Contributors

Ben McMahan
SWCO Editor; Assistant Research Scientist
CLIMAS, Institute of the Environment

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

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.

November Southwest Climate Outlook

Monthly Precipitation and Temperature: October precipitation in Arizona ranged from below average to record driest, while most of New Mexico was average to above average (Fig. 1a). October temperatures were mostly average to below average in Arizona and New Mexico (Fig. 1b). The daily average temperature anomalies for Oct 1 – Nov 19 (Fig. 2) highlight the fluctuations at select stations around the region including a number of cold spells.

Annual Precipitation and Temperature: Total precipitation for 2019 (Jan-Oct) in Arizona was mostly average to above average, except for the four corners region, while New Mexico was drier with below average conditions across most of the state (Fig. 3a). Mean temperatures in 2019 so far are mostly average to above average in Arizona and above average to much above average in New Mexico (Fig. 3b).

Snowpack & Water Supply: Early season can change quickly, but as of November 18, many Arizona basins are above median snowpack, while New Mexico, Colorado and Utah, are mostly below average (Fig 4). Many of the reservoirs in the region are at or above the values recorded at this time last year, but most are below their long-term average (see reservoir storage on p. 5). There have been improvements over the last year, but concerns remain about the recent below average precipitation, along with the accumulated water resource deficits associated with multiple years of drought.

Drought: Drought conditions continue to expand across the Southwest in the Nov. 12 U.S. Drought Monitor (USDM) (Fig. 5). Little precipitation in October, a below average monsoon, and limited incursions of tropical moisture this fall, all contributed to the return of drought designations in much of Arizona and western New Mexico. A large pocket of Severe Drought (D2) is centered on the Arizona/Utah border, but extends well into Arizona, Utah, Colorado, and New Mexico, with Moderate Drought (D1) and Abnormally Dry (D0) making up the characterizations for much of the rest of the Southwest.

Tropical Storm Activity: The eastern North Pacific hurricane season has been near normal with 19 named storms and 4 major hurricanes (category 4 or above). Climatology for the same period is approximately 16.5 named storms and 4.3 major hurricanes. Accumulated Cyclonic Energy in 2019 is at 97.5, with 131 the average total by this date.

ENSO Tracker: Oceanic and atmospheric conditions are generally consistent with an ENSO-neutral outlook for 2019 and into 2020 (see ENSO-tracker on p. 3 for details).

Precipitation and Temperature Forecast: The three-month outlook for November through January calls for increased chances of above-normal precipitation in much of New Mexico, but equal chances of above or below normal precipitation across most of the rest of the Southwest. (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across most of the U.S. Southwest and northern Mexico (Fig. 7, bottom).

Tweet Nov 2019 SW Climate Outlook

CLICK TO TWEET

NOV2019 @CLIMAS_UA SW Climate Outlook, ENSO Tracker, TS Recap, AZ & NM Reservoir volumes, https://bit.ly/2pEdXuj #SWclimate #AZWX #NMWX

November 2019 SW Climate Outlook

Online Resources

Figures 1,3
National Centers for Environmental Information
ncei.noaa.gov

Figure 2
Climate Assessment for the Southwest
climas.arizona.edu

Figure 4
Natural Resources Conservation Service
nrcs.usda.gov

Figure 5
U.S. Drought Monitor
droughtmonitor.unl.edu

Figure 6
NWS Eastern North Pacific Hurricane Tracker
nhc.noaa.gov

Figure 7
Intl. Research Institute for Climate and Society
iri.columbia.edu

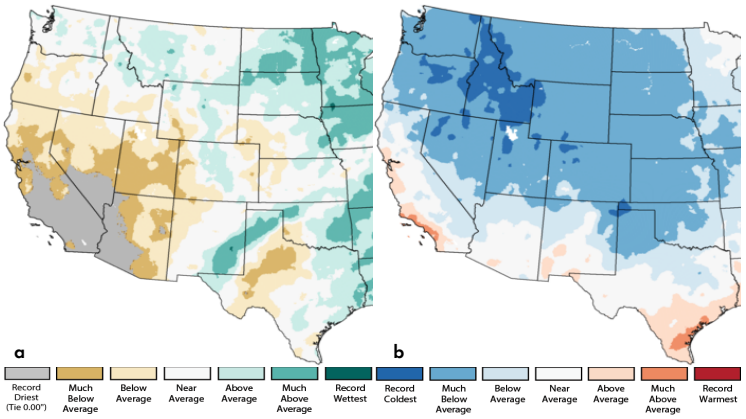


Figure 1: Oct 2019 Precipitation (a) & Temperature Ranks (b)

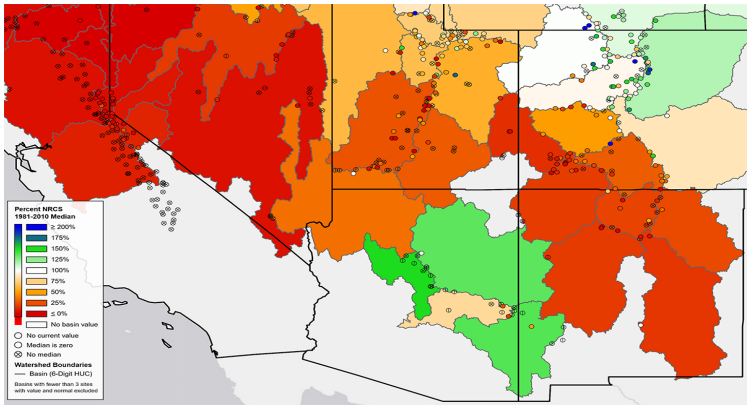


Figure 4: Nov 17 Snow Water Equivalent (Pct. 1981-2010 Median)

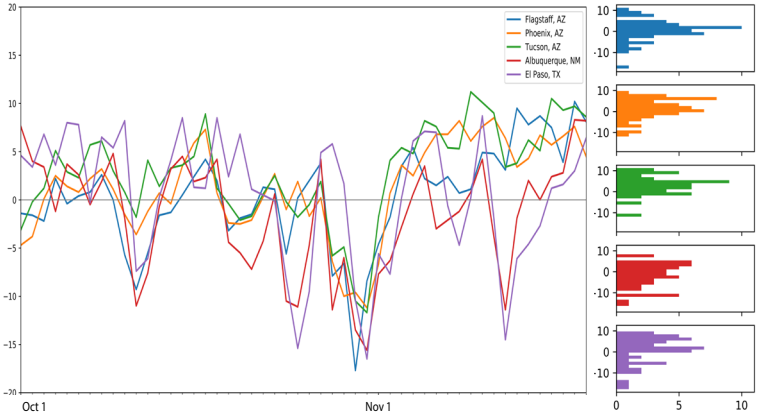


Figure 2: Daily Temperature Anomalies Oct 1 - Nov 19 (L) & Frequency of Anomalies (R)

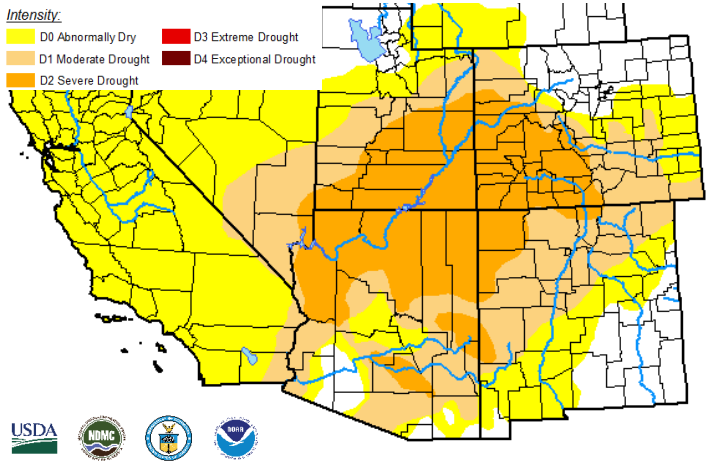


Figure 5: US Drought Monitor - Nov 12, 2019

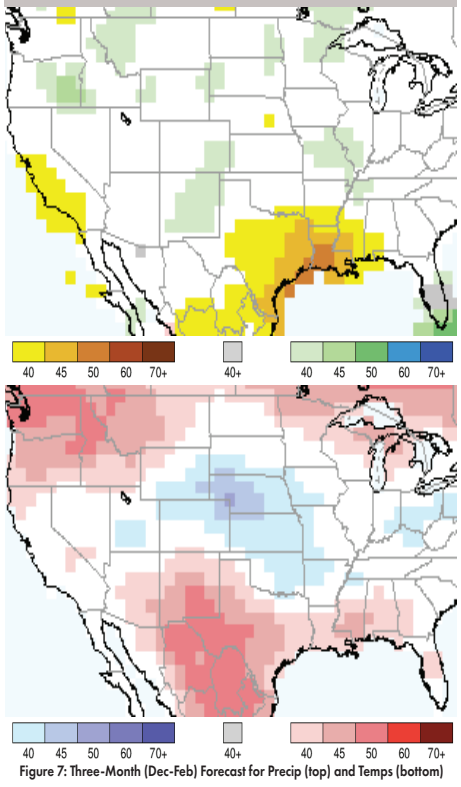


Figure 7: Three-Month (Dec-Feb) Forecast for Precip (top) and Temps (bottom)

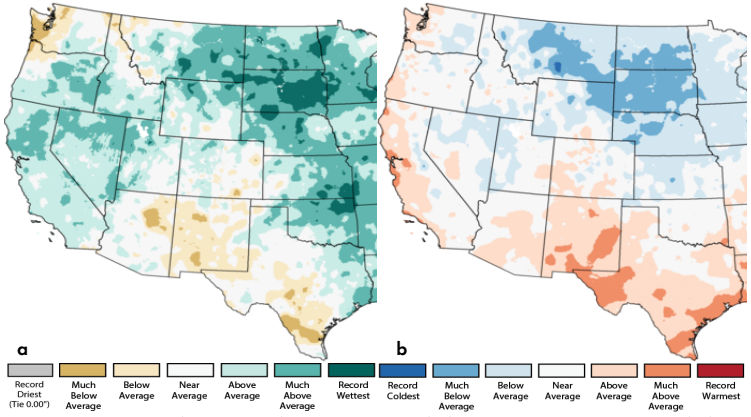


Figure 3: 2019 (Jan - Oct) Precipitation (a) & Temperature Ranks (b)

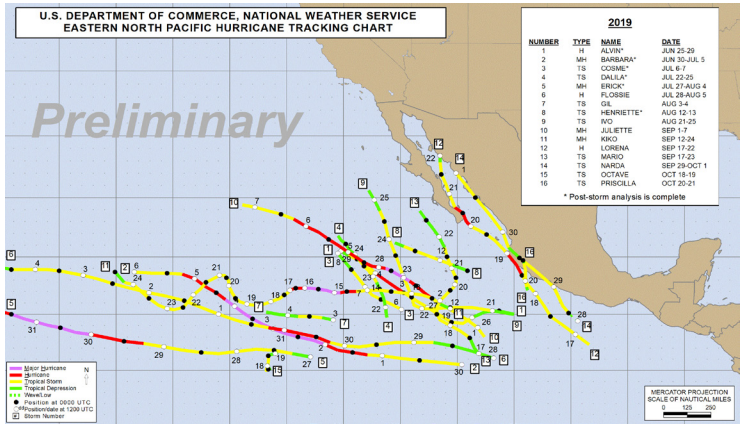


Figure 6: National Weather Service Eastern North Pacific Tracking Chart

Online Resources

Figure 1
Australian Bureau of Meteorology
bom.gov.au/climate/enso

Figure 2
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

Figure 3
International Research Institute for Climate and Society
iri.columbia.edu

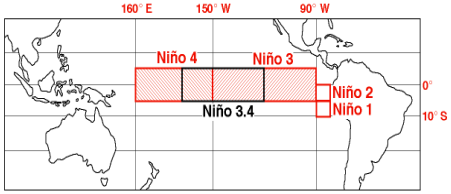
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

El Niño / La Niña

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

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

Equatorial Niño Regions



For more information: ncdc.noaa.gov/teleconnections/enso/indicators/sst/

Image source: aoml.noaa.gov/

ENSO Tracker

As with last month, warm waters have been lingering in the equatorial Pacific (Figs. 1-2). The consensus is on subseasonal variability and not borderline El Niño conditions, and they are expected to revert back to close to normal over winter and spring. Seasonal outlooks and forecasts all point to ENSO-neutral conditions lasting through 2019 and into 2020.

Forecast Roundup: On Nov 11, the Japanese Meteorological Agency (JMA) highlighted lingering warmer-than-normal SSTs in the western equatorial Pacific, but saw cooling subsurface temperatures, and maintained their call for a 60-percent chance of ENSO-neutral conditions to continue until spring 2020. On Nov 12, the Australian Bureau of Meteorology maintained their ENSO Outlook at 'inactive' noting the slightly warmer than average oceanic conditions, but with atmospheric indicators "generally neutral". On Nov 14, the NOAA Climate Prediction Center (CPC) issued their ENSO diagnostic discussion with an inactive alert status. They noted the positive SST anomalies and adjusted their forecast chances of ENSO-netural conditions to 70-percent (winter) and 60 to 65-percent (spring). On Nov 19, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "oceanic warming is attributed to intraseasonal variability". Their forecasts see ENSO-neutral as the most likely outcome, but remain at "slightly higher chances for El Niño than La Niña". The Nov 2019 North American Multi-Model Ensemble (NMME) saw a bounce back towards positive SST anomalies in October, but is generally predicted to return and remain within the range of ENSO-neutral through 2019 and into 2020 (Fig. 4).

Summary: Despite recent short term warming in SSTs, atmospheric conditions remain within the range of ENSO-neutral, and ENSO-neutral remains the most likely outcome for 2019 into spring 2020. So what does this mean for the Southwest? The short answer is, it is hard to say. ENSO-neutral winters have produced some of the wettest and driest winters (and everything in between). Rather than a signal that drags our chances wet (as with El Niño) or dry (as with La Niña), ENSO-neutral calls for equal chances of either (or just a normal winter). This means we will continue to monitor sub-seasonal and short term forecasts for insight into upcoming events, but that within the bounds of a "typical" southwestern winter, pretty much anything is on the table.

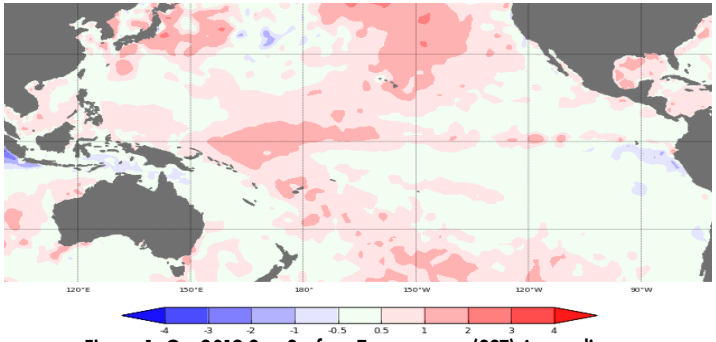


Figure 1: Oct 2019 Sea Surface Temperature (SST) Anomalies

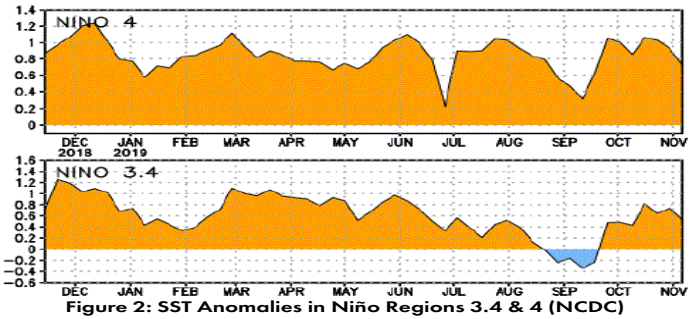


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

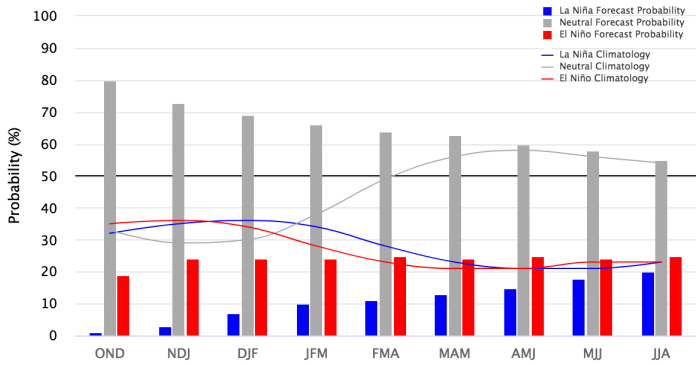


Figure 3: Early-Nov IRI/CPC Model-Based Probabilistic ENSO Forecast

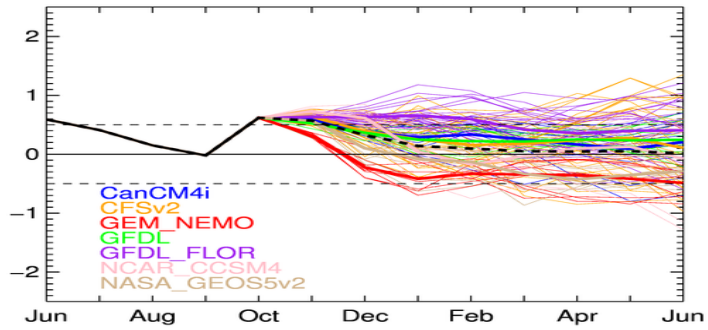


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

October & Tropical Storm Recap

Over the last two years, precipitation in October demonstrates just how much rainfall can vary in the Southwest.

In 2018, buoyed by tropical storm activity, the monthly total for much of the Southwest reflected the widespread and recurring tropical storm activity that supplemented rainfall totals (Fig. 1). In 2019, the region saw widespread dry conditions, including zero rainfall across most of Arizona, southern Nevada, and southern and central California (Fig. 2).

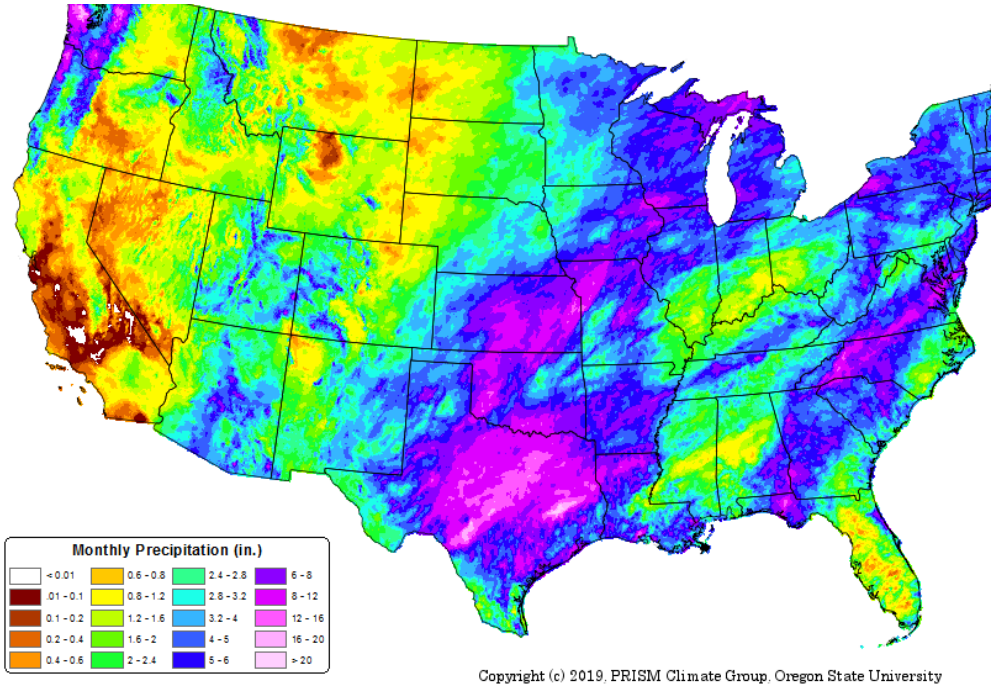


Figure 1: Oct 2018 Total Precipitation (PRISM)

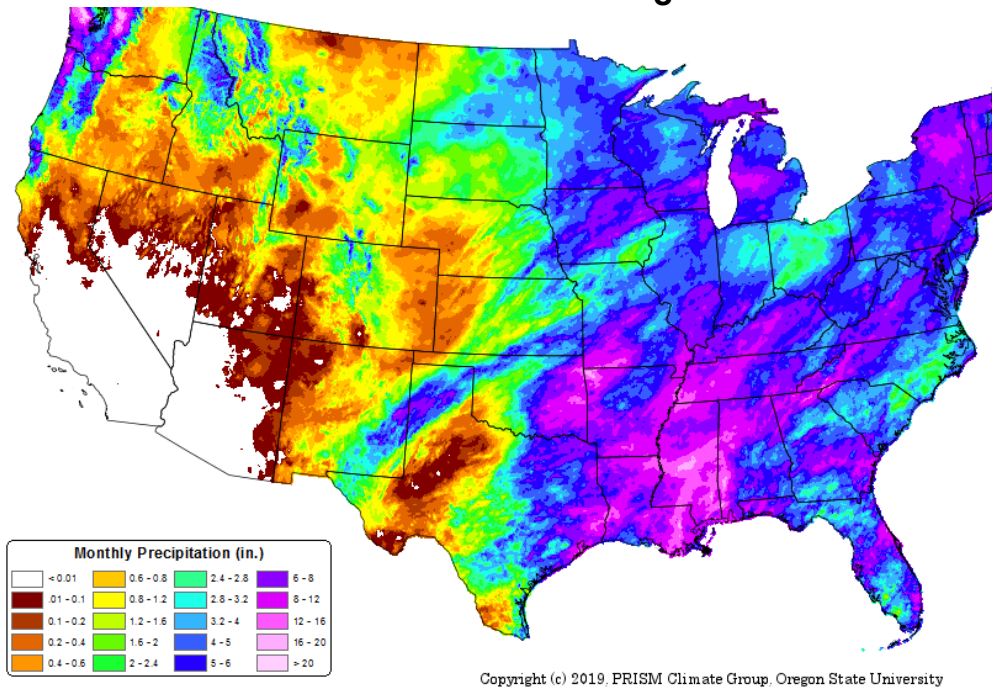


Figure 2: Oct 2019 Total Precipitation (PRISM)

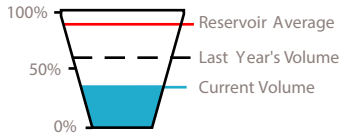
Online Resources

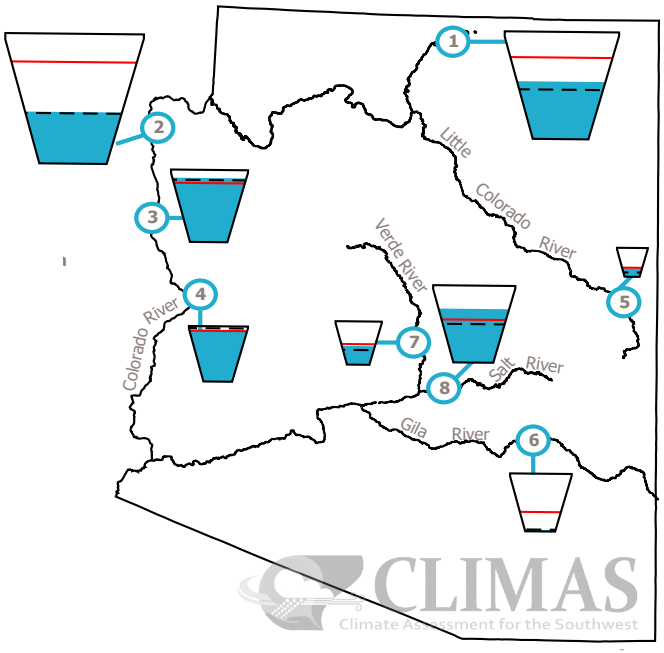
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

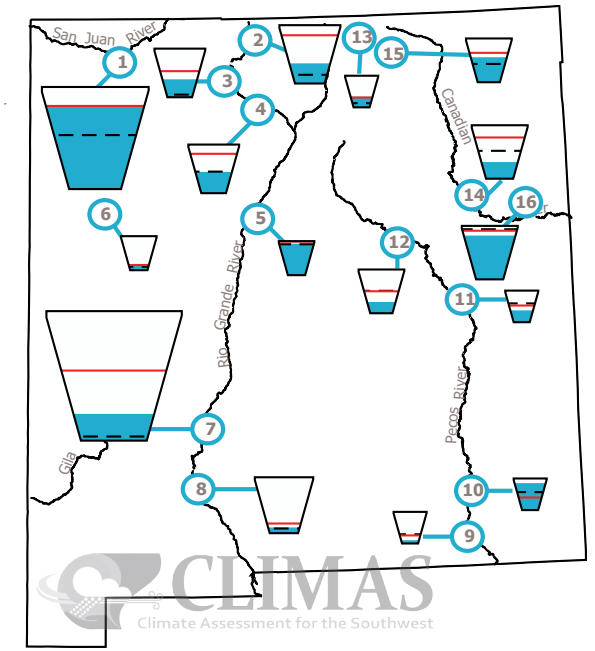
Contact Ben McMahan with questions/comments.

Reservoir Volumes

DATA THROUGH NOV 1, 2019
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	54%	13,033.6	24,322.0	-243.8
2. Lake Mead	39%	10,228.0	26,159.0	-39.0
3. Lake Mohave	87%	1,570.0	1,810.0	-6.0
4. Lake Havasu	93%	578.1	619.0	-24.5
5. Lyman	30%	8.9	30.0	-1.2
6. San Carlos	1%	6.0	875.0	-5.0
7. Verde River System	43%	123.3	287.4	-32.4
8. Salt River System	69%	1,407.9	2,025.8	-13.4

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	80%	1361.6	1,696.0	-26.5
2. Heron	34%	134.6	400.0	-4.3
3. El Vado	36%	69.2	190.3	-30.3
4. Abiquiu	43%	81.2	186.8	-5.9
5. Cochiti	92%	46.0	50.0	0.9
6. Bluewater	18%	6.8	38.5	-0.4
7. Elephant Butte	20%	436.0	2,195.0	7.7
8. Caballo	9%	29.7	332.0	-2.9
9. Lake Avalon	9%	0.4	4.5	-1.2
10. Brantley	85%	35.8	42.2	14.0
11. Sumner	38%	13.7	35.9	-1.2
12. Santa Rosa	25%	26.0	105.9	-0.4
13. Costilla	33%	5.4	16.0	0.4
14. Conchas	30%	75.6	254.2	-7.6
15. Eagle Nest	57%	44.9	79.0	-2.0
16. Ute Reservoir	81%	161	200	-3.0

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).

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA

UA Institute of the Environment

environment.arizona.edu

New Mexico Climate Center

weather.nmsu.edu

CLIMAS Research & Activities

CLIMAS Research

climas.arizona.edu/research

CLIMAS Outreach

climas.arizona.edu/outreach

Climate Services

climas.arizona.edu/climate-services

CLIMAS

Climate Assessment for the Southwest
A NOAA RISA TEAM

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 Institute of the Environment—is a collaboration between the University of Arizona 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.

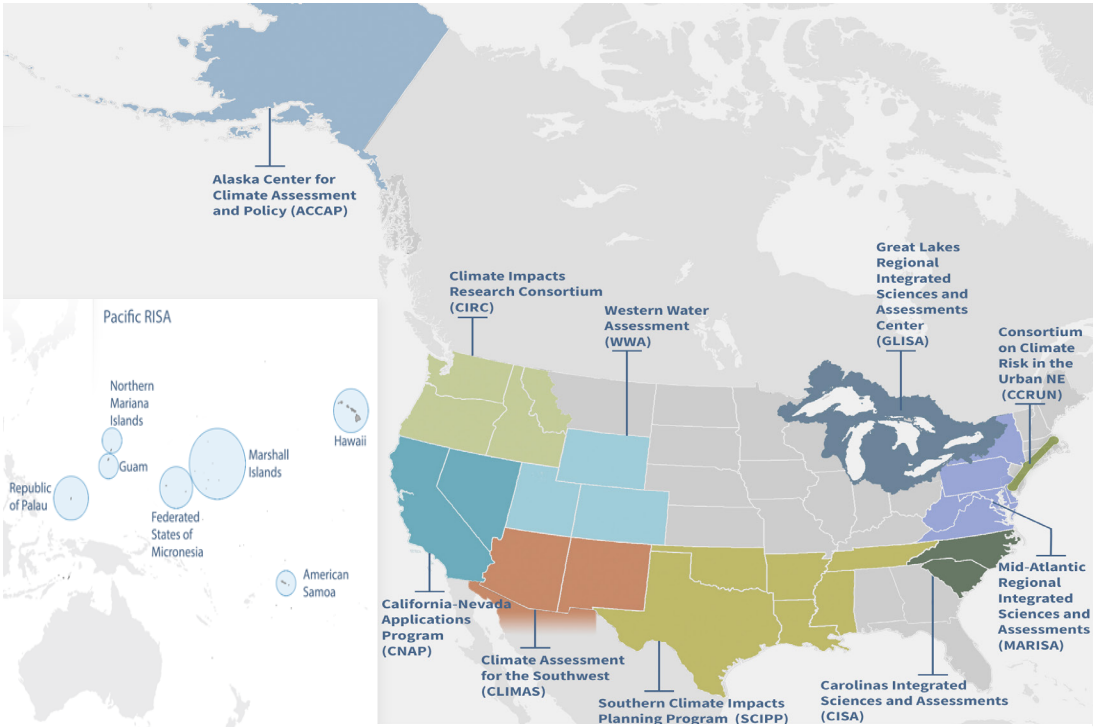


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions