December 22, 2009

Southwest Climate Outlook

Vol. 8 Issue 12

December Climate Summary

Drought – Arizona is blanketed in drought conditions. All of the state has abnormally dry conditions or worse, according to the US Drought Monitor. Although a storm in early December brought widespread snow and rain to many parts of Arizona, dry conditions since the summer have heavily influenced the current drought status. In New Mexico, 43 percent of the state has abnormally dry conditions or worse.

Temperature – During the past 30 days, most regions in Arizona and New Mexico have experienced chillier-than-average temperatures. Except for parts of southern Arizona where temperatures have been 0–2 degrees above average, temperatures generally have been 0–4 degrees below average in the region.

Precipitation – In the past 30 days, central and northwestern Arizona and southern New Mexico have received more than 150 percent of average precipitation. However, more storms are needed to make up for a dry beginning to the water year, which began October 1. Since then, most of Arizona has received less than 50 percent of average precipitation and the western half of New Mexico has received less than 90 percent.

ENSO – Sea surface temperatures in the tropical Pacific Ocean warmed in the past month, and the current El Niño event is moderate in strength. It is likely that El Niño will become stronger or remain the same during the next few months, according to the NOAA–Climate Prediction Center. El Niño conditions also will likely persist into the spring.

Snow – Snowpack in Arizona and New Mexico is well above average. In the Verde River Basin in Arizona, the water contained in the snow (snow water equivalent, or SWE) is 276 percent of average. In the six other reporting basins, SWE is more than 115 percent of average. The Upper Rio Grande Basin in New Mexico reports SWE values of 108 percent of average. Most watersheds in Colorado report between 80 and 100 percent of average SWE.

Forecasts – Temperature forecasts issued by the NOAA–Climate Predictions Center for February–March indicate slightly enhanced chances for below-average temperatures in southeastern Arizona and all of New Mexico; the April–June forecast calls for above-average temperatures. Precipitation forecasts through May call for elevated chances for Arizona and New Mexico to experience above-average precipitation.

The Bottom Line – A dry summer and fall has left the Southwest thirsty for winter storms. While copious rain and snow pounded much of Arizona and parts of New Mexico in early December, more storms are needed to improve drought conditions. Fortunately, El Niño events increase the chances for wetter winters, and the current forecast calls for El Niño conditions to persist or strengthen during the next few months.

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This work is published by the Climate Assessment for the Southwest (CLIMAS) project and the University of Arizona Cooperative Extension; and is funded by CLIMAS, the Institute of the Environment, and the Technology and Research Initiative Fund of The University of Arizona Water Sustainability Program through the SAHRA NSF Science and Technology Center at the University of Arizona.

Delayed benefits from winter rain and snow

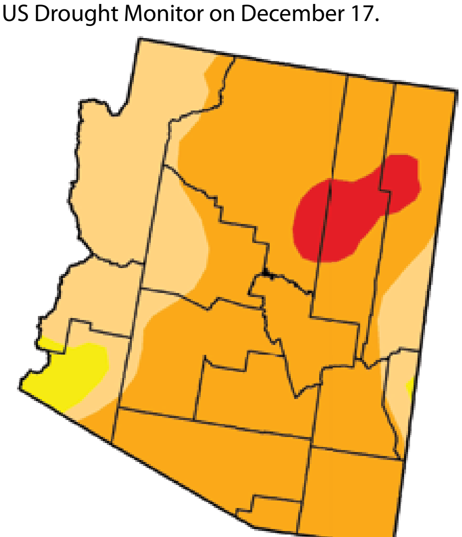
By Zack Guido

Soon after heavy snowfall and soaking rains tapered off on December 8, ending Arizona's first significant winter storm, email messages crisscrossed the country. The authors of the US Drought Monitor, which provides weekly updates on the drought status for all 50 states, needed an answer: did the storm improve drought conditions in Arizona? While more than 18 inches of snow fell in the Flagstaff area and steady rain soaked lower elevations across the state, local experts and scientists eyeing drought conditions weighed in.

"We don't get into a drought situation in one week and we don't get out of one in a week," said Michael Crimmins, climate extension specialist for the University of Arizona.

Despite the precipitation, the December 17 US Drought Monitor classified the entire state of Arizona as abnormally dry or worse, with about 65 percent of the state experiencing severe drought (Figure 1). Drought in New Mexico is not as widespread; only 43 percent of the state has abnormally dry conditions or worse. The pattern of drought intensity depicted in the Drought Monitor for both states has remained largely unchanged since mid-October, and drought conditions have enveloped nearly all of Arizona since early August, when the effects of the dry monsoon first became apparent.

Figure 1. Arizona drought status updated by US Drought Monitor on December 17.



Drought Intensity

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional

The region depends on both the monsoon and winter rain and snow for moisture, but winter precipitation is particularly important because it saturates soils, and the water stored in snow helps fill reservoirs and streams in the spring and summer. A large snowpack can reduce the threat of water shortages, and soaked soils provide a constant water source for plants. Building these reserves, however, requires many storms. As a result, the impact of winter precipitation on drought is not completely assessed until the dry foresummer begins around April.

Precipitation from the recent storm is helpful, Crimmins wrote in an email conversation between national and local drought watchers. "But we have a lot of catching up to do [in Arizona], even in the short term, and it is a tough time of year to gauge improvements. This one storm will probably help some stations meet or exceed their average December totals, but I am not sure if it will alleviate specific impacts," Crimmins said.

The same can be said for New Mexico, particularly the northwestern area, which received the brunt of the recent storm.

El Niño strengthening

More storms like the one that whacked the Southwest earlier this month may blow into the region this winter, as El Niño conditions often change atmospheric circulation. Statistics indicate that when sea surface temperatures in the tropical Pacific Ocean are warmer than average—a characteristic typical of an El Niño event—the Southwest has a greater chance of receiving wetter-than-average conditions.

The reason for this is complicated and is a hot topic for scientific research. In general, the Southwest receives more winter precipitation during El Niño events because the warmer ocean temperatures strengthen the winds of the Subtropical Jet Stream and cause them to flow over Arizona and New Mexico (Figure 2). Moisture from the Pacific Ocean is able to hitch a ride with the winds into the region, which is what happened earlier this month. During non-El Niño years, the Subtropical Jet Stream is weaker or non-existent, and storms follow a more northerly path across the country.

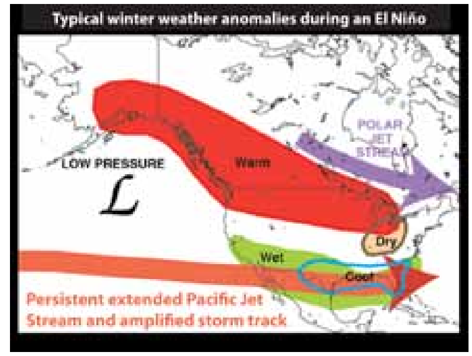


Figure 2. El Niño often enhances winter precipitation in the Southwest by altering atmospheric circulation. *Source: NOAA.*

Although experts are quick to point out that this circulation pattern doesn't always hold and El Niño events don't always bring copious rain and snow, early indications bode well for a wet winter. The National Oceanic and Atmospheric Administration (NOAA) reported that El Niño strengthened between October and November, and wind maps show that the Subtropical Jet formed in the classic El Niño pattern. NOAA's official forecast also states that it is equally likely that El Niño will strengthen or remain at moderate strength during the next few months.

After one of the driest monsoon seasons on record (see the November issue of the *Southwest Climate Outlook*), the Southwest needs abundant winter precipitation. While there is reason to be optimistic, assessing how much of an effect this winter's rain and snow has on drought conditions may have to wait until the spring.

Arizona Reservoir Levels
(through 11/30/09)

Source: NRCS, National Water and Climate Center

Water storage in Lake Powell dropped 275,000 acre-feet during November and is at 62 percent of capacity (Figure 1). The US Bureau of Reclamation stated that the inflow into Lake Powell was 77 percent of the 30-year average in November. The agency predicts that December's inflow will be 86 percent of the 30-year average.

At the end of November, the water level in Lake Mead was nearly 1,094 feet above sea level, or 42 percent of capacity, and was approximately 20 feet higher than the 1,075-foot elevation mark that triggers the first tier of water conservation strategies. The combined storage in Lake Mead and Lake Powell was 228,000 acre-feet lower than it was during the same time last year.

In other reservoirs, the San Carlos Reservoir contains only 2,400 acre-feet, which is less than 1 percent of its capacity–average storage for November is 39 percent of capacity. Storage on the Salt and Verde River Basin systems remains well above average, although water levels declined in November.

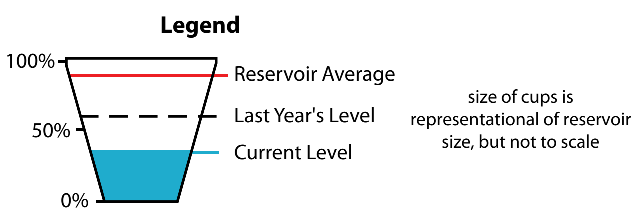
Notes:

The map gives a representation of current storage levels for reservoirs in Arizona. 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 level (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 level (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels 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 4 people for a year. The last column of the table list an increase or decrease in storage since last month. A line indicates no change.

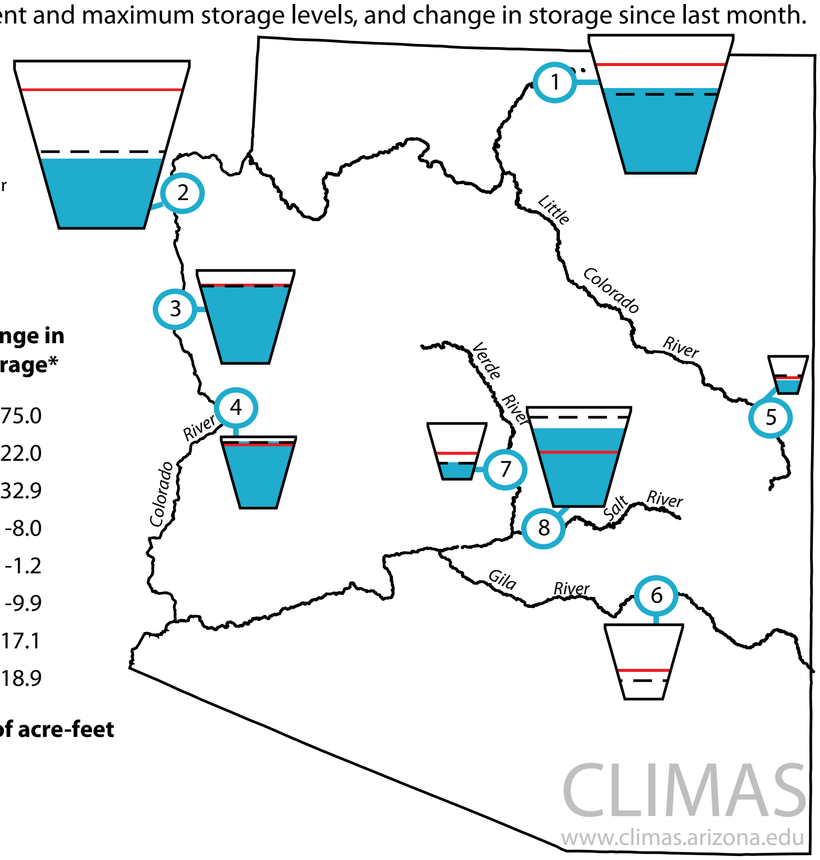
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

Figure 1. Arizona reservoir levels for November 2009 as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Lake Powell	62%	14,976.0	24,322.0	-275.0
2. Lake Mead	42%	10,919.0	26,159.0	22.0
3. Lake Mohave	83%	1,501.6	1,810.0	32.9
4. Lake Havasu	93%	572.6	619.0	-8.0
5. Lyman Reservoir	36%	10.7	30.0	-1.2
6. San Carlos	0%	2.4	875.0	-9.9
7. Verde River System	30%	85.5	287.4	-17.1
8. Salt River System	79%	1,600.1	2,025.8	-18.9

*** thousands of acre-feet**



On the Web:

Portions of the information provided in this figure can be accessed at the NRCS website:
http://www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

New Mexico Reservoir Levels

(through 11/30/09)

Source: NRCS, National Water and Climate Center

The total reservoir storage in New Mexico increased by about 3,700 acre-feet during November (Figure 2). Most of the storage decreases were in the northwestern region of the state, in the Navajo and Heron reservoirs. Those reservoirs and Elephant Butte—New Mexico's three large storage systems—each contain less water than they did one year ago. Current storage is above average only in El Vado, Abiquiu, and Costilla reservoirs.

In water-related news, the Office of the State Engineer issued an order to prevent new agricultural wells that tap the Ogallala Aquifer (cnjonline.com, December 3). The order is intended to preserve the aquifer, which is a major source of groundwater in eastern New Mexico, for future use. State Engineer John D'Antonio stated that water for agriculture accounts for more than 90 percent of water used in Curry and Roosevelt counties. The region could be bailed out by the Ute Water Project, but not for another 10-12 years.

Notes:

The map gives a representation of current storage levels for reservoirs in 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 level (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 level (dotted line) and the 1971–2000 reservoir average (red line).

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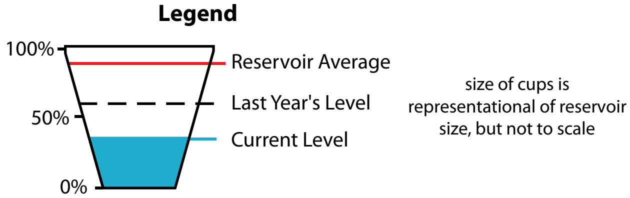
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Richard Armijo, Richard.Armijo@nm.usda.gov.

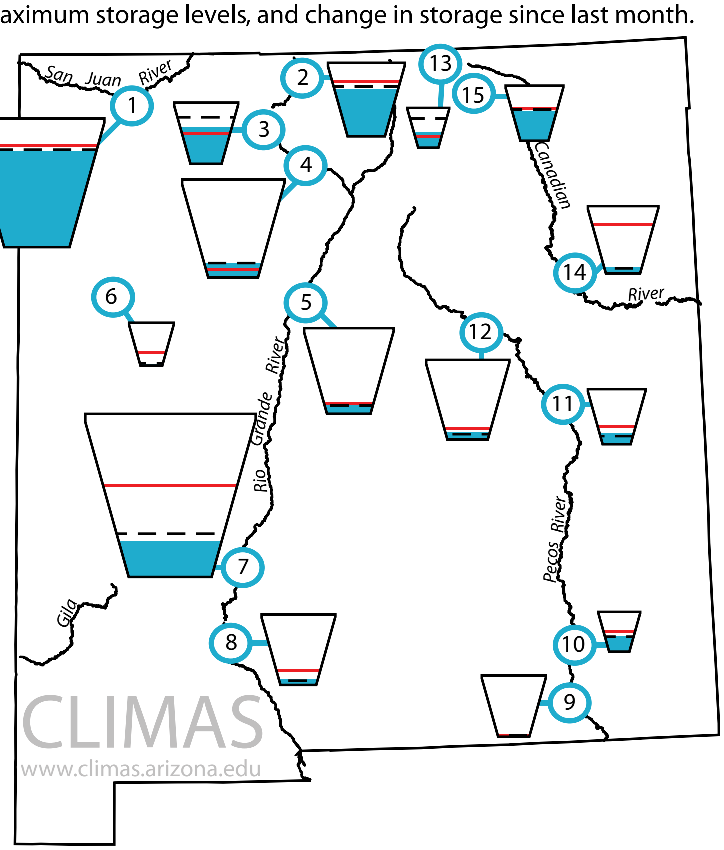
Figure 2. New Mexico reservoir levels for November 2009 as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.

Legend



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	75%	1265.3	1,696.0	-17.3
2. Heron	65%	261.4	400.0	-11.6
3. El Vado	60%	114.5	190.3	4.9
4. Abiquiu	15%	181.9	1192.8	-0.6
5. Cochiti	11%	53.2	491.0	-0.1
6. Bluewater	4%	1.5	38.5	-5.9
7. Elephant Butte	22%	483.8	2,195.0	29.3
8. Caballo	8%	27.3	332.0	1.2
9. Brantley	1%	13.1	1008.2	1.2
10. Lake Avalon	40%	1.6	4.0	0.8
11. Sumner	20%	20.0	102.0	3.5
12. Santa Rosa	10%	43.3	438.3	-0.3
13. Costilla	40%	6.4	16.0	0.4
14. Conchas	10%	24.7	254.2	-1.5
15. Eagle Nest	55%	43.3	79.0	-0.3

*** thousands of acre-feet**



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