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# November 2021 Southwest Climate Outlook

**Precipitation and Temperature:** Oct precipitation was between below average and above average in Arizona and between average and much below average in New Mexico (Fig. 1a). Oct temperatures were between average and below average in Arizona and between average and much above average in New Mexico (Fig. 1b). Jan-Oct precipitation was between below average and much above average in Arizona and between much below and much above average in New Mexico (Fig. 2a). Jan-Oct temperatures were between above average and much above average across the Southwest (Fig. 2b). Precipitation totals for the past few months were wetter than average in northern California, western Nevada, much of Utah, and parts of central and southeastern Arizona, but dry across much of eastern Colorado and New Mexico (Fig. 3).

**Drought:** The U.S. Drought Monitor (USDM) showed minor improvements in drought categorizations in New Mexico and Arizona, but drought conditions are still found across both states, and the entire western United States (Fig. 4). The variable monsoon totals and the impending La Niña this winter, continue to raise concerns about long-term and cumulative precipitation deficits.

**Snowpack & Water Supply:** It is early in the season, but Nov 1 snow water equivalent (SWE) is highly variable in the Southwest, including well-above- and well-below-average conditions (Fig. 6). Most of the reservoirs in Arizona and New Mexico are at or below the values recorded at this time last year. Most are also below their long-term average (see reservoir storage on p 5). Water levels at Lakes Mead and Powell continue to drive the conversation about Colorado River water management and shortage declarations in response to those water levels. The Rio Grande in New Mexico and Elephant Butte Reservoir raise similar concerns in New Mexico, although there has been less national attention compared to Lake Mead.

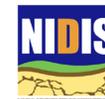
**Hurricanes & Tropical Storms:** The Eastern North Pacific saw activity across the bulk of the season, with 19 named storms but only two major hurricanes (Fig. 5). The accumulated cyclonic energy (ACE) was near normal through August, but September and October were quiet with only a few storms, resulting in a seasonal ACE of approximately 75% of normal.

**ENSO Tracker:** ENSO has reached La Niña status according to most outlooks, based on observed and forecast SSTs, emergent atmospheric conditions, and coupling between the two that is indicative of La Niña (see ENSO-tracker on p.4 for details).



## Tweet Nov 2021 SW Climate Outlook

NOV2021 @CLIMAS\_UA SW Climate Outlook, Seasonal Forecasts, ENSO Tracker, AZ & NM Reservoirs, SW Climate Podcast, <https://bit.ly/3HxyVy5> #SWclimate #AZWx #NMWx



## Online Resources

**Figures 1-2**  
National Centers for Environmental Information  
[ncdc.noaa.gov/sotc](http://ncdc.noaa.gov/sotc)

**Figure 3**  
West Wide Drought Tracker  
[wwdt.dri.edu](http://wwdt.dri.edu)

**Figure 4**  
U.S. Drought Monitor  
[droughtmonitor.unl.edu](http://droughtmonitor.unl.edu)

**Figure 5**  
US Dept of Commerce NWS  
[nhc.noaa.gov](http://nhc.noaa.gov)

**Figure 6**  
National Resource Conservation Service (NRCS)  
[nrcs.usda.gov](http://nrcs.usda.gov)

# November 2021 - Climate Summary

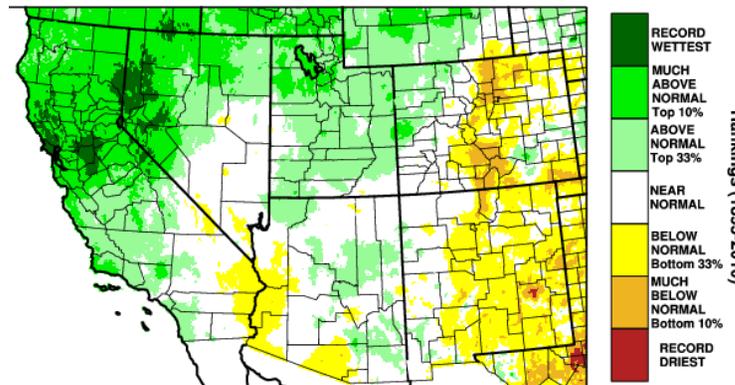
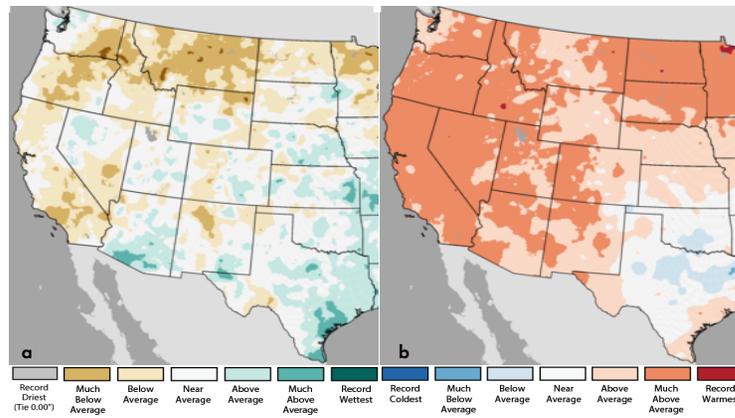
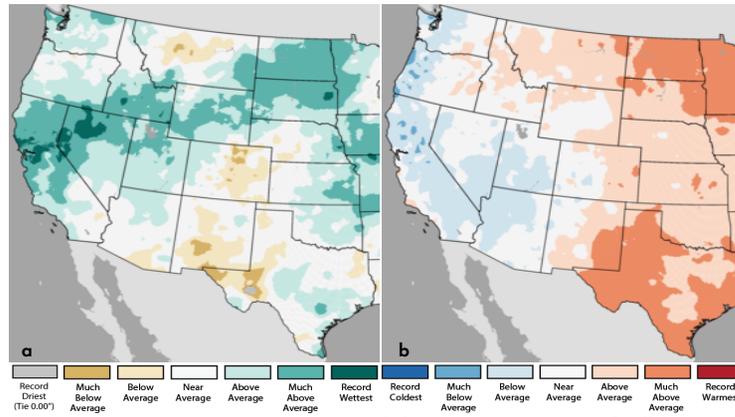


Figure 3: Sept - Oct 2021 Precip Rankings

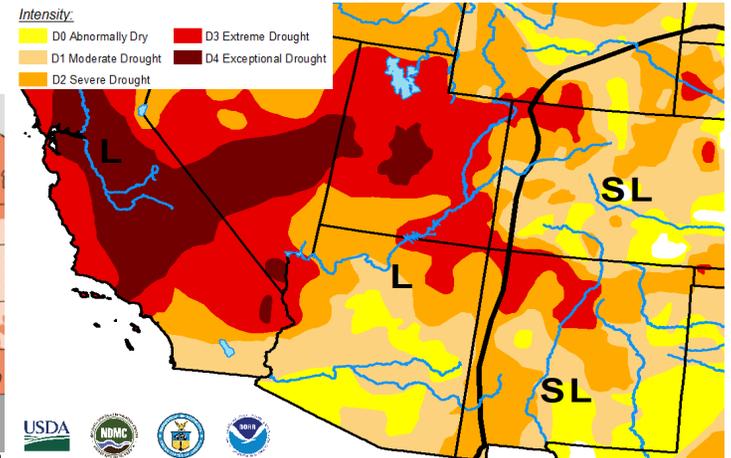


Figure 4: US Drought Monitor - Nov 9, 2021

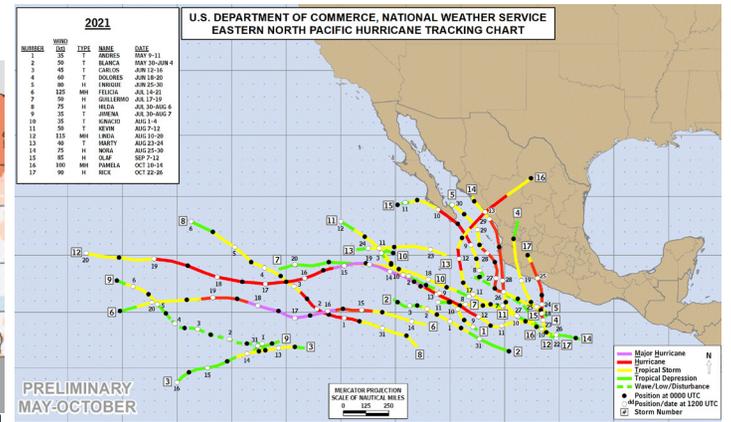


Figure 5: Eastern North Pacific 2021 Hurricane Tracking Chart

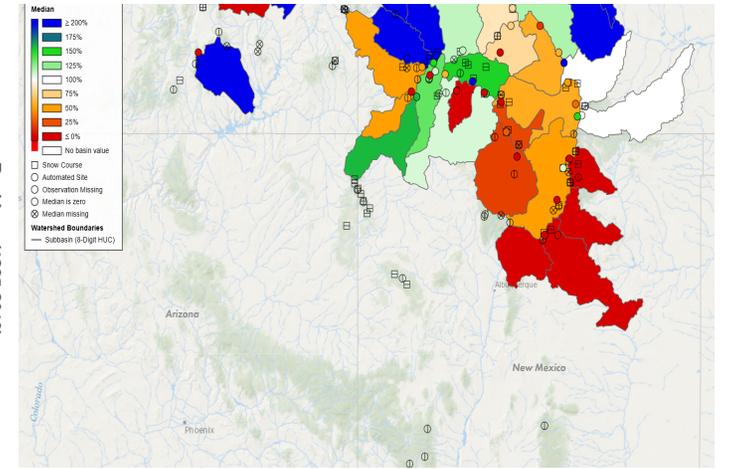


Figure 6: Snow Water Equivalent (SWE) - Percent of NRCS Median (1991-2020)

## Online Resources

### Figure 7

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

### Figure 8

NOAA Climate Prediction Center  
cpc.ncep.noaa.gov

# November 2021 - Seasonal Forecasts

## Precipitation

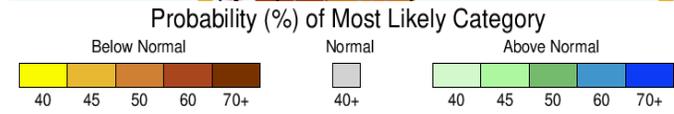
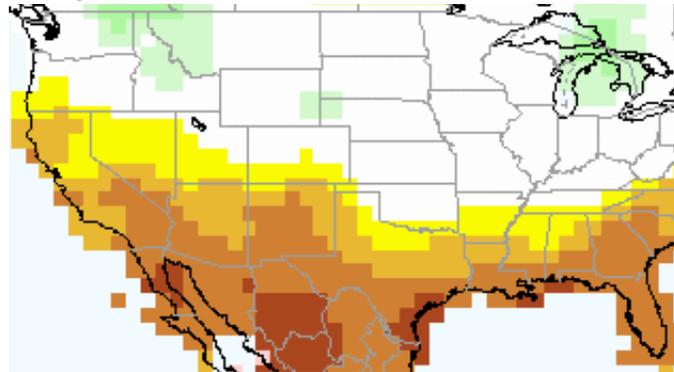


Figure 7A: Three-Month (Dec-Feb) Forecast for Precipitation

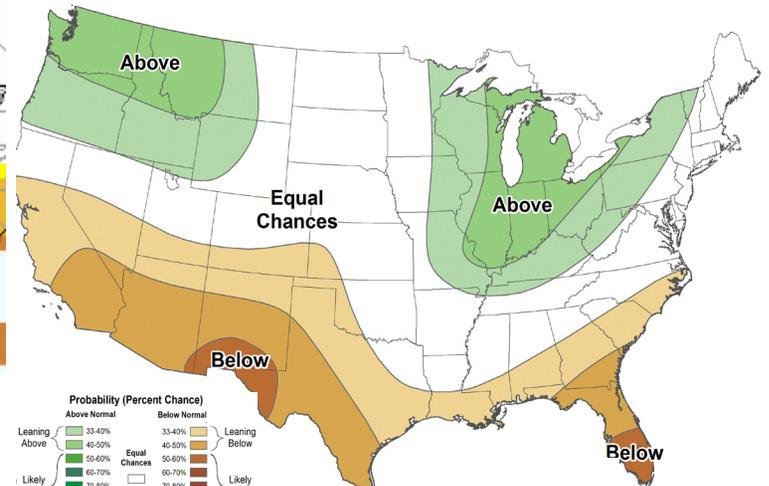


Figure 8A: CPC Three-Month (Dec-Feb) Precipitation Forecast

## Temperature

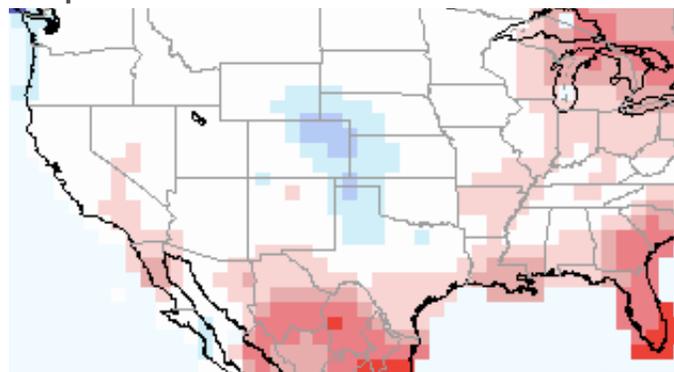


Figure 7B: Three-Month (Dec-Feb) Forecast for Temperature

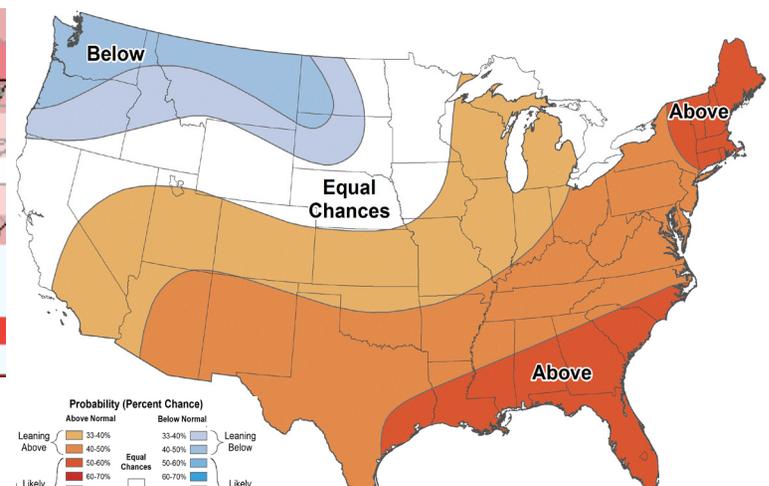


Figure 8B: CPC Three-Month (Dec-Feb) Temperature Forecast

**Precipitation Forecasts:** The IRI outlook calls for increased chances of below-normal precipitation across most of the southwestern U.S. and northern Mexico, (Fig. 7a). The CPC outlook calls for increased chances of below-normal precipitation across the Southwest (Fig. 8a).

**Temperature Forecasts:** The IRI outlook calls for mostly equal chances of above- and below-normal temperatures in much of the southwestern U.S. and increased chances of above-normal temperatures in most of northern Mexico (Fig. 7b). The CPC outlook calls for increased chances of above-normal temperatures across the Southwest (Fig. 8b).

## 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  
[cpc.ncep.noaa.gov](http://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)

## Equatorial Niño Regions



For more information: [ncdc.noaa.gov/  
 teleconnections/enso/indicators/sst/](http://ncdc.noaa.gov/teleconnections/enso/indicators/sst/)

Image source: [aoml.noaa.gov/](http://aoml.noaa.gov/)

## ENSO Tracker

Sea surface temperature (SST) forecasts for Dec 2021 – Feb 2022 indicate cool conditions across the equatorial Pacific (Fig. 1). Current Niño 3.4/4 anomalies appear to have reached the La Niña threshold (Fig. 2), and most ENSO outlooks now call for La Niña conditions to last through winter 2021-2022.

**Forecast Roundup:** Forecast Roundup: On Nov 10 the Japanese Meteorological Agency (JMA) observed La Niña conditions are present and called for a 60-percent chance of La Niña conditions to last through winter. On Nov 9 the Australian Bureau of Meteorology ENSO maintained their La Niña ALERT status noting “International climate models have strengthened their forecast likelihood of La Niña forming before the end of the year”, but that “atmospheric and oceanic observations have yet to consistently reach La Niña levels.” On Nov 11 the NOAA Climate Prediction Center (CPC) maintained their “La Niña Advisory” noting strengthening La Niña conditions, and calling for a 90-percent chance of La Niña during winter 2021-2022. On Nov 11 the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting “the evolution of key oceanic and atmospheric variables is consistent with La Niña conditions”. The North American Multi-Model Ensemble (solid and dashed black line, Fig. 4) reached La Niña levels, and indicates a further swing to moderate La Niña in late 2021 and into 2022.

**Summary:** The seasonal outlooks have shifted to near consensus on a La Niña event in winter 2021-2022. This is tied to cooling SSTs in the equatorial region, and oceanic/atmospheric coupling indicative of La Niña, with overall consensus on a La Niña event of weak to moderate intensity. There are still lingering questions about whether conditions will last long enough to be classified as a La Niña event, but each month the forecasts are more confident the conditions will meet that threshold. La Niña winters are frequently warmer and drier than average in the Southwest, so this forecast is something to watch, given the drought conditions and cumulative precipitation deficits affecting the region.

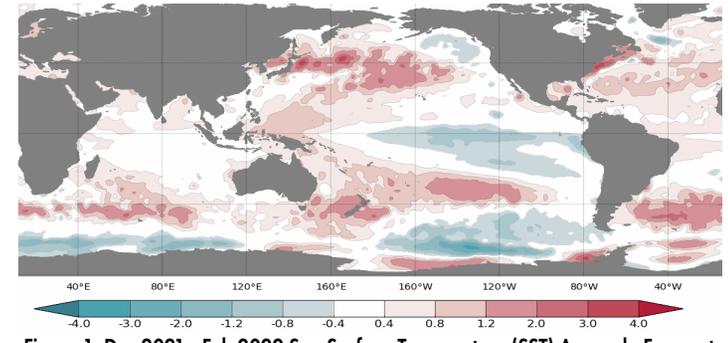


Figure 1: Dec 2021 - Feb 2022 Sea Surface Temperature (SST) Anomaly Forecast

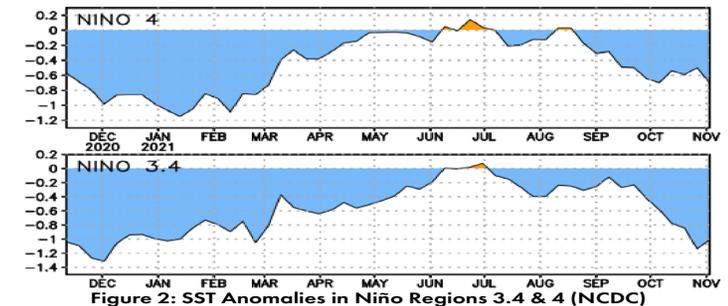


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

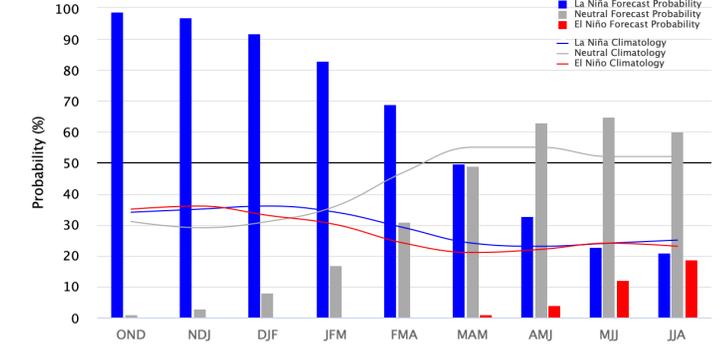


Figure 3: Early-Nov IRI/CPC Model-Based Probabilistic ENSO Forecast

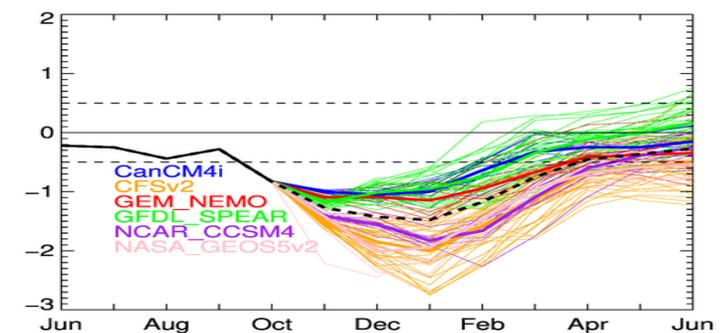


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

## Online Resources

Portions of the information provided in this figure is available 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 questions/comments.

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).

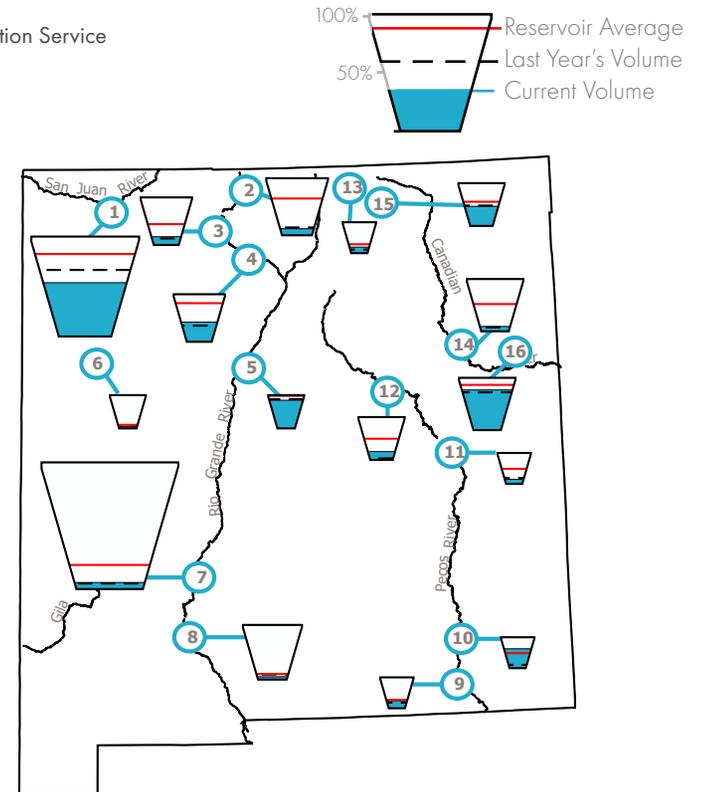
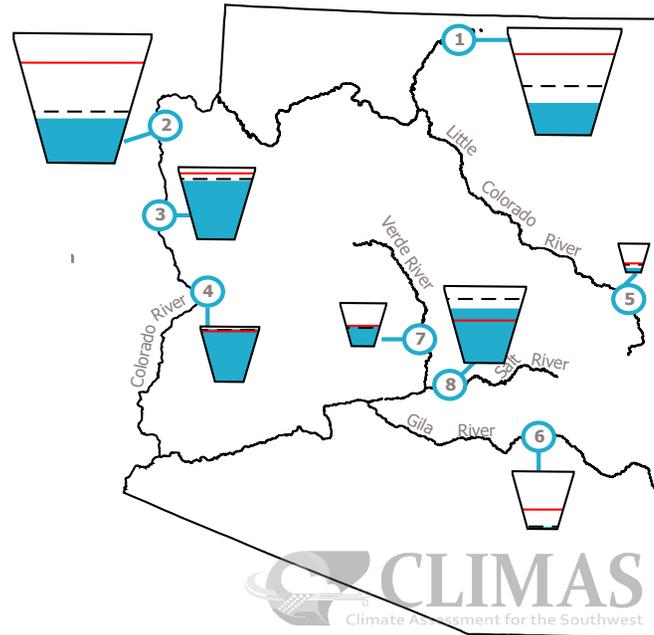
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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 NOV 1, 2021

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	30%	7,180.8	24,322.0	-76.9
2. Lake Mead	34%	8,934.6	26,159.0	-81.4
3. Lake Mohave	81%	1,468.0	1,810.0	-102.0
4. Lake Havasu	95%	589.5	619.0	-2.4
5. Lyman	16%	4.9	30.0	-0.3
6. San Carlos	3%	29.0	875.0	-2.4
7. Verde River System	50%	143.8	287.4	-4.7
8. Salt River System	71%	1,440.9	2,025.8	-21.9

\*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	52%	887.1	1,696.0	-63.5
2. Heron	11%	44.0	400.0	-0.2
3. El Vado	17%	32.1	190.3	-1.6
4. Abiquiu	41%	75.9	186.8	-0.7
5. Cochiti	82%	41.2	50.0	-0.2
6. Bluewater	5%	2.1	38.5	-0.1
7. Elephant Butte	5%	116.6	2,195.0	6.0
8. Caballo	4%	14.4	332.0	-0.2
9. Lake Avalon	24%	1.1	4.5	1.1
10. Brantley	61%	25.8	42.2	-8.1
11. Sumner	14%	4.9	35.9	-1.1
12. Santa Rosa	18%	19.0	105.9	-0.4
13. Costilla	18%	2.9	16.0	0.4
14. Conchas	9%	22.1	254.2	-1.6
15. Eagle Nest	45%	35.7	79.0	-0.8
16. Ute Reservoir	75%	149	200	-3.0

## Southwest Climate Podcast

[climas.arizona.edu/media/podcasts](https://climas.arizona.edu/media/podcasts)

### iTunes

<https://apple.co/3kHh8bf>

### Spotify

<https://spoti.fi/3zZlvWu>

### Android

<https://bit.ly/2ILYHos>

### Stitcher

<https://bit.ly/3nEWhHd>

We also finally have podcast gear (shirts and mugs).



Order at: [teespring.com/stores/the-southwest-climate-podcast](https://teespring.com/stores/the-southwest-climate-podcast).

Prices are the wholesale cost, so we don't make any money, but if you are interested in showing your support - or enjoying the (lack of a) monsoon in style, this is one way to do so.

## The Southwest Climate Podcast



### Nov 2021 Southwest Climate Podcast Monsoon 2021 Roundup

In the November edition of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido look back to monsoon 2021 to do a recap of the seasonal totals. They are joined by Paul Iniguez, the Science and Operations Officer for the National Weather Service office in Phoenix, to take a closer look at the 2021 monsoon, how it stacked up around the region, and to hear a bit more about how the NWS offices work across the monsoon. This is a single focus episode - see the Oct 2021 episode for the normal monthly roundup and recap. Watch this space: <https://www.weather.gov/psr/eventsummaries> for the 2021 monsoon recap from NWS Phoenix, as well as some detailed storm event reports from across the season (and year).

<https://bit.ly/3FcjvNH>

### Oct 2021 Southwest Climate Podcast

#### Diving into ENSO and the La Niña Double Dip

In the October 2021 edition of the Southwest Climate Podcast, Mike Crimmins and Zack Guido reconvene after a long pause to revisit recent conditions in September and October, dive into what ENSO and La Niña might have in store for the Southwest, and what the Double Dip is and why it's more likely in back to back La Niñas. For monsoon fantasy players, they recap the monsoon game and how the leaderboard shook up in the final day in the first segment. Production note: We recorded two podcasts this week, the standard monthly recap (this podcast) and a monsoon recap extravaganza with Paul Iniguez of the NWS office up in Phoenix. Look for that monsoon recap podcast in a few days (also in this feed) and keep an eye on the NWS pages for their in-depth monsoon recaps.

<https://bit.ly/3orYfwP>

## Online Resources

### Figure 1 Climate Program Office

[cpo.noaa.gov](http://cpo.noaa.gov)

### RISA Program Homepage

[cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA](http://cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA)

### 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)



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.

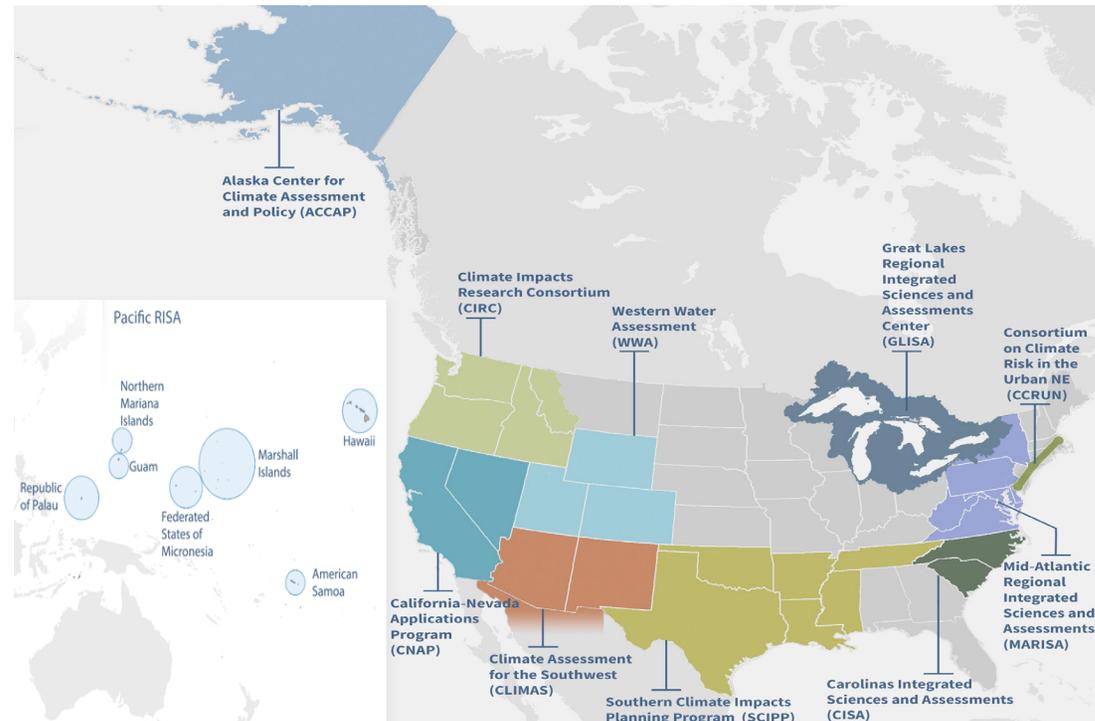


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions