July 26, 2011

Southwest Climate Outlook

Vol. 10 Issue 7

Source: Melissa Haun

The waning sun peaks through monsoon clouds near Tucson, Arizona, on July 24.

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...

July Climate Summary

Drought– A spotty and slow start to the monsoon has caused drought conditions to deepen across much of New Mexico. Most of Arizona also remains gripped in drought, with little relief so far.

Temperature–Most of New Mexico was 2–6 degrees Fahrenheit warmer than average in the past month, while temperatures in most of Arizona ranged between 0–2 degrees F warmer than average.

Precipitation– The monsoon has brought relief to the higher elevations of Arizona, but rainfall in New Mexico generally has been scant, particularly in the southeast and southwest corners of the state.

ENSO– neutral conditions were present again across the equatorial Pacific Ocean in the past 30 days. Neutral conditions are expected to persist through the remainder of 2011, but there is some indication that La Niña could reemerge later this fall.

Climate Forecasts– Precipitation forecasts spanning the monsoon are historically difficult to make, and the NOAA-Climate Prediction Center calls for equal chances of above-, below-, or near-average rainfall. Temperature forecasts call for increased chances for above-average temperatures through the winter.

The Bottom Line–Exceptional drought, which is defined as a drought that occurs once in every 50 years, remains entrenched in New Mexico and southeast Arizona. Since the monsoon officially began on June 15, little rain has fallen in New Mexico. On the other hand, a gulf surge from Tropical Storm Arlene provided Arizona with much needed precipitation around July 4, and spotty thunderstorms have moistened the parched landscape, especially at higher elevations. Another gulf surge beginning on July 23—which is not reflected in this issue—dumped copious rains in southeast Arizona and southwest New Mexico and will help alleviate drought in those area. Forecasts call for improving drought conditions in parts of both states. However, even if the monsoon delivers average or above-average rain, the dry conditions brought on by this past winter's La Niña event will not be completely erased. While a high probability exists that ENSO-neutral conditions will persist into at least early next year, a pool of cold water below the sea surface in the tropical Pacific Ocean hints at a return to La Niña conditions in the fall. The state of ENSO this winter will become clearer in upcoming months.

National Climate Assessment for Southwest Gearing Up

Experts from around the Southwest have started preparations for the most comprehensive report on climate change science and impacts for the region, which includes Arizona, California, Utah, Colorado, and Nevada. The report will synthesize state-of-the-art scientific knowledge about the physical climate and its impacts on ecosystems and society. It will also highlight options for mitigation and adaptation and important uncertainties in scientific knowledge.

CLIMAS, among with a host of other institutions and individuals from around the region, will publish the report in the spring of 2012. The report will contribute to the National Climate Assessment (NCA), a broader effort that encompasses the entire United States. The NCA will help the federal government prioritize climate science investments, and in doing so provide science that can inform sustainable and environmentally-sound plans for national, regional, and local development. The NCA will publish its final report in 2013; subsequent assessments will occur every four years, fulfilling a mandate under the Global Change Research Act of 1990.

Read more about the NCA at: http://globalchange.gov/what-we-do/assessment

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.

Summer Blooms Wait on the Rain

By Zack Guido

Where have all the summer flower blooms gone?

To hear Dave Bertelsen tell it, this summer has been nearly petal-less along the eight-mile Finger Rock Canyon Trail in the Santa Catalina Mountains north of Tucson—a route the self-trained botanist has hiked, round-trip, 1,326 times, half of those during the summer.

"This is one of the worst beginnings of the summer blooming season I've ever seen," Bertelsen said on July 15. He knows what he's talking about. In the 26 years he's hiked the trail, Bertelsen has logged more than 13,000 observations of flowering summer plants representing 240 species that span about 4,000 vertical feet.

Bertelsen and University of Arizona researchers Theresa and Michael Crimmins mined that information treasure trove, finding that summer blooms on the trail are tied tightly to early and continuous monsoon rains. Their research was published in *New Phytologist* in March.

The connection between monsoon rains and summer flowers is novel for most researchers studying the life cycle events of plants, a field known as phenology.

"[This research] is one of only a few studies to address the timing of flower blooms in arid regions," said Michael Crimmins, UA climate extension specialist. "Most people don't have data [on flower blooms] in dry places."

Most phenological research occurs in temperate regions where plants bloom only once a year. In the Southwest, however, precipitation falls in two distinct periods, causing the landscapes to liven in March and April and in mid- to late summer. In the winter, flowering at lower elevations is prompted by precipitation, while plants at higher elevations are influenced more by temperature. In the summer, the cue is only rain.

Figure 1. The Schott's yucca recently started blooming on the Finger Rock Canyon Trail. However, Bertelsen has only seen two in bloom through July 14. It is one of many species off to a slow start this summer. Photo was taken in 2009 by Dave Bertelsen.

"It doesn't matter what plant species you are or at what elevation you're rooted, you're waiting for the monsoon rains to begin," said Theresa Crimmins, partnership coordinator for the USA National Phenology Network, headquartered at the UA.

There are, however, nuances to summer flowering. Plant species at lower elevations on the trail fall within the Sonoran Desert ecosystem and begin sprouting rapidly after rain, while those at higher elevations are slower to respond. Also, the number of blooming species in the summer depends on the total July precipitation. For years in which July rains were high, the number of blooming species also was high, and vice versa.

continued on page 4

Summer Blooms, continued

Because high July precipitation usually occurs when monsoon rains arrive early and are continuous, Bertelsen and the Crimmins' suggest the character of the monsoon also is important.

This is perhaps the reason why plants on the Finger Rock Canyon Trail are not yet verdant. While an inch of rain had fallen on the trail through mid-July—Bertelsen also monitors three rain gauges at different elevations on the trail—it all came in one splash around the July 4 weekend. A two-week break likely has stunted development.

"I typically see on average about 60 species in bloom in July. Yesterday [on July 14], I saw only 14, which is close to the lowest I have seen for this month," Bertelsen said.

Figure 2. Evening storms drench Pistol Hill and Colossal Cave near Vail, AZ. Photo was taken by Holly Lawson.

The number of plant species in bloom likely will increase as the monsoon ramps up and summer advances—blooming typically peaks in August. However, repeated years of delayed blossoms can cause chain reactions in the ecosystem. In Europe, for example, the presence of caterpillars, which are a vital food source for the pied flycatcher, are occurring earlier in the year, in part because their food souce, the leaves of oak trees, have started to bud earlier. By the time the birds start their northward migration, many of the caterpillars are gone, sending the pied flycatcher population plummeting by about 90 percent in recent decades.

"I don't know if people have pinned down the cascading effects of delayed flowering in the Southwest, but we can anticipate similar things will happen here, too [with a shift in the timing of summer blooms]," Theresa Crimmins said.

If the onset of the monsoon season influences when plants bloom, changes in future monsoon seasons could spark an ecological chain reaction. Unfortunately, basic science principles paint plausible yet contrasting pictures of a drier or wetter monsoon.

On one hand, warming air temperatures will require clouds to ascend to higher altitudes before the vapor condenses into rain. If the atmosphere warms up enough, the mountains—which push air upwards and help develop thunderous storms—would not play as prominent a role in organizing rainfall, and total monsoon rainfall may be lower.

On the other hand, warmer air temperatures carry more moisture and may increase the temperature difference between the Southwest and the eastern Pacific Ocean. The monsoon winds would then intensify and deliver more moisture to the region, theoretically increasing rainfall.

Speculating about future temperature, however, is far less uncertain. The Southwest almost surely will continue to warm, and this likely will delay the onset of flowering and decrease the total number of species in bloom if increases in rain do not accompany warmer temperatures.

Warmer temperatures mean soils are drier and dry out faster after rain events. More rain therefore is needed to compensate for increases in temperature.

"Increasing temperatures will likely cause plant diversity to decrease, all else being equal," Bertelsen said. "The hotter it is the more rain it takes for plants to produce seeds."

While the numbers have been low through the first half of July, it's too early to tell how many species ultimately will bloom this summer.

"So far, this year reminds me of 2006, which also had a dry spring and a slow start," Bertelsen said. "But when the monsoon rains finally came, the plants sprouted like gangbusters."

Temperature (through 7/20/11)

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 are averaging between 60 and 70 degrees Fahrenheit in the southwest deserts and along the Arizona-California border, mostly 55 to 65 degrees F in southeastern Arizona and along the New Mexico-Mexico border, generally 45 to 55 degrees F in central and northeastern New Mexico, and 40 to 55 degrees F across the Colorado Plateau and the northwestern quarter of New Mexico (*Figure 1a*). The highest elevations have seen temperature averages between 35 and 45 degrees F. Temperatures are within 1 degree F of average across western Arizona and western New Mexico (*Figure 1b*). The eastern two-thirds of New Mexico has been 1–4 degrees F warmer than average, while the eastern and southern borders and central Arizona have been 1–2 degrees F warmer than average. Gila County has seen the highest temperatures in Arizona, and Otero, Roosevelt, and Union counties have been the warmest parts of New Mexico.

Temperatures during the past 30 days have been 0–4 degrees F warmer than average across most of Arizona and northwestern New Mexico, and 2–8 degrees F warmer than average across the rest of New Mexico (*Figures 1c-d*). The warmest areas in New Mexico have been in the northeastern corner and Roosevelt and Santa Fe counties, where temperatures have been 6–8 degrees F above average

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

Figure 1a. Water year '10–'11 (October 1 through July 20) average temperature.

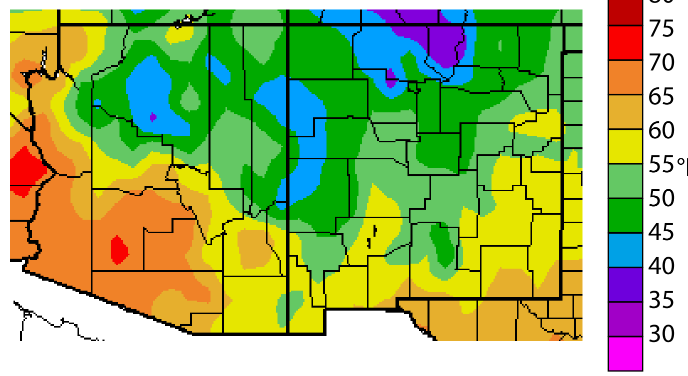


Figure 1b. Water year '10–'11 (October 1 through July 20) departure from average temperature.

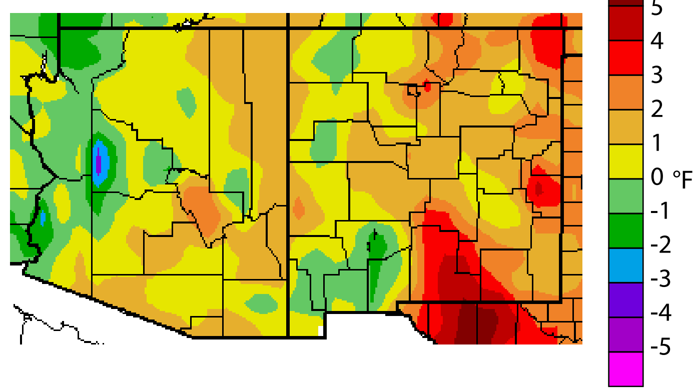


Figure 1c. Previous 30 days (June 21–July 20) departure from average temperature (interpolated).

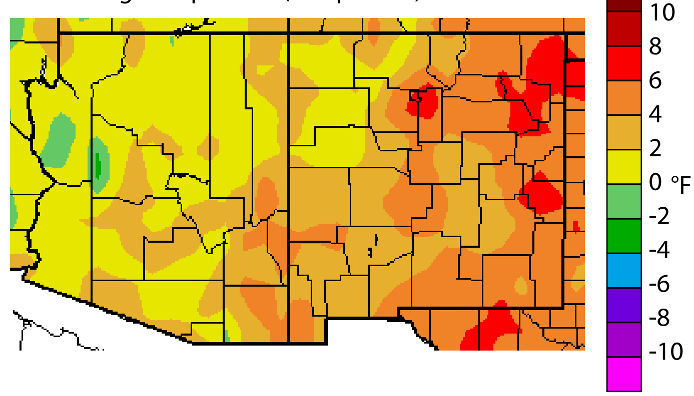
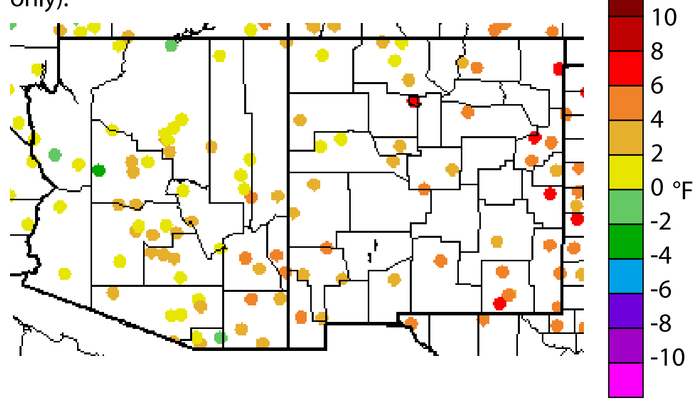


Figure 1d. Previous 30 days (June 21–July 20) departure from average temperature (data collection locations only).



Precipitation (through 7/20/11)

Data Source: High Plains Regional Climate Center

Precipitation since the water year began on October 1 has shown a decreasing pattern from northwest to southeast that falls from more than 150 percent of average to less than 5 percent of average (*Figures 2a-b*). In Arizona, much of the Colorado Plateau and central counties have received 50–100 percent of average precipitation, while most of the southeast counties have received between 25 and 50 percent of average. In New Mexico, most of the northwestern counties have seen 70–100 percent of average, while much of the northeastern and central counties have received 25–70 percent of average. The southern half of New Mexico has been the driest, receiving only 5–25 percent of average.

In the last 30 days, the monsoon has not made up for the dry conditions brought on by the winter La Niña event. Monsoon moisture has brought only minor relief to southern and northern Arizona and no relief for most of New Mexico. Only southwestern, northeastern, and central Arizona and Otero County in southern New Mexico have received more 100 percent of average rainfall (*Figures 2c-d*). The monsoon has been relatively dry so far, and most of the activity has been in Arizona, especially at the higher elevations.

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

Figure 2a. Water year '10–'11 (October 1 through July 20) percent of average precipitation (interpolated).

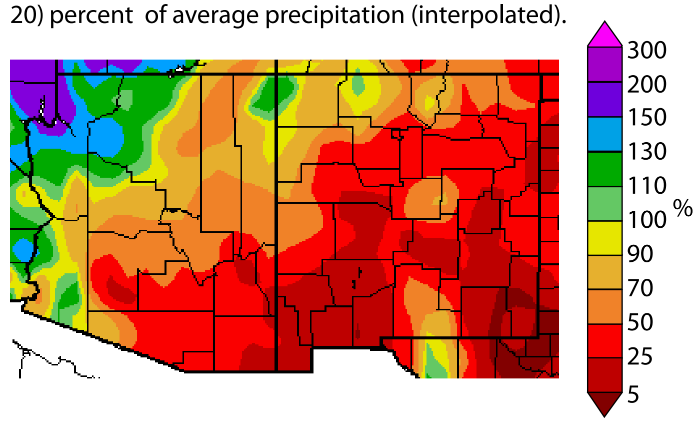


Figure 2b. Water year '10–'11 (October 1 through July 20) percent of average precipitation (data collection locations only).

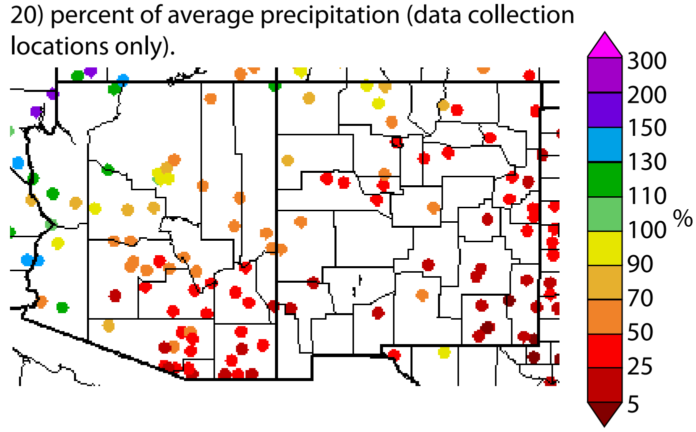


Figure 2c. Previous 30 days (June 21–July 20) percent of average precipitation (interpolated).

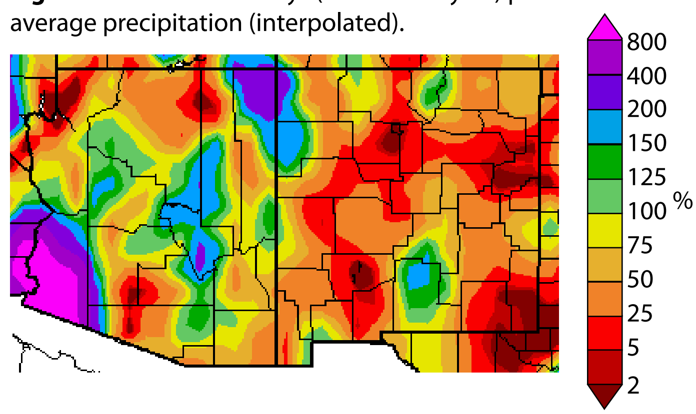
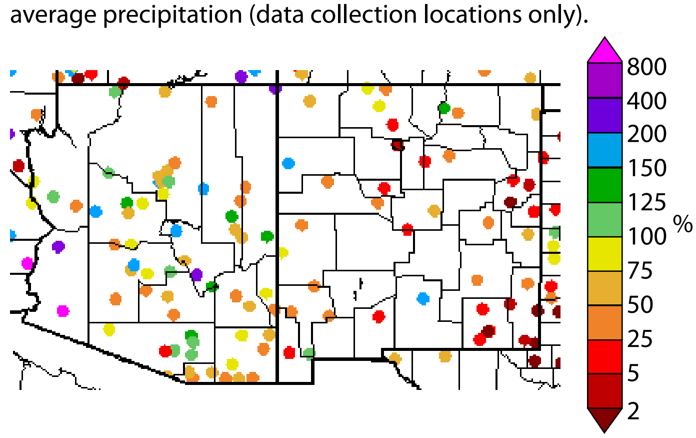


Figure 2d. Previous 30 days (June 21–July 20 percent of average precipitation (data collection locations only).



U.S. Drought Monitor (data through 7/19/11)

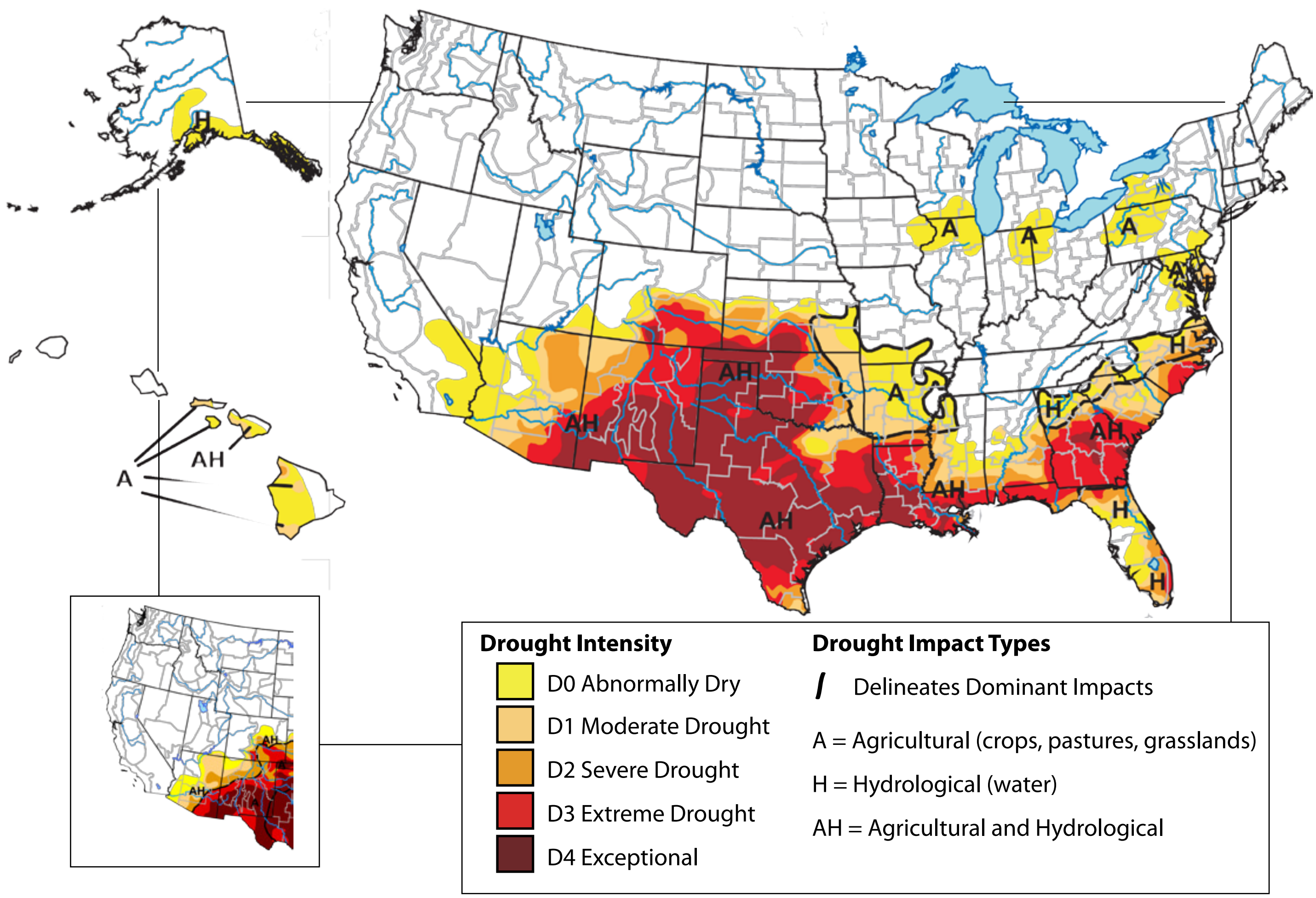
Data Sources: U.S. Department of Agriculture, National Drought Mitigation Center, National Oceanic and Atmospheric Administration

Much 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 have continued to intensify. 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. Across the West, drought expanded slightly, from 21 percent in mid-June to 25 percent in mid-July, according to the July 19 update of the U.S. Drought Monitor (*Figure 3*). Most of the expansion occurred in western Arizona and Southern California, where monsoon precipitation has been limited. Drought conditions intensified over large portions of New Mexico, eastern Arizona, and southern Colorado. Extreme and exceptional drought conditions expanded across these areas due to ongoing and increasing precipitation deficits.

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 July 19, 2011 (full size), and June 14, 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 7/19/11)

Data Source: U.S. Drought Monitor

Monsoon precipitation has been spotty across much of the Southwest during the past 30 days and has not helped alleviate drought conditions. Rather, dry conditions expanded and intensified across parts of Arizona, including the expansion of abnormally dry conditions along the Colorado River Valley and severe drought conditions across the northeast quarter of the state, according to the July 19 update of the U.S. Drought Monitor. More than 60 percent of Arizona is experiencing some level of drought, an increase from about 56 percent last month (*Figures 4a–b*). Drought impacts from southeast Arizona reported through Arizona DroughtWatch indicate the severity of the situation: very poor range conditions and lack of livestock water and forage.

Read more impacts at: http://azdroughtwatch.org.

Figure 4a. Arizona drought map based on data through July 19, 2011.

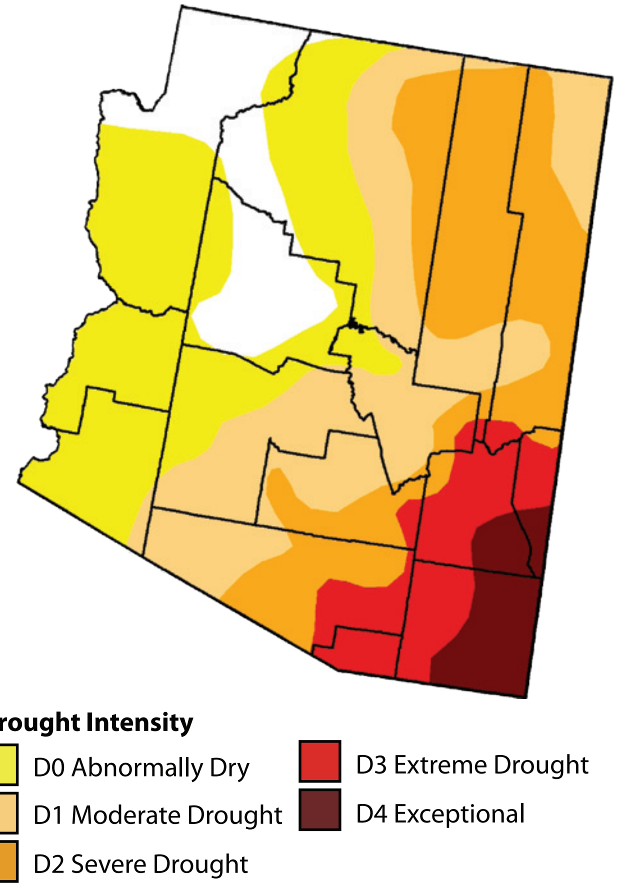


Figure 4b. Percent of Arizona designated with drought conditions based on data through July 19, 2011.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	11.15	88.85	60.35	37.15	14.28	4.83
Last Week (07/12/2011 map)	12.78	87.22	60.35	38.20	15.02	4.83
3 Months Ago (04/19/2011 map)	25.62	74.38	49.30	22.16	11.73	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 (07/13/2010 map)	41.94	58.06	16.04	4.21	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 7/19/11)

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

Drought conditions worsened across New Mexico during the past 30 days. According to the July 19 update of the U.S. Drought Monitor, all of the state is experiencing at least moderate drought conditions and almost half of the state is categorized at the worst level, exceptional drought (*Figures 5a–b*). Exceptional drought is defined as a drought that occurs, on average, once in every 50 years. Current drought conditions across New Mexico are almost unprecedented in the 100-year historical record, with much of the state observing record low precipitation during the past six months. The dry conditions primarily reflect the effect of this past winter's moderate to strong La Niña event, which helped direct storms north of the state; La Niña events generally bring drier-than-average conditions to the Southwest. However, monsoon rains also have been lackluster and slow to materialize. Since the beginning of July, most of New Mexico has experienced less than 75 percent of average rain, with some areas receiving less than 25 percent. The widespread and acute drought conditions have hit many sectors, from agricultural producers to water supply to wildlife. In recent weeks animals, including bears, have encroached into urban areas to find food (*The Houston Chronicle*, July 17).

Figure 5a. New Mexico drought map based on data through July 19, 2011.

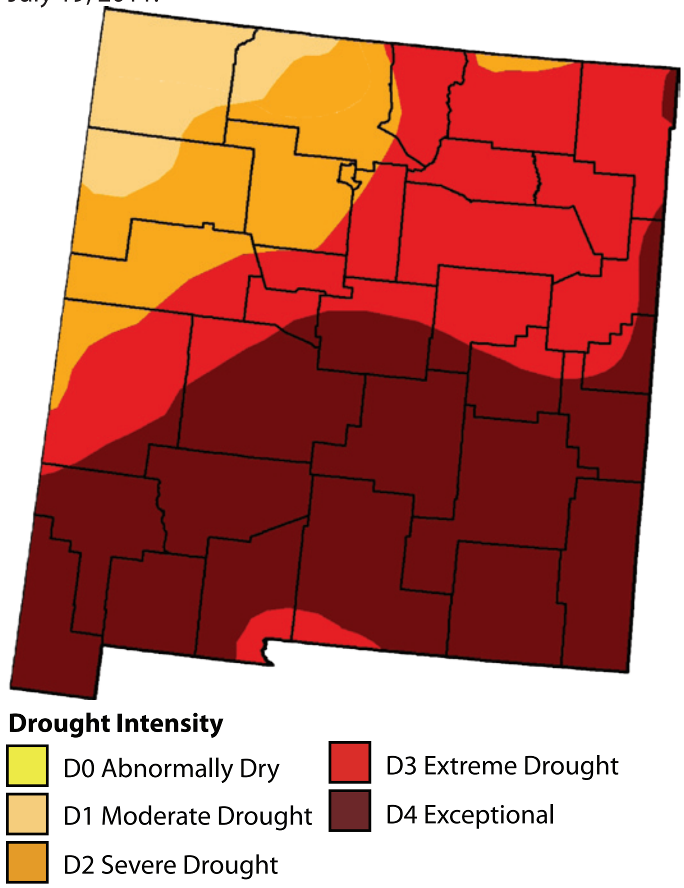


Figure 5b. Percent of New Mexico designated with drought conditions based on data through July 19, 2011.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	93.24	79.00	48.10
Last Week (07/12/2011 map)	0.00	100.00	100.00	93.96	79.01	48.21
3 Months Ago (04/19/2011 map)	0.00	100.00	94.42	74.67	32.65	0.00
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 (07/13/2010 map)	50.19	49.81	17.27	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 6/30/11)

Data Source: National Water and Climate Center

Combined storage in Lakes Mead and Powell increased by about 4.8 million acre-feet in June. As of July 1, total storage in both lakes was at 57 percent of capacity, which is 4.7 percent more than a year ago (*Figure 6*). The elevation of Lake Powell is projected to peak near 3,660 feet above sea level by the end of July. The last time Lake Powell's water elevation was at its current level was in October 2001. Storage in the other reservoirs within Arizona's borders prevented weredecreased by more than 150,000 acre-feet in June. San Carlos Reservoir, located in drought-stricken southeastern Arizona, is at a mere 3 percent of capacity.

In water-related news, per capita rates of water deliveries to customers in Phoenix declined by 30 percent between 1990 and 2008, indicating significant gains in efficient water use (July 13, climatecentral.org). Also, a starter tunnel that ultimately will allow water to be drawn from deeper in Lake Mead is near completion (*Las Vegas Review-Journal*, July 9). A deeper intake will facilitate continued delivery of water to the Southern Nevada Water Authority, even if one of the two existing intake tunnels is shut down.

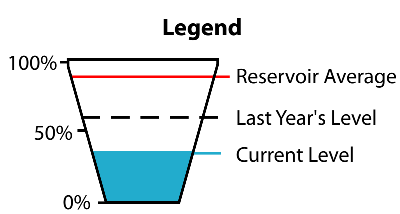
Notes:

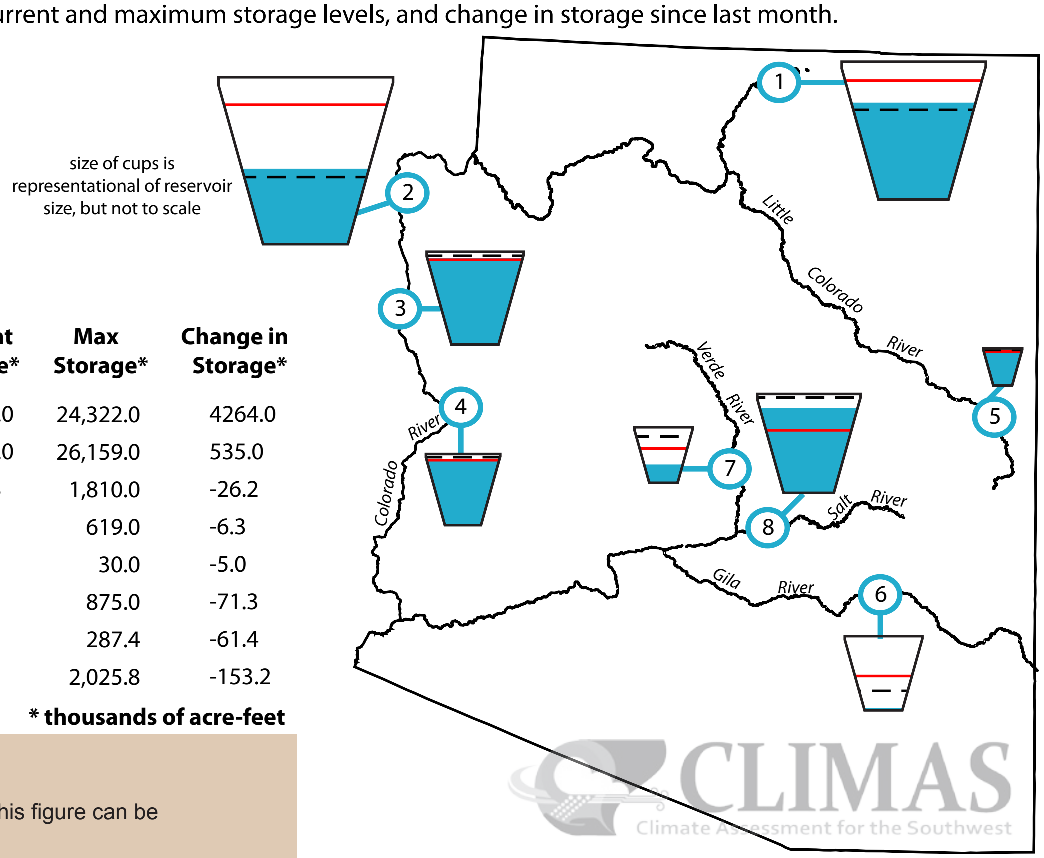
The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 June 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	70%	17,085.0	24,322.0	4264.0
2. Lake Mead	45%	11,705.0	26,159.0	535.0
3. Lake Mohave	93%	1,678.8	1,810.0	-26.2
4. Lake Havasu	93%	574.9	619.0	-6.3
5. Lyman Reservoir	42%	12.7	30.0	-5.0
6. San Carlos	3%	23.7	875.0	-71.3
7. Verde River System	33%	94	287.4	-61.4
8. Salt River System	86%	1,743.2	2,025.8	-153.2

*** 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 6/30/11)

Data Source: National Water and Climate Center

The total reservoir storage in New Mexico declined by only 3,400 acre-feet in June (*Figure 7*). While there were substantial increases in storage in reservoirs in northwestern New Mexico, including Navajo, Heron, and El Vado, decreases occurred in most other reservoirs in the state. In June, storage in Elephant Butte Reservoir decreased by more than 183,000 acre-feet, a reduction of about 10 percent of its capacity. This brings the state's largest reservoir to its lowest level since July 2006. Elsewhere, storage in reservoirs in the Pecos River Basin decreased by 31,400 acre-feet in June. Compared to one year ago, storage is lower in all of the 15 reservoirs monitored here.

In water-related news, irrigators in the Elephant Butte irrigation district are experiencing the shortest irrigation season on record (Associated Press, July 13). Farmers in the Hatch, Rincon, and Mesilla valleys have been allocated a scant 4 inches of water per acre this year. In the Carlsbad irrigation district, irrigators have been depending on groundwater pumping since March to augment anemic Pecos River flows. Also, Portales imposed mandatory water restrictions in July (KOB Eyewitness News 4, July 5). The restrictions are expected to remain in place throughout the summer and will limit outdoor water use.

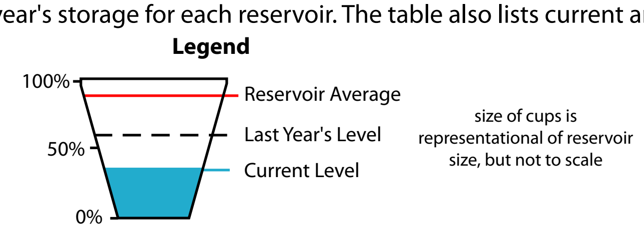
Notes:

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.

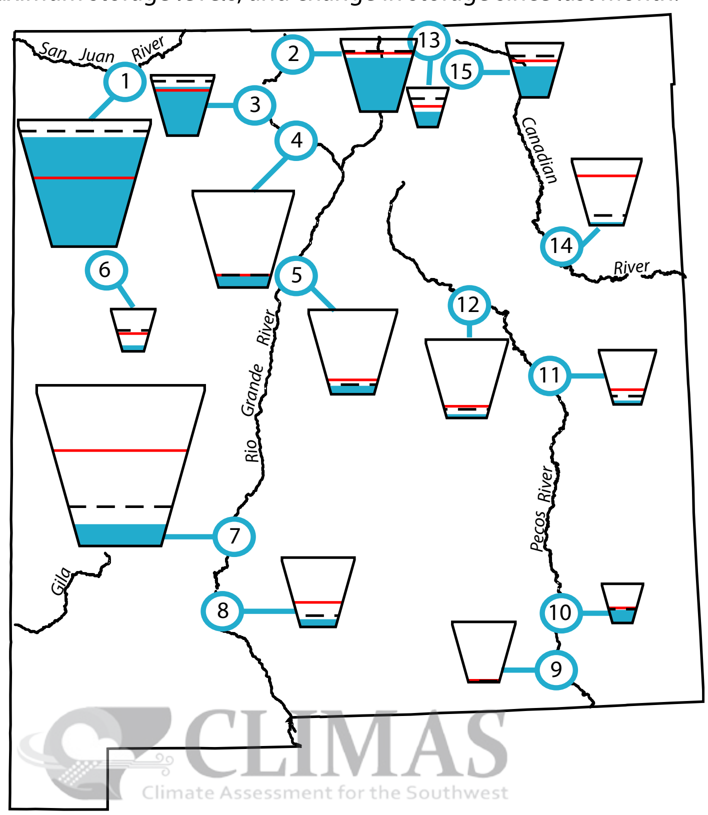
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Wayne Sleep, wayne.sleep@nm.usda.gov.

Figure 7. New Mexico reservoir levels for June 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	86%	1,462.2	1,696.0	136.1
2. Heron	74%	296.2	400.0	71.9
3. El Vado	81%	154.7	190.3	46.5
4. Abiquiu	13%	151.0	1,192.8	-23.5
5. Cochiti	10%	49.9	491.0	-2.9
6. Bluewater	14%	5.4	38.5	-1.3
7. Elephant Butte	13%	283.1	2,195.0	-183.3
8. Caballo	11%	37.5	332.0	-3.4
9. Brantley	1%	9.5	1,008.2	-19.8
10. Lake Avalon	33%	1.3	4.0	-0.3
11. Sumner	7%	7.1	102.0	-9.8
12. Santa Rosa	5%	20.4	438.3	-2.1
13. Costilla	39%	6.2	16.0	-2.7
14. Conchas	5%	12.6	254.2	-9.0
15. Eagle Nest	57%	45.1	79.0	-7.2

*** 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 6/15/11)

Source: Southwest Coordination Center

Fire conditions have been ripe this year. Low soil and vegetation moisture due to extended periods of scant precipitation, above-average temperatures, and high winds helped make this year the worst fire season since 1990, when record-keeping began. More than 1.85 million acres burned this year through July 20, according to Predictive Services at the Southwest Coordination Center (*Figure 8a*). The previous record was in 2002, when 1.05 million acres were charred. Most of the fires in Arizona have occurred in the southeast and the White Mountains, while in New Mexico many of the fires have burned in the eastern part of the state (*Figures 8b–c*).

The onset of the monsoon in many parts of Arizona during the July 4 weekend helped extinguish many of the large wildfires burning across the Southwest, including the Wallow Fire, the largest recorded fire in the history of Arizona. More than 538,000 acres burned in that blaze, which began on May 29 in the White Mountains, eventually spreading across four counties in Arizona and spilling into New Mexico. Only a few small fires have ignited in Arizona since the monsoon began. The Bolt Fire in the Coconino National Forest is currently the largest active fire in Arizona. It has blackened 590 acres since flames first erupted on July 21.

New Mexico on the other hand, has not received much monsoon moisture and continues to experience large wildfires. The Las Conchas Fire is the largest active fire in the Southwest. It began on June 26, 12 miles southwest of Los Alamos and has burned about 157,000 acres.

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of July 20, 2011.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	879	923,786	276	12,373	1,155	936,159
NM	883	717,870	354	186,031	1,237	894,019
Total	1,762	1,641,656	630	198,404	2,392	1,830,178

Figure 8b. Arizona large fire incidents as of July 20, 2011.

Figure 8c. New Mexico large fire incidents as of July 20, 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 7/20/2011)

Data Source: Western Regional Climate Center

A gulf surge from Tropical Storm Arlene kicked off monsoon rainfall in many parts of Arizona during the July 4 weekend which was right around the average onset date for the southern part of the state. Copious rains soaked the parched southwestern landscape along the Colorado River Valley, up into Nevada and Colorado, and as far east as Tucson. However, storms did not form over New Mexico, hindering improvement in drought conditions in the state. After the July 4 weekend, dew points fell below 50 degrees Fahrenheit in southern Arizona for nearly one week and dry conditions returned to the Southwest—dew points above 50 degrees F usually favor the formation of thunderstorms. Between July 14 and 21, convective storms returned to Arizona and finally made their way into New Mexico.

In the past 30 days, since June 21, rains have totaled less than 3 inches in most of the Southwest, with many areas experiencing less than 1 inch (*Figure 9a*). These totals are below average for many areas, particularly New Mexico (*Figures 9b–c*). Southern New Mexico, which is experiencing exceptional drought—a drought that occurs about once in every 50 years—has been the driest. Monsoon moisture essentially has skipped this area in part because the eastern half of the monsoon region in Mexico has been drier than average, limiting the moisture available to flow into New Mexico. In addition, the position of the high-pressure monsoon ridge aloft has been slightly to the east, preventing water vapor from the south from moving into the state. Some areas have fared better than others in New Mexico since the beginning of July. Western counties along the Arizona-New Mexico border have seen the most consistent convective activity, and the southern mountain regions have also fared reasonably well. However, elsewhere the hit-or-miss character of the summer precipitation has resulted in fewer-than-normal opportunities for needed rainfall. Precipitation forecasts for August, issued by the NOAA-Climate Prediction Center (CPC), call for an equal chance of above-, below-, or near-average rainfall.

Figure 9a. Total precipitation in inches (June 21–July 20, 2011).

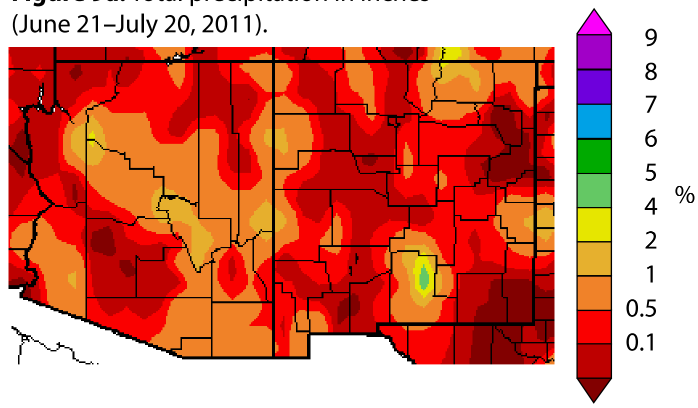


Figure 9b. Departure from average precipitation in inches (June 21–July 20, 2011).

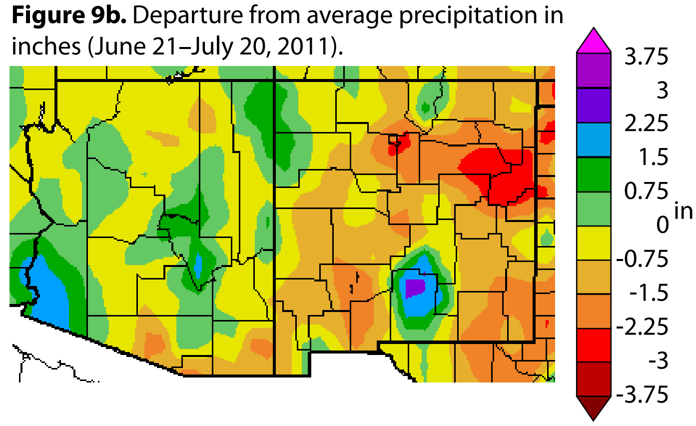
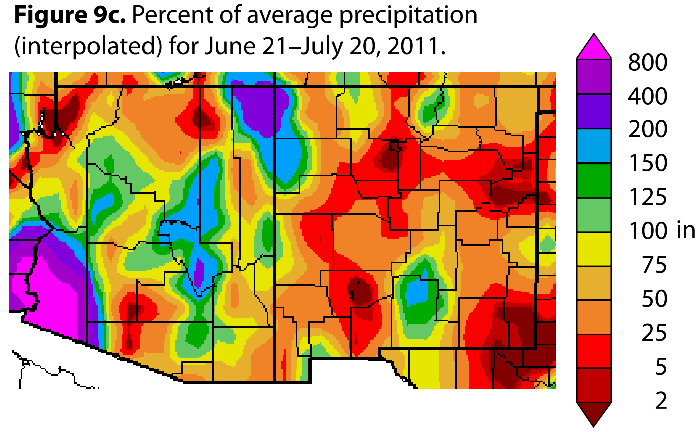


Figure 9c. Percent of average precipitation (interpolated) for June 21–July 20, 2011.



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
(August 2011–January 2012)

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA–Climate Prediction Center (CPC) in July call for increased chances for temperatures to be similar to those of the warmest 10 years of the 1981–2010 period through the spring and summer. For the August–October and September–November periods, 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 parts of New Mexico (*Figures 10a–b*). These forecasts are based in part on decadal trends and low soil moisture present in June as a result of the dry winter and spring. The forecast issued for October–December calls for temperatures in most of Arizona and southwestern New Mexico to have a greater than a 40 percent probability of being similar to those of the warmest 10 years in the climatological record (*Figure 10c*). For November–January, temperatures have an equal chance of being above-, below-, or near-average (*Figure 10d*). This equal chance forecast is influenced by the uncertainty of a returning La Niña event or the development of an El Niño event.

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 August–October 2011.

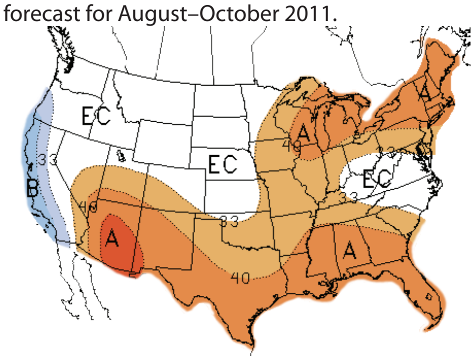


Figure 10b. Long-lead national temperature forecast for September–November 2011.

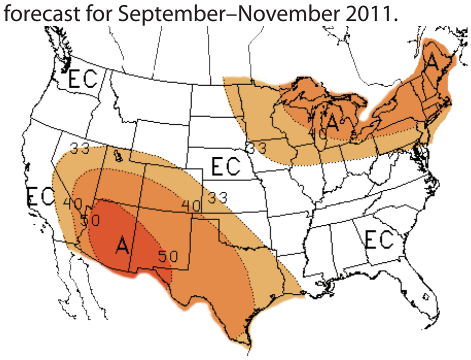


Figure 10c. Long-lead national temperature forecast for October-December 2011.

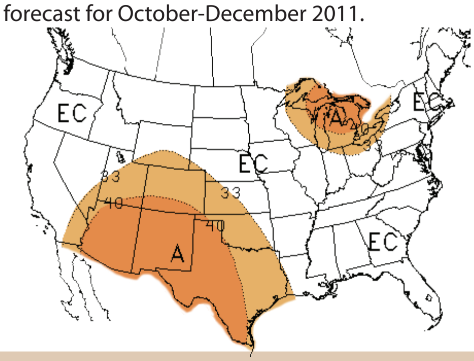
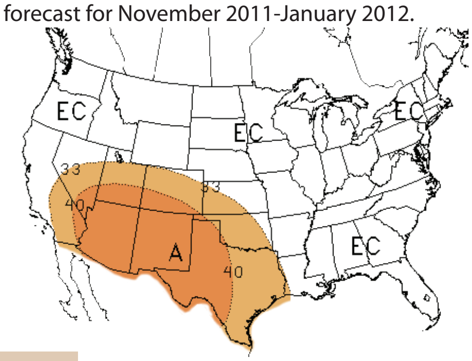


Figure 10d. Long-lead national temperature forecast for November 2011-January 2012.



A = Above: 50.0–59.9% | 40.0–49.9% | 33.3–39.9%

B = Below: 50.0–59.9% | 40.0–49.9% | 33.3–39.9%

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

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
(August 2011–January 2012)
Data Source: NOAA-Climate Prediction Center (CPC)

Analysis tools are providing conflicting signals for monsoon precipitation, according to the NOAA-Climate Prediction Center (CPC). Several forecast model ensembles suggest the possibility of a weak monsoon for the Southwest and southern Rocky Mountains. On the other hand, a springtime precipitation pattern similar to what was observed earlier this year—dry conditions in the southern Rockies and wet conditions in the northern Rockies and Pacific Northwest—has been associated with an active monsoon season. However, the historical accuracy of these models has not fared well. As a result, CPC forecasts an equal likelihood of near-average, above-average, and below-average precipitation in Arizona and New Mexico during the August–October period (*Figure 11a*). For the September–November, October–December, and November–January lead times, the forecasts also call for equal chances of above-, below-, or near-average conditions in most of Arizona, with slightly increased chances for below-average precipitation for the southern portion of New Mexico (*Figures 11b–d*).

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 August-October 2011.

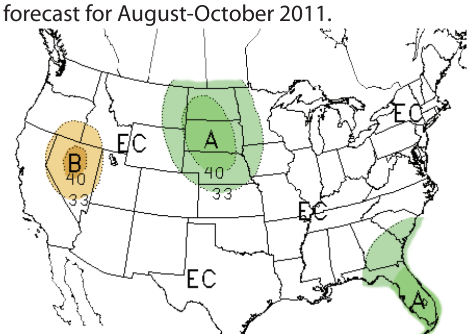


Figure 11b. Long-lead national precipitation forecast for September-November 2011.

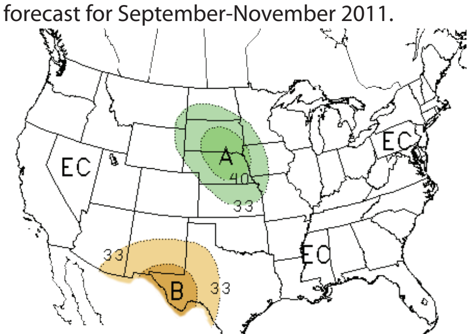


Figure 11c. Long-lead national precipitation forecast for October-December 2011.

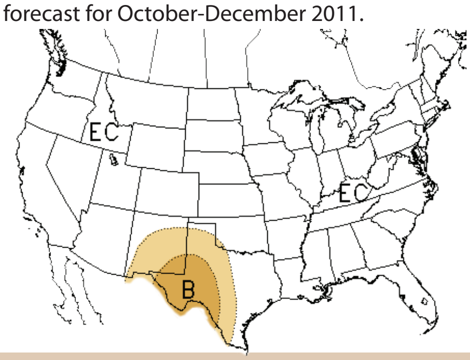
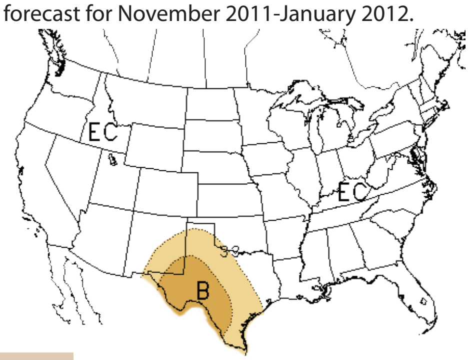


Figure 11d. Long-lead national precipitation forecast for November 2011-January 2012.



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 October)

Data Source: NOAA–Climate Prediction Center (CPC)

This summary is partially excerpted and edited from the July 19 Seasonal Drought Outlook technical discussion produced by the NOAA–Climate Prediction Center (CPC) and written by forecaster A. Allgood.

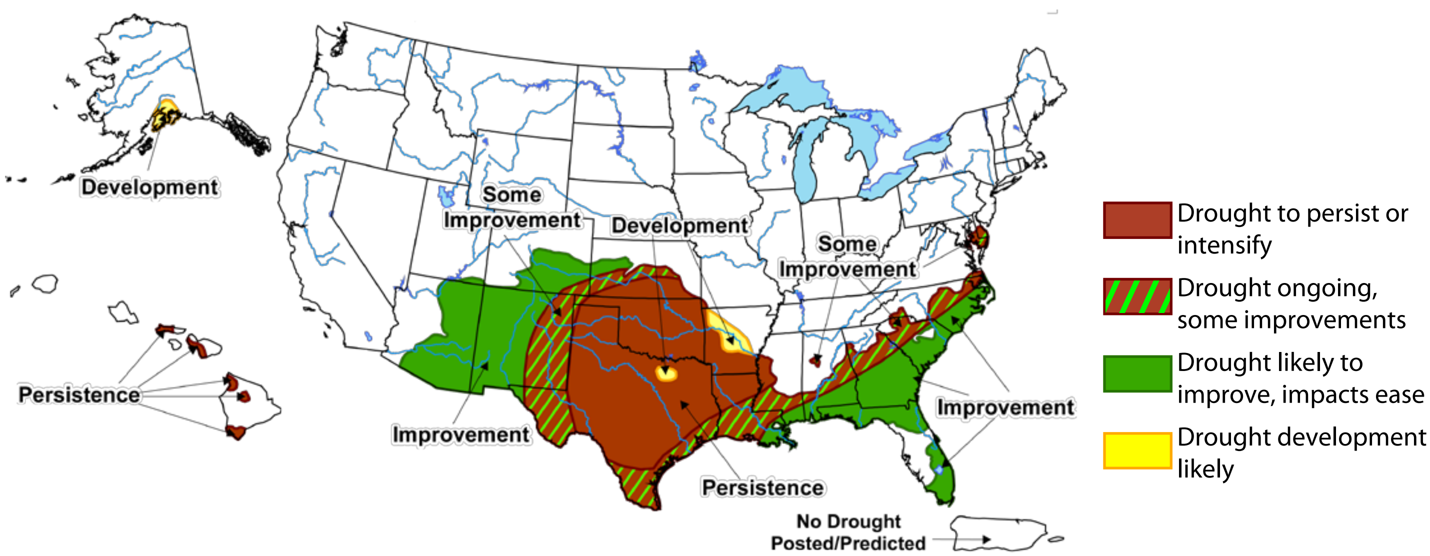
Monsoon rainfall began around the July 4 weekend primarily in Arizona, Utah, and Colorado when a surge of moist air driven into the region from the outflow of Tropical Storm Arlene doused many areas. In New Mexico, however, where drought conditions are present across nearly the entire state, thunderstorm activity has been sparse. For the next 8-14 days, the NOAA-Climate Prediction Center (CPC) indicates a greater chance for increased monsoon rainfall across the New Mexico and Arizona border, but suppressed thunderstorm activity is more likely to continue across eastern New Mexico. For the three-month, August–October season precipitation outlook, the CPC calls for equal chances of above-, below-, and near-average rainfall. Based on these forecasts, drought improvement is forecast for Arizona, western New Mexico, and southern Colorado (*Figure 12*).

However, due to the late start to the monsoon in western New Mexico and suppressed monsoon activity between July 21 and August 4, drought forecasts are less certain in this region. The confidence for this forecast is moderate.

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 October (released July 21).



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

(August–October 2011)

Sources: National Interagency Coordination Center, Southwest Coordination Center

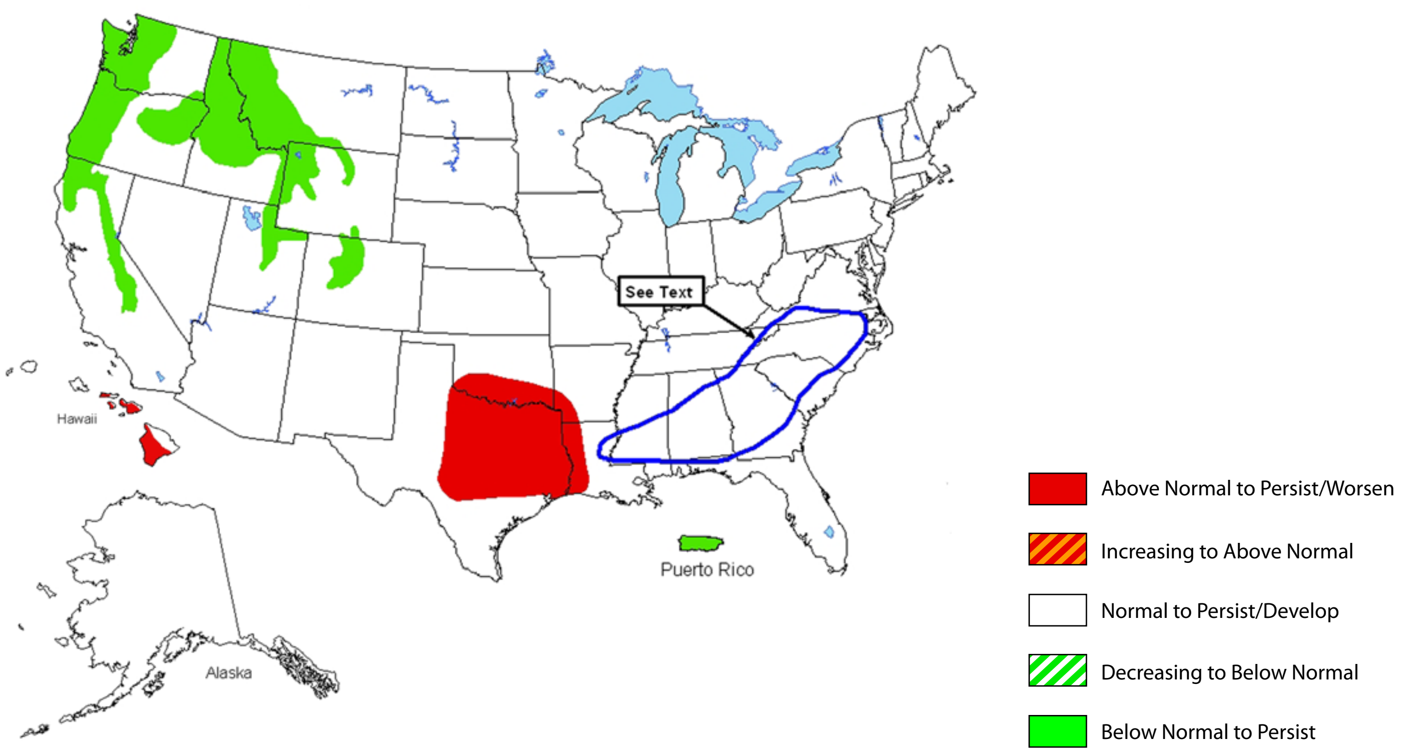
Significant fire potential across the Southwest decreased from above normal to normal in July, according to the Predictive Services at the Southwest Coordination Center. The expectation is that significant fire potential will stay at normal levels for the August–October period (*Figure 13*). Significant 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 August–October. CPC forecast models for precipitation across the Southwest, however, show both above-average and below-average rains. As a result, the forecast is for equal chances for above-, below-average, or near-average levels. Wildfire activity typically peaks in June before the onset of the monsoon. However, if dry conditions persist in New Mexico, widespread fire activity likely will continue.

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. The forecasts (Figure 12) 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 August–October 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)

Near-average sea surface temperatures (SSTs) reigned across the equatorial Pacific Ocean again this past month, reflecting ENSO-neutral conditions. Values of the Southern Oscillation Index (SOI), which tracks the atmospheric response to ENSO events, also dropped close to zero last month after peaking at record high values in April and May (*Figure 14a*). This also reflects a return to neutral conditions. There are some weak and lingering remnants of the La Niña event in the atmosphere, but they are having little impact on overall atmospheric circulation patterns, according to the NOAA-Climate Prediction Center (CPC).

Forecasts issued by the International Research Institute for Climate and Society (IRI) indicate a strong chance—greater than 80 percent—that neutral conditions will persist through the summer. This decreases in the fall to about 60 percent, while the chance that El Niño or La Niña will develop is 14 and 26 percent, respectively (*Figure 14b*). However, the combination of a weak but lingering La Niña pattern in the atmosphere and the emergence of slightly cooler-than-average water temperatures below the surface in the eastern Pacific suggest a possible return of La Niña conditions in the upcoming fall or winter. Most forecast models still paint the return of La Niña as an unlikely outcome, but the area of cool subsurface water will be monitored closely over the next several months. The return of La Niña conditions could be bad news for an already parched Southwest battered by a record dry winter and spring. La Niña events have a strong tendency to drive the winter storm track north and away from Arizona and New Mexico, as was the case this past winter.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through May 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–May 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).

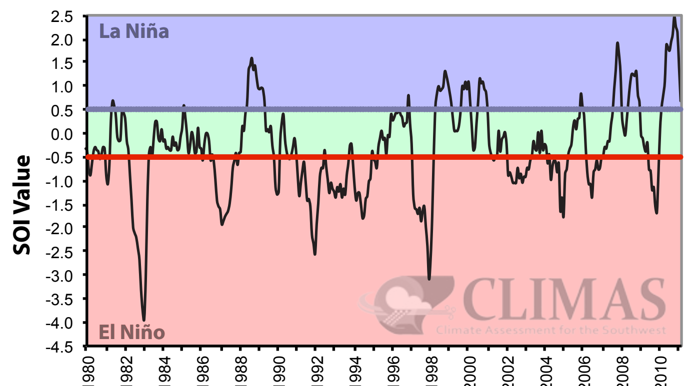


Figure 14b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released July 21). Colored lines represent average historical probability of El Niño, La Niña, and neutral.