Contributors

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

Mike Crimmins
UA Extension Specialist

Stephanie Doster
Institute of the Environment Editor

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

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January Southwest Climate Outlook

Precipitation & Temperature: December precipitation totals for the past 30 days were above average to much above average in Arizona's climate divisions and were mostly above average in New Mexico's climate divisions (Fig. 1a). December temperatures were much above average across most of southern Arizona and southwestern New Mexico, with mostly above-average temperatures across the remainder of the two states (Fig. 1b). A number of storm systems in so far 2017 have brought well above-average moisture to the region, although portions of Arizona have missed out on this precipitation (Fig. 2). January temperatures have been warmer than average across the Southwest and colder than average across the Northwest. **Year in Review:** Globally, 2016 was the warmest year on record, and it was the second warmest year on record for the contiguous United States. Regionally, Arizona and New Mexico recorded the second warmest year statewide, with record-warm temperatures in the climate divisions along the U.S./Mexico border (Fig. 3a). Precipitation totals for 2016 were near average for most of Arizona and New Mexico, with below-average precipitation in the central region of both states (Fig. 3b).

Snowpack & Water Supply: An atmospheric river hammered the West with rain and snow, resulting in flooding at lower elevations and tremendous increases in snowpack across the mountainous portions of northern California and the Intermountain West. Snow water equivalent (SWE) is above average across much of those areas, but it remains to be seen how much above-average temperatures affect the water storage dynamic across the West (e.g., rain vs. snow, storage, evaporation, runoff, infiltration, etc.). SWE remains average to below average across most of Arizona and New Mexico (Fig. 4), especially in the southern half of both states.

Drought: Long-term drought conditions persist across the Southwest (Fig. 5), although the recent run of moisture in the West has improved drought in regions of northern California and parts of the Intermountain West. According to the Jan. 17 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. Pockets of north-central New Mexico and along the U.S.-Mexico border are still designated as abnormally dry (D0) with a few small remaining areas of moderate drought (D1).

ENSO & La Niña: Borderline weak La Niña conditions are present, but neutral conditions are forecast to return by February and last through at least the first half of 2017. The conditions technically reflect a La Niña event, but in the Southwest, weak La Niña events have been less reliably dry compared to moderate and strong La Niña events. The influence of a weak La Niña might not have even stood out in comparison to normal seasonal variation in the dry Southwest, which already receives limited precipitation in the cool season.

Precipitation & Temperature Forecasts: The Jan. 19 NOAA-Climate Prediction Center's outlook for February increased chances of below-average precipitation and above-average temperatures across the region. The three-month outlook for February through April calls for increased chances of below-average precipitation for parts of Arizona and most of New Mexico (Fig. 6, top) and increased chances of above-average temperatures for most of the region (Fig. 6, bottom).

Tweet Jan SW Climate Outlook CLICK TO TWEET

JAN2017 @CLIMAS_UA SW Climate Outlook & Summary, La Niña Tracker, Reservoir Volumes -- http://bit.ly/2iY7u7e #SWclimate #AZWX #NMWX #SWCO

Online Resources

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

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

Figure 3
National Center for Environmental Information
https://www.ncdc.noaa.gov

Figure 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/

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January Southwest Climate Outlook

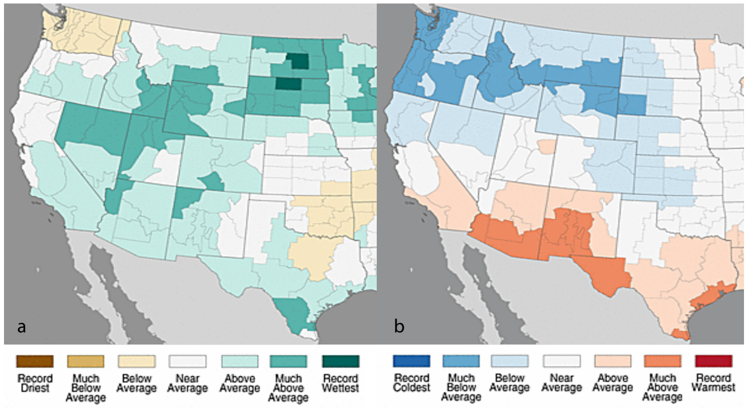


Figure 1: Dec 2016 Precipitation (a) & Temperature Ranks (b)

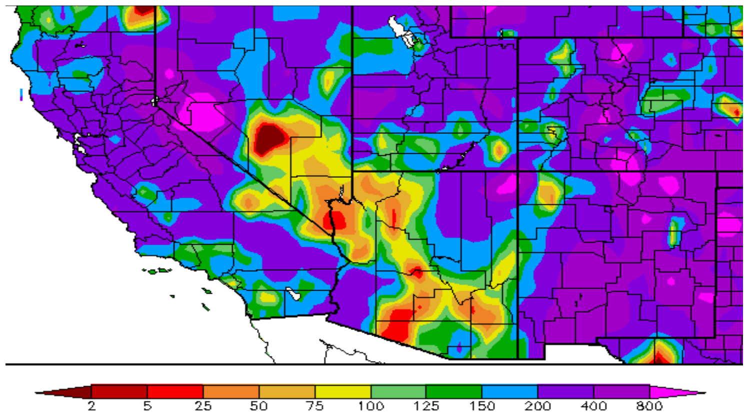


Figure 2: January 2017 Percent of Normal Precipitation

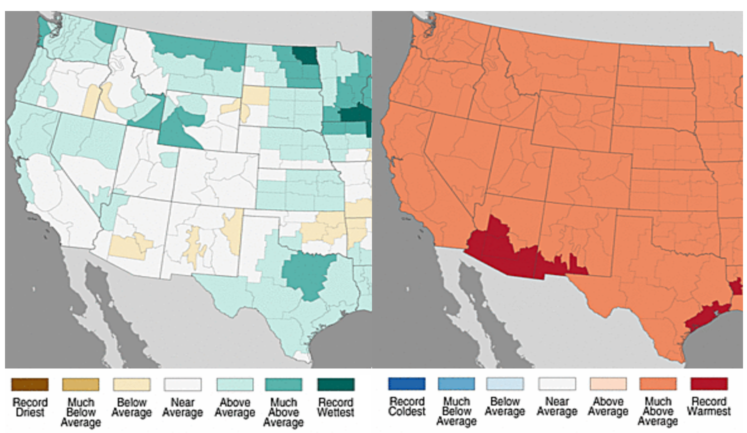


Figure 3: Jan 2016 - Dec 2016 Precipitation (a) & Temperature Ranks (b)

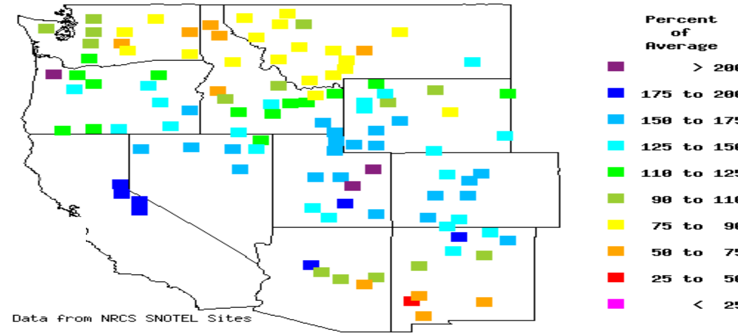


Figure 4: Basin Percent of Average Snow Water Equivalent (Jan 17, 2017)

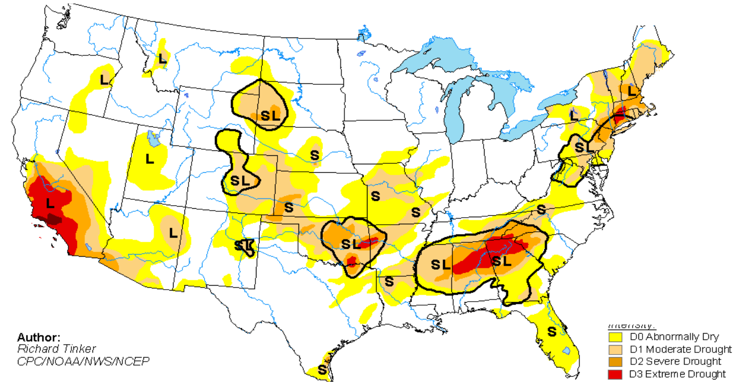


Figure 5: US Drought Monitor - Jan 17, 2017

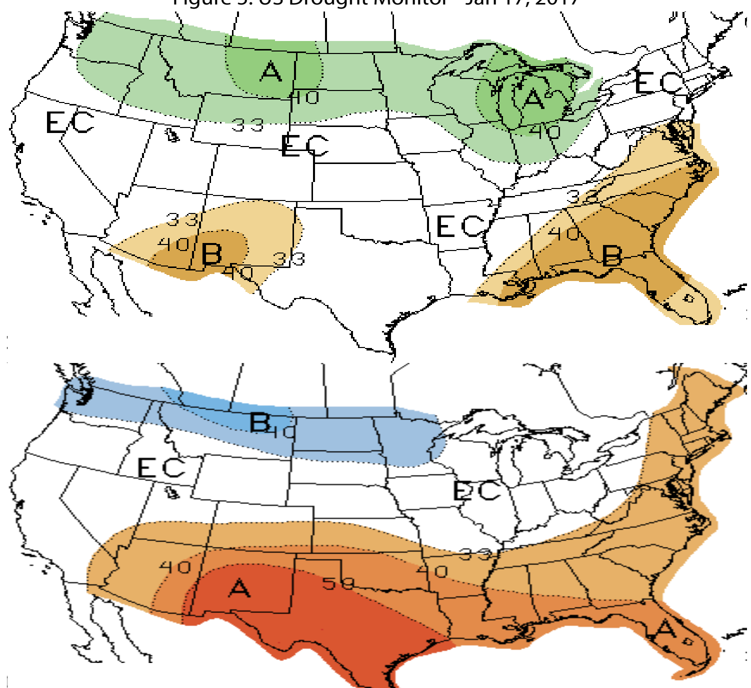


Figure 6: Three-Month Outlook - Precipitation (top) & Temperature (bottom) - Jan 19, 2017

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

La Niña Tracker

Oceanic and atmospheric indicators of the El Niño-Southern Oscillation (ENSO) continue to indicate weak La Niña conditions that are in rapid decline. Most forecast agencies identified a likely end to La Niña conditions (and by extension, this La Niña event) by February. This is not surprising given many of the oceanic and atmospheric indicators of La Niña have been weak to borderline neutral for much of the last few months (Figs. 1-2).

A closer look at the forecasts and seasonal outlooks continues to provide insight into the range of predictions for La Niña and its decline this winter. On Jan. 11, the Japanese Meteorological Agency declared the La Niña event was winding down, with a 70 percent chance of ENSO-neutral conditions through spring. On Jan. 12, the NOAA-Climate Prediction Center (CPC) maintained its La Niña advisory, based on oceanic and atmospheric conditions during December, and forecast a transition to ENSO-neutral conditions by February. On Jan. 17, the Australian Bureau of Meteorology continued the inactive status for its ENSO outlook, seeing currently neutral conditions with “little sign of El Niño or La Niña developing in the coming months.” On Jan. 19, the International Research Institute for Climate and Society (IRI) and CPC forecast this La Niña event will end by spring (Fig. 3), with global precipitation forecasts reflecting ENSO-neutral conditions (see Fig. 7 on p. 4). The North American Multi-Model Ensemble (NMME) characterizes the current model spread and highlights the variability looking forward to 2017. The NMME mean already has risen above the La Niña threshold in the current run and is forecast to remain ENSO-neutral through the first half of 2017 (Fig. 4).

Based on established criteria, a weak La Niña event started in fall 2016 and is nearly over as of mid-January. This event never locked in or escalated in strength, but instead wavered around the categorical distinction between weak La Niña and ENSO-neutral conditions, highlighting the difficulty in classifying borderline conditions into a categorical designation. The line between a weak ENSO event (La Niño or El Niño) and ENSO neutral conditions is relatively straightforward (i.e., the conditions are met or not), but the effect that a weak ENSO signal has on regional precipitation and temperature is less clear cut.

(continued on next page)

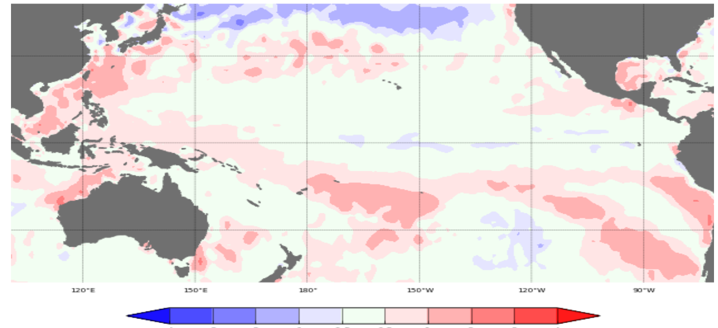


Figure 1: December 2016 Sea Surface Temperature (SST) Anomalies

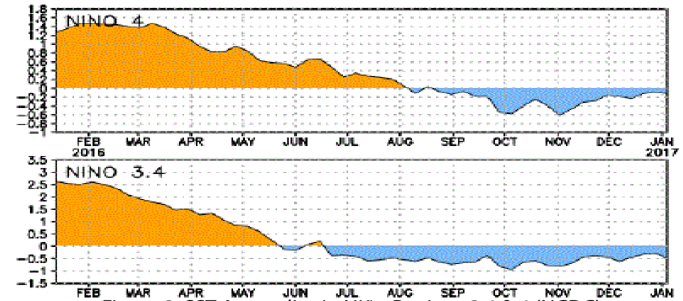


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

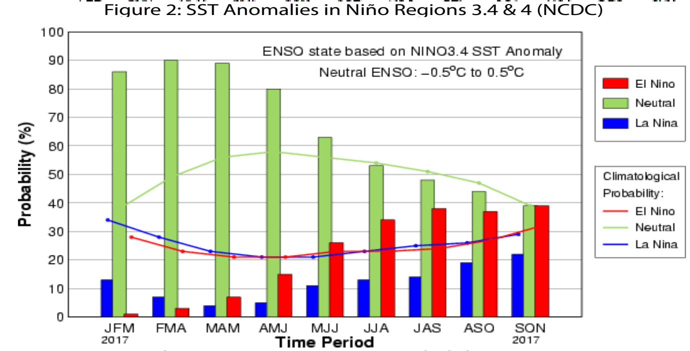


Figure 3: Mid-Jan IRI/CPC Consensus Probabilistic ENSO Forecast

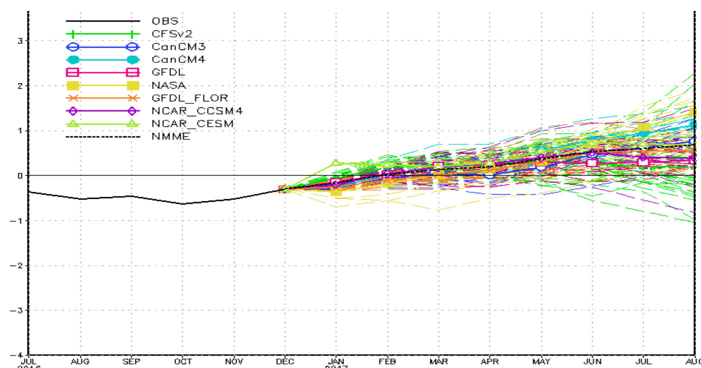


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

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

Figures 6a-6b
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

Figure 7
IRI - International Research Institute for Climate and Society
http://iri.columbia.edu/

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

La Niña Tracker - continued

In the Southwest, a La Niña event is more likely than not to bring warmer- and drier-than-average conditions to the Southwest over the cool season. La Niña years cluster on the dry end of seasonal precipitation distributions (Fig. 5), but weak La Niña events have a weaker relationship to reduced seasonal precipitation. In addition, southwestern winters are relatively dry in the first place, so a weak La Niña event might not even stand out compared to normal seasonal variation. On the other hand, a reduction in regional and western snowpack could have impacts on regional streamflow and reservoir storage going into the spring and summer, so the tendency for La Niña events to veer dry added to concern about the ongoing drought going into this event.

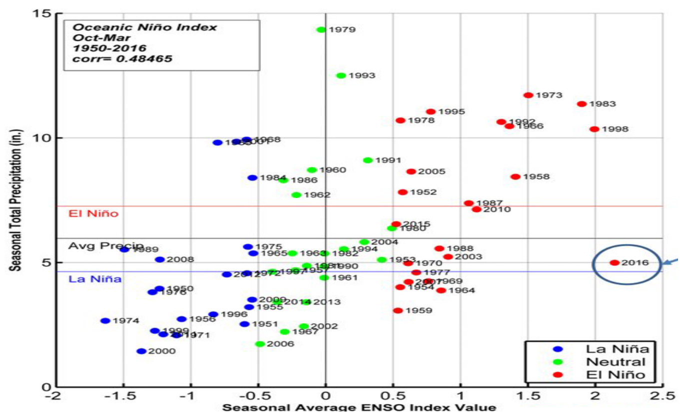


Figure 5: Arizona Climate Division 7 - ENSO vs. Precipitation

The monthly and seasonal forecasts likely have been incorporating the influence of La Niña into their projections, and for as long as this La Niña event persists, even in a weak form, we can expect these forecasts will continue to suggest warmer- and drier-than-average conditions (Figs. 6a–b, 7). Whether the season actually adheres to these forecasts is another story –last year's El Niño event was a bit of a dud in the Southwest. In a paradoxical twist, recent precipitation events in the West have caused some to joke about this La Niña doing a great El Niño impersonation. The mechanisms are different, even if some unexpected patterns are shaping out in the short term. It remains to be seen how seasonal totals come together, along with the role that elevated temperature might play in altering snowpack and water storage over winter, with downstream impacts on water resource management over the coming months and years.

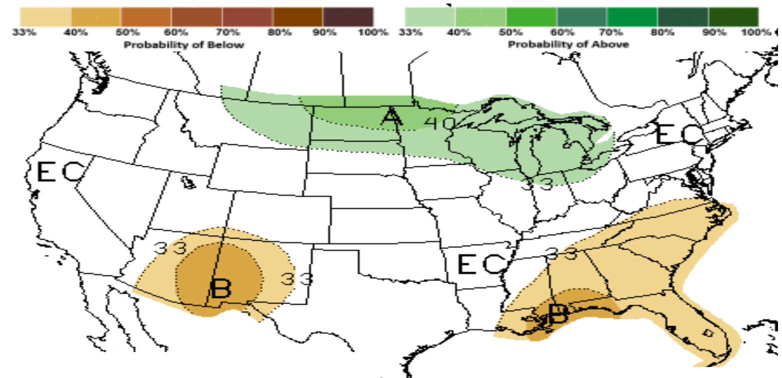


Figure 6a: Three-Month Precipitation Outlook Mar 2017 - May 2017

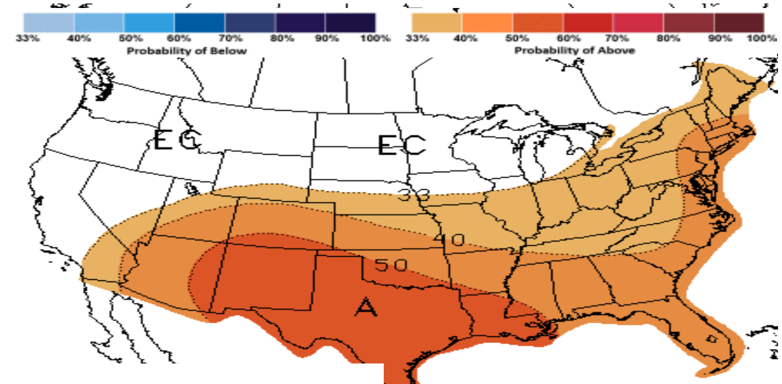


Figure 6b: Three-Month Temperature Outlook Mar 2017 - May 2017

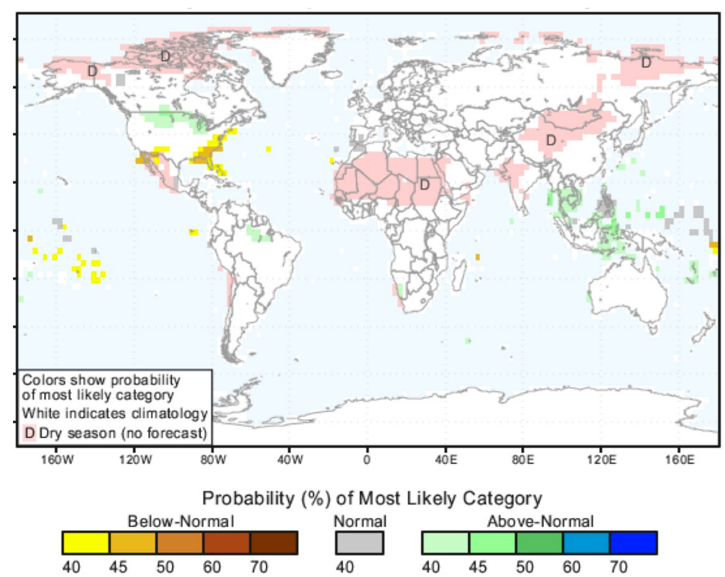


Figure 7: IRI Multi-Model Precipitation Probability Forecast Feb-Apr 2017

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).

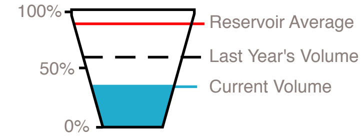
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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.

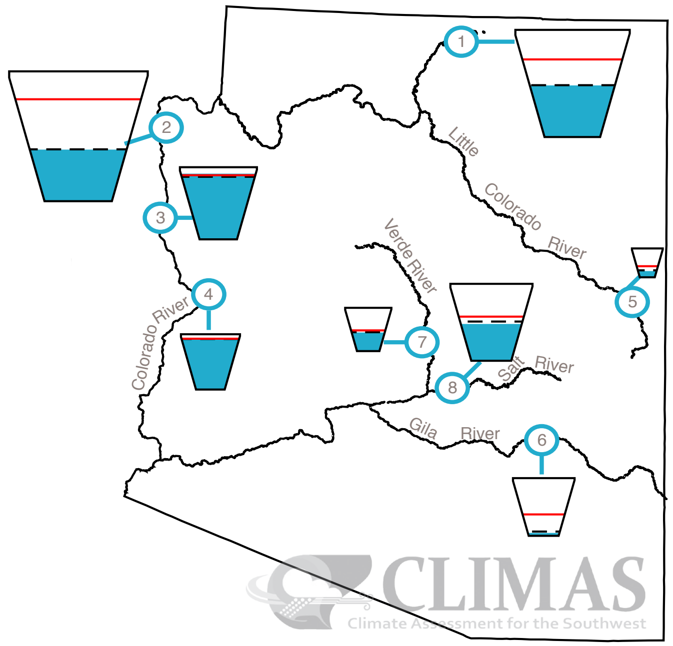
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

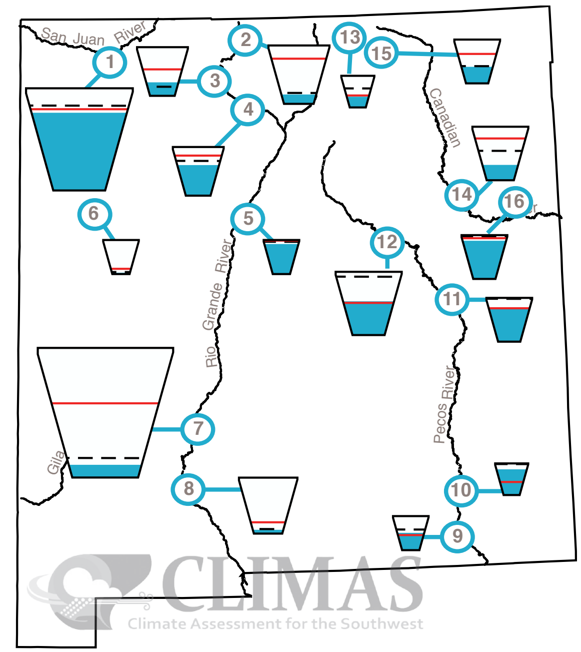
Reservoir Volumes

DATA THROUGH DEC 31, 2016

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	48%	11,782.5	24,322.0	-539.5
2. Lake Mead	39%	10,093.0	26,159.0	366.0
3. Lake Mohave	91%	1,650.0	1,810.0	34.0
4. Lake Havasu	93%	574.9	619.0	24.1
5. Lyman	21%	6.3	30.0	0.3
6. San Carlos	5%	46.0	875.0	15,6
7. Verde River System	43%	123.6	287.4	28.3
8. Salt River System	48%	965.7	2,025.8	47.8

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	76%	1,296.8	1,696.0	0.9
2. Heron	16%	64.4	400.0	-13.4
3. El Vado	27%	51.9	190.3	10.1
4. Abiquiu	63%	118.5	186.8**	-1.7
5. Cochiti	89%	44.4	50.0**	-0.8
6. Bluewater	4%	1.6	38.5	0.0
7. Elephant Butte	9%	204.0	2,195.0	41.9
8. Caballo	6%	21.0	332.0	1.8
9. Lake Avalon	51%	2.3	4.5**	0.7
10. Brantley	82%	34.8	42.2**	1.5
11. Sumner	74%	26.7	102.0**	5.0
12. Santa Rosa	53%	56.3	105.9**	0.0
13. Costilla	33%	5.3	16.0	0.4
14. Conchas	28%	71.3	254.2	0.0
15. Eagle Nest	38%	29.8	79.0	0.5
16. Ute Reservoir	87%	173	200	-1.0