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March Southwest Climate Outlook

Precipitation & Temperature: Over the past 30 days, precipitation totals were well below average for most of the southwestern U.S. (Fig. 1). Despite anticipation for above-average precipitation this winter due to the strong El Niño event, a ridge of high pressure diverted moisture around the Southwest for much of the last 60 days. The resulting precipitation patterns look more like La Niña than El Niño, as the coastal Northwest and northern California have recorded well above-average precipitation and the Southwest has been very warm and dry (see El Niño Tracker on pages 3-4 for details). Temperatures in February were well above average for most of the Southwest, setting numerous high-temperature records, especially in southern Arizona and coastal Southern California (Fig. 2).

Drought: Long-term drought persists across much of the Southwest, and recent warm and dry conditions have done little to improve regional outlooks on short-term drought (Fig. 3). There was hope that a strong El Niño might reduce precipitation deficits, but multi-year droughts, such as those experienced during much of this century so far, will require more sustained above-average precipitation over multi-year periods to fully recover.

Snowpack & Water Supply: This winter, below-average precipitation and above-average temperatures have dropped snow water equivalent (SWE) percent of normal to well below average in Arizona and southern New Mexico, with values ranging between 0 and 25 percent of normal. Northern New Mexico and much of the Upper Colorado River Basin are faring somewhat better, with SWE values between 75 and 110 percent of normal (Fig. 4). It remains to be seen how the rest of winter and spring will play out in high elevation areas, and how this will affect reservoir storage in the region (See reservoir storage information on page 5).

El Niño Tracker: With winter winding down and little on the horizon to indicate a shift towards a wetter signal, this El Niño event is shaping up to be a bit of a disappointment compared to forecasts and media characterizations that dominated the run up to the actual event. Expectations for a strong El Niño had been high, beginning with the false start of this El Niño event in 2014–2015, and continuing with a general sense of the potential a strong El Niño event could have to mitigate ongoing drought conditions (see expanded El Niño Tracker on pages 3-4).

Environmental Health & Safety: The Southwest has been awash in color as flowering plants exploded to life, fed by the increased precipitation during fall 2015 and kickstarted by above-average temperatures of the past month or so. As a result, pollen counts are up, and as dry conditions persist, we can expect increased dust and particulate matter as well. Wildfire also looms on the horizon, as growth spurts in fine fuels last fall and dry conditions this winter and spring have combined to increase fire danger classifications across the Southwest (Fig. 5).

Precipitation & Temperature Forecast: The March 17 NOAA-Climate Prediction Center three-month seasonal outlook calls for increased chances of above-average precipitation for most of the Southwest (Fig. 6, top), and increased chances of above-average temperatures across most of the western United States (Fig. 6, bottom).

Tweet Mar SW Climate Outlook

CLICK TO TWEET

MAR2016 @CLIMAS_UA SW Climate Outlook & Summary, El Niño Tracker, Reservoir Volumes - last gasp for El Niño? http://bit.ly/1LtCN4u

March Southwest Climate Outlook

Online Resources

Figures 1
National Weather Service - AHPS
http://water.weather.gov/precip

Figure 2
NOAA National Center for Environmental Information - NCEI
http://www.ncdc.noaa.gov/

Figure 3
U.S. Drought Monitor
http://droughtmonitor.unl.edu/

Figure 4
Western Regional Climate Center
http://www.wrcc.dri.edu/

Figure 5
Wildland Fire Assessment System
http://www.wfas.net/

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

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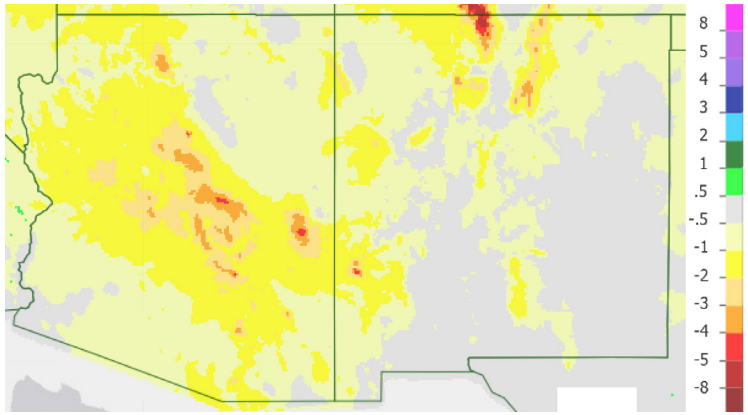


Figure 1: Departure from Normal Precipitation - Past 30 Days

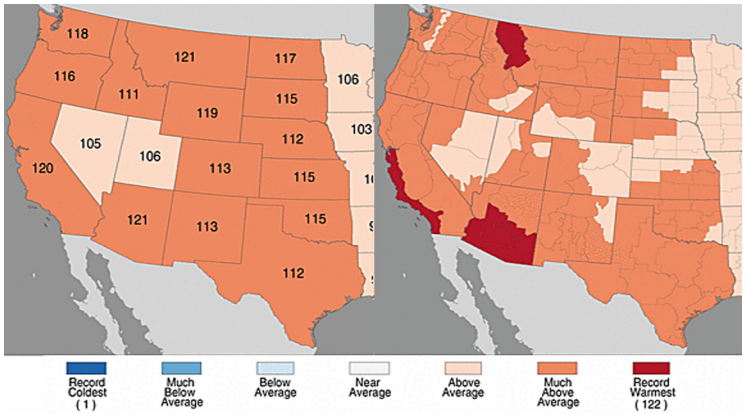


Figure 2: Feb 2016 Temperature Ranks - Statewide Ave (L) & Divisional Max (R)

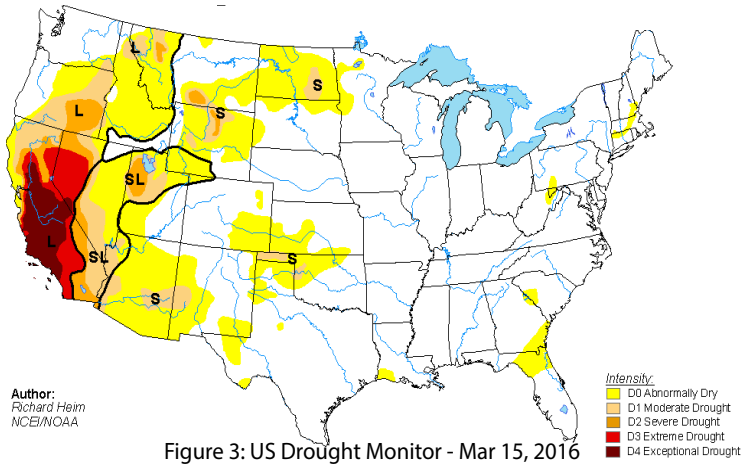


Figure 3: US Drought Monitor - Mar 15, 2016

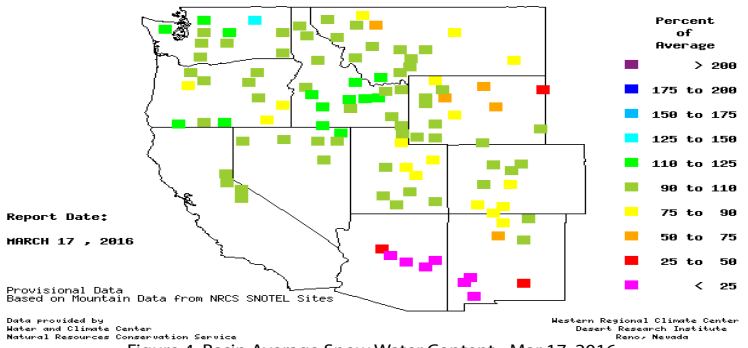


Figure 4: Basin Average Snow Water Content - Mar 17, 2016

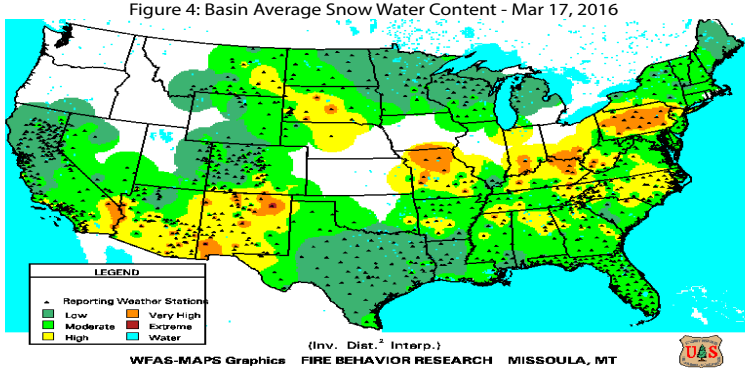


Figure 5: Forecast Fire Danger Class - Mar 17, 2016

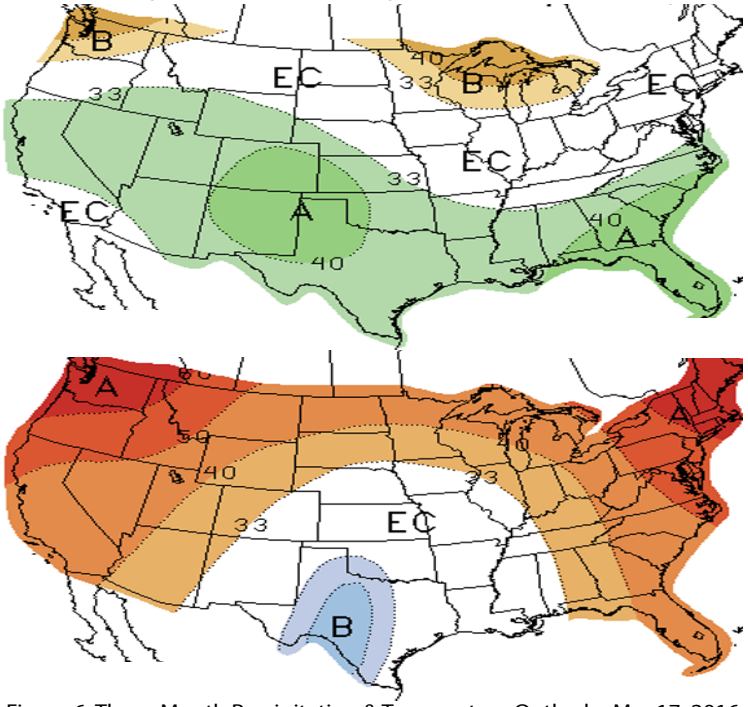


Figure 6: Three-Month Precipitation & Temperature Outlook - Mar 17, 2016

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/

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 2015–2016

We spent 2014 and the first part of 2015 waiting in anticipation for an El Niño event that was forecast to be one of the strongest events on record. By early 2015, the event in question had not yet materialized, and some questioned whether El Niño would ever arrive. Eventually it did, and it has been going strong for months, with most forecasts indicating that it will remain strong through the winter. There are numerous impacts we expect to see across the Southwest over our cool season (approximately October – March). We have been aggregating news, information, and commentary about the possible and expected impacts of El Niño, from the perspective of what is most relevant and applicable to the Southwest.

For more information, please visit www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation, our repository for El Niño related materials, which we will update with timely and relevant information throughout the winter.

2015–2016 El Niño Tracker

El Niño conditions continued for a 13th straight month, but the peak of this event has passed. Monitoring and forecast discussions emphasize strong positive sea surface temperature (SST) anomalies (Figs. 1–2) and enhanced convective activity in the central and eastern Pacific. These positive temperature anomalies are waning, and trade wind activity is increasing, indications that this El Niño event is on the decline. Most forecasts emphasize this event will continue through spring or early summer before returning to ENSO-neutral status. There is also the possibility of swinging to La Niña conditions later in 2016, although there is considerable model and forecast uncertainty regarding the chances of La Niña vs. ENSO-neutral conditions.

On Mar. 10, the Japan Meteorological Agency identified ongoing El Niño conditions that had peaked and were actively decaying and expected to weaken to neutral conditions by summer. On the same day, the NOAA-Climate Prediction Center (CPC) extended its El Niño advisory, identifying current atmospheric and oceanic anomalies as reflecting a strong El Niño that will likely persist through most of the spring before transitioning to ENSO-neutral conditions in late spring or early summer. On Mar. 15, the Australian Bureau of Meteorology maintained its tracker at official El Niño status, but noted a slow and steady decline, with decreasing positive temperature anomalies and near-normal trade winds as two key indicators of this event's ongoing deterioration. On Mar. 17, the International Research Institute for Climate and Society (IRI) and CPC forecasts described mixed signals regarding El Niño, with zonal winds and SSTs in decline, while convective activity and the Southern Oscillation Index (SOI) remained strong. The IRI/CPC forecast still identifies a return to ENSO-neutral conditions by summer, with a 50 percent chance of transition to La Niña conditions later in 2016 (Fig. 3), but also points out that the spring predictability barrier will affect our certainty regarding ENSO-neutral vs. La Niña outlooks. *(cont. on next page)*

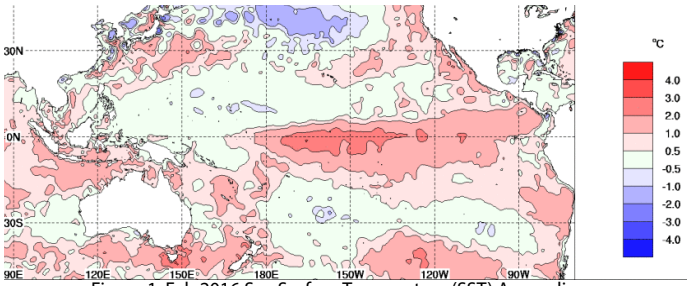


Figure 1: Feb 2016 Sea Surface Temperature (SST) Anomalies

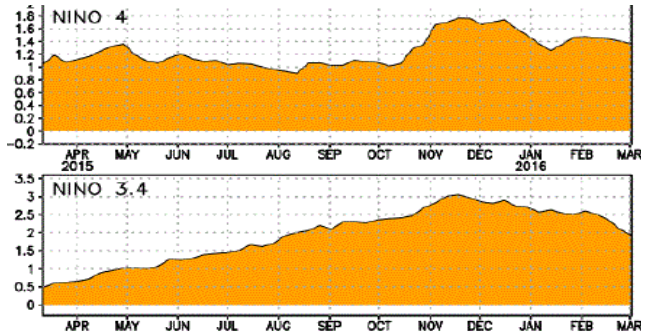


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

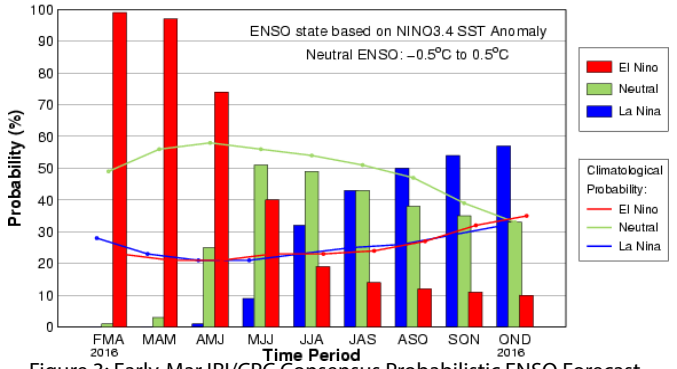


Figure 3: Early-Mar IRI/CPC Consensus Probabilistic ENSO Forecast

Online Resources

Figure 4
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

Figures 5
International Research Institute for Climate & Society
http://iri.columbia.edu/

Figures 6
High Plains Regional Climate Center
http://hprcc.unl.edu

El Niño

Information on this page is also found on the CLIMAS website:
www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation

2015-2016 El Niño Tracker (continued)

The North American multi-model ensemble currently shows a strong event extending into early spring with gradual weakening to neutral conditions by early summer (Fig. 4).

This El Niño is not over; atmospheric and oceanic conditions are still indicative of a strong El Niño event. The CPC/IRI forecast noted this fact, stating that "El Niño is not done yet," and that at a global scale, strong signals are still associated with El Niño, particularly in Brazil and southeast Asia (Fig. 5). In the southwestern U.S., we are nearing our dry season, meaning limited time remains for additional El Niño-influenced precipitation events of significance.

The IRI/CPC forecast also made note of the lack of "typical teleconnections" in this El Niño event. In the Southwest, for example, winter precipitation has been sparse following the storms of early January. These storms were exactly the sort of events expected in an El NIño year, but they were followed by a persistent ridge of high pressure that set up and limited the influx of additional moisture into the Southwest. This diverted moisture resulted in well above-average precipitation in the coastal northwestern U.S. and northern California, even while the Southwest was drier than normal (Fig. 6), a pattern which more closely aligns with La Niña. This occurred at an especially inopportune time in terms of southwestern climate patterns, as it effectively limited the opportunity for El Niño-associated storms during much of the the winter season. Sub-seasonal variability limited El Niño's potential, and with the Southwest already characterized by dry conditions in a normal year, conditions that limit opportunities for precipitation can cut into seasonal totals significantly.

Next month's issue will include a seasonal recap of El Niño and comparisons to seasonal averages as well as other El Niño events, but this high pressure ridge is likely one of the major reasons why the Southwest (and Arizona in particular) have not seen as frequent or as intense precipitation events as were forecast in seasonal outlooks. These forecasts and projections were dependent on the influence of a strong El Niño signal at a climate timescale (i.e., how these events cluster over years or decades), without the benefit of foresight of how a persistent high pressure ridge operating at a weather timescale (i.e., days or weeks) would knock the precipitation signal out of alignment for weeks on end.

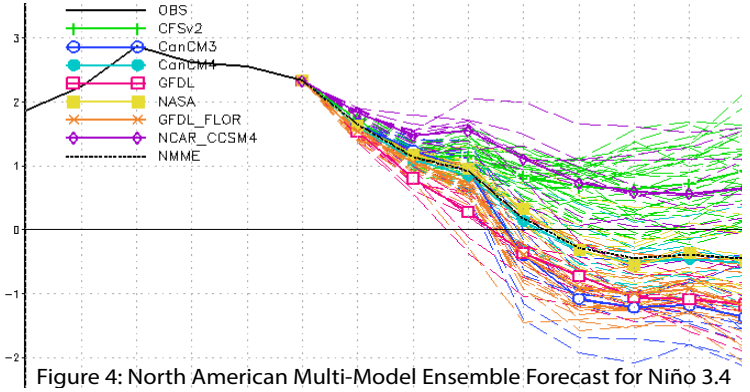


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

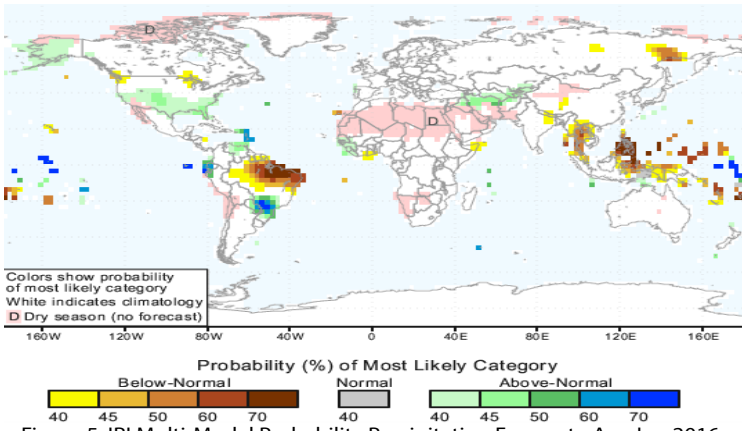


Figure 5: IRI Multi-Model Probability Precipitation Forecast - Apr-Jun 2016

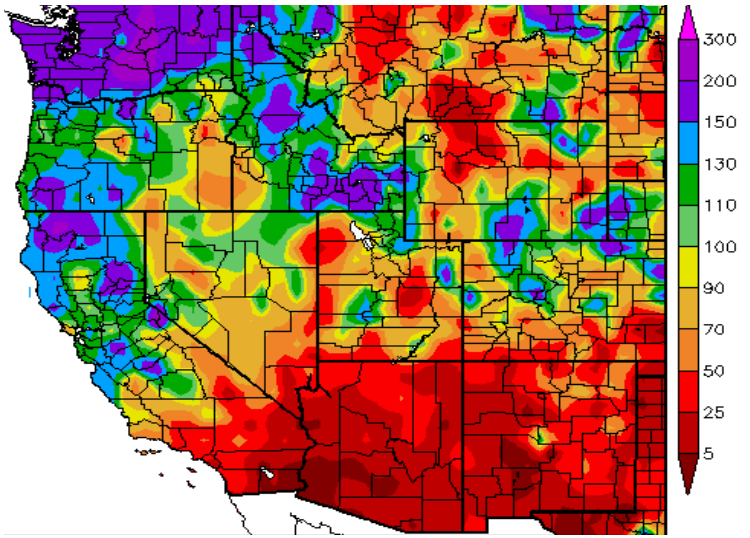


Figure 6: Percent of Normal Precipitation - Last 60 days

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 are updating our 'max storage' values for numerous NM reservoirs based on conservation storage vs. maximum flood capacity. This alters 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).

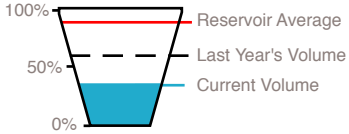
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons).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

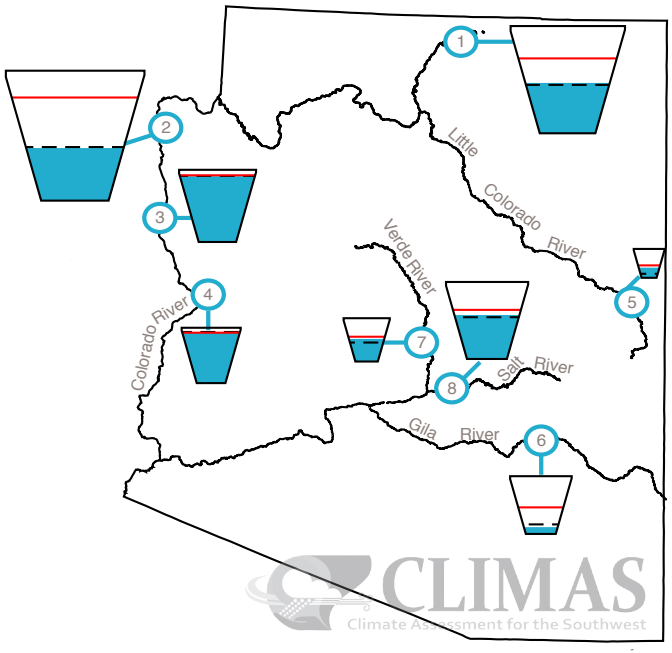
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

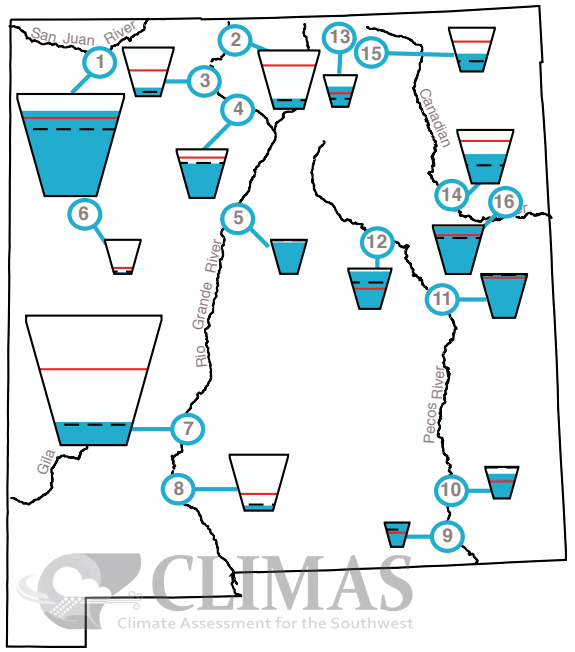
Reservoir Volumes

DATA THROUGH FEB 29, 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	46%	11,229.1	24,322.0	-200.4
2. Lake Mead	40%	10,360.0	26,159.0	42.0
3. Lake Mohave	91%	1,647.0	1,810.0	0.0
4. Lake Havasu	90%	554.1	619.0	-0.8
5. Lyman	35%	10.4	30.0	2.2
6. San Carlos	12%	108.6	875.0	16.5
7. Verde River System	52%	148.1	287.4	1.0
8. Salt River System	57%	1164.5	2,025.8	67.7

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	83%	1,404.7	1,696.0	8.2
2. Heron	18%	71.1	400.0	3.6
3. El Vado	18%	35.2	190.3	0.6
4. Abiquiu	71%	132.4	186.8**	0.2
5. Cochiti	93%	46.4	50.0**	-0.8
6. Bluewater	5%	2.1	38.5	0.1
7. Elephant Butte	18%	400.8	2,195.0	39.7
8. Caballo	9%	30.8	332.0	1.6
9. Lake Avalon	98%	4.4	4.5**	-0.5
10. Brantley	79%	33.5	42.2**	0.4
11. Sumner	128%	46.1	102.0**	-0.1
12. Santa Rosa	92%	97.7	105.9**	1.0
13. Costilla	64%	10.3	16.0	0.5
14. Conchas	55%	139.1	254.2	0.9
15. Eagle Nest	40%	31.4	79.0	1.1
16. Ute Reservoir	97%	194	200	0.0

On the CLIMAS Website

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http://www.climas.arizona.edu/blog

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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

Feb 2016 - Delusions of Hydroclimate Grandeur

In the February episode of the CLIMAS Southwest Climate Podcast, Zack Guido is back, and he and Mike Crimmins sit down to talk, you guessed it, El Niño. They recap what we've seen over the past month and take a closer look at whether this El Niño event is actually underperforming, whether expectations were set too high going into the season, and what we might expect for the upcoming month if we can ever break out of this high pressure system.

Listen: http://climas.arizona.edu/podcast/feb-2016-climas-sw-climate-podcast-delusions-hydroclimate-grandeur

Jan 2016 - Great Expectations for El Niño Winters in the SW

In the January episode of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Ben McMahan recap the transitional weather patterns of the last few months of 2015 as we moved from fall into winter, and discuss whether this transitional season matched general expectations, given what is expected in an El Niño year. They also discuss what a characteristic southwestern winter pattern looks like, and conclude the podcast with a conversation about how this El Niño event has stacked up so far this winter and what they anticipate over the next few months.

Listen: http://climas.arizona.edu/podcast/jan-2016-climas-sw-climate-podcast-great-expectations-el-niño-winters-sw