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# December Southwest Climate Outlook

**Precipitation & Temperature:** November precipitation was below average across most of Arizona, with record-dry conditions in the western third of the state (Fig. 1a). In New Mexico, precipitation was average to much-below average, with small pockets of record-dry conditions in the central part of the state (Fig. 1a). November temperatures broke record highs across nearly all of Arizona and New Mexico (Fig. 1b). Thus far, December has continued the trend of above-average to near-record temperatures and very dry conditions (Fig. 2), although at the time of this writing (Dec. 20), a series of storms had brought welcome precipitation to the Southwest (Fig. 3). Year-to-date precipitation ranges widely from much-below average in southeastern Arizona to much-above average in northeastern New Mexico (Fig. 4a). Year-to-date temperatures have been consistently warmer than average, with most of Arizona and New Mexico recording either much-above average or record-warmest conditions (Fig. 4b).

**Snowpack & Water Supply:** Snowpack and snow water equivalent (SWE) are below average across the Southwest, California, and the Pacific Northwest, with a mix of above- and below-average conditions in the Intermountain West (Fig. 5). Most of the Southwest has experienced above-average temperatures and below-average precipitation for much of the fall season (Sept-Oct-Nov), which is a primary factor in the below-average snowpack and concerns about water supply for 2017-2018. The ongoing La Niña event – and its associated warmer and drier conditions in the Southwest – has potential implications for drought and water resource management over the winter season (see p.5 for AZ and NM reservoir volumes).

**Drought:** Above-average temperatures and below-normal precipitation are reflected in the expanding areas of drought designation, with both Arizona and New Mexico seeing increases in extent and intensity of drought. On the Dec. 19 U.S. Drought Monitor (Fig. 6), nearly all of Arizona is classified as moderate drought (D1), with a pocket of severe drought (D2) on the U.S.-Mexico border. New Mexico has likewise seen a widespread expansion of drought conditions, with most of the state now classified as abnormally dry (D0) and intensifying to moderate drought (D1) along the western edge. These classifications are primarily the result of below-average precipitation across much of the region over the last few months, but also include the effect of long-term persistent drought.

**ENSO & La Niña:** After a relatively late start, La Niña has ramped up in terms of observed conditions and projected intensity, and current forecasts suggest a weak-to-moderate La Niña event lasting through winter 2018. Weak La Niña events tend to produce drier-than-average winters, but moderate events have resulted in more consistently dry conditions over the winter season (see La Niña Tracker on pp.3-4 for details). Thus, this projected increase in strength is worth watching over the next few months to see how the Southwest fares in terms of winter precipitation, drought, and water resource management.

**Precipitation & Temperature Forecast:** The three-month outlook for January through March calls for increased chances of below-average precipitation for all of Arizona and New Mexico (Fig. 7, top), and increased chances of above-average temperatures for the entire southwestern United States (Fig. 7, bottom).



**Tweet Dec 2017 SW Climate Outlook** [CLICK TO TWEET](#)

DEC2017 @CLIMAS\_UA SW Climate Outlook, La Niña Tracker, Reservoir volumes <http://bit.ly/2kWTfzl> #SWclimate #AZWX #NMWX #SWCO



## Online Resources

**Figures 1,4**  
National Centers for Environmental Information  
ncei.noaa.gov

**Figures 2-3**  
High Plains Regional Climate Center  
hprcc.unl.edu

**Figure 5**  
Western Regional Climate Center  
wrcc.dri.edu

**Figure 6**  
U.S. Drought Monitor  
droughtmonitor.unl.edu

**Figure 7**  
NOAA - Climate Prediction Center  
cpc.ncep.noaa.gov

# December 2017 SW Climate Outlook

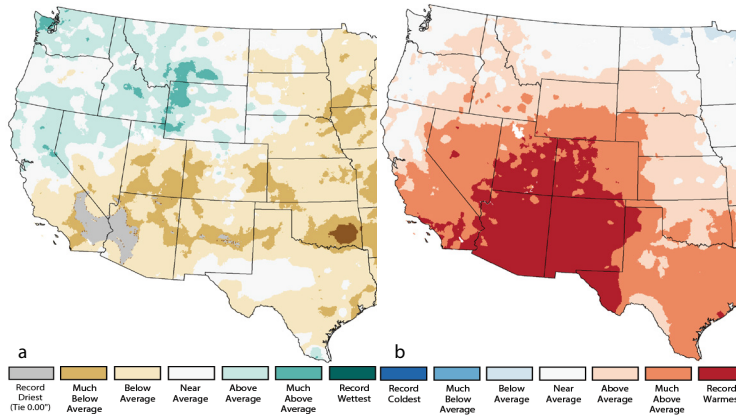


Figure 1: Nov 2017 Precipitation (a) & Temperature Ranks (b)

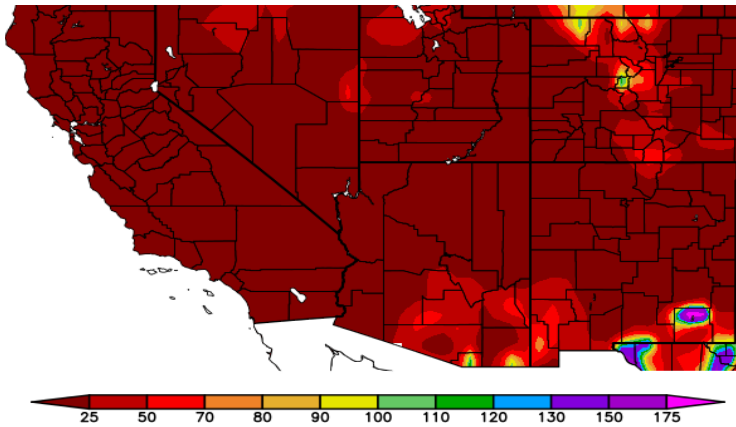


Figure 2: Dec 1 - Dec 17, 2017 - Precipitation Percent of Normal

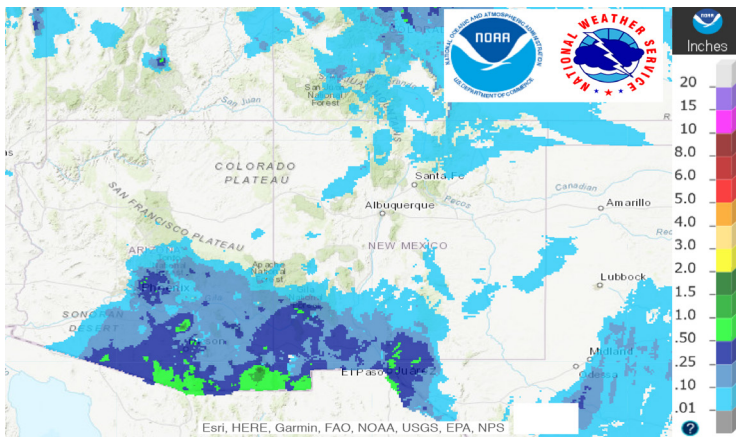


Figure 3: Seven Day Observed Precipitation Dec 12-19, 2017

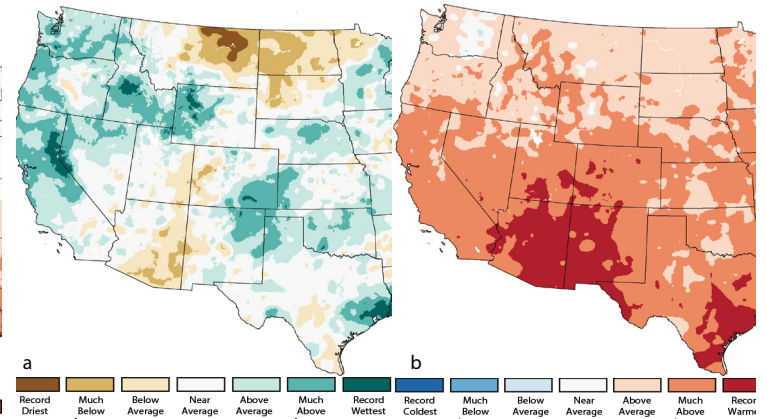


Figure 4: 2017 (Jan - Nov) Precipitation (a) & Temperature Ranks (b)

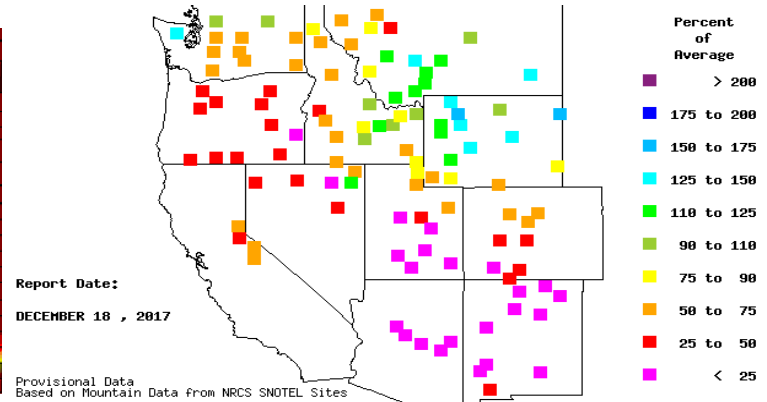


Figure 5: Basin Percent of Average Snow Water Content

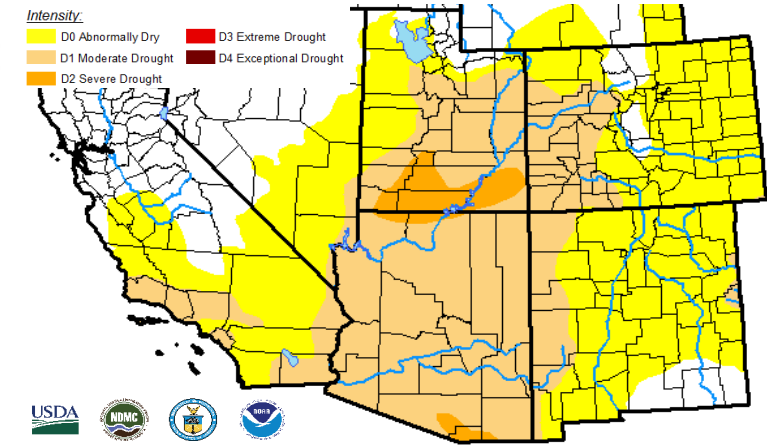


Figure 6: US Drought Monitor - Dec 19, 2017

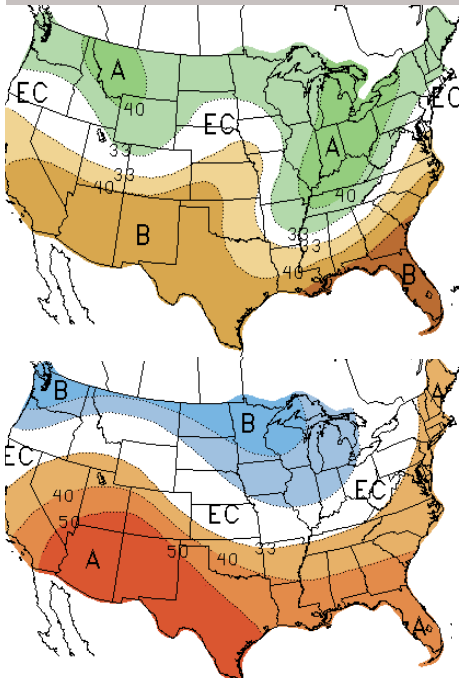


Figure 7: Three-Month Outlook - Precipitation (top) & Temperature (bottom) - Dec 21, 2017

## Online Resources

**Figure 1**  
**Australian Bureau of Meteorology**  
[bom.gov.au/climate/enso](http://bom.gov.au/climate/enso)

**Figure 2**  
**NOAA - Climate Prediction Center**  
[cpc.ncep.noaa.gov](http://cpc.ncep.noaa.gov)

**Figure 3**  
**International Research Institute for Climate and Society**  
[iri.columbia.edu](http://iri.columbia.edu)

**Figure 4**  
**NOAA - Climate Prediction Center**  
[www.cpc.ncep.noaa.gov](http://www.cpc.ncep.noaa.gov)

## El Niño / La Niña

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

[climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://climas.arizona.edu/sw-climate/el-niño-southern-oscillation)

## La Niña Tracker

After a relatively late start, La Niña has ramped up over the past 30 days in terms of observed conditions and projected intensity, with sea-surface temperatures (SSTs) demonstrating a more consistent La Niña pattern (Figs. 1-2). Current forecasts and outlooks suggest a weak-to-moderate La Niña event lasting through the winter. On Dec. 11, the Japanese Meteorological Agency (JMA) identified ongoing La Niña conditions and called for a 60-percent chance of these conditions persisting until spring 2018. On Dec. 14, the NOAA Climate Prediction Center (CPC) extended its La Niña advisory, identifying an 80-percent chance of La Niña conditions lasting through the winter, with a likely transition to ENSO-neutral in the spring. The CPC forecast consensus identified La Niña conditions in the sea-surface and sub-surface temperatures as well as in atmospheric patterns. On Dec. 19, the Australian Bureau of Meteorology updated its ENSO tracker to reflect the emergence of La Niña conditions, but noted that this event was “expected to be short-lived.” On Dec. 19, the International Research Institute (IRI) issued its December ENSO quick look, calling for La Niña to last into the spring (Fig. 3), most likely as a weak event, but with the possibility of increasing to moderate strength. The North American Multi-Model Ensemble (NMME) is consistently indicative of a La Niña event of weak to moderate intensity this winter (Fig. 4).

**Summary:** The seasonal outlooks converged on a forecast for La Niña to last through the winter based on consistent La Niña patterns observed in both oceanic and atmospheric indicators. The intensity of the event is still under consideration, with a weak event the most likely scenario, but with increasing possibility of a moderate event mainly due to models and forecasts nudging towards the moderate threshold in the past month. Given the warmer- and drier-than-average winter conditions associated with La Niña in the Southwest, its presence may heighten ongoing concerns regarding winter precipitation and persistent drought. Southwestern winters are already relatively dry, however, so the emergence of a La Niña doesn’t necessarily ensure an exceptionally dry winter, it just takes wetter-than-average winters off the table based on past La Niña events. If the La Niña strengthens to moderate intensity, the likelihood of an even drier Southwest winter increases (see following page for a few examples).

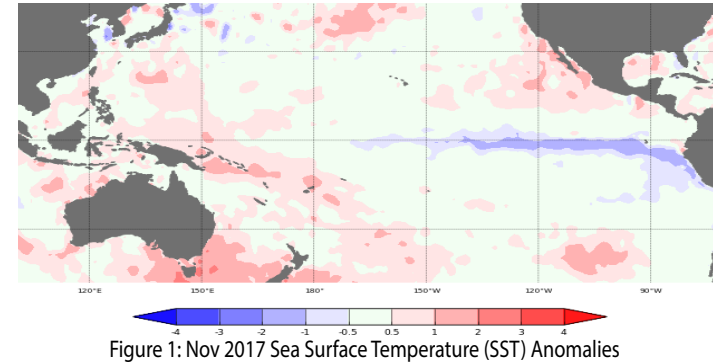


Figure 1: Nov 2017 Sea Surface Temperature (SST) Anomalies

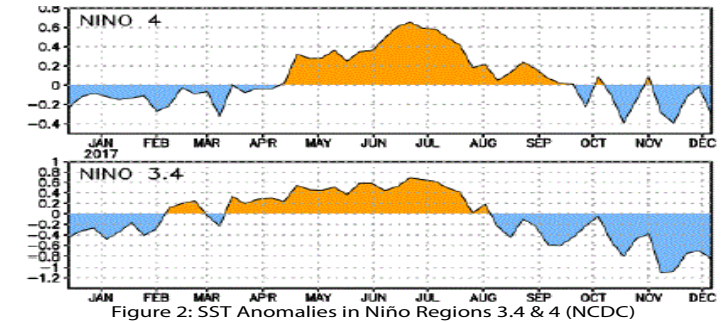


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

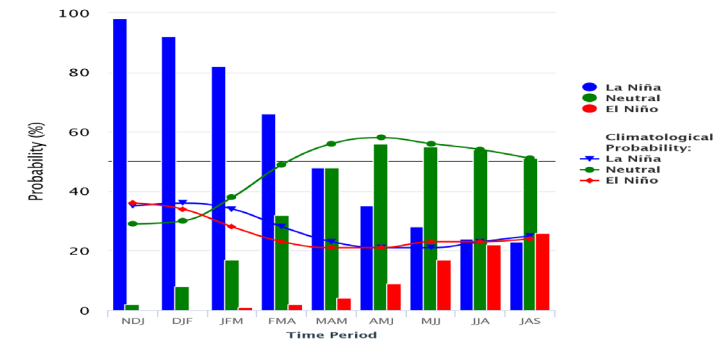


Figure 3: Early-Dec IRI/CPC Model-Based Probabilistic ENSO Forecast

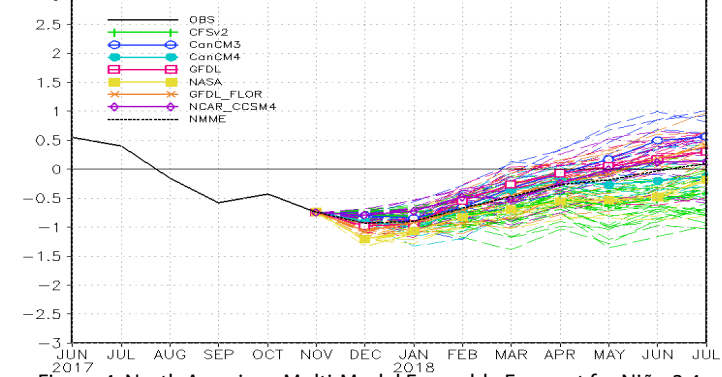


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

# Online Resources

Figures 5-6  
 UA Climate Science Applications Program  
[cals.arizona.edu/climate](http://cals.arizona.edu/climate)

Figure 7-8  
 CLIMAS: Climate Assessment for the Southwest  
[climas.arizona.edu](http://climas.arizona.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](http://www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation)

## La Niña Tracker (cont.)

Looking more closely at winter Dec-Feb (DJF) precipitation, most weak La Niña events (ENSO Index Value between -0.5 and -1.0) recorded below-average precipitation, although a few years (1968, 1985) are notable outliers (Figs. 5-6). Looking at the monthly breakdown of weak, moderate, and strong La Niña events reveals that while the DJF totals for Tucson, AZ and Las Cruces, NM are mostly below average (Figs. 7-8), there have been some individual months that recorded precipitation above the monthly average (represented by black lines on the plots). The most likely outcome is below-average precipitation totals for the winter season, but the way that these events unfold will have an impact on how residents of the Southwest perceive and experience this La Niña event.

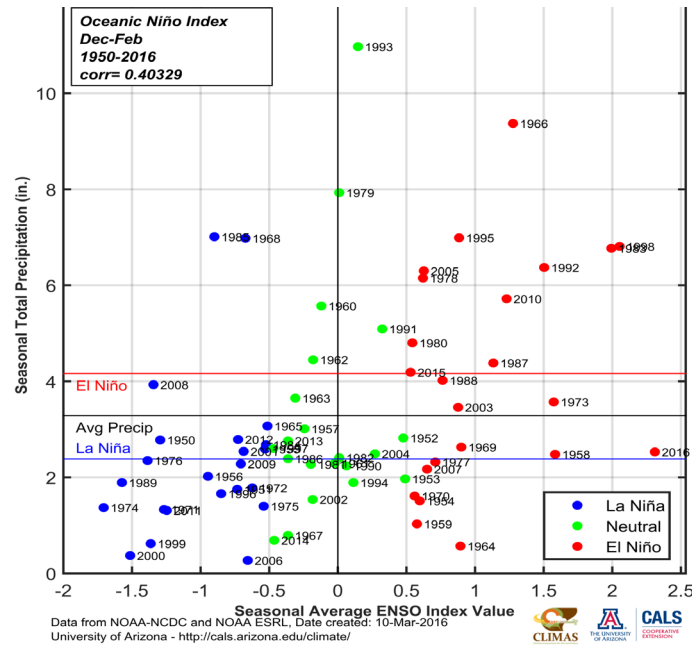


Figure 5: Arizona Climate Division 7 - ENSO vs. Winter (DJF) Precipitation

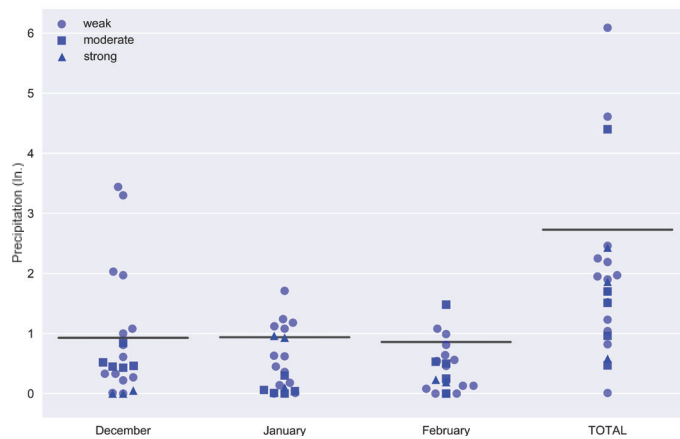


Figure 7 - La Niña Winter (DJF) Precipitation - Tucson, AZ

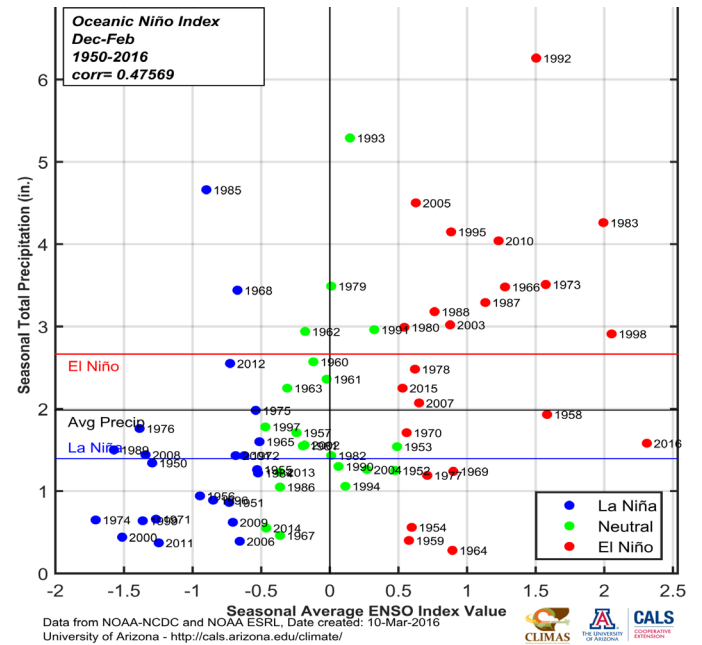


Figure 6: New Mexico Climate Division 8 - ENSO vs. Winter (DJF) Precip

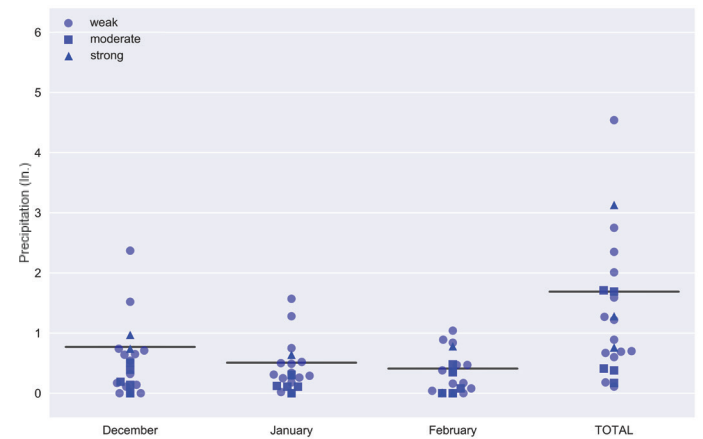


Figure 8 - La Niña Winter (DJF) Precipitation - Las Cruces, NM

## Online Resources

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

[www.wcc.nrcs.usda.gov/BOR/basin.html](http://www.wcc.nrcs.usda.gov/BOR/basin.html)

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).

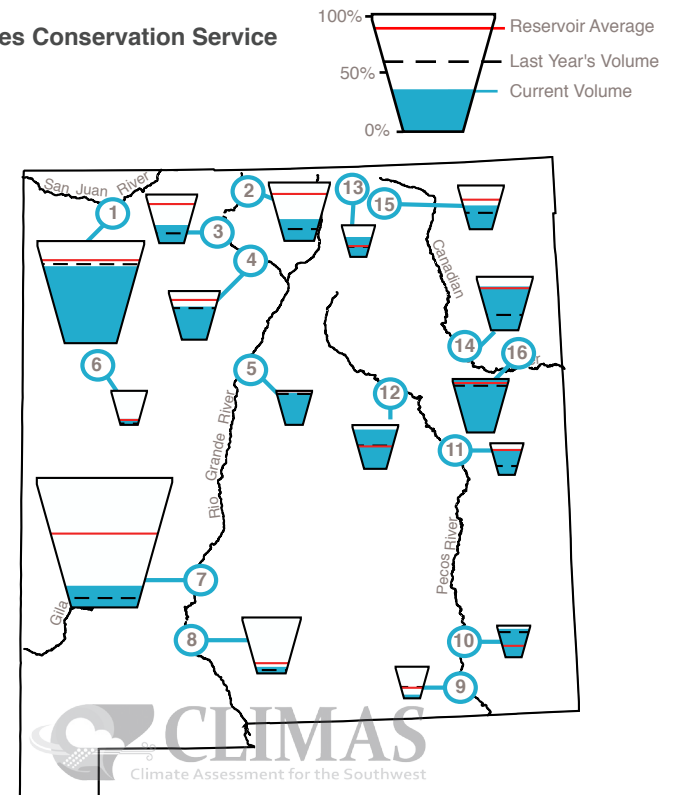
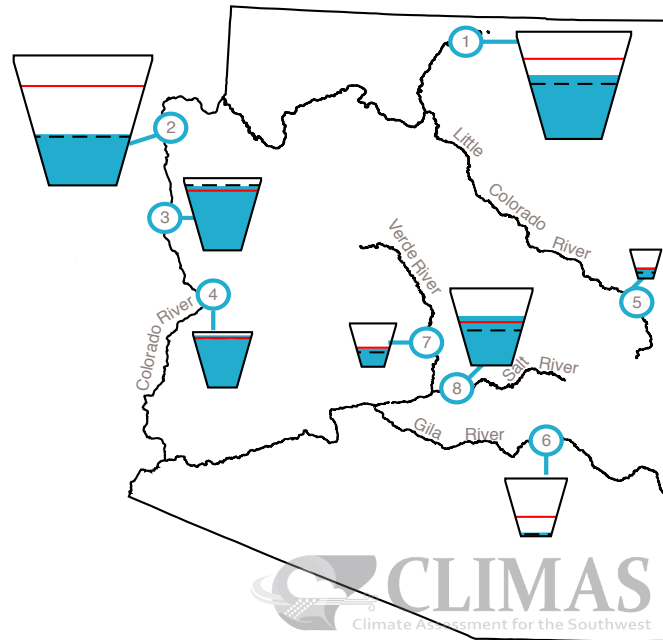
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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 NOVEMBER 30, 2017

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



\* in KAF = thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	59%	14,332.1	24,322.0	-197.4
2. Lake Mead	39%	10,090.0	26,159.0	-112.0
3. Lake Mohave	89%	1,617.0	1,810.0	111.0
4. Lake Havasu	94%	579.0	619.0	29.1
5. Lyman	38%	11.3	30.0	-0.5
6. San Carlos	7%	59.4	875.0	-9.4
7. Verde River System	42%	122.0	287.4	-24.3
8. Salt River System	63%	1,284.0	2,025.8	0.3

\*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	76%	1,286.0	1,696.0	-10.4
2. Heron	37%	147.6	400.0	-1.8
3. El Vado	47%	89.6	190.3	-21.9
4. Abiquiu	69%	128.5	186.8	-10.8
5. Cochiti	94%	47.1	50.0	-0.7
6. Bluewater	17%	6.7	38.5	-0.2
7. Elephant Butte	16%	354.7	2,195.0	56.8
8. Caballo	11%	36.3	332.0	0.7
9. Lake Avalon	0%	0.0	4.5	-0.8
10. Brantley	90%	37.8	42.2	3.9
11. Sumner	100%	35.9	102.0	3.2
12. Santa Rosa	90%	95.3	105.9	-0.9
13. Costilla	63%	10.2	16.0	0.7
14. Conchas	82%	209.5	254.2	5.0
15. Eagle Nest	54%	42.4	79.0	0.3
16. Ute Reservoir	100%	203	200	-3.0

## Online Resources

**Figure 1**  
**Climate Program Office**  
[cpo.noaa.gov](http://cpo.noaa.gov)

### RISA Program Homepage

<http://cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA>

### UA Institute of the Environment

[environment.arizona.edu](http://environment.arizona.edu)

### New Mexico Climate Center

[weather.nmsu.edu](http://weather.nmsu.edu)

## CLIMAS

### Research & Activities

#### CLIMAS Research

[climas.arizona.edu/research](http://climas.arizona.edu/research)

#### CLIMAS Outreach

[climas.arizona.edu/outreach](http://climas.arizona.edu/outreach)

#### Climate Services

[climas.arizona.edu/climate-services](http://climas.arizona.edu/climate-services)



### What is CLIMAS?

The Climate Assessment for the Southwest (CLIMAS) program was established in 1998 as part of the National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments program. CLIMAS —housed at the University of Arizona's (UA) Institute of the Environment—is a collaboration between UA and New Mexico State University.

The CLIMAS team is made up of experts from a variety of social, physical, and natural sciences who work with partners across the Southwest to develop sustainable answers to regional climate challenges.

### What does CLIMAS do?

The CLIMAS team and its partners work to improve the ability of the region's social and ecological systems to respond to and thrive in a variable and changing climate. The program promotes collaborative research involving scientists, decision makers, resource managers and users, educators, and others who need more and better information about climate and its impacts. Current CLIMAS work falls into six closely related areas: 1) decision-relevant questions about the physical climate of the region; 2) planning for regional water sustainability in the face of persistent drought and warming; 3) the effects of climate on human health; 4) economic trade-offs and opportunities that arise from the impacts of climate on water security in a warming and drying Southwest; 5) building adaptive capacity in socially vulnerable populations; and 6) regional climate service options to support communities working to adapt to climate change.

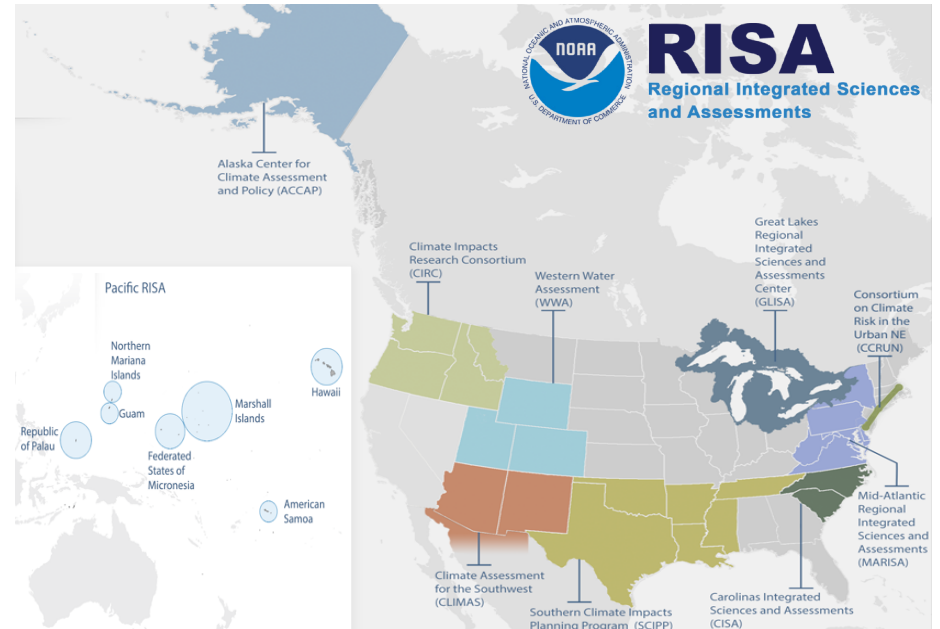


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

### November 3rd - CLIMAS Climate & Health Project Showcase

**Heidi Brown & Erika Barrett** – <https://youtu.be/k4BKecrKTQQ>

Applying Vector-Borne Disease Projections for Climate and Health Strategic Planning in Arizona

**Gregg Garfin & Sarah LeRoy** – <https://youtu.be/TYPJjqQKy9s>

Accidental Tourists: Adventures in Climate and Public Health in the U.S.-Mexico Border Region

**Ben McMahan** – [https://youtu.be/DDN89XTj\\_i8](https://youtu.be/DDN89XTj_i8)

Heat and Vulnerability in the U.S. Southwest – Assessing Connections Between Social and Environmental Risks Across Multiple Timescales

Videos of the presentations (slides + audio) are available on the CLIMAS youtube channel – [youtube.com/user/UACLIMAS](https://youtube.com/user/UACLIMAS)

For more details:

[climas.arizona.edu/event/climas-colloquium-series-climate-health-southwest](http://climas.arizona.edu/event/climas-colloquium-series-climate-health-southwest)