August 23, 2011

Southwest Climate Outlook

Vol. 10 Issue 8

Credit: John Capuano

The monsoon brought its own impressive July 4 display with a lightning show in Tucson, AZ.

Would you like to have your favorite photograph featured on the cover of the Southwest Climate Outlook? For consideration send a photo representing Southwest climate and a detailed caption to: zguido@email.arizona.edu

In this issue...

August Climate Summary

Drought-Exceptional drought declined slightly in Arizona and New Mexico in the last month. However, monsoon rains generally have been below average and drought conditions are still widespread and intense in most of the region.

Temperature-A strong high pressure ridge has left New Mexico with extremely warm temperatures that have been between 2 and 8 degrees Fahrenheit above average in the last month. In Arizona, temperatures have been generally 0–4 degrees F above average.

Precipitation-The monsoon delivered above-average rain to southeastern Arizona in the last month; below-average rain still characterizes the monsoon season for most of the rest of Arizona and New Mexico.

ENSO-ENSO-neutral conditions are still present across the equatorial Pacific Ocean, but signs are mounting that weak La Niña conditions may return as early as this fall.

Climate Forecasts-Forecasts call for increased chances for above-average temperatures and below-average rainfall during the September–November period for most of Arizona and New Mexico. These forecasts are based in part on recent conditions and trends.

The Bottom Line-With much of the monsoon season now over, constant and copious rains have not yet materialized for most of the region. Only the southwestern and southeastern corners of Arizona and New Mexico, respectively, have experienced above-average rainfall. A more easterly position of the monsoon ridge, which has helped block moisture from New Mexico, and weak winds aloft, which have prevented storms from moving off the mountains and into the valleys, are partly to blame for the drier-than-average monsoon season. As a result, about 77 percent of New Mexico and 12 percent of Arizona are classified with exceptional and extreme drought, respectively. Relief does not appear to be on the horizon. Forecast models call for slightly increased chances for below-average rain in September. Also, forecasters have been increasing the odds that La Niña will return this winter—currently, there's a 44 percent chance that La Niña will develop and a 54 percent chance that neutral conditions will persist during November-January. A back-to-back La Niña event would likely intensify and spread drought to the region. Next month should provide a more definite picture of whether the winter will be influenced by La Niña.

Big Snowpacks Boon for Colorado River Reservoirs

Most La Niña events have not delivered as much snow to the Rocky Mountains as the one did last winter. It was a welcome windfall for the Colorado River, which provides water for nearly 30 million people in seven states and Mexico. At the onset of winter, things were looking grim. Lake Powell was at 63 percent of capacity, while the water level in Lake Mead was only six feet above a trigger point for water conservation—a record low. In the last decade, Lake Mead's elevation plunged nearly 100 feet as enduring drought gripped the Colorado River Basin.

In recent months, however, Lake Powell has risen by more than 40 feet, peaking at a 10-year high in July at 76 percent of capacity (*Los Angeles Times*, August 13). Lake Mead also has risen by about 30 feet and is expected to continue to climb by about another 40 feet during the next year and a half as water from Powell is released into Lake Mead to fulfill obligations established in the Colorado River Compact. While many researchers and water managers expect the joint effects of high demand and climate changes to trigger water conservation measures at some point soon, some estimates now suggest that date may not be reached until at least 2014 (*Las Vegas Sun*, August 17).

Table of Contents:

SWCO Staff:

Mike Crimmins,
UA Extension Specialist

Stephanie Doster,
Institute of the Environment Editor

Dan Ferguson,
CLIMAS Program Director

Gregg Garfin,
Institute of the Environment
Deputy Director of Outreach

Zack Guido,
CLIMAS Associate Staff Scientist

Gigi Owen,
CLIMAS Assistant Staff Scientist

Nancy J. Selover,
Arizona State Climatologist

This work is published by the Climate Assessment for the Southwest (CLIMAS) project, the University of Arizona Cooperative Extension, and the Arizona State Climate Office.

A Double-Dip? Mounting Evidence Suggests La Niña Will Return This Winter

By Zack Guido and Michael Crimmins

Blame it on La Niña.

Pushing the jet stream and the storms it carried north of the region, La Niña played a starring role in a record-dry winter in the Southwest this past year. The lack of rain and snow led to extensive fires in Arizona and New Mexico, skimpy irrigation allotments, and withered vegetation in the spring. Now mounting evidence suggests that after a brief summer hiatus La Niña may be back.

This would not be welcome news for most of the Southwest and especially those areas mired in extreme and exceptional drought, particularly since the second year in back-to-back La Niña events is often drier than the first.

Current conditions and how we got here

During the 20 winters since 1950 in which La Niña was present, precipitation has been, on average, below-average across the region (*Figure 1*). Last winter upheld this dry pattern, as a moderate to strong La Niña event developed in June 2010 and dissipated in April.

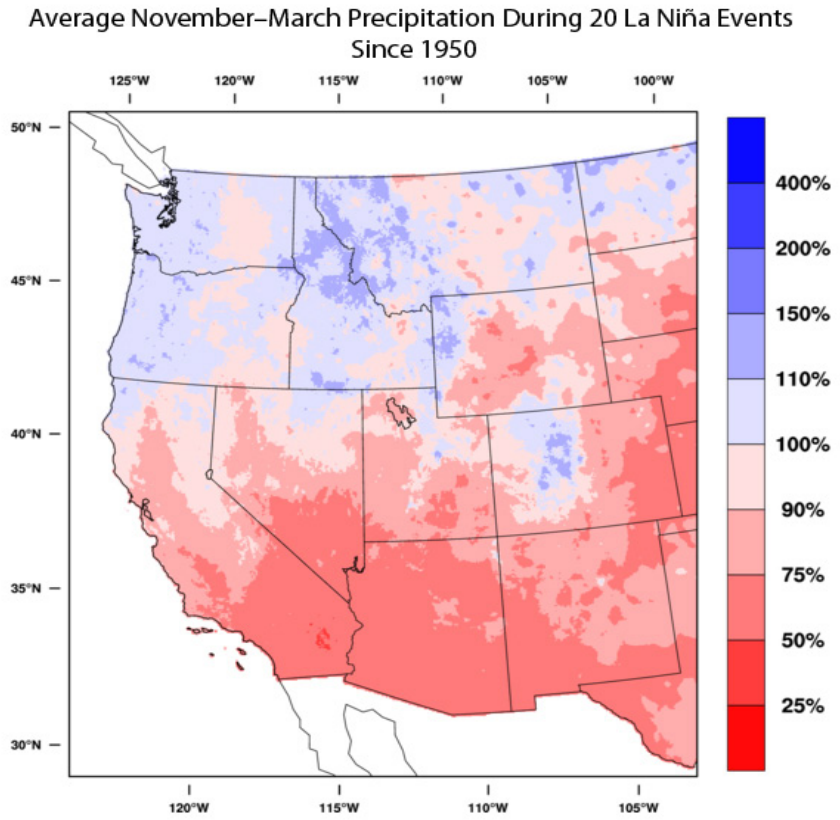


Figure 1. Average November–March precipitation during the 20 winters since 1950 in which a La Niña event was present. Map is from WestMap and utilizes PRISM (Parameter-elevation Regressions on Independent Slopes Model) data.

At the onset of winter, in the beginning of November, only about 3 percent of Arizona was classified with moderate drought conditions; New Mexico was drought-free. By the beginning of the 2011 monsoon season in mid-June, however, 56 and 99 percent of Arizona and New Mexico, respectively, were in the grips of moderate, if not more severe, drought.

Drought also intensified in nearly every region. By mid-June, nearly 6 and 45 percent of Arizona and New Mexico, respectively, were pegged with the most severe drought category—exceptional drought, which occurs once in every 50 years; about another 13 and 23 percent were classified with extreme drought, which occurs once in every 20 years.

With the region desiccated in the lead-up to the summer rains, climatologists at the University of Arizona and National Drought Mitigation Center at the University of Nebraska stated that an average monsoon season would be insufficient to significantly improve drought conditions. The region needed constant and copious moisture. In most of New Mexico and all of Texas, the October–July period was either the first or second driest in the last 117 years, while southeast Arizona ranked in the top six (*Figure 2*).

To date, however, the thunderous storms have been inconsistent and spottier than usual, and most of the region continues to accumulate rainfall deficits. It is unlikely that summer rains will provide widespread drought relief this late in the season. The NOAA-Climate Prediction Center (CPC) assigns less than a 3 percent chance that moisture in the upcoming four months will be sufficient to erase drought conditions in southern Arizona and New Mexico where

continued on page 4

La Niña, continued

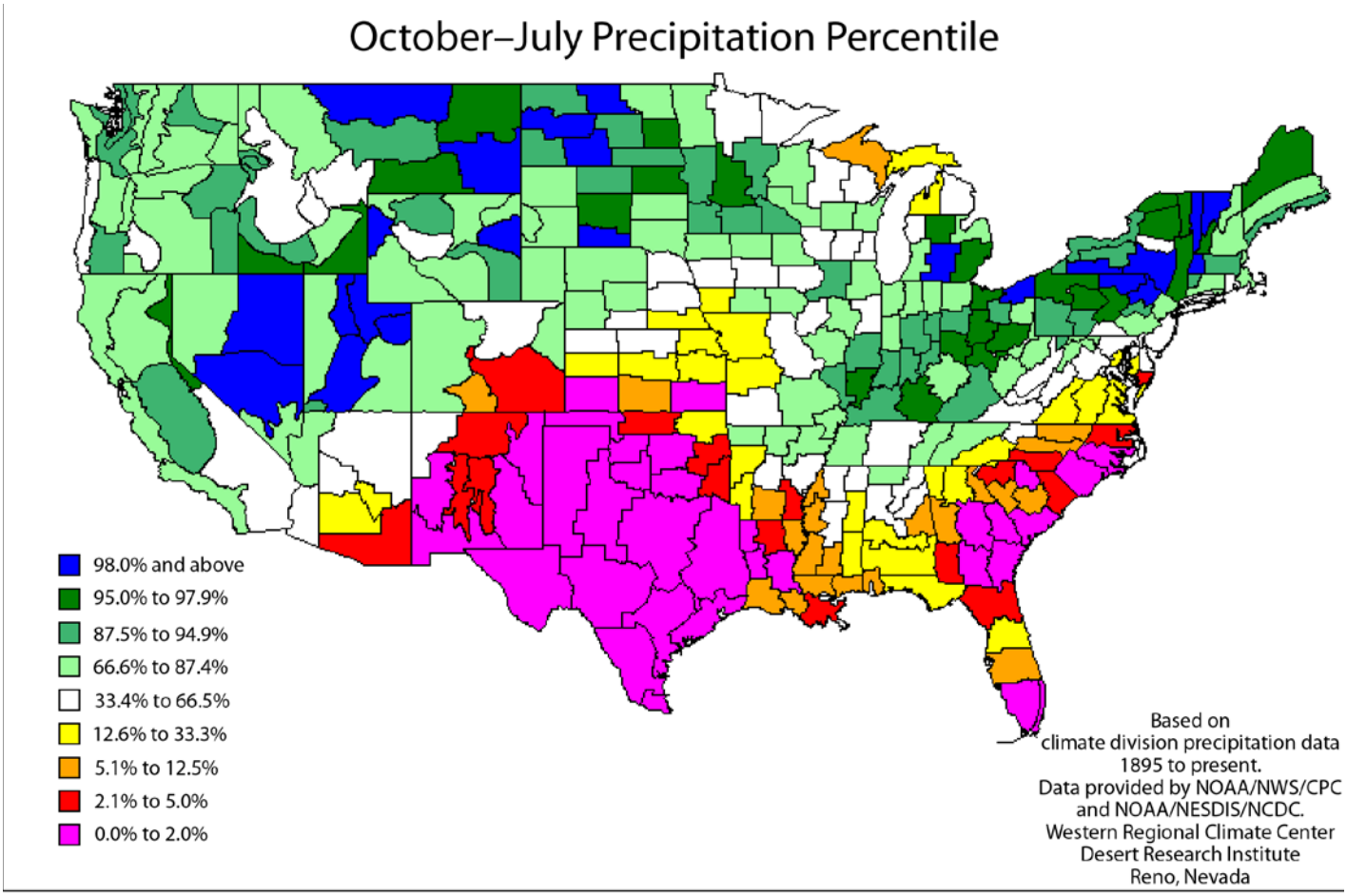


Figure 2. Less than 2 percent of the October–July periods since 1895 have been drier than they are currently for all of Texas and many parts of New Mexico. These areas experienced either their driest or second driest October–July periods in the last 117 years. Less than 6 percent of the October–July periods have been drier than current conditions in southeastern Arizona. Source: Western Regional Climate Center

drought conditions are most severe. This doesn't bode well for the region.

"The bigger the droughts are, the longer they last," said Klaus Wolter, research scientist at the Climate Diagnostics Center at the University of Colorado. "I think when you have a big drought it can perpetuate itself."

Another La Niña would only exacerbate the situation.

La Niña brewing

In July, the CPC issued a La Niña Watch, indicating favorable conditions for the development of another La Niña event in the next six months. With colder-than-average waters once again upwelling in the tropical Pacific Ocean, La Niña appears to be re-forming.

"Temperatures below the sea surface have decreased quite markedly in the last few months," said David Unger, meteorologist at the CPC. In addition, he said, the Climate Forecast System model—a state of the art climate model that integrates interactions between the Earth's oceans, land, and atmosphere—has been impressive in its prediction capabilities in the last few years and has been increasingly more confident in the development of a La Niña this winter.

"It's close to even odds right now that La Niña or neutral conditions will develop," Unger said. "It's pretty trivial chances that El Niño will form."

The International Research Institute for Climate and Society (IRI) also indicates increasing odds for a return of La Niña. Based on statistical and dynamical models and conditions that developed in the last week, there is a 43 percent chance that La Niña will develop during the October–December period, an increase from 25 percent assigned last month to this period.

Historically speaking, back-to-back La Niña events are not surprising. The climate system tends to have a more difficult time shedding a moderate or strong La Niña event than a weaker one. An intense

continued on page 5

La Niña, continued

La Niña tends to persist for multiple years; one even lasted for 34 consecutive months between 1954 and 1957.

A La Niña event may return the following fall season even if it weakened or disappeared during the summer, as was the case this summer, Wolter said. His insight, detailed in his experimental forecast discussion (http://www.esrl.noaa.gov/psd/enso/mei/), lies in looking at past La Niña events that, like last winter's event, had rapid onsets and were associated with very cold sea surface temperature anomalies. Dynamical and statistical climate models are now starting to agree with Wolter, but he thinks this event will be less intense than last winter's.

"My expectation is that this winter's [La Niña] will be weaker," Wolter said. "Last winter was the third strongest event [according to his Multivariate El-Niño–Southern Oscillation Index (MEI), which assess up to 10 ocean and atmospheric variables in order to characterize the strength of La Niña and El Niño events] and it will be hard to beat that; it's an opinion based purely on statistics."

A weaker event doesn't necessarily bring wetter conditions than a stronger event, however. Wolter recreated the MEI back to 1870 and found that for the 10 historical cases in which La Niña lasted at least two consecutive years, eight generated lower flows in the Colorado River Basin in the second year. Lower flows are very likely to happen this year because record snows packed the Upper Colorado River Basin last winter.

"[Last winter] was the first time since 1917 that the Colorado River had a big runoff year—with more than 20 million acre-feet—in a La Niña event," Wolter said.

Looking ahead

La Niña's re-emergence isn't a done deal, however. Forecast models are still mixed, though a growing number are suggesting a double-dip, and forecasters are waiting for additional data before increasing the odds of a return to La Niña.

"I'll continue to look at the subsurface temperatures, which are a leading indicator of La Niña events, and I'll keep an eye on the models," Unger said. "In my experience, the best indicator is coherence in models."

In the next few months, forecasters should have a better idea of the final call: La Niña or neutral conditions. Regardless of which wins out, eastern New Mexico likely will experience a dry winter. Neutral events in this area, along with West Texas, often bring slightly drier conditions, Unger said.

For the rest of the region, southwesterners are crossing their fingers for a neutral event. In the past these events have brought either a wet or a dry winter.

"You don't have to have a severe dry period to make an existing drought worse," Wolter said. "I'm concerned about an increased probability of this winter being drier than average."

Temperature (through 8/17/11)

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 are averaging between 60 and 75 degrees Fahrenheit in the southwest deserts and along the Arizona-California border; 55 to 65 degrees F in southeastern Arizona, along the New Mexico-Mexico border, and in southeastern New Mexico; and 45 to 55 degrees F in central and northwestern New Mexico and across the Colorado Plateau in Arizona (*Figure 1a*). The highest elevations are seeing temperatures between 35 and 45 degrees F. These temperatures have been 1–2 degrees F warmer than average across parts of Arizona and most of New Mexico (*Figure 1b*). The highest above-average temperatures have been in Otero County along the New Mexico-Mexico border. The warm conditions are due to a persistent high pressure ridge over the area which suppressed monsoon precipitation.

Temperatures during the past 30 days have been warmer than average across most of Arizona and all of New Mexico (*Figures 1c–d*). In the southwest Arizona deserts, temperatures increased by about 5 degrees F over the previous month due to increased humidity and warmer nighttime temperatures. New Mexico has experienced the warmest conditions. Temperatures have been progressively warmer to the southeast, which matches the drought pattern in recent weeks—the driest and hottest conditions have been toward southeastern New Mexico.

Figure 1a. Water year '10–'11 (October 1 through August 17) average temperature.

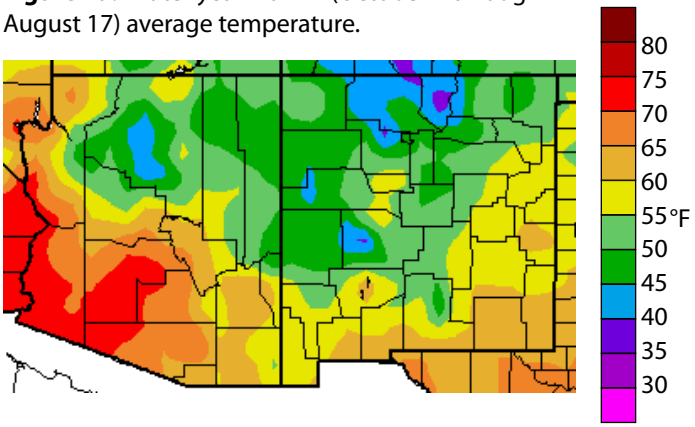


Figure 1b. Water year '10–'11 (October 1 through August 17) departure from average temperature.

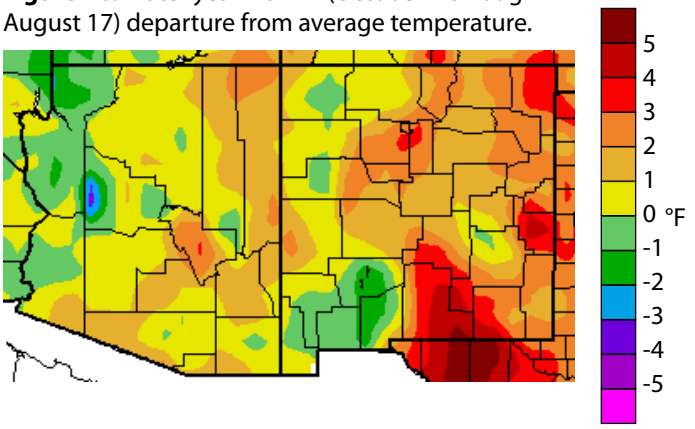


Figure 1c. Previous 30 days (July 19–August 17) departure from average temperature (interpolated).

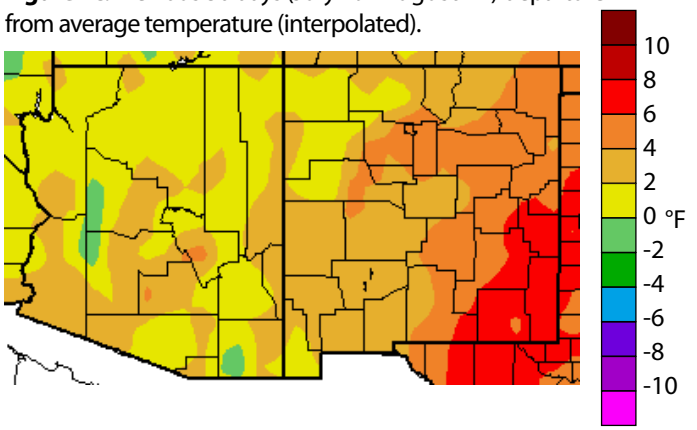
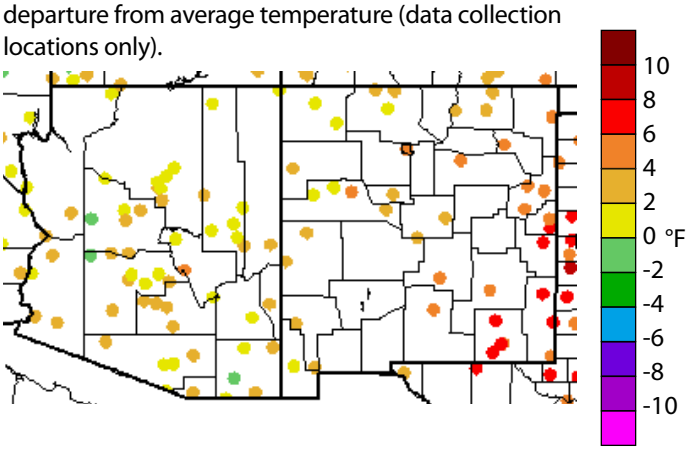


Figure 1d. Previous 30 days (July 19–August 17) departure from average temperature (data collection locations only).



Notes:

The water year begins on October 1 and ends on September 30 of the following year. Water year is more commonly used in association with precipitation; water year temperature can be used to measure the temperatures associated with the hydrological activity during the water year.

Average refers to the arithmetic mean of annual data from 1971–2000. Departure from average temperature is calculated by subtracting current data from the average. The result can be positive or negative.

The continuous color maps (Figures 1a, 1b, 1c) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. The dots in Figure 1d show data values for individual stations. Interpolation procedures can cause aberrant values in data-sparse regions.

These are experimental products from the High Plains Regional Climate Center.

On the Web:

For these and other temperature maps, visit
http://www.hprcc.unl.edu/maps/current/

For information on temperature and precipitation trends, visit
http://www.cpc.ncep.noaa.gov/trndtext.shtml

Precipitation (through 8/17/11)

Data Source: High Plains Regional Climate Center

Precipitation since the water year began on October 1 generally has ranged from 130 percent of average in the northwest corner of Arizona to less than 25 percent of average in the southeastern corner of New Mexico (*Figures 2a–b*). The wet-to-dry gradient continues to run diagonally across both states. The Colorado Plateau and central counties of Arizona, as well as the northwest and northern borders of New Mexico, have received between 50 to 90 percent of average precipitation. The southern Arizona counties and the southeastern two-thirds of New Mexico have received 25–50 percent of average. Eddy, Chaves, and Lea counties in southeastern New Mexico have received even less.

In the last 30 days, monsoon storms have delivered copious rains to parts of southeastern Arizona including Graham, Greenlee, and western Cochise counties, as well as to central Coconino County in northern Arizona and southern Hidalgo and Luna counties in southwest New Mexico (*Figures 2c–d*). However, most of the Southwest has received less than 70 percent of average rainfall in the last month, most notably western Arizona and eastern New Mexico, which have received less than 50 percent of their average.

Figure 2a. Water year '10–'11 (October 1 through August 17) percent of average precipitation (interpolated).

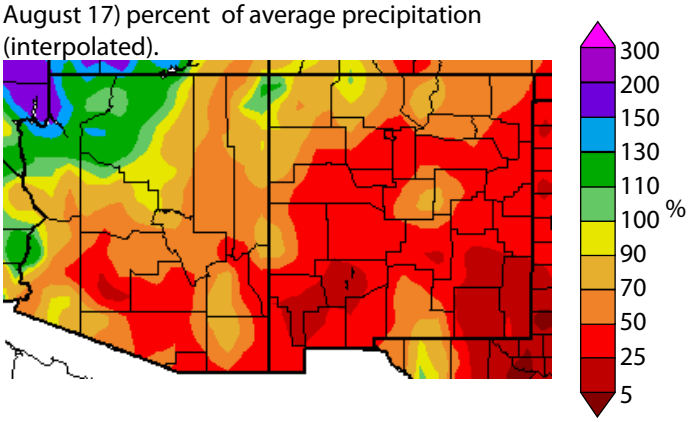


Figure 2b. Water year '10–'11 (October 1 through August 17) percent of average precipitation (data collection locations only).

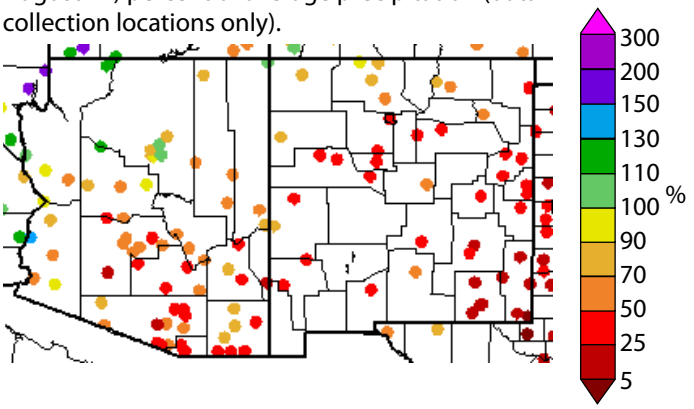


Figure 2c. Previous 30 days (July 19–August 17) percent of average precipitation (interpolated).

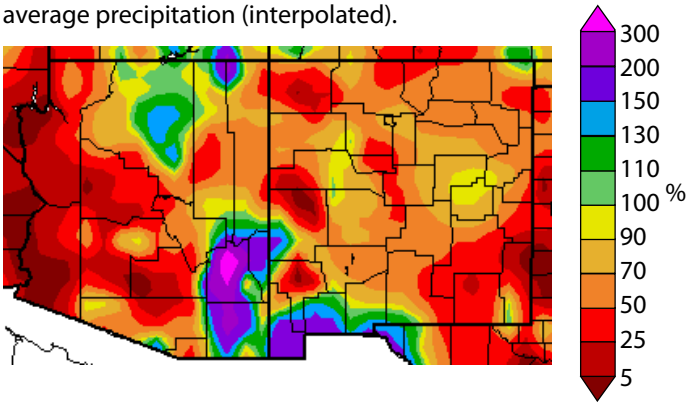
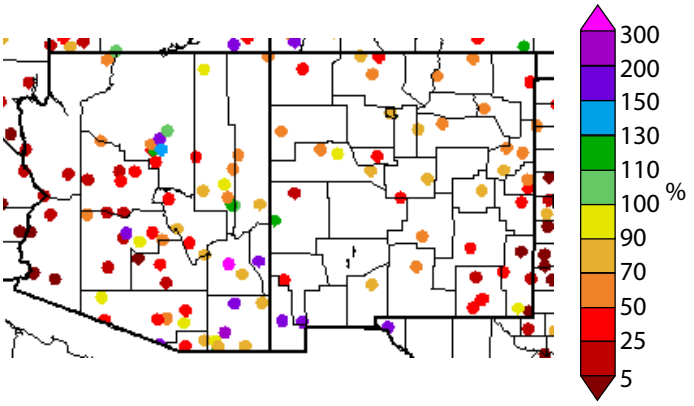


Figure 2d. Previous 30 days (July 19–August 17) percent of average precipitation (data collection locations only).



Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2010, we are in the 2011 water year. The water year is a more hydrologically sound measure of climate and hydrological activity than is the standard calendar year.

Average refers to the arithmetic mean of annual data from 1971–2000. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100.

The continuous color maps (Figures 2a, 2c) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. Interpolation procedures can cause aberrant values in data-sparse regions.

The dots in Figures 2b and 2d show data values for individual meteorological stations.

On the Web:

For these and other precipitation maps, visit
http://www.hprcc.unl.edu/maps/current/

For National Climatic Data Center monthly precipitation and drought reports for Arizona, New Mexico, and the Southwest region, visit
http://lwf.ncdc.noaa.gov/oa/climate/research/2003/perspectives.html#monthly

U.S. Drought Monitor (data through 8/16/11)

Data Sources: U.S. Department of Agriculture, National Drought Mitigation Center, National Oceanic and Atmospheric Administration

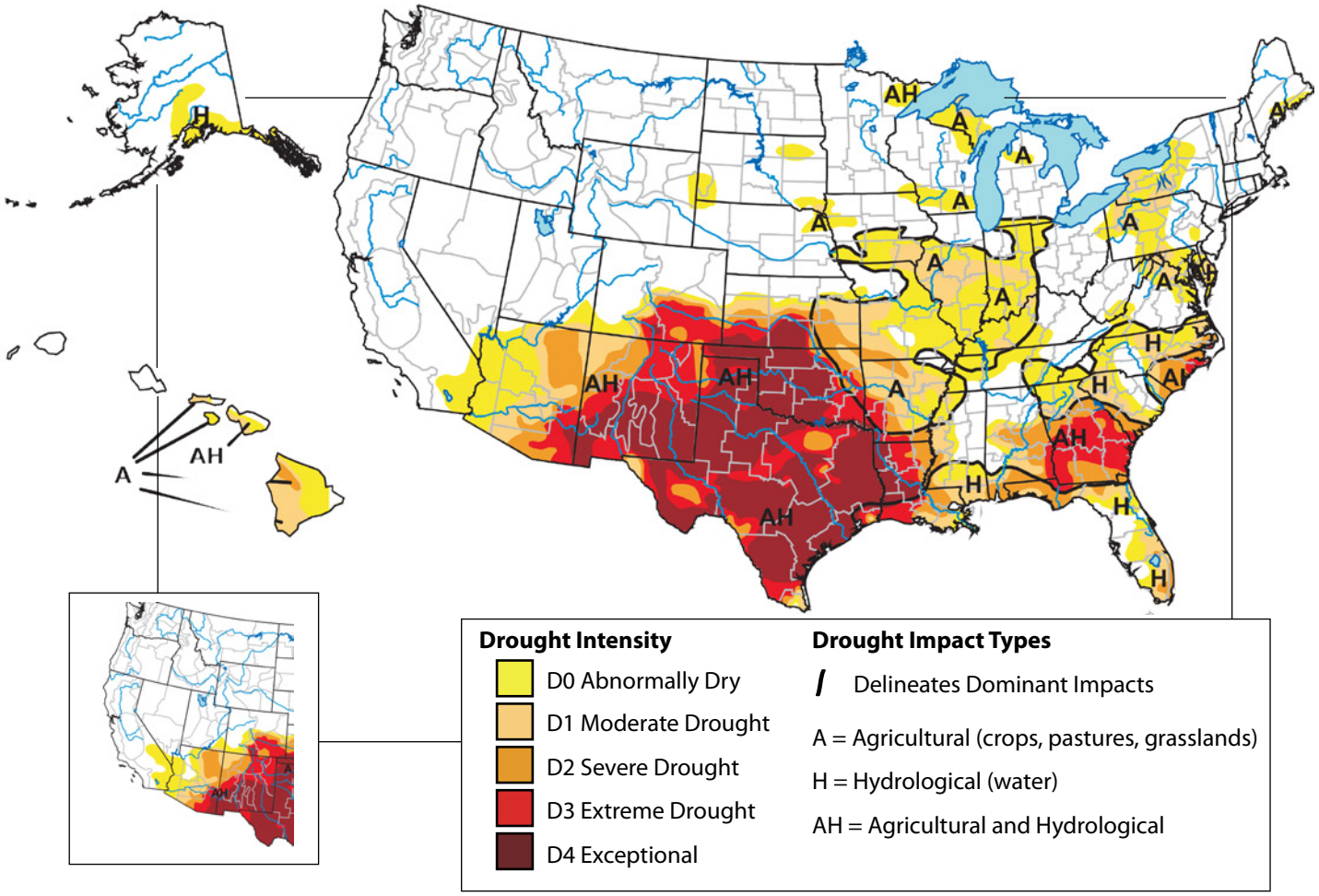
Most of the western U.S. remains drought-free after a banner wet winter and spring. The exceptions are Arizona and New Mexico, where drought conditions continued to occupy nearly all of both states. The monsoon started with a bang in a few parts of Arizona—although precipitation was not widespread or heavy enough to improve drought conditions—and a bust for most of New Mexico; precipitation during the last 30 days has also been slightly below average in most of the two states except for the southeastern and southwestern corners of Arizona and New Mexico, respectively. Across the West, the percent of area covered by abnormally dry conditions or a more severe drought category remained virtually unchanged from one month ago and currently sits at about 25 percent, according to the August 16 update of the U.S. Drought Monitor *(Figure 3)*.

Drought conditions also remain unchanged in Texas, were exceptional drought conditions currently occupy 75 percent of the state.

Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The inset (lower left) shows the western United States from the previous month's map. The U.S. Drought Monitor maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of several agencies; the author of this monitor is Mathew Rosencrans, NOAA/NWS/NCEP/CPC.

Figure 3. Drought Monitor data through August 16, 2011 (full size), and July 19, 2011 (inset, lower left).



On the Web:

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor website http://www.drought.gov/portal/server.pt/community/current_drought/208

Arizona Drought Status

(data through 8/16/11)

Data Source: U.S. Drought Monitor

Monsoon thunderstorms have been spottier than usual and relatively infrequent over much of Arizona over the past 30 days, bringing little relief to drought conditions plaguing much of the state. Drought expanded across western Arizona, while conditions eased slightly in far southeast Arizona in the last month, according to the August 16 update of the U.S. Drought Monitor *(Figures 4a–b)*. In far northwestern Arizona, incursions of moisture and thunderstorms have been few and far between, leaving mounting precipitation deficits and the return of abnormally dry conditions to this region—abnormally dry conditions are not a drought category but signal drought will develop if dry conditions continue. In southeastern Arizona, a handful of widespread precipitation events over Cochise and Graham counties during the last 30 days have slightly reduced extreme and exceptional drought, but overall drought conditions are still very severe due to long-term precipitation deficits and a lackluster monsoon season so far. Reports submitted through Arizona DroughtWatch (http://azdroughtwatch.org) for southeast Arizona continue to portray very poor rangeland conditions and impacts to livestock that include calling herds, hauling water, and providing supplemntal forage due to continuing extreme drought conditions.

Figure 4a. Arizona drought map based on data through August 16, 2011.

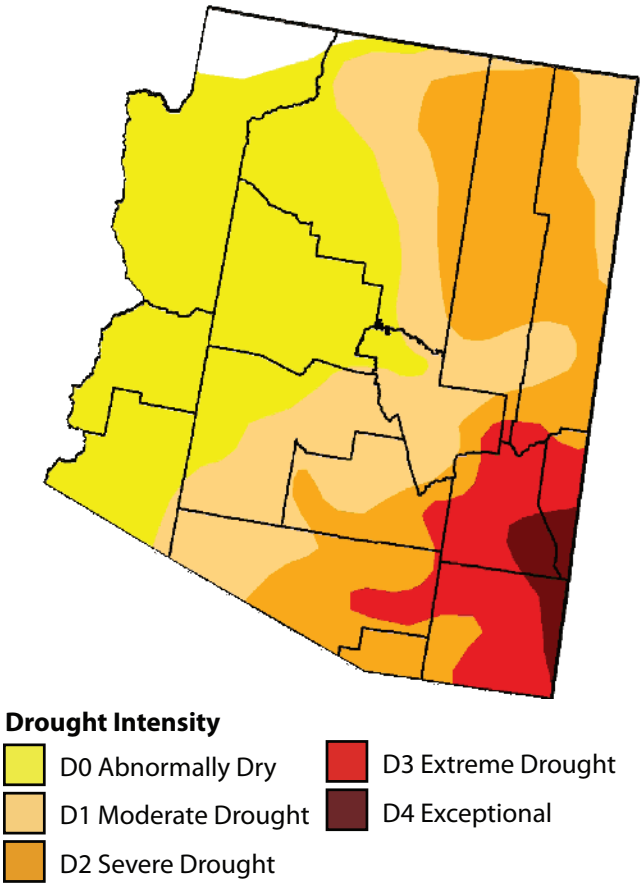


Figure 4b. Percent of Arizona designated with drought conditions based on data through August 16, 2011.

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	2.41	97.59	61.56	36.79	11.52	2.08
Last Week (08/09/2011 map)	11.15	88.85	60.35	37.15	14.02	4.83
3 Months Ago (05/17/2011 map)	13.83	86.17	58.25	31.54	15.59	0.00
Start of Calendar Year (12/28/2010 map)	31.40	68.60	32.45	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	40.00	60.00	18.58	3.23	0.00	0.00
One Year Ago (08/10/2010 map)	40.00	60.00	13.38	2.67	0.00	0.00

Notes:

The Arizona section of the U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of several agencies.

On the Web:

For the most current drought status map, visit http://www.drought.unl.edu/dm/DM_state.htm?AZ,W

For monthly short-term and quarterly long-term Arizona drought status maps, visit http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm

New Mexico Drought Status

(data through 8/16/11)

Data Source: New Mexico State Drought Monitoring Committee, U.S. Drought Monitor

New Mexico generally has received less than 70 percent of average rainfall in the past month. The exception has been in the southwest corner of the state, where storms have delivered more than 130 percent of average. As a result, the entire state is still classified with some drought category *(Figures 5a-b)*. About 42 percent of the state is pegged with exceptional drought, which is defined as a drought that occurs, on average, once in every 50 years. Another 35 and 16 percent of the state is experiencing extreme and moderate drought, respectively. Compared to one month ago, exceptional drought declined by about 6 percent, extreme drought increased by about 4 percent, and moderate drought increased by about 2 percent. The NOAA-Climate Prediction Center September forecast calls for slightly increased chances for below-average rainfall. In addition, the probability for a return of La Niña this winter is increasing. Both these forecasts suggest that drought conditions will not improve and may actually intensify and spread.

Figure 5a. New Mexico drought map based on data through August 16, 2011.

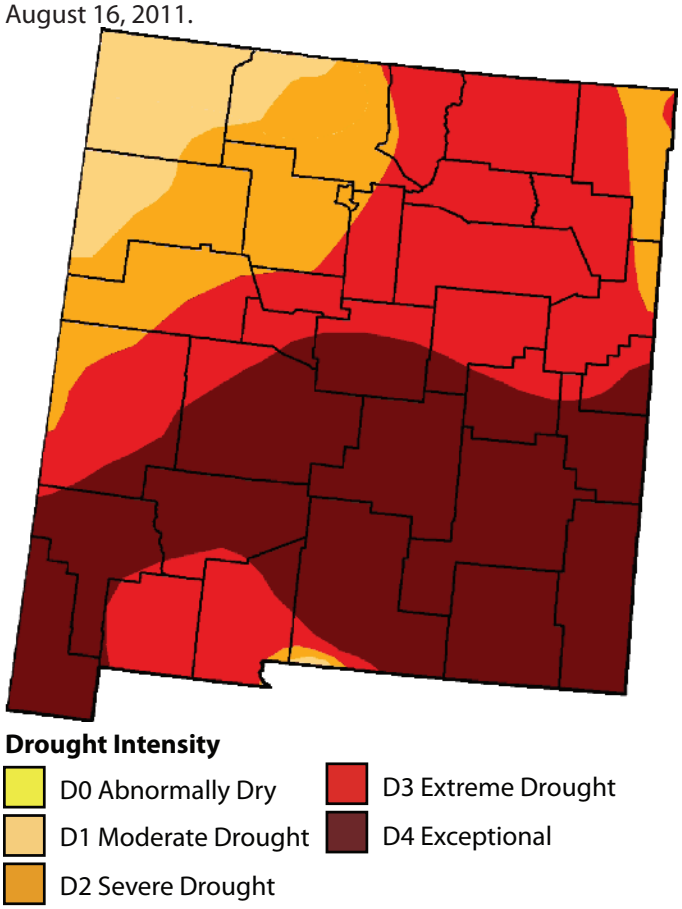


Figure 5b. Percent of New Mexico designated with drought conditions based on data through August 16, 2011.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	92.66	77.07	42.39
Last Week (08/09/2011 map)	0.00	100.00	100.00	93.16	77.31	47.30
3 Months Ago (05/17/2011 map)	0.00	100.00	96.66	87.36	64.59	31.67
Start of Calendar Year (12/28/2010 map)	6.16	93.84	40.40	0.00	0.00	0.00
Start of Water Year (09/28/2010 map)	76.66	23.34	0.00	0.00	0.00	0.00
One Year Ago (08/10/2010 map)	79.55	20.45	0.00	0.00	0.00	0.00

Notes:

The New Mexico section of the U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of several agencies.

This summary contains substantial contributions from the New Mexico Drought Working Group.

On the Web:

For the most current drought status map, visit http://www.drought.unl.edu/dm/DM_state.htm?NM,W

For the most current Drought Status Reports, visit http://www.nmdrought.state.nm.us/MonitoringWorkGroup/wk-monitoring.html

Arizona Reservoir Levels
(through 7/31/11)

Data Source: National Water and Climate Center

Combined storage in Lakes Mead and Lake Powell increased by almost 2 million acre-feet during July. As of July 1, Mead and Powell storage was at 61 percent of capacity *(Figure 6)*, which is around 10 percent more than a year ago. On July 30, the elevation of Lake Powell peaked for the water year at 3,660.9 feet, which is 39.1 feet below full capacity. The projected unregulated inflow to Lake Powell for the 2011 water year is 17.0 million acre-feet, or 141 percent of average. Storage in other reservoirs within Arizona's borders decreased by more than 116,000 acre-feet in July. San Carlos Reservoir, in drought-stricken southeastern Arizona, is at a mere 1 percent of capacity.

The increase in Lake Mead's level, which is currently about 20 feet higher than it was one year ago, allowed the U.S. National Park Service to reopen several boat-launch ramps along the lake's National Recreation Area *(Las Vegas Review Journal,* August 7).

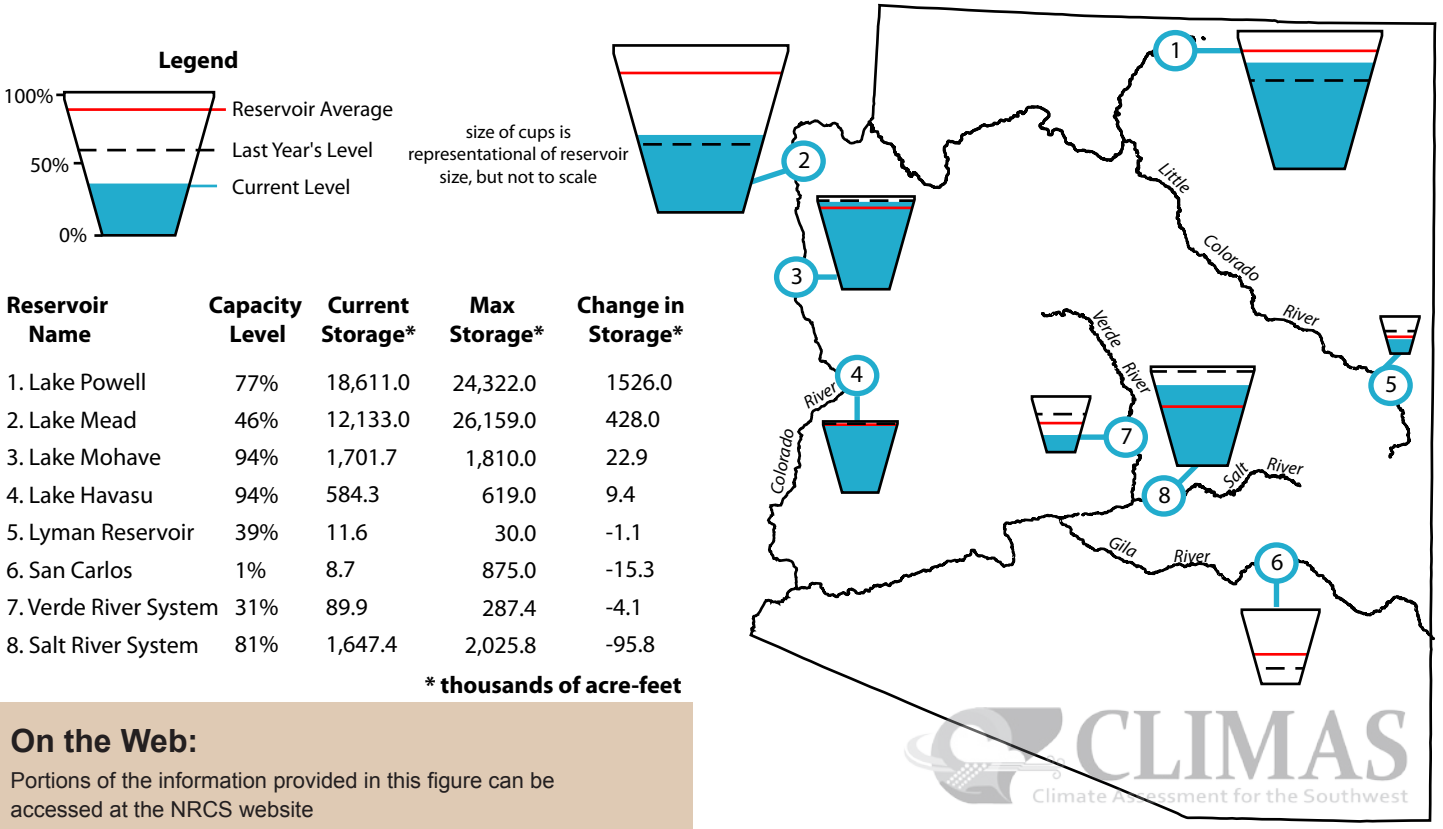
Notes:

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 6. Arizona reservoir levels for July 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	77%	18,611.0	24,322.0	1526.0
2. Lake Mead	46%	12,133.0	26,159.0	428.0
3. Lake Mohave	94%	1,701.7	1,810.0	22.9
4. Lake Havasu	94%	584.3	619.0	9.4
5. Lyman Reservoir	39%	11.6	30.0	-1.1
6. San Carlos	1%	8.7	875.0	-15.3
7. Verde River System	31%	89.9	287.4	-4.1
8. Salt River System	81%	1,647.4	2,025.8	-95.8

*** 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 7/31/11)

Data Source: National Water and Climate Center

The total reservoir storage in New Mexico declined by about 160,000 acre-feet in July *(Figure 7)*. There were substantial decreases in storage in the state's largest reservoirs—Navajo and Elephant Butte declined by 39,200 and 60,100 acre-feet, respectively. Compared with one year ago, storage declined in every New Mexico reservoir included in Figure 7, except Abiquiu, which contains only 700 acre-feet more than one year ago.

In water-related news, the Buckman Direct Diversion project, which brings Rio Grande water to Santa Fe, was closed for about a month after rain washed ash and debris from the Las Conchas Fire into the river system *(Santa Fe New Mexican,* August 6). The closure prevented the ash from clogging filters and required Santa Fe, whose local reservoirs are only around one-third full, to pump groundwater.

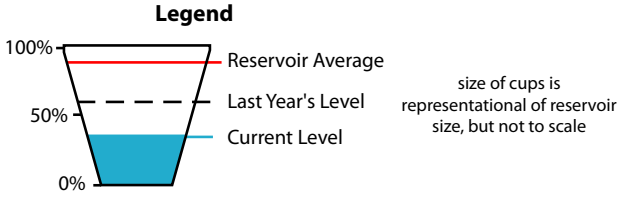
Notes:

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).

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.

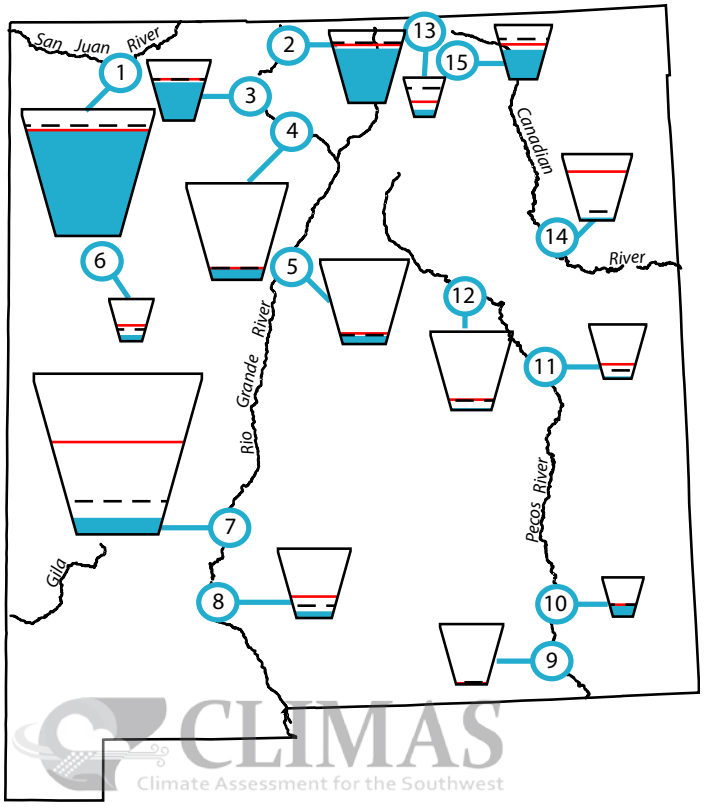
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Wayne Sleep, wayne.sleep@nm.usda.gov.

Figure 7. New Mexico reservoir levels for July 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. Navajo	84%	1,423.0	1,696.0	-39.2
2. Heron	75%	301.8	400.0	5.6
3. El Vado	63%	120.4	190.3	-34.3
4. Abiquiu	12%	148.7	1,192.8	-2.3
5. Cochiti	10%	50.1	491.0	0.2
6. Bluewater	14%	5.3	38.5	-0.1
7. Elephant Butte	10%	223.0	2,195.0	-60.1
8. Caballo	10%	32.2	332.0	-5.3
9. Brantley	1%	8.6	1,008.2	-0.9
10. Lake Avalon	28%	1.1	4.0	-0.2
11. Sumner	4%	4.5	102.0	-2.6
12. Santa Rosa	2%	8.7	438.3	-11.7
13. Costilla	18%	2.8	16.0	-3.4
14. Conchas	4%	9.6	254.2	-3.0
15. Eagle Nest	54%	42.7	79.0	-2.4

*** 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

Southwest Fire Summary
(updated 8/12/11)

Source: Southwest Coordination Center

Wildfires have abated since the monsoon began in early July and storms have helped quell many large fires, including the record-setting Wallow Fire that burned more than 538,000 acres in eastern Arizona and western New Mexico. Between July 20 and August 16, more than 150,000 acres burned across Arizona and New Mexico, according to Predictive Services at the Southwest Coordination Center. Since the beginning of the calendar year, more than 970,000 acres in Arizona and 1 million acres in New Mexico have burned in wildfires *(Figure 8a)*, which is about 900,000 more acres burned then the previous record set in 2002. In Arizona, most wildfires occurred in the central and southern parts of the state *(Figure 8b)*, while the eastern areas of New Mexico have experienced the highest fire activity *(Figure 8c)*.

As of August 18, 11 fires larger than 100 acres were burning in Arizona. Most of these were relatively small, having charred less than 5,000 acres. In New Mexico, seven fires were burning and all but one covered fewer than 300 acres; the largest fire has burned fewer than 5,000 acres.

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of August 12, 2011.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	962	923,997	471	47,888	1,433	971,885
NM	914	807,124	667	235,351	1,581	1,010,939
Total	1,876	1,731,121	1138	283,239	3,014	1,982,824

Figure 8b. Arizona large fire incidents as of August 12, 2011.

Figure 8b. Arizona large fire incidents as of August 12, 2011.

Notes:

The fires discussed here have been reported by federal, state, or tribal agencies during 2011. The figures include information both for current fires and for fires that have been suppressed. The top figure shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. The bottom two figures indicate the approximate locations of past and present "large" wildland fires and prescribed burns in Arizona and in New Mexico. A "large" fire is defined as a blaze covering 100 acres or more in timber or 300 acres or more in grass or brush. The name of each fire is provided next to the symbol.

On the Web:

These data are obtained from the Southwest Coordination Center website:
http://gacc.nifc.gov/swcc/predictive/intelligence/daily/ytd_all_wf_by_state.pdf

http://gacc.nifc.gov/swcc/predictive/intelligence/ytd_historical/ytd/large_fires/swa_ytd_combined.htm

Monsoon Summary
(through 8/14/2011)

Data Source: Western Regional Climate Center

The first two months of the monsoon season have been underwhelming and spottier than normal in many parts of Arizona and New Mexico despite persistant high humidity. Although moisture has been present, a lack of strong winds aloft and atmospheric stability has prevented widespread and constant rains. As a result, rainfall between June 16 and August 14 in New Mexico and Arizona generally has been less than 3.5 inches, with precipitation deficits ranging from 1.5 to 4.5 inches in New Mexico (*Figures 9a–b*). Rainfall has measured less than 75 percent of average in most of New Mexico, with the driest conditions occurring in the southeast corner (*Figure 9c*). Only parts of southeast and southwest Arizona and the Four Corners region have experienced above-average rainfall. The drier-than-average conditions in New Mexico can be blamed in part on the position of the subtropical high, or the monsoon ridge, which has hovered too far to the east to deliver copious rains to most of the state. This extensive dome of high pressure has generally extended from the East Coast to eastern New Mexico, causing winds over New Mexico to waft generally from the east instead of the south. The drier-than-average conditions have not helped improve widespread and intense drought for most of the region. On August 16, 12 and 77 percent of Arizona and New Mexico, respectively, were pegged with extreme or exceptional drought. Two months earlier, at the onset of the monsoon season, those numbers were 18 and 68 percent.

Figure 9a. Total precipitation in inches (June 16 –August 14, 2011).

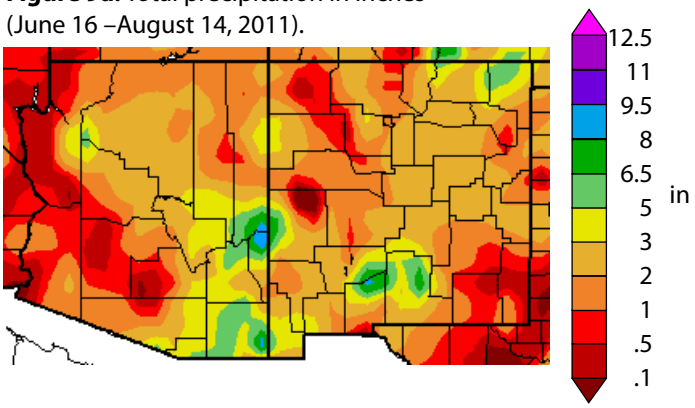


Figure 9b. Departure from average precipitation in inches (June 16 –August 14, 2011).

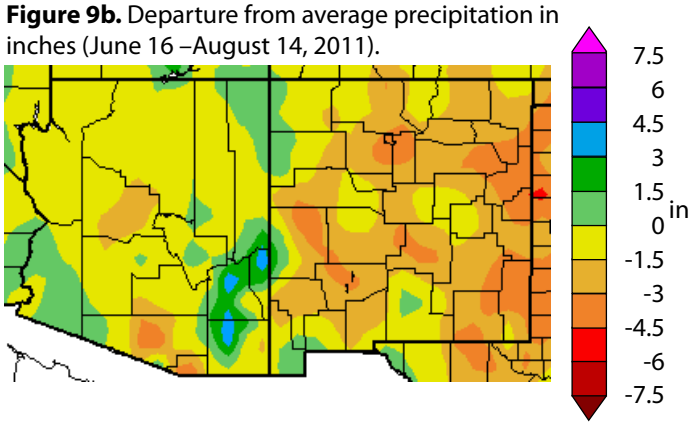
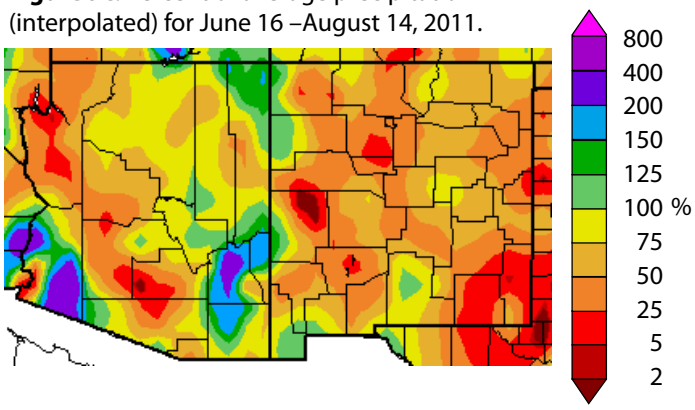


Figure 9c. Percent of average precipitation (interpolated) for June 16 –August 14, 2011.



Notes:

The continuous color maps (figures above) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. Interpolation procedures can cause aberrant values in data-sparse regions.

Average refers to the arithmetic mean of annual data from 1971–2000. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100. Departure from average precipitation is calculated by subtracting the average from the current precipitation.

On the Web:

These data are obtained from the National Climatic Data Center:
http://www.hprcc.unl.edu/maps/current/

Temperature Outlook
(September 2011–February 2012)
Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in August call for increased chances for temperatures to be similar to those of the warmest 10 years of the 1981–2010 period through the spring. For the September–November period CPC outlooks call for greater than a 50 percent chance that temperatures will resemble the warmest years in the climatological record in most of Arizona and southern New Mexico (*Figure 10a*). These forecasts are based in part on decadal trends and statistical and dynamical forecasts. The forecast issued for the October–December and November–January periods calls for temperatures in most of Arizona and in New Mexico to have greater than a 40 percent probability of being similar to those of the warmest 10 years in the climatological record, with slightly higher probabilities in southern parts of both states (*Figures 10b–c*). For the December–February period, temperatures have an equal chance of being above-, below-, or near-average in Arizona and slightly enhanced odds for warmer-than-average temperatures in New Mexico (*Figure 10d*).

Notes:

These outlooks predict the likelihood (chance) of above-average, average, and below-average temperature, but not the magnitude of such variation. The numbers on the maps do not refer to degrees of temperature.

The NOAA-CPC outlooks are a 3-category forecast. As a starting point, the 1981–2010 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC temperature outlook, areas with light brown shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average temperature. A shade darker brown indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average temperature, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 10a. Long-lead national temperature forecast for September–November 2011.

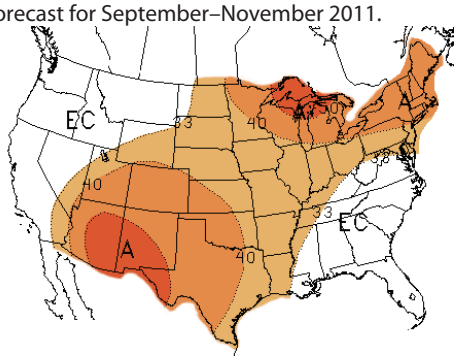


Figure 10b. Long-lead national temperature forecast for October-December 2011.

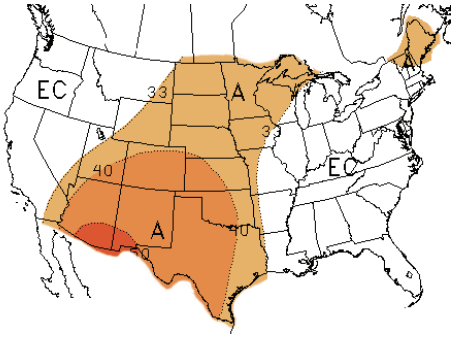


Figure 10c. Long-lead national temperature forecast for November 2011-January 2012.

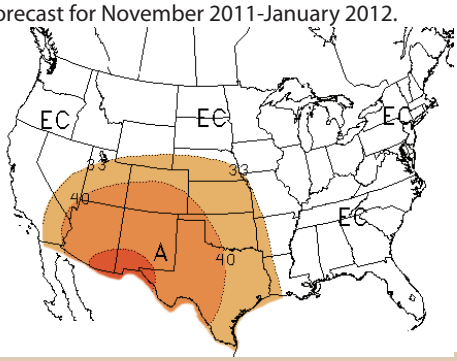
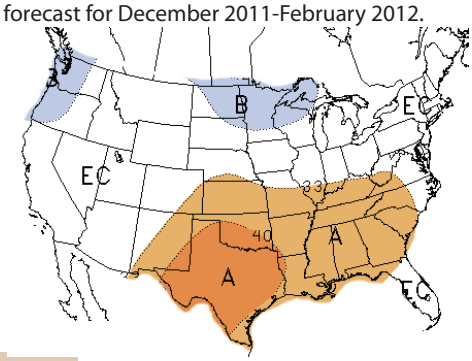
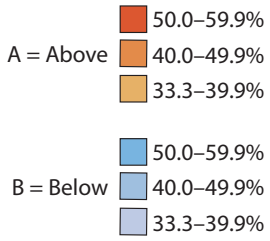


Figure 10d. Long-lead national temperature forecast for December 2011-February 2012.





EC = Equal chances. No forecasted anomalies.

On the Web:

For more information on CPC forecasts, visit http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php

For seasonal temperature forecast downscaled to the local scale, visit http://www.weather.gov/climate/l3mto.php

For IRI forecasts, visit http://iri.columbia.edu/climate/forecast/net_asmt/

Precipitation Outlook
(September 2011–February 2012)

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in August call for slightly increased chances for precipitation during September–November and October–December to be similar to the driest 10 years of the 1981–2010 period (*Figures 11a–b*). The greatest chances are in the southern portions of both states. These forecasts are based in part on current dry soil moisture conditions and trends for drier conditions during these periods. For November–January, the CPC calls for equal chances of above-, below-, or near-average conditions (*Figure 11c*) for most of the region. The southern tier of the region has slightly enhanced odds at drier-than-average conditions for the December–February period (*Figure 11d*). This forecast is influenced in part by the increasing likelihood that a La Niña event will develop this winter. La Niña events historically bring dry conditions to the Southwest.

Notes:

These outlooks predict the likelihood (chance) of above-average, average, and below-average precipitation, but not the magnitude of such variation. The numbers on the maps do not refer to inches of precipitation.

The NOAA-CPC outlooks are a 3-category forecast. As a starting point, the 1981–2010 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC precipitation outlook, areas with light green shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average precipitation. A shade darker green indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average precipitation, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 11a. Long-lead national precipitation forecast for September-November 2011.

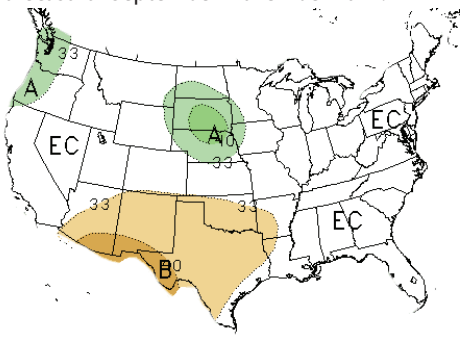


Figure 11b. Long-lead national precipitation forecast for October-December 2011.

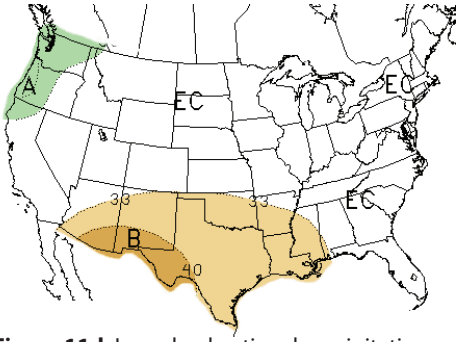


Figure 11c. Long-lead national precipitation forecast for November 2011-January 2012.

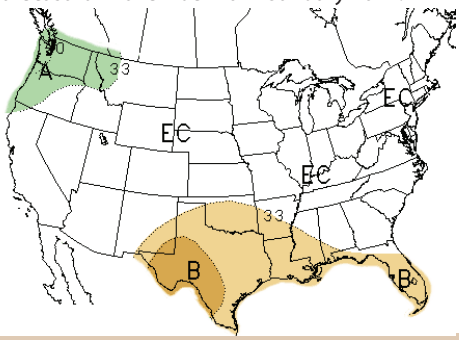
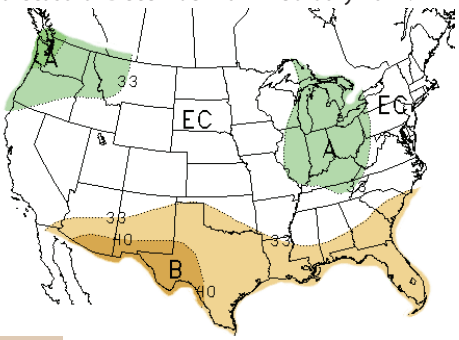


Figure 11d. Long-lead national precipitation forecast for December 2011-February 2012.



A = Above
- 40.0–49.9%
- 33.3–39.9%

B = Below
- 60.0–69.9%
- 50.0–59.9%
- 40.0–49.9%
- 40.0–49.9%

EC = Equal chances. No forecasted anomalies.

On the Web:

For more information on CPC forecasts, visit http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php
(note that this website has many graphics and March load slowly on your computer)

For IRI forecasts, visit http://iri.columbia.edu/climate/forecast/net_asmt/

Seasonal Drought Outlook
(through November)

Data Source: NOAA–Climate Prediction Center (CPC)

This summary is partially excerpted and edited from the August 16 Seasonal Drought Outlook technical discussion produced by the NOAA-Climate Prediction Center (CPC) and written by forecaster D. Miskus.

Monsoon rainfall began in earnest during the first half of July across portions of the Southwest, primarily in Arizona, Utah, and Colorado. In New Mexico, however, drought remained entrenched in the eastern half of the state, while some monsoon showers aided the far western areas. In recent weeks, monsoon activity has been centered near the Arizona and New Mexico border with some showers spreading into northeastern New Mexico and the Texas and Oklahoma panhandles. However, storms have missed southeastern New Mexico and far western Texas. Short -and medium-term forecasts spanning 6–10 and 8–14 days favor drier weather for the western sections of the Southwest, and near-average precipitation for the eastern parts. The NOAA-Climate Prediction Center (CPC) monthly and seasonal outlooks support increased chances of below-median rainfall and above-average temperatures across the entire Southwest monsoon region. Also, there are increasing chances for the re-emergence of a La Niña event this winter. In the past, the second winter in back-to-back La Niña events has delivered below-average precipitation to the Southwest.

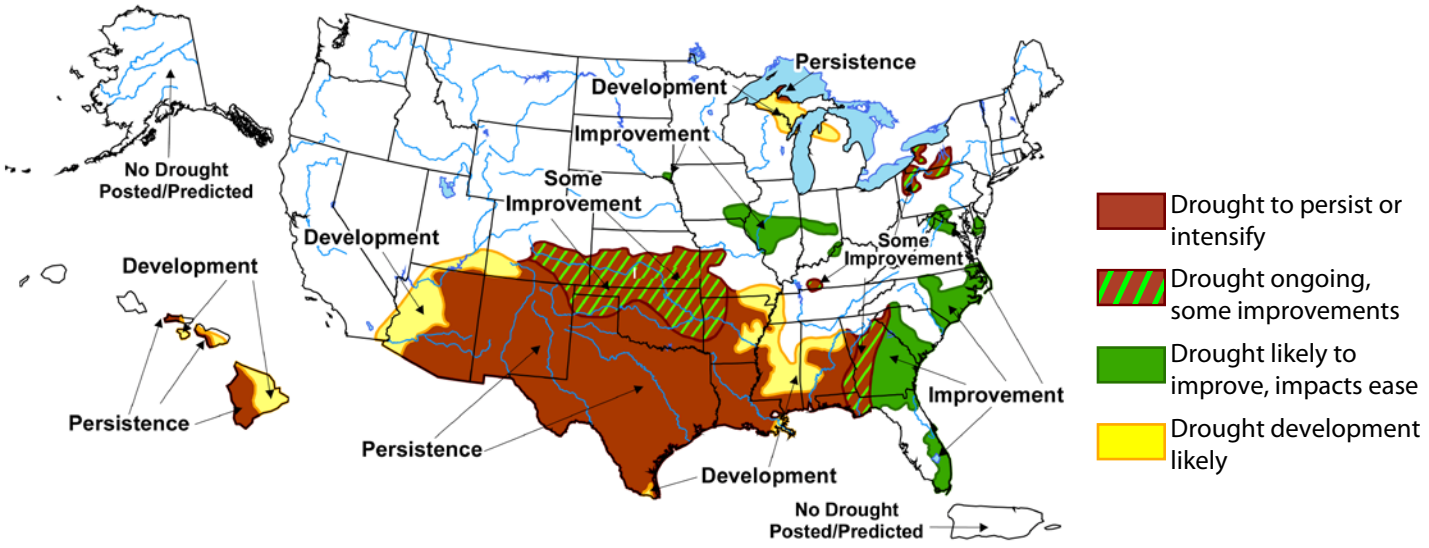
Based on these forecasts, drought is forecast to persist from Arizona into New Mexico, with possible development in western Arizona and southern Utah and Colorado (*Figure 12*). The CPC assigns a medium confidence for this forecast.

A persistent ridge of high pressure has maintained hot and dry conditions across the south-central U.S. for the second consecutive month, exacerbating the drought in the southern Plains and contributing to below-average rainfall in many parts of New Mexico. Texas and Oklahoma experienced the warmest July in the last 117 years, while Texas had the second driest July on record. For the May–June period, Texas and New Mexico experienced the second driest period on record, while February–July was the driest on record for New Mexico.

Notes:

The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators, including the official precipitation outlooks, various medium- and short-range forecasts , models such as the 6-10 day and 8-14 day forecasts, soil moisture tools, and climatology.

Figure 12. Seasonal drought outlook through November (released August 18).



On the Web:

For more information, visit http://www.drought.gov/portal/server.pt

For medium- and short-range forecasts, visit http://www.cpc.ncep.noaa.gov/products/forecasts/

For soil moisture tools, visit http://www.cpc.ncep.noaa.gov/soilmst/forecasts.shtml

Wildland Fire Outlook

(September–November 2011)

Sources: National Interagency Coordination Center, Southwest Coordination Center

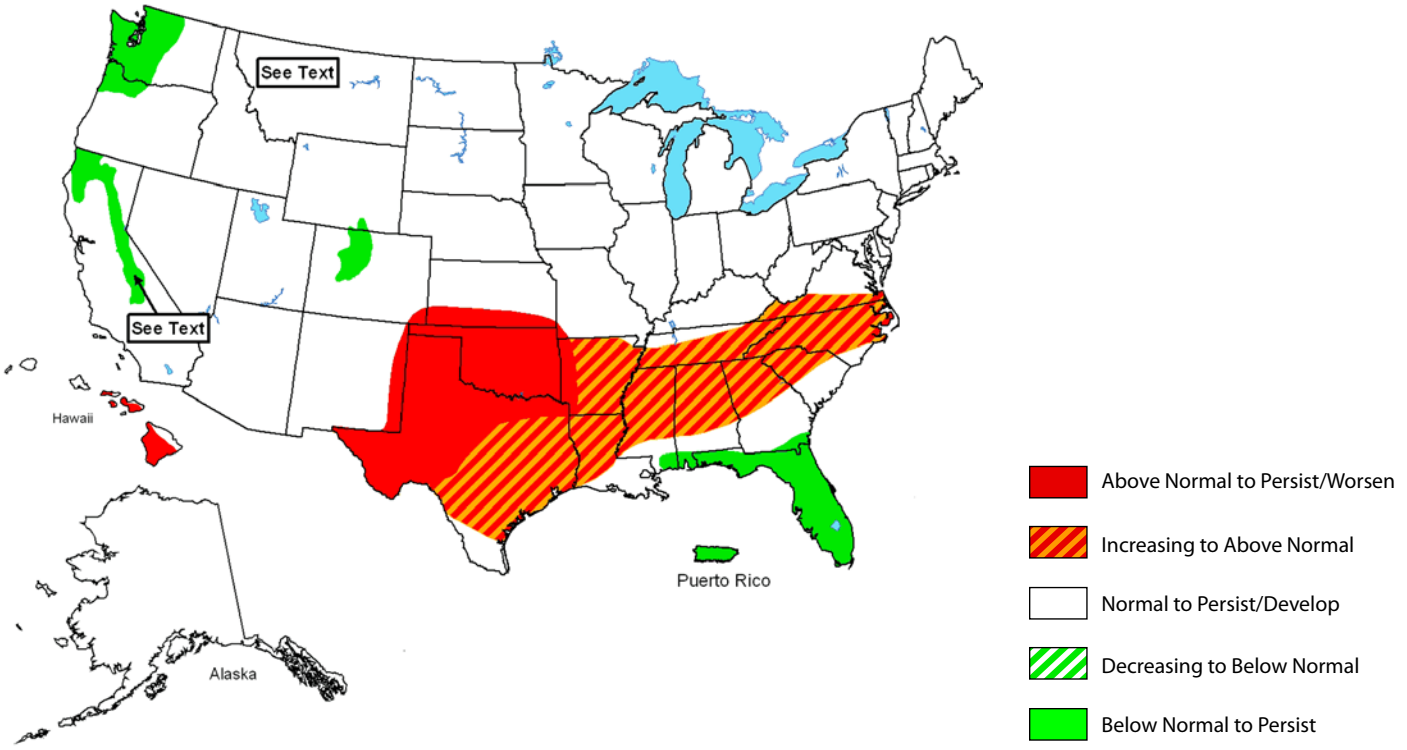
Significant fire potential is expected to remain normal across most of Arizona and New Mexico for the September–November period, according to the Predictive Services at the Southwest Coordination Center *(Figure 13)*. Only the far eastern edge of New Mexico, where conditions have been hotter and drier than average, shows signs of above-normal significant fire potential. Significant fire potential is the likelihood that a wildland fire event will require additional fire management resources from outside the region where the fire originated.

Temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) show an increased likelihood for above-average temperatures for the September–November period. CPC precipitation forecasts for the same time period show slightly increased chances for below-average rainfall across most of the Southwest *(see Figures 10a and 11a)*. However, significant fire potential remains normal due to monsoon-related moisture. Although actual rainfall has been variable across the region, high day and night humidity levels accompanying the monsoon have helped and will continue to help mitigate fire potential through September. High nighttime humidity is particularly important because it allows vegetation to regain moisture, making these potential fuels less likely to burn. Additionally, the recent lack of windy conditions has diminished the occurrence of large wildfires. If the number of wind events remains low, wildfires will have less potential to grow into significant events in the coming months.

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. The forecasts (Figure 13) consider observed climate conditions, climate and weather forecasts, vegetation health, and surface-fuels conditions in order to assess fire potential for fires greater than 100 acres. They are subjective assessments, that synthesize information provided by fire and climate experts throughout the United States.

Figure 13. National wildland fire potential for fires greater than 100 acres (valid September–November 2011).



On the Web:

National Wildland Fire Outlook web page
http://www.nifc.gov/news/nicc.html

Southwest Coordination Center web page
http://gacc.nifc.gov/swcc/predictive/outlooks/outlooks.htm

El Niño Status and Forecast

Data Sources: NOAA-Climate Prediction Center (CPC), International Research Institute for Climate and Society (IRI)

Sea surface temperatures across the central and eastern equatorial Pacific Ocean were close to average again this month, signaling the continuation of ENSO-neutral conditions. Southern Oscillation Index (SOI) values are also near zero, additional evidence for neutral conditions *(Figure 14a)*. However, similar to last month, the NOAA-Climate Prediction Center (CPC) states there are several weak atmospheric circulation patterns characteristic of La Niña that continue to linger from last winter's La Niña event, including slightly enhanced easterly winds along the equator and suppressed convection in the eastern Pacific.

The La Niña-like conditions in the atmosphere, albeit weak, and a pool of below-average ocean temperatures below the surface in the eastern Pacific have caused models to increase probabilities for a return of La Niña as early as this fall. Forecasts issued by the International Research Institute for Climate and Society (IRI) indicate a 44 percent chance that La Niña conditions will develop during the November–January period, an increase from 26 percent issued last month. It is important to note that the probability of neutral conditions continuing this fall is 54 percent; the chance for the development of El Niño is very low at 2 percent *(Figure 14b)*.

Seasonal precipitation forecasts for the Southwest reflect in part the idea that a weak La Niña may return and persist through the fall and winter season. An increased chance of below-average precipitation across southern Arizona and New Mexico shows up in seasonal precipitation forecasts issued by the NOAA-CPC for December 2011 through April 2012. This is consistent with dry conditions characteristic of a La Niña event and would be the continuation of a very dry pattern for a second year in a row in the Southwest. The prospect of back-to-back dry winters is bad news for drought-stricken areas in Arizona and New Mexico.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through June 2011. The SOI measures the atmospheric response to SST changes across the Pacific Ocean basin. The SOI is strongly associated with climate effects in the Southwest. Values greater than 0.5 represent La Niña conditions, which are frequently associated with dry winters and sometimes with wet summers. Values less than -0.5 represent El Niño conditions, which are often associated with wet winters.

The second figure shows the International Research Institute for Climate and Society (IRI) probabilistic El Niño-Southern Oscillation (ENSO) forecast for overlapping three month seasons. The forecast expresses the probabilities (chances) of the occurrence of three ocean conditions in the ENSO-sensitive Niño 3.4 region, as follows: El Niño, defined as the warmest 25 percent of Niño 3.4 sea-surface temperatures (SSTs) during the three month period in question; La Niña conditions, coolest 25 percent of Niño 3.4 SSTs; and neutral conditions where SSTs fall within the remaining 50 percent of observations. The IRI probabilistic ENSO forecast is a subjective assessment of current model forecasts of Niño 3.4 SSTs that are made monthly. The forecast takes into account the indications of the individual forecast models (including expert knowledge of model skill), an average of the models, and other factors.

On the Web:

For a technical discussion of current El Niño conditions, visit http://www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

For more information about El Niño and to access graphics similar to the figures on this page, visit http://iri.columbia.edu/climate/ENSO/

Figure 14a. The standardized values of the Southern Oscillation Index from January 1980–July 2011. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red) respectively. Values between these thresholds are relatively neutral (green).

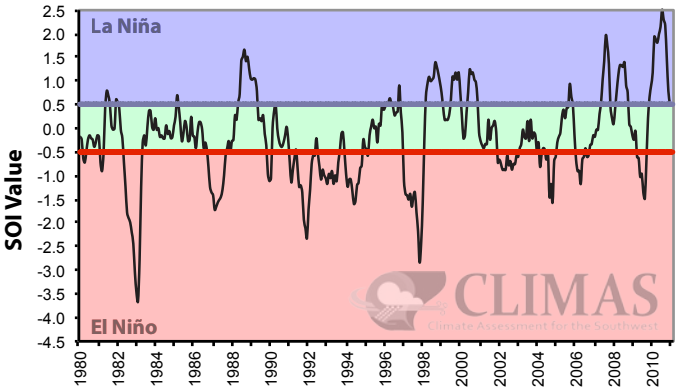


Figure 14b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released August 18). Colored lines represent average historical probability of El Niño, La Niña, and neutral.