105.9**	-4.8
13. Costilla	5%	5.3	16.0	***
14. Conchas	28%	72.1	254.2	0.8
15. Eagle Nest	39%	30.7	79.0	0.9
16. Ute Reservoir	87%	173	200	0.0