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# July Southwest Climate Outlook

**Precipitation & Temperature:** June precipitation totals generally were average to above average in Arizona and New Mexico, with the exception of southern Arizona (much above average) and the Four Corners region of New Mexico (below average) (Fig. 1a). Temperatures were above average to record warm across most of the Southwest (Fig. 1b), with two periods of extreme heat (June 3–5 and June 18–20), the latter of which resulted in multiple fatalities in southern Arizona. As of July 20, temperatures this month have remained mostly above average across the Southwest (Fig. 2).

**Monsoon:** Following a strong start to the monsoon in late June, there was a considerable decline during much of July, aside from sporadic storms that pushed into the southeastern corner of Arizona (Fig. 3). This decline, or "break," is associated with a shift in the monsoon circulation patterns, in which a high pressure ridge diverts moisture and storm activity away from southern Arizona (see Monsoon Tracker on p. 4 for more information).

**Drought & Water Supply:** Long-term drought persists across the Southwest (Fig. 4), reflecting multiple years of drought and accumulating precipitation deficits. The southern half of Arizona and the western edge of New Mexico are experiencing moderate drought, while most of the rest of these two states are designated as abnormally dry. Water year precipitation to date in Southern California, most of southern Arizona, and western New Mexico is below average (Fig. 5). Lakes Mead and Powell in Arizona and Elephant Butte Reservoir in New Mexico are at 36, 57, and 14 percent of capacity, respectively (see reservoir storage diagrams on p. 5). Lake Mead is of particular interest, given water restrictions that would be triggered were levels to drop below critical thresholds (see CLIMAS 1075 podcast series – climas.arizona.edu/media/podcasts).

**La Niña:** Sea surface temperature anomalies and atmospheric patterns all indicate ENSO-neutral conditions. Most models point towards the formation of a weak La Niña event sometime in late summer or early fall that is likely to last through winter 2017. Some uncertainty remains regarding the strength and timing of the event (see La Niña Tracker on p. 3).

**Wildfire:** Given the abundant fine fuels that grew following a strong monsoon and tropical storm season in fall 2015 and given the warmer- and drier-than-expected conditions in winter and early spring 2016, there was concern over the possible severity of wildfire in 2016. Relatively cooler and wetter-than-average conditions (linked to the lingering effect of El Niño) tamped down early-season fire activity in April and May. Fire activity increased in June, but numerous precipitation events, a strong start to the monsoon, and increased relative humidity across the region helped limit the risk of severe wildfire. As of July 20, wildland fires had burned approximately 177,000 acres in Arizona and approximately 135,000 acres in New Mexico. Much of the fire activity this year has been managed for beneficial use. With the onset of the monsoon and the associated increase in precipitation activity and relative humidity, the window for severe fire is nearly closed.

**Precipitation & Temperature Forecasts:** The July 21 NOAA-Climate Prediction Center's one-month seasonal outlook calls for increased chances of above-average precipitation for most of Arizona and western New Mexico (Fig. 6, top), and increased chances of above-average temperatures across the entire western United States (Fig. 6, bottom).

## Tweet June SW Climate Outlook CLICK TO TWEET

JUL2016 @CLIMAS_UA SW Climate Outlook - Climate Summary, La Niña & Monsoon Trackers, Reservoirs and Water Supply - http://bit.ly/29ZuI8K

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

# July Southwest Climate Outlook

## Online Resources

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

**Figures 2-3**
**High Plains Regional Climate Center**
http://www.hprcc.unl.edu/

**Figure 4**
**U.S. Drought Monitor**
http://droughtmonitor.unl.edu/

**Figure 5**
**West Wide Drought Tracker**
http://www.wrcc.dri.edu/wwdt

**Figure 6**
**NWS Climate Prediction Center**
http://www.cpc.ncep.noaa.gov/

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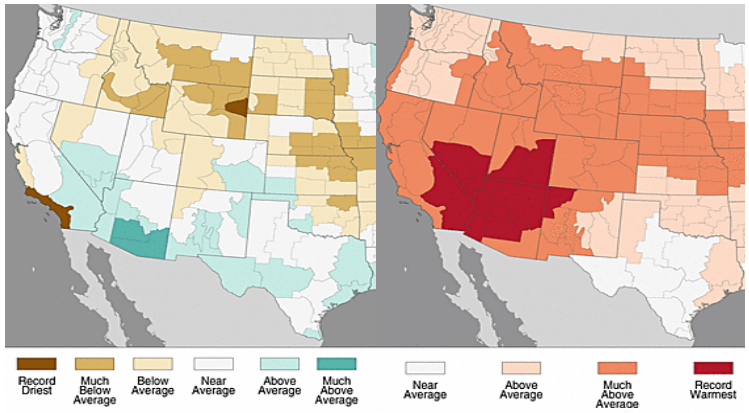



Figure 1: June 2016 Precipitation (a) & Temperature Ranks (b)

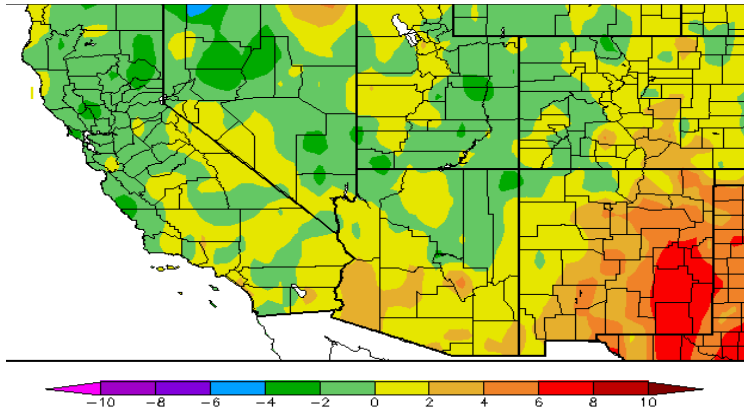



Figure 2: Departure from Normal Temperature July 1 - July 20 2016

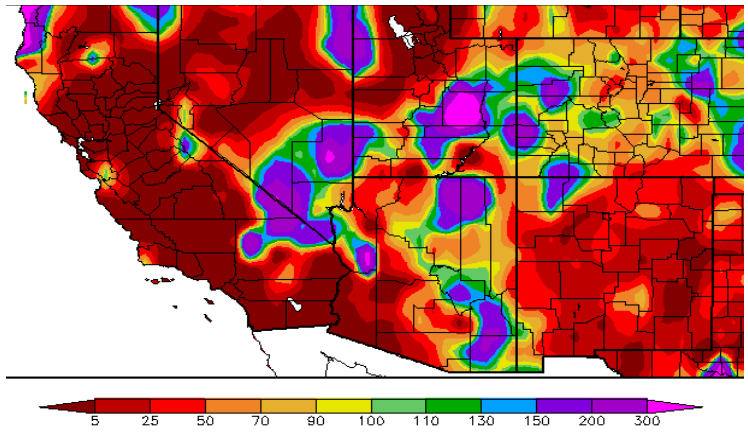



Figure 3: Percent of Normal Precipitation July 1 - July 20 2016

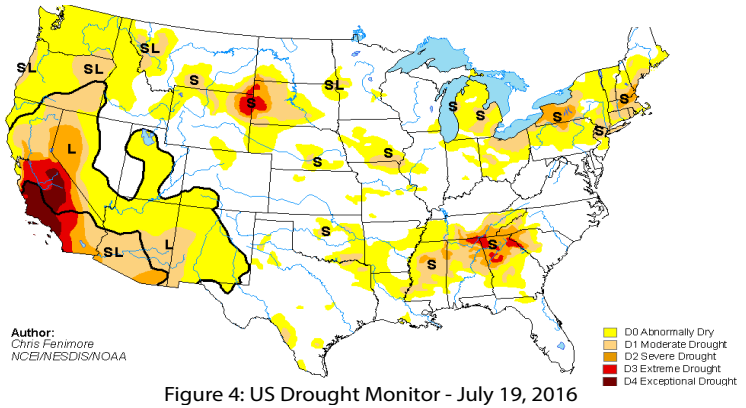



Figure 4: US Drought Monitor - July 19, 2016

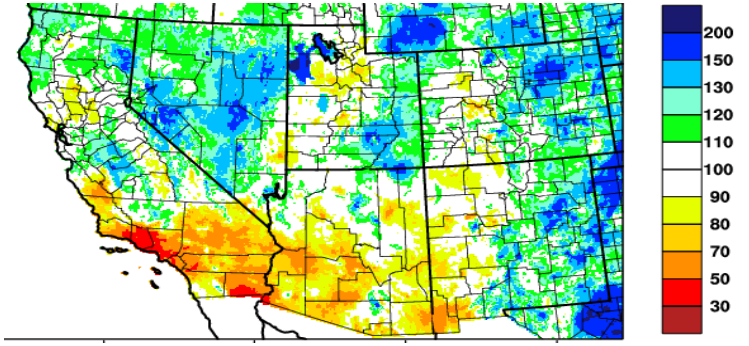



Figure 5: Percent of Normal Precipitation Oct 1 2015 - June 30 2016

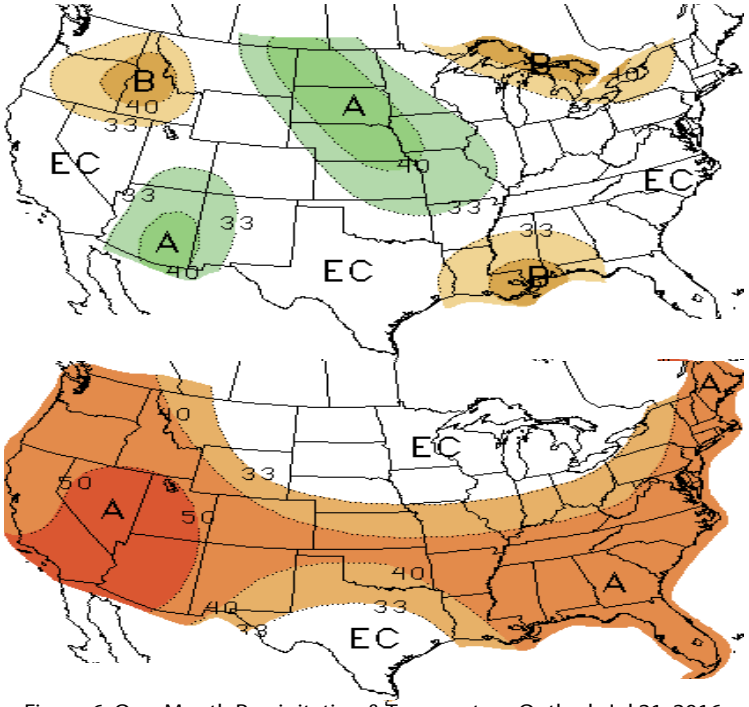



Figure 6: One-Month Precipitation & Temperature Outlook-Jul 21, 2016

## 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

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

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

# El Niño Southern Oscillation La Niña Tracker

All oceanic and atmospheric indicators of the El Niño-Southern Oscillation (ENSO) have returned to neutral conditions (Figs. 1-2). The development of a La Niña event in 2016 remains a distinct possibility, even while the timing and intensity remain relatively uncertain.

On July 14, the NOAA Climate Prediction Center (CPC) highlighted the persistent neutral conditions currently observed and identified some tension between statistical and dynamical models, the former predicting a later onset and weaker event than the latter. The CPC forecast took a middle ground between these models and forecast a 55–60 percent chance of a weak La Niña event starting sometime between August and October 2016. On July 19, the Australian Bureau of Meteorology maintained its La Niña watch but saw some recent declines in model projections that decreased the forecast probability to a 50 percent chance of a La Niña event developing. On July 21, the International Research Institute for Climate and Society (IRI) and CPC forecasts highlighted that while most of the oceanic and atmospheric conditions were indicative of a La Niña event forming, the trade winds had not yet shifted towards La Niña, and there was a lack of coupling between ocean and atmosphere that is crucial to the formation of a La Niña event. The IRI-CPC forecast still sees the formation of a La Niña event in 2016 as more likely than not, but with the timing delayed and the intensity of the event not likely to exceed weak status (Fig. 3). The North American multi-model ensemble characterizes the current model spread and highlights the variability looking forward to 2017, but the ensemble mean hovers close to weak La Niña status for fall and winter of the coming year (Fig. 4).

La Niña typically brings drier-than-average conditions to the Southwest, and it will be important to track both the timing and intensity of this event in relation to precipitation, temperature, snowpack, and water supply over the coming year. CLIMAS researchers are contributing to a La Niña information hub that will mirror the El Niño hub, with the goal of providing a curated set of news and forecast models regarding La Niña, as well as expert commentary and analysis on the possible impacts to the Southwest.

Visit climas.arizona.edu for more information.

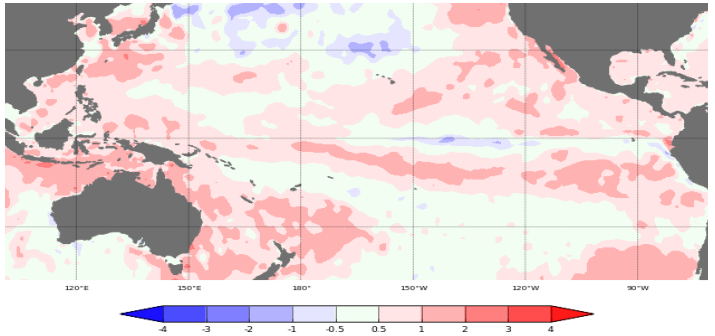


Figure 1: June 2016 Sea Surface Temperature (SST) Anomalies

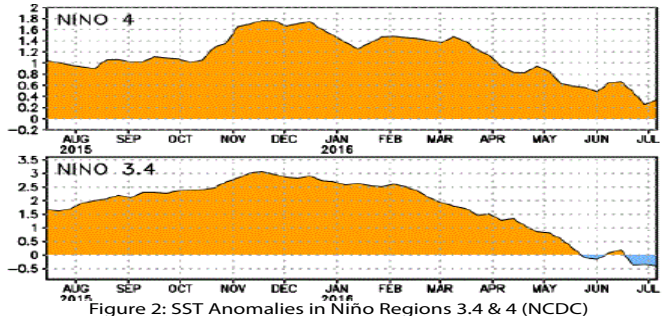


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

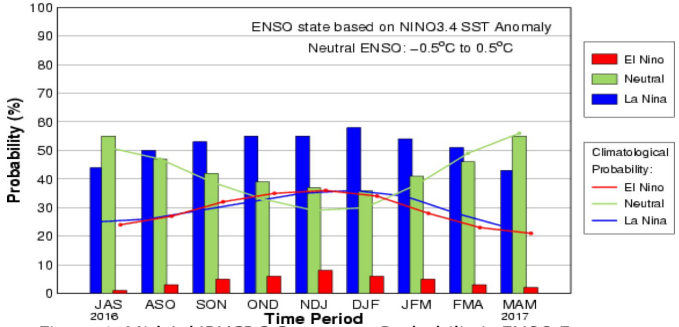


Figure 3: Mid-Jul IRI/CPC Consensus Probabilistic ENSO Forecast

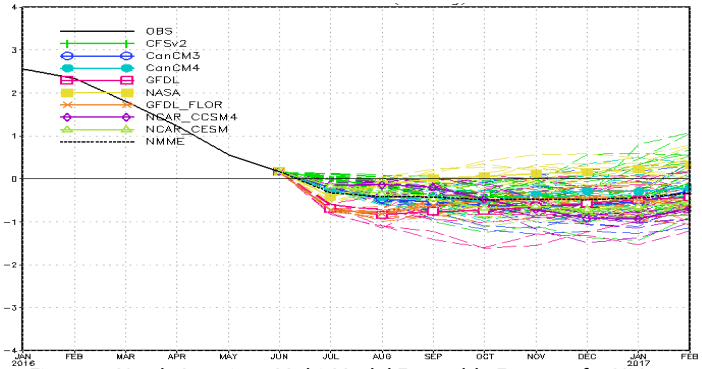


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

## Online Resources

**Figure 1**
**Earth Systems Research Lab**
http://www.esrl.noaa.gov

**Figures 3-6**
**Climate Science Applications Program**
http://cals.arizona.edu/climate

## SW Monsoon

For More Information, visit:

www.climas.arizona.edu/sw-climate/monsoon

# Monsoon Tracker (Jun 15 - Jul 20)

The southwestern monsoon officially starts June 15 and ends September 30 – the dates the National Weather Service began using in 2008 to identify the window of typical activity for the region. The historical start date of monsoon activity (increased dew point, onset of precipitation events) varies across the region and is reflected in a generally westward migration over the season (Fig. 1). The monsoon ridge also shifts throughout the season, and the location of this ridge helps determine where storms and precipitation events will occur.

The Southwest saw a strong start to the monsoon in the second half of June, with a number of heavy rainfall events, particularly across southern Arizona. Most of July has been characterized by a monsoon "break" for the Southwest, with very few precipitation events other than in the southeastern corner of Arizona. Since the start of the monsoon, most of Arizona and New Mexico have recorded below-average precipitation (Figs. 2a-b), but this is early in the season and a wide range of precipitation totals and considerable spatial variability is to be expected at this point (Figs. 3a-b). The percent of days with rain highlights the irregular coverage of monsoon precipitation thus far, with much of the heavy precipitation activity clustered in southeastern Arizona and across much of New Mexico (Figs. 4a-b).

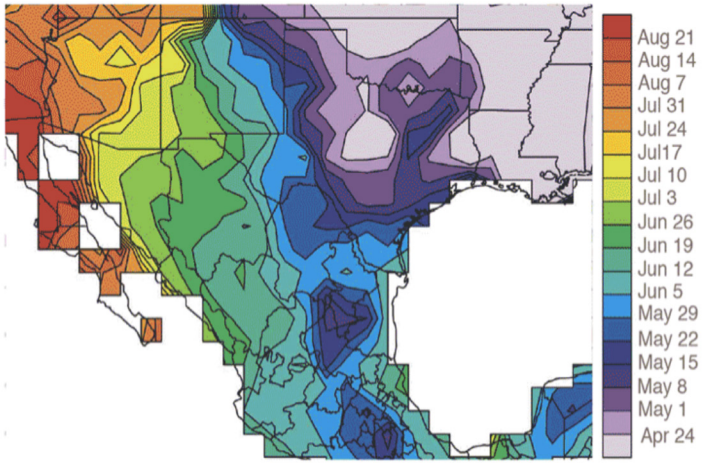



Figure 1: Historical Monsoon Onset Date

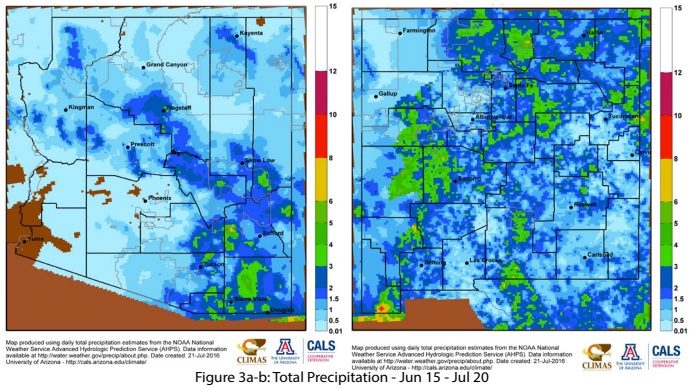


Figure 3a-b: Total Precipitation - Jun 15 - Jul 20

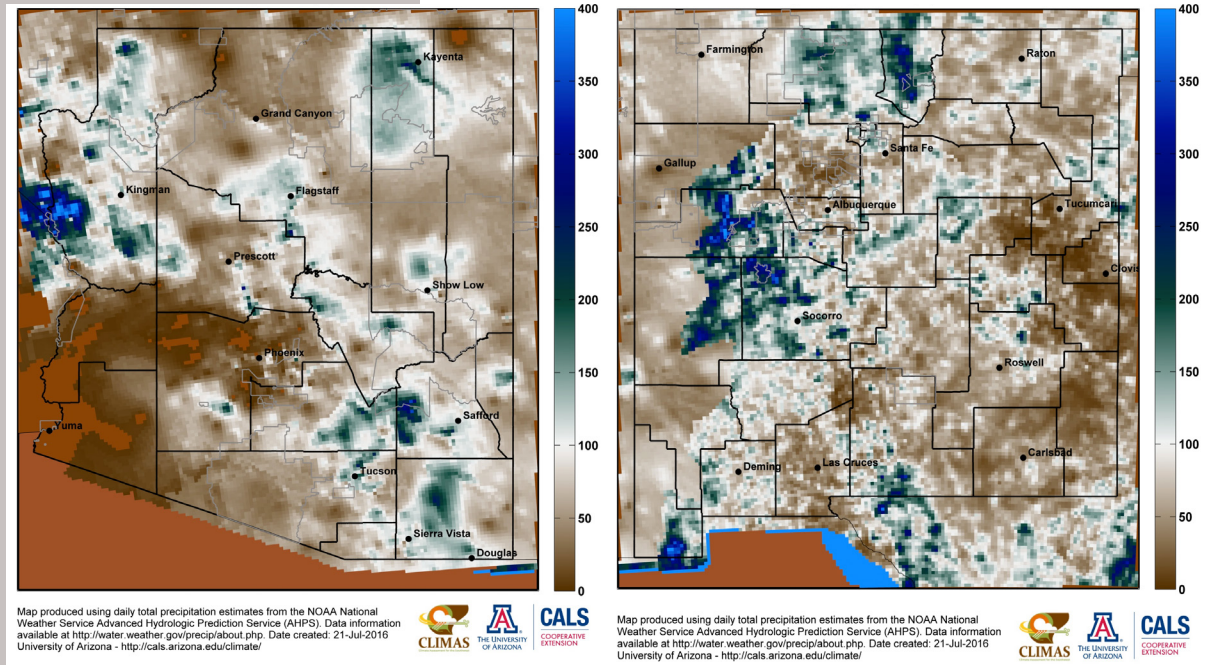



Figure 2a-b: Percent of Average Precipitation - Jun 15 - Jul 20

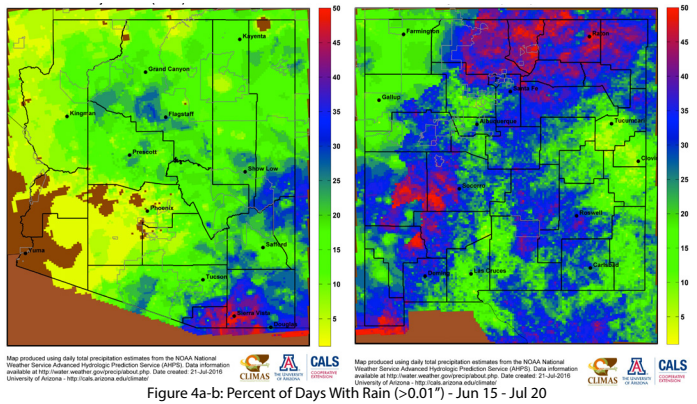


Figure 4a-b: Percent of Days With Rain (>0.01") - Jun 15 - Jul 20

## 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

We updated our 'max storage' values for numerous NM reservoirs based on conservation storage vs. maximum flood capacity. This altered the percent full calculations, even while 'current storage' numbers are unchanged.

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).

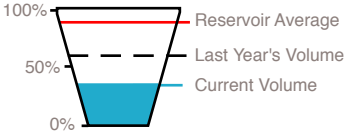
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons).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

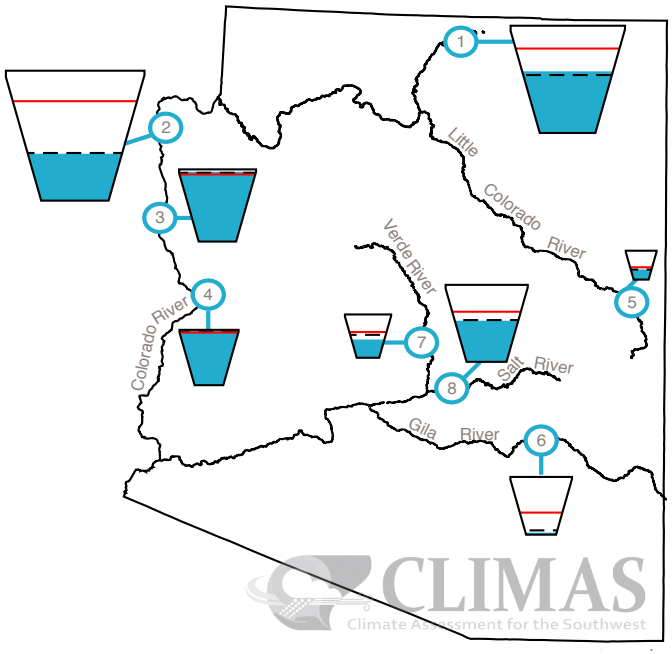
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

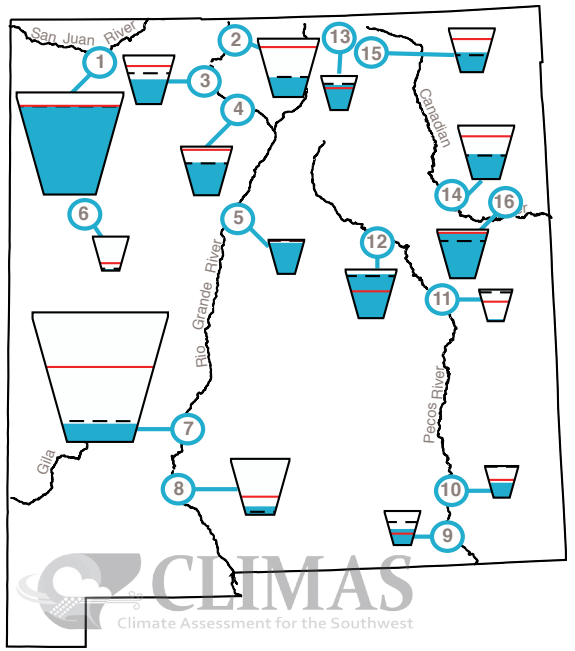
# Reservoir Volumes

DATA THROUGH JUNE 30, 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 | 57% | 13,764.3 | 24,322.0 | 1683.9 |
| 2. Lake Mead | 36% | 9,330.0 | 26,159.0 | -160.0 |
| 3. Lake Mohave | 96% | 1,740.0 | 1,810.0 | 39.0 |
| 4. Lake Havasu | 97% | 597.8 | 619.0 | 14.2 |
| 5. Lyman | 35% | 10.5 | 30.0 | -1.5 |
| 6. San Carlos | 3% | 30.3 | 875.0 | -19.4 |
| 7. Verde River System | 42% | 122.0 | 287.4 | -3.7 |
| 8. Salt River System | 53% | 1,080.4 | 2,025.8 | -61.4 |

*KAF: thousands of acre-feet

| Reservoir | Capacity | Current Storage* | Max Storage* | One-Month Change in Storage* |
|---|---|---|---|---|
| 1. Navajo | 85% | 1,437.1 | 1,696.0 | -112.3 |
| 2. Heron | 34% | 135.8 | 400.0 | 30.4 |
| 3. El Vado | 51% | 96.8 | 190.3 | -6.8 |
| 4. Abiquiu | 67% | 124.6 | 186.8** | -22.5 |
| 5. Cochiti | 92% | 46.1 | 50.0** | -2.1 |
| 6. Bluewater | 5% | 1.9 | 38.5 | -0.2 |
| 7. Elephant Butte | 14% | 298.3 | 2,195.0 | -12.2 |
| 8. Caballo | 15% | 51.1 | 332.0 | -19.8 |
| 9. Lake Avalon | 47% | 2.1 | 4.5** | -0.3 |
| 10. Brantley | 46% | 19.4 | 42.2** | -8.8 |
| 11. Sumner | 6% | 2.2 | 102.0** | -27.1 |
| 12. Santa Rosa | 90% | 95.0 | 105.9** | -10.0 |
| 13. Costilla | 74% | 11.9 | 16.0 | 0.1 |
| 14. Conchas | 46% | 116.1 | 254.2 | -4.8 |
| 15. Eagle Nest | 44% | 35.0 | 79.0 | -0.4 |
| 16. Ute Reservoir | 93% | 186 | 200 | 1.0 |

## On the CLIMAS Website

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# Rio Grande|Bravo

CLIMATE IMPACTS & OUTLOOK

The Rio Grande–Bravo Climate Impacts & Outlook is a monthly product that provides timely climate, weather, and impacts information to stakeholders, researchers, and other interested parties in the Rio Grande–Bravo Basin region of New Mexico, Texas, and Mexico. Each edition recaps conditions over the previous months, including notable events, and then shows forecasts for the next three months for temperature, precipitation, and fire conditions.

The outlook is a product of the North American Climate Services Partnership (NACSP), an innovative trilateral partnership between the U.S., Mexico, and Canada. This partnership was established to respond to an increasing demand for accessible and timely scientific data and information in order to make informed decisions and build resilience in our communities. CLIMAS is an active participant in the NACSP Rio Grande–Rio Bravo Regional Pilot Area. CLIMAS co-produces the Rio Grande–Bravo Climate Impacts & Outlook with NACSP partners and is one of several partners hosting the outlook.

*Read more at: http://www.climas.arizona.edu/rgbo*

## CLIMAS Southwest Climate Podcast
## June 2016 - Monsoon in the SW: Predictably Inevitable, but Inevitably Unpredictable

In the June 2016 episode of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido look back at May and June to discuss the relatively mild weather of May, the near-record heat in June, and the transition into the monsoon. In the second half of the podcast, they dive into the weeds on monsoon climatology and the variable spatial and temporal patterns that characterize the monsoon in the Southwest. They highlight what we might expect in the next 90 days, along with a discussion of the difficulty of creating regional monsoon forecasts given the high degree of spatial and temporal variability and the randomness of weather.

**Listen***: http://www.climas.arizona.edu/podcast/june-2016-climas-sw-climate-podcast-monsoon-sw-predictably-inevitable-inevitably*

## Monsoon 2016

The official start of the monsoon is June 15, but early July is the most common start time for monsoon conditions. We will track the monsoon in the *Southwest Climate Outlook* and on the CLIMAS website *http://www.climas.arizona.edu/sw-climate/monsoon*