Author/Editor

Ben McMahan
Assistant Research Professor, UArizona

Contributors

Mike Crimmins
UArizona Extension Specialist

Dave Dubois
New Mexico State Climatologist

Gregg Garfin
Founding Editor

Zack Guido
Arizona Institutes for Resilience

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.

October Southwest Climate Outlook

Monthly Precipitation and Temperature: September precipitation ranged between record driest and below average in most of Arizona and much of New Mexico (Fig. 1a). September temperatures were above average to record warmest in Arizona and average to above average in most of New Mexico (Fig. 1b). The daily average temperature anomalies for Sept. 1 – Oct. 14 (Fig. 2) highlight the fluctuations at select stations around the region.

Monsoon Precipitation: Monsoon precipitation (June-July-August-September) was record driest to much below normal (bottom 10%) across Arizona and ranged from near normal to record driest in most of New Mexico (Fig. 3) (see monsoon recap on p. 4-5).

Water Supply: Water year precipitation (Oct 2019 – Sept 2020) was near normal to above normal in parts of southwestern Arizona and southern New Mexico (along with west Texas and southern California), while most of the Four Corners region, northern New Mexico, and southern Colorado were below normal or much below normal (Fig. 4). Many of the reservoirs in the region are at or below the values recorded at this time last year. Most are below their long-term average (see Arizona and New Mexico reservoir storage on p. 6).

Drought: The Sept. 4 U.S. Drought Monitor (USDM) showed widespread areas of extreme drought (D3) and pockets of exceptional drought (D4) across Arizona and New Mexico, along with much of Nevada, Utah, and Colorado (Fig. 5). A major driver for this drought characterization was the well below average monsoon precipitation and accumulated long term precipitation deficits. The USDM from Jun. 30, 2020, highlights just how much drought expanded with the record or near-record dry monsoon across much of the southwest (Fig. 6)

ENSO Tracker: La Niña conditions are present and are expected to continue through winter (see ENSO-tracker on p. 3 for details).

Precipitation and Temperature Forecast: The three-month outlook for Nov through Jan calls for increased chances for below-normal precipitation across much of the southwestern U.S. and all of northern Mexico (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across most of the southwestern U.S. and northern Mexico (Fig. 7, bottom).

Tweet Oct 2020 SW Climate Outlook

OCT2020 @CLIMAS_UA SW Climate Outlook, La Niña Outlook, SW Monsoon (and lack thereof), AZ & NM Reservoirs, https://bit.ly/3nUlAGn #SWclimate #AZWx #NMWx

Oct 2020 SW Climate Outlook

Online Resources

Figure 1
National Centers for Environmental Information
ncei.noaa.gov

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

Figures 3, 4
West Wide Drought Tracker
wrcc.dri.edu/wwdt

Figures 5, 6
U.S. Drought Monitor
droughtmonitor.unl.edu

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

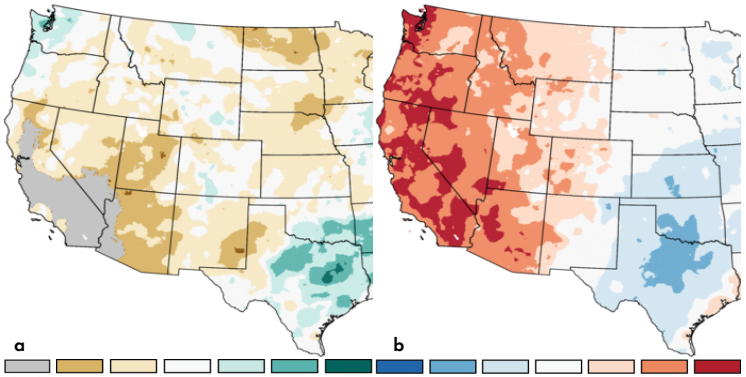


Figure 1: Sept 2020 Precipitation (a) & Temperature Ranks (b)

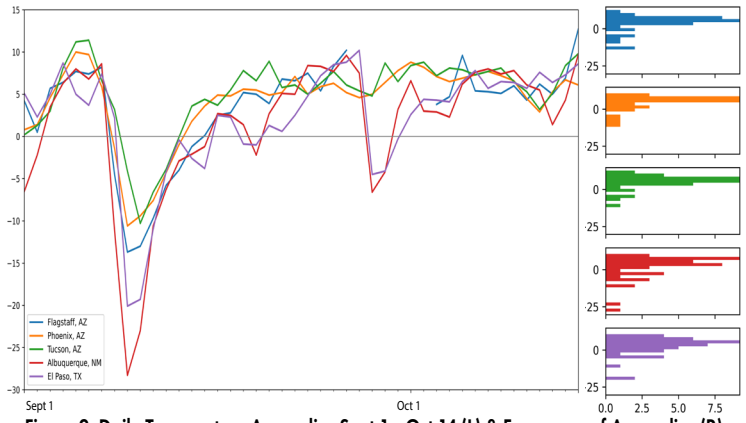


Figure 2: Daily Temperature Anomalies Sept 1 - Oct 14 (L) & Frequency of Anomalies (R)

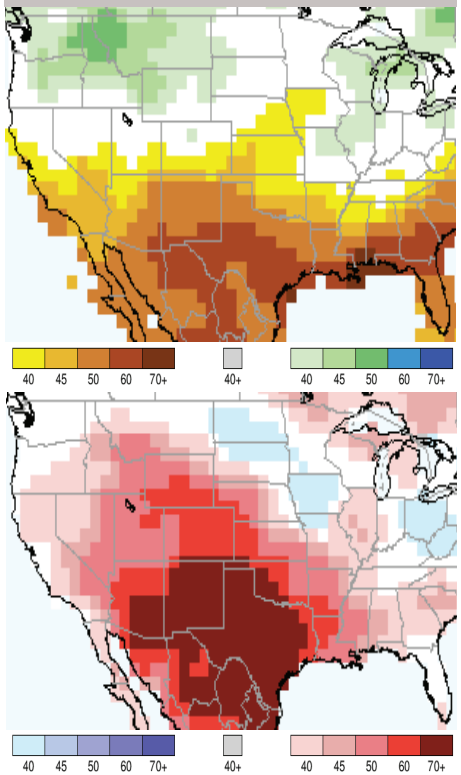


Figure 7: Three-Month (Nov-Jan) Forecast for Precip (top) and Temps (bottom)

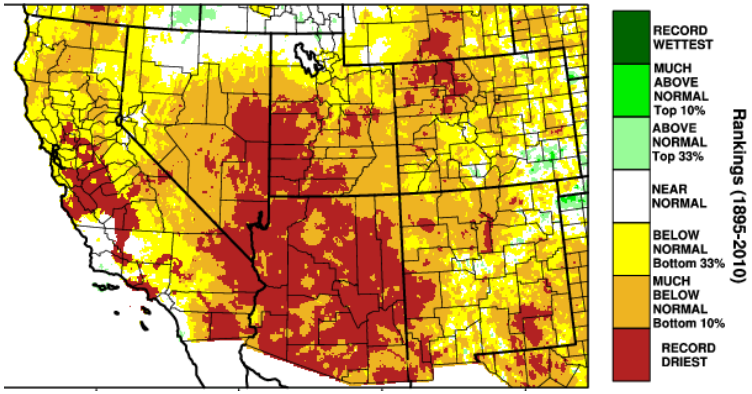


Figure 3: Monsoon 2020 Precipitation (June - Sept 2020)

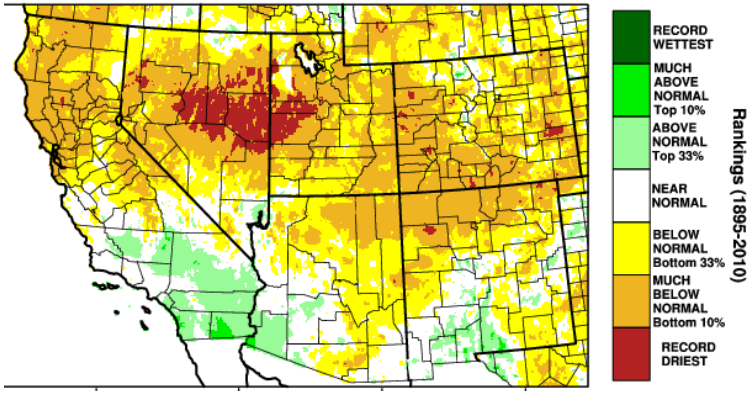


Figure 4: Water Year Precipitation (Oct 2019 - Sept 2020)

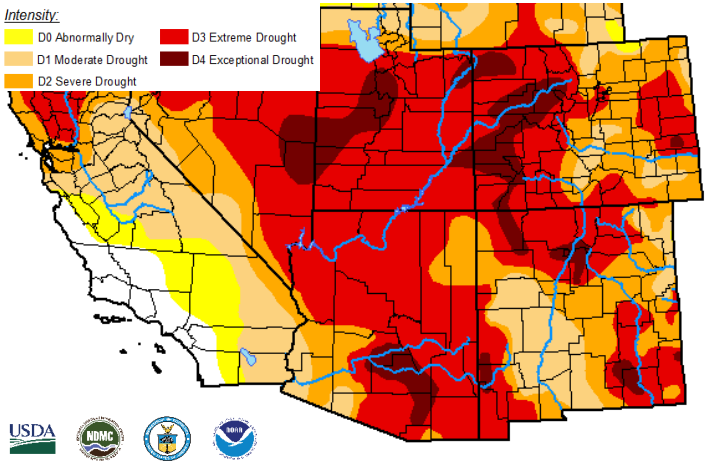


Figure 5: US Drought Monitor - Oct 6, 2020

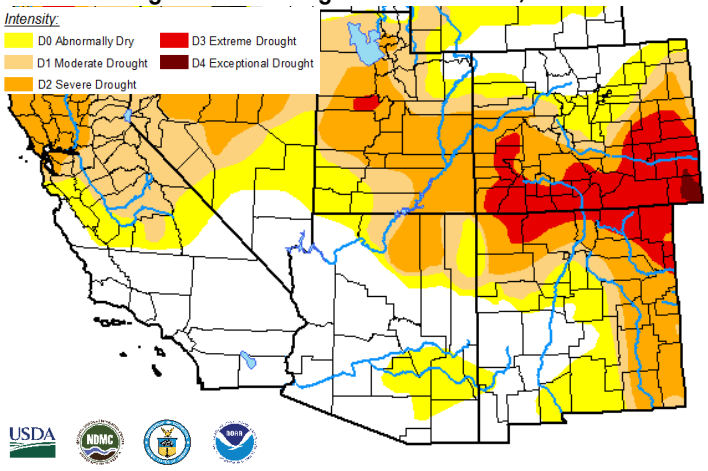


Figure 6: US Drought Monitor - June 30, 2020

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

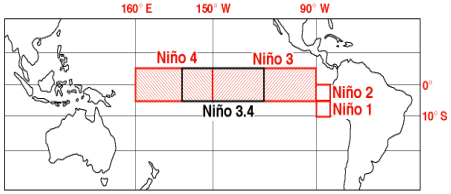
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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

Sea surface temperature (SST) forecasts are for below normal across the equatorial Pacific (Fig. 1), extending the trend of the last 3-4 months (Fig. 2). International climate outlooks describe La Niña conditions as likely to remain a La Niña event through winter 2020.

Forecast Roundup: On Oct 8, the NOAA Climate Prediction Center (CPC) ENSO status was at La Niña Advisory. The CPC called for an 85-percent chance of La Niña continuing through winter 2020-2021 and a 60-percent chance of lasting through April 2021. On Oct 8, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "SSTs in the east-central Pacific are roughly 1 degree C below average, and all key atmospheric variables are consistent with La Niña conditions". On Oct 9, the Japanese Meteorological Agency (JMA) elevated its forecast to a 90-percent chance of La Niña conditions to last through winter 2020-2021. On Oct 13, the Australian Bureau of Meteorology was at official La Niña status and noted "around half of the models anticipate a strong event." They also indicated a shorter duration in comparison to previous strong events (e.g., 2010-2012). The North American Multi-Model Ensemble (dashed black line, Fig. 4) has moved well into La Niña territory, and projections indicate it will remain La Niña until at least early 2021.

Summary: La Niña conditions are present, and most forecasts and outlooks call for these conditions to last through winter 2020-2021. La Niña events tend to result in drier than normal conditions over winter, a pattern found in the monthly and seasonal climate outlooks. The forecast strength of this event (moderate to strong) increases confidence in forecasts that call for a drier than normal winter. If this forecast is correct, it will further exacerbate the precipitation deficits from the monsoon and bring about the uncommon circumstance where consecutive periods of seasonal rainfall in the Southwest (in this case, monsoon 2020, then winter 2020-2021) are both drier than average.

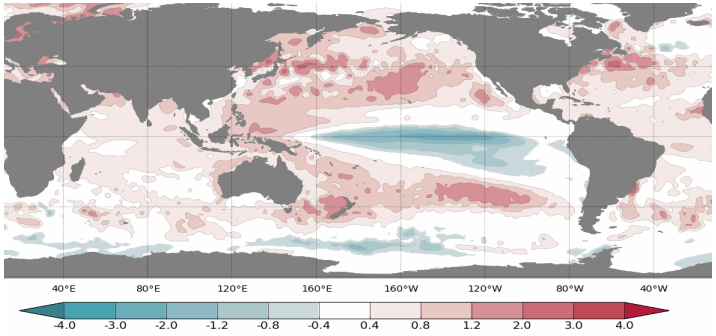


Figure 1: Nov 2020 - Jan 2021 Sea Surface Temperature (SST) Anomaly Forecast

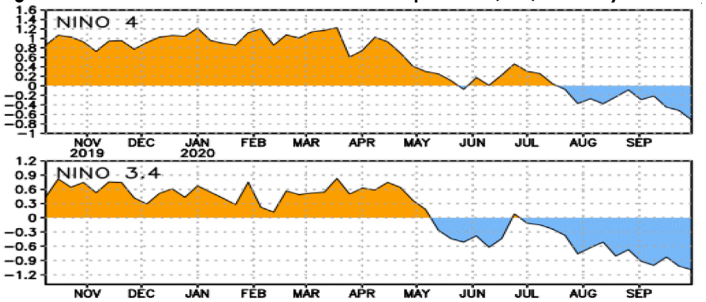


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

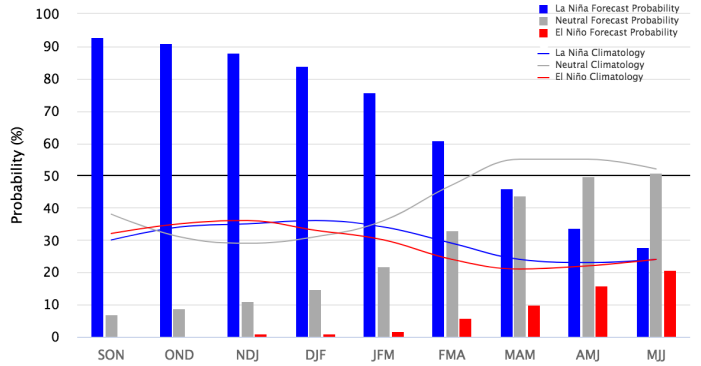


Figure 3: Early-Oct IRI/CPC Model-Based Probabilistic ENSO Forecast

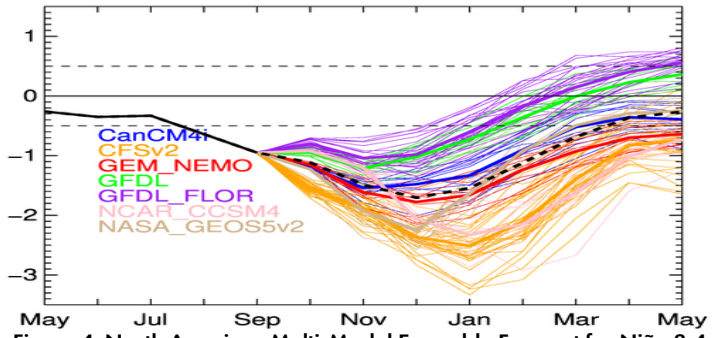


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figure 1
UArizona Climate Science Applications Program
cals.arizona.edu/climate/

data: PRISM Climate Group

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

data: RCC-ACIS

Figure 3
West Wide Drought Tracker
wrcc.dri.edu/wwdt

Monsoon 2020: Well Below Average or Historically Dry?

Total precipitation (Jun 15 - Sept 30) for Arizona and New Mexico identifies the range of precipitation observed this monsoon (Fig. 1). July-Aug-Sept precipitation at stations around the region (Fig. 2), and maps of the seasonal ranking (Fig. 3), both illustrate features of a drier than normal monsoon.

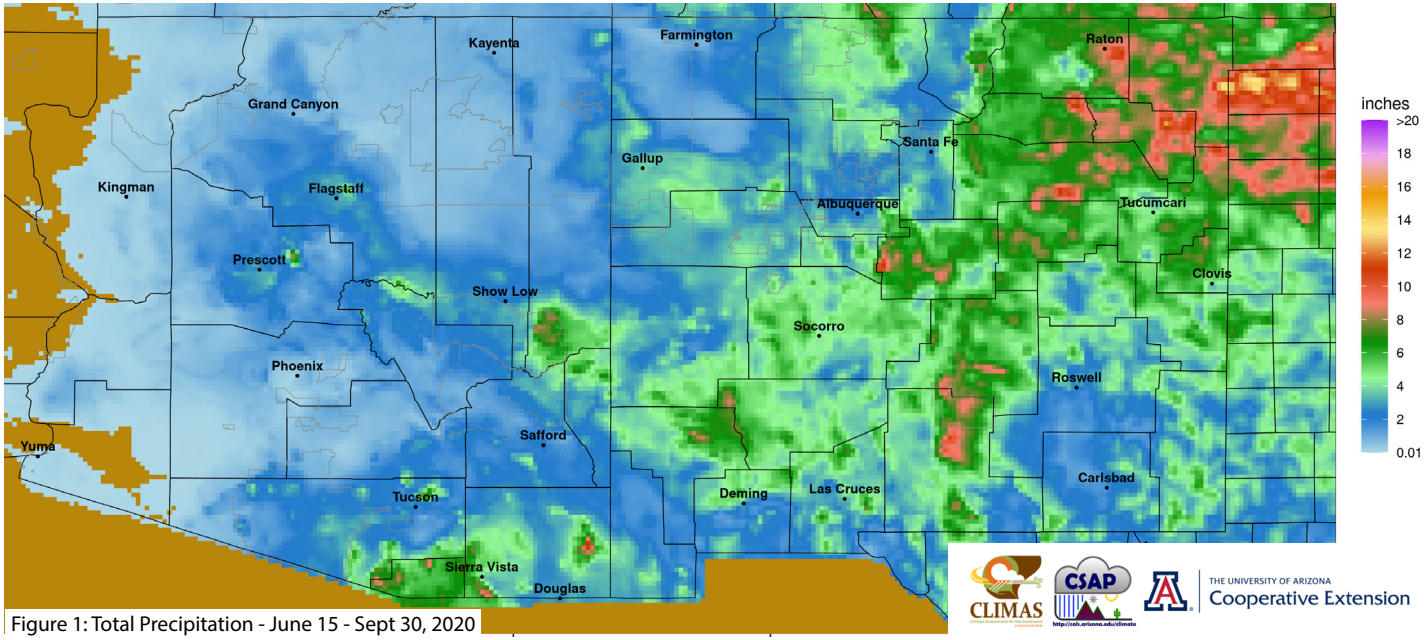


Figure 1: Total Precipitation - June 15 - Sept 30, 2020

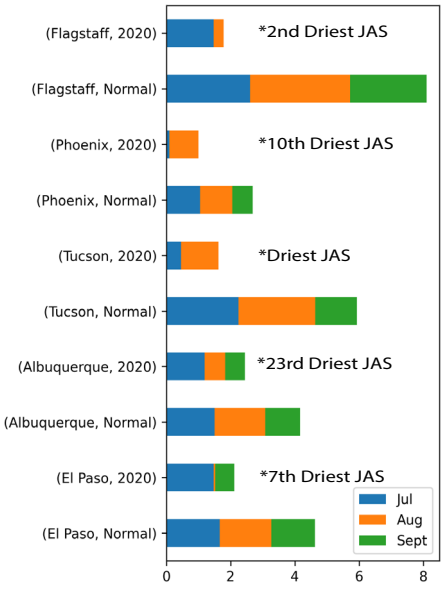


Fig 02: Monsoon Precip July-Aug-Sept

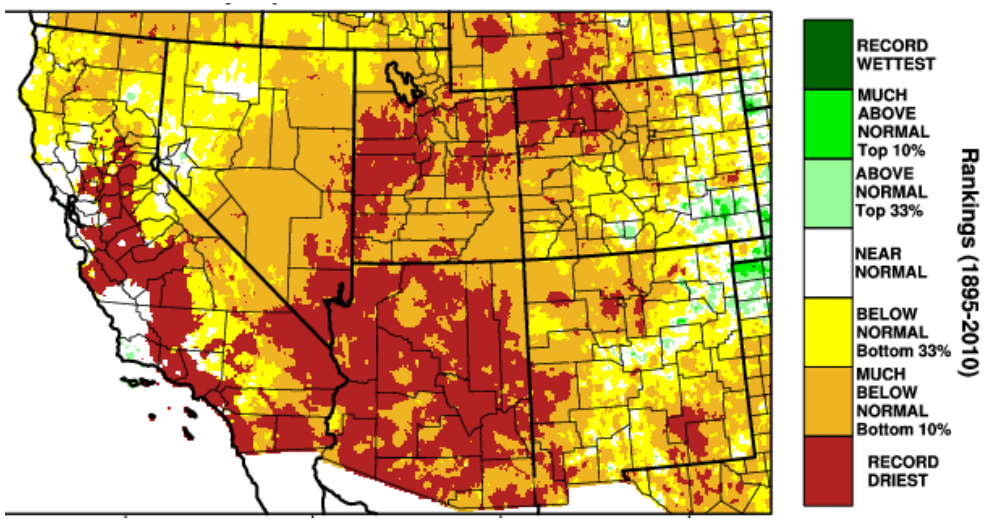


Figure 3: Monsoon 2020 Precipitation (Jul - Aug - Sept 2020)

Online Resources

Figures 4-5
UArizona Climate Science Applications Program
cals.arizona.edu/climate/

data: PRISM Climate Group

Monsoon 2020: Well Below Average or Historically Dry?

Percent of normal precipitation (Fig. 4) and percent of days with rain (Fig. 5) during the monsoon (Jun 15 - Sept 30) further illustrate the widespread nature of the below average monsoon in 2020. In the historical record, there have been drier monsoons at various locations (see Fig. 2, previous page), but to see these low values across the region is much less common.

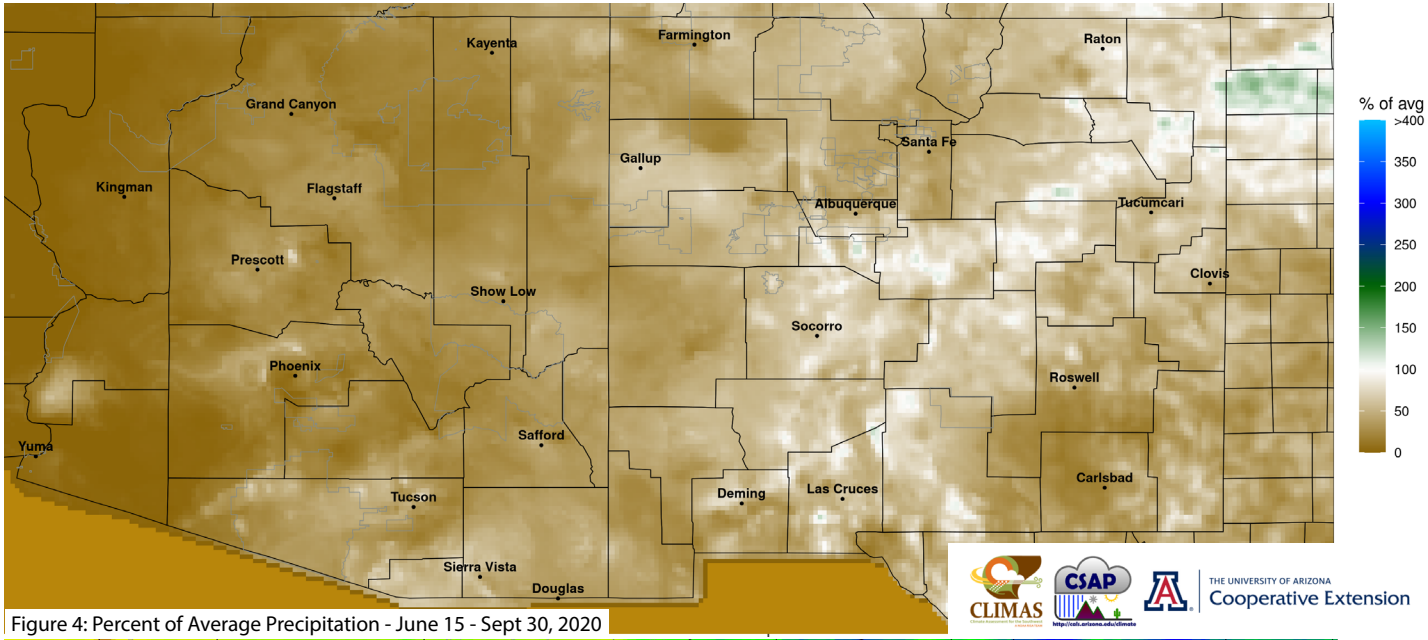


Figure 4: Percent of Average Precipitation - June 15 - Sept 30, 2020

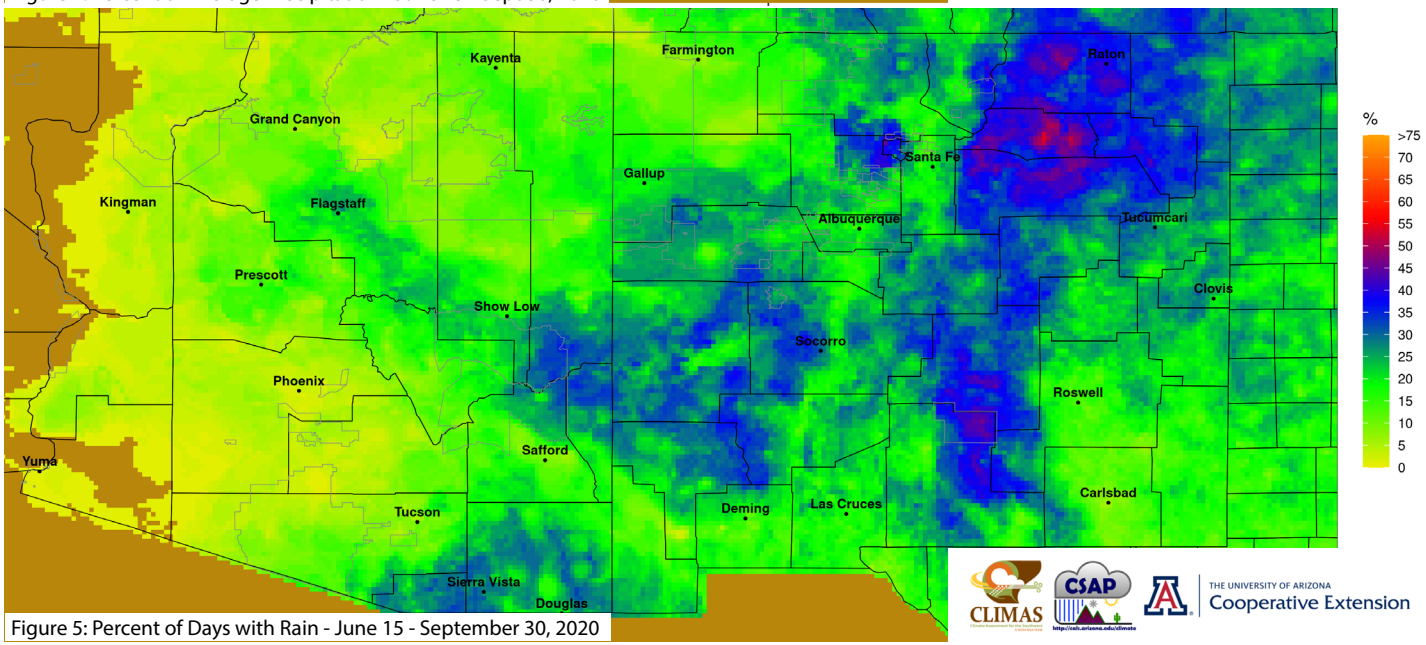


Figure 5: Percent of Days with Rain - June 15 - September 30, 2020

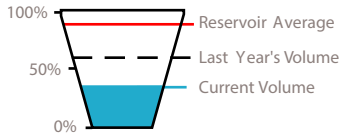
Online Resources

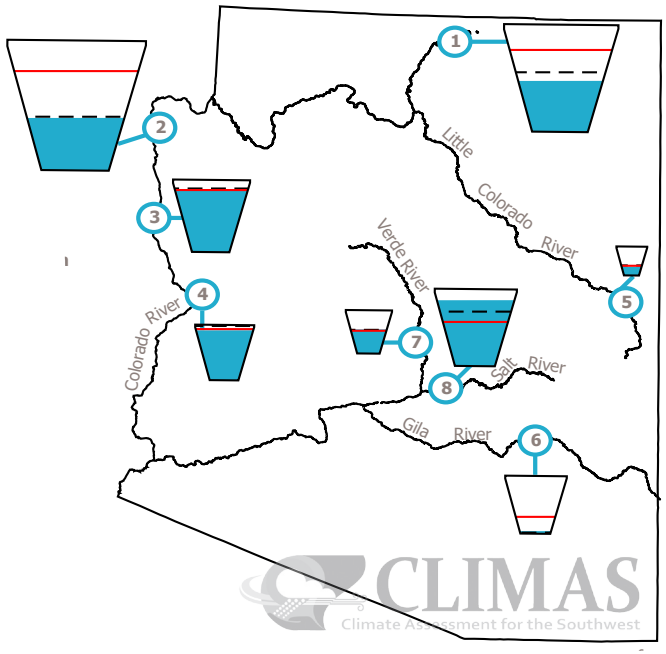
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

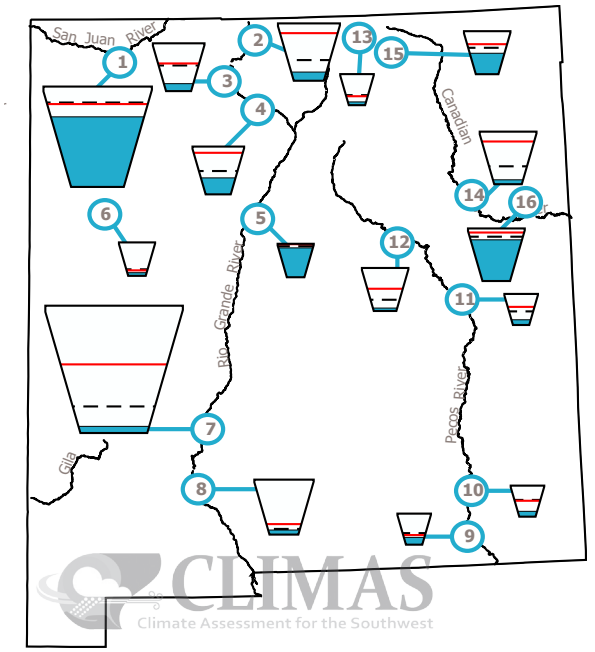
Contact Ben McMahan with questions/comments.

Reservoir Volumes

DATA THROUGH OCT 1, 2020
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	47%	11,370.5	24,322.0	-352.8
2. Lake Mead	39%	10,279.0	26,159.0	-70.0
3. Lake Mohave	84%	1,525.0	1,810.0	-163.0
4. Lake Havasu	90%	555.6	619.0	-28.4
5. Lyman	28%	8.4	30.0	-1.2
6. San Carlos	4%	36.1	875.0	-21.9
7. Verde River System	55%	159.0	287.4	-8.0
8. Salt River System	84%	1,708.0	2,025.8	528.8

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	68%	1,149.2	1,696.0	-53.2
2. Heron	14%	54.2	400.0	-33.0
3. El Vado	15%	29.5	190.3	-0.3
4. Abiquiu	33%	61.9	186.8	10.1
5. Cochiti	86%	43.1	50.0	43.1
6. Bluewater	9%	3.6	38.5	-0.2
7. Elephant Butte	4%	82.8	2,195.0	-25.7
8. Caballo	8%	27.8	332.0	-5.0
9. Lake Avalon	22%	1.0	4.5	-0.2
10. Brantley	17%	7.3	42.2	-5.7
11. Sumner	16%	5.8	35.9	-1.0
12. Santa Rosa	6%	6.7	105.9	-0.8
13. Costilla	9%	1.4	16.0	-0.1
14. Conchas	8%	21.4	254.2	-66.2
15. Eagle Nest	47%	37.2	79.0	-1.4
16. Ute Reservoir	76%	152	200	-6.0

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

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.

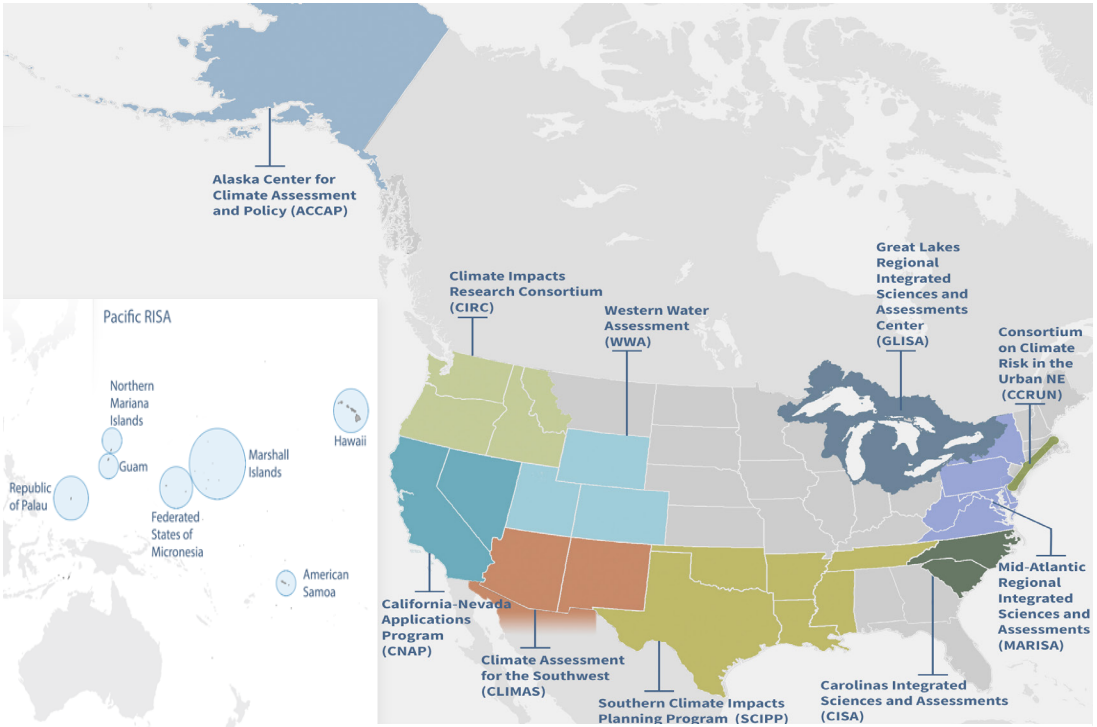


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions