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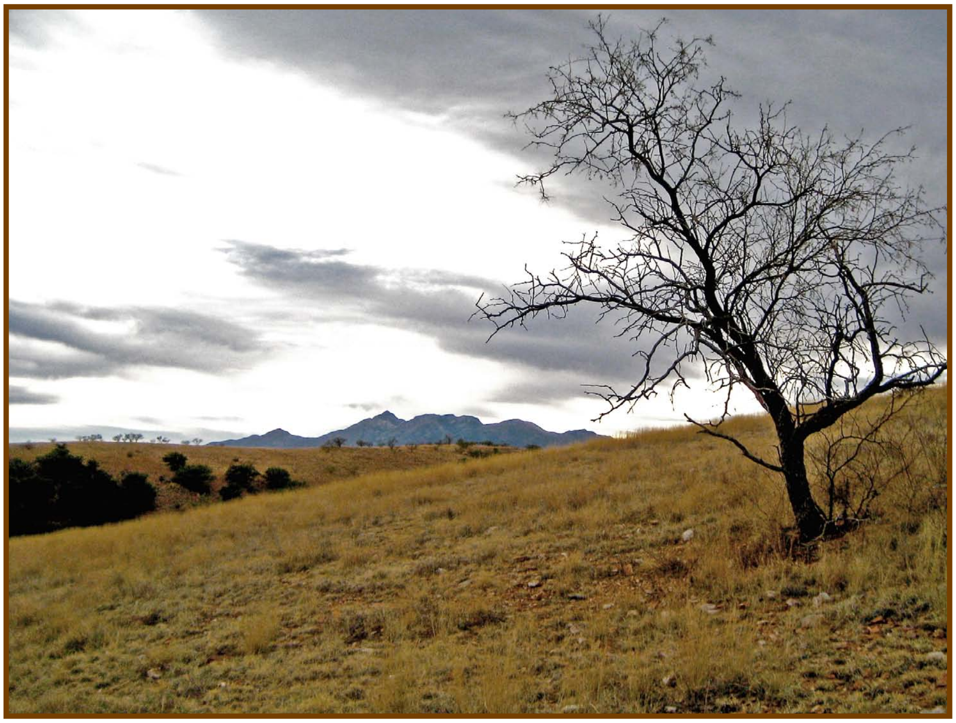

Source: Benjamin Blonder

In the Las Cienegas National Conservation Area southeast of Tucson, the parched winter has primed grasses and trees for fire. Dry conditions have become a mainstay in many parts of Arizona and New Mexico since November, causing fire activity to be above average, particularly in southern regions of the Southwest. Photo was taken on December 5, 2010.

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...

May Climate Summary

Drought– Drought conditions have continued to intensify across Arizona and New Mexico during the past 30 days, with exceptional drought expanding across much of southern New Mexico. Extreme and exceptional drought now occupies about 16 and 65 percent of Arizona and New Mexico, respectively.

Temperature– Temperatures are within 2 degrees F of average, with the northern counties of Arizona and New Mexico generally cooler than average and the southern counties generally warmer than average.

Precipitation– The southern halves of Arizona and New Mexico have received less than 2 percent of average precipitation during the last 30 days.

ENSO– Sea-surface temperatures continued to warm this past month across the eastern Pacific and the La Niña event has officially ended. Neutral conditions are expected to persist through the upcoming summer season.

Climate Forecasts– Temperature outlooks call for greater than a 50 percent chance of warmer-than-average conditions in the Southwest through the summer; monsoon precipitation forecasts call for an equal likelihood of near-, above-, and below-average precipitation.

The Bottom Line–A record-setting dry winter in parts of the Southwest has led to widespread and intense drought conditions that are fueling increased fire activity. The next few months are typically dry and forecasts call for warmer-than-average conditions, making parts of the region still vulnerable to wildland fires. To date, nearly 1,000 fires have burned 425,000 acres in Arizona and New Mexico this year. The risk of fire and the effect of other drought impacts likely will continue to mount until the monsoon season begins. While the official monsoon outlook forecasts equal chances for above-, below-, and near-average precipitation, there is reason for optimism. Generally, dry winters are followed by wet summers, although this pattern has not always held true.

Southwestern Trees Hold the History—and Future?—of El Niño

The impact of tropical Pacific Ocean temperatures on the hydrology and climate of the Southwest is profound. On timescales of two to eight years, El Niño and La Niña events, which feed off those ocean temperatures, influence the amount of winter precipitation the region receives. Trees living across the Southwest record these changes in moisture in the width of their rings, providing a history of precipitation going back thousands of years.

Scientists contributing to the Southwest Climate Change Network reviewed a study in the journal *Nature Climate Change* that used tree rings to reconstruct the strength of past El Niño and La Niña events. The study indicated that during past time periods when the tropical Pacific Ocean was warmer, the strengths of La Niña and El Niño events were stronger. This implies that global warming could intensify the impacts associated with these events in the future, bringing more severe dry winters during la Niña events and more precipitation during El Niños.

Read more about this study and other climate-related news and information at: http://www.southwestclimatechange.org

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SWCO Staff:

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.

Dry Winter Escalates Need for Wet Monsoon

By Zack Guido

Wilting crops. Dry irrigation channels. Rampant fires. These are the results of a drought that is only seen about once in every 50 years, but one that has gained a purchase in New Mexico since the beginning of the winter.

The landscape is so dry that a blown tire on a highway in the southeastern part of the state ignited a fire that ravaged rangelands. Southern Arizona is only slightly less parched, and impacts in both states likely will continue to mount as the historically hot and dry spring provides little relief. The onus is now squarely on the monsoon season to reverse drought expansion and intensification—but it is going to take a wet summer to substantially improve short-term drought conditions, experts say.

Dry Conditions Across the Southwest

Nearly all of Arizona and New Mexico are classified as at least abnormally dry. Abnormally dry conditions are considered precursors to drought and happen about once in every three years. As dry conditions persist, a resource called the U.S. Drought Monitor relies on climate and landscape indicators like precipitation and streamflow and expert assessments to determine which areas fall within one of four progressively severe drought categories: moderate, severe, extreme, and exceptional drought *(Figure 1)*. Impacts associated with these conditions range from lower crop yields for dry land crops to widespread water shortages in reservoirs, streams, and wells.

The Drought Monitor informs regional decision makers of current conditions and is part of an interactive system that highlights impacts and provides early warning about emerging and anticipated droughts. The Drought Monitor is not just descriptive; it enables ranchers to qualify for a one-time lump payment from the federal government to ease the economic burdens of drought through programs like the Livestock Forage Program.

"The Livestock Forage Program provides a short-term sum of $20 to $60 per head of cattle, depending on the drought severity," said Salomon Ramirez, state executive director for the Farm Service Agency in New Mexico. Currently, ranchers from across the region are taking advantage of this program.

An average monsoon season in 2010 that followed on the heels of a wet winter had wiped short-term drought categories off the U.S. Drought Monitor maps. However, by May 17, about 16 and 33 percent of Arizona and New Mexico, respectively, was classified with extreme drought, while about 32 percent of New Mexico was pegged with exceptional drought *(Figure 2)*. The dry winter began to take its toll in the spring.

"Alot of ranchers and farmers are saying this is the worst year in a long time,"

Category	Definition
Abnormally Dry (D0)	Abnormally dry conditions signal the possible onset of drought. Crops that are not irrigated may grow slowly under these conditions, and there is above-average risk for wildland fires. Abnormally dry conditions occur about every three years.
Moderate (D1)	Moderate drought conditions are characterized by some damage to crops and pastures, high risk of wildland fires, and generally low levels in streams and reservoirs that may cause water shortages and voluntary water restrictions. They occur about every five years.
Severe (D2)	Severe drought conditions cause some losses to crops and damage to pastures. Fire risk is very high and water shortages occur and restrictions are imposed. They occur about every 10 years.
Extreme (D3)	Extreme drought conditions cause significant losses in crops and damage to pastures, extreme risk of fire danger, and widespread water shortages and restrictions. They occur about every 20 years.
Exceptional (D4)	Exceptional drought conditions cause widespread losses to crops and pastures, exceptional risk of wildland fires, and exceptional water shortages in reservoirs, streams, and wells, producing water emergencies. They occur about every 50 years or more.

Figure 1. The U.S. Drought Monitor has four drought categories in addition to abnormally dry. Categories are defined by a combination of climate indices, including precipitation, expert assessments, and impacts, such as damage to crops and water scarcity.

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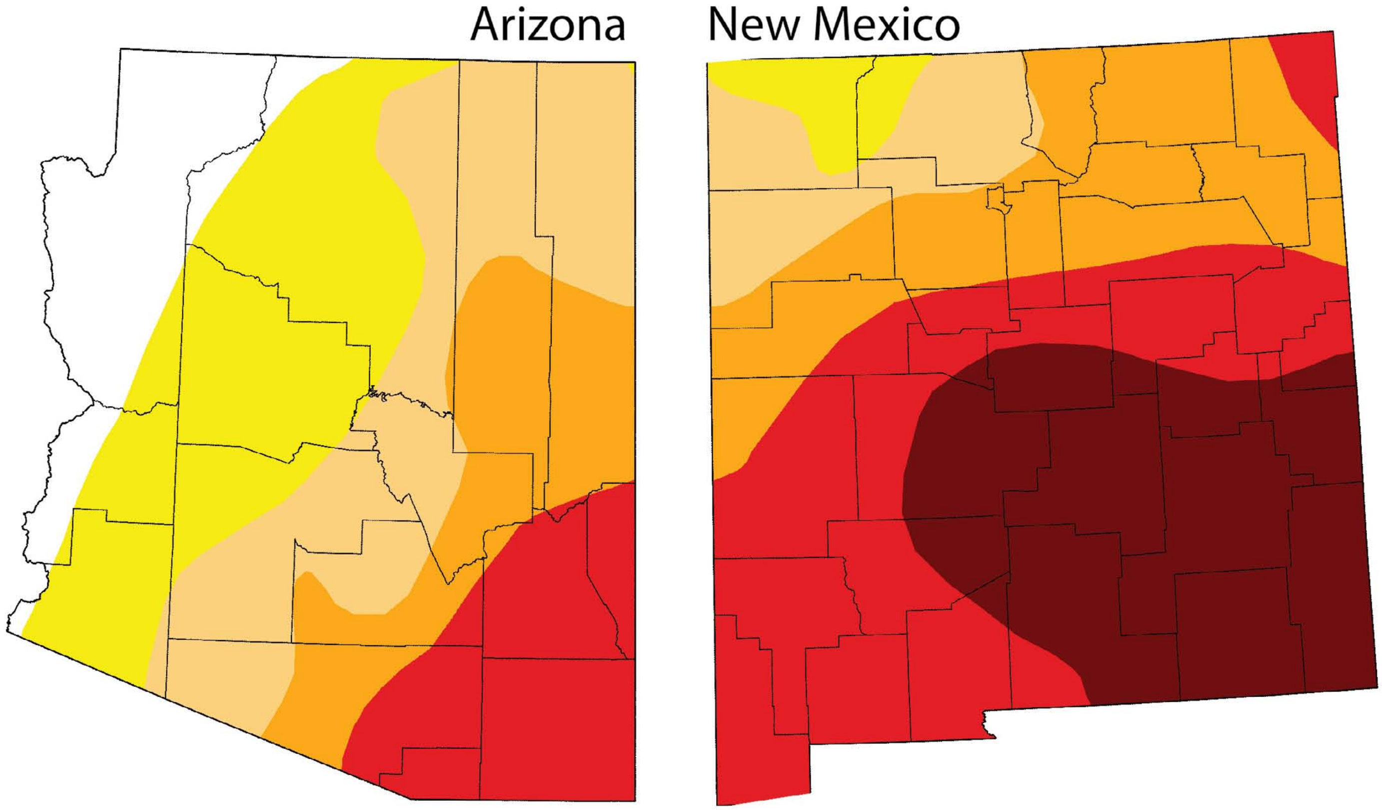
Dry Winter, continued



Drought Conditions in the Southwest on May 17 (Percent Area)

	None	D0–D4	D1–D4	D2–D4	D3–D4	D4
Arizona	13.83	86.17	58.25	31.54	15.59	0.00
New Mexico	0.00	100.00	96.66	87.36	64.59	31.67

Figure 2. Nearly all of Arizona and New Mexico fell into an abnormally dry or more severe drought category in the May 17 U.S. Drought Monitor.

Ramirez said. "I've been part of the Farm Service for 30 years and never have I heard as many drought impact reports."

These include the decision by many farmers in the Rio Grande Valley to grow cotton instead of onions or other staples in the region because the Elephant Butte Irrigation District is only doling out about three inches of water per acre. It takes three feet of water per acre to grow onions, for example.

There is also concern that dry conditions will spark a vicious cycle.

"Drought can begin to feed itself," said Mark Svoboda, climatologist for the National Drought Mitigation Center. "Without moisture in the soils, vegetation growth is low, and when temperatures ramp up there is no moisture to evaporate and cool the environment. This can cause a persistent dome of high pressure that can spread north and intensify the drought."

The Perfect Fire Storm

Drier and more widespread drought is not what firefighters are hoping for. Already, the 2011 fire season has been active, particularly in New Mexico. About 240,000 acres have burned each year in the state, on average, in the last 20 years. By May 18, fire had enveloped nearly 348,000 acres this year alone.

Arizona landscapes have not burned as frequently or extensively—fires had consumed about 57,000 acres by May 10, or about one-third of the yearly average. However, these numbers are expected to grow. The National Interagency Fire Center forecasts above-normal significant fire potential in most of southern Arizona and New Mexico through mid-July. Significant fire potential is the likelihood that a wildland fire event will require additional fire management resources from outside the area in which the fire originated.

Parched conditions favor fire, but drought is not the only important variable. Recent research by Michael Crimmins, climate extension specialist at the University of Arizona, analyzed the regional weather patterns that corresponded to days deemed as having

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Dry Winter, continued

extreme fire-weather potential. When the climate has primed the region with sustained dry conditions, the perfect fire storm occurs on days with high winds, low moisture wafting in the atmosphere, and warm temperatures.

When winter is transitioning into summer, collisions often occur between storms moving in from the west and developing high pressure in the Southwest, producing strong winds, Crimmins said. These storms often bring little moisture and occur at a time when temperatures are on the rise. If dry conditions are present, the stage is set for high fire risk.

The risk of fire changes daily as a result of weather and longer-term fluctuations in climate. Sea surface temperature patterns in the tropical and north Pacific Ocean can act together to enhance the number of days with extreme fire danger.

During La Niña events and negative phases of the Pacific Decadal Oscillation (PDO)—a sea surface temperature pattern located in the north Pacific Ocean—there are more days with extreme fire potential, Crimmins said.

These patterns also enhance drought conditions.

"Negative PDO conditions and La Niña events favor drought as well as windier conditions, so it's a double whammy for fire," he said.

These conditions may help explain why fires in New Mexico already have burned 108,000 acres more than the 20-year historical yearly average.

"We had a strong La Niña event this winter," Crimmins said. "The PDO is also hovering around in negative values, and current conditions are very similar to years in the past that had many days of extreme fire risk."

Monsoon Outlook

With a drought that occurs about once in every 50 years in southeast New Mexico and extreme drought conditions in parts of Arizona, relief likely will not come until the monsoon season begins in earnest.

The most current outlook issued by the National Oceanic and Atmospheric Administration's Climate Prediction Center (NOAA–CPC) for the July–September period is fuzzy. The CPC forecasts an equal chance that the monsoon season will be above-, below- or near-average. This forecast may change as the season approaches, but there is some reason to be optimistic that replenishing rains will come.

Looking back 100 years, dry winters in the Southwest are generally followed by wet monsoons, and vice versa. Researchers have hypothesized that low snowpacks in the winter allow the landscape to heat up sooner because the Sun's energy does not have to melt as much snow. Warmer conditions increase the temperature difference between the hot landscape and the cooler ocean waters off the coast of Baja California, which in turn causes moisture to waft into the Southwest sooner and more routinely. By this reasoning, the Southwest monsoon may come earlier than average, or before the first week in July, and deliver much needed rains.

Other research also suggests that summer thunderstorms will be plentiful, at least in July. Research published in 2001 by Christopher Castro, assistant professor of atmospheric sciences at the University of Arizona, showed that monsoon seasons during a La Niña event and negative PDO phase—the current climate context—came early and delivered above-average rainfall in the first of the monsoon season.

These are not unwavering relationships. A dry winter has been followed by a dry summer, and there is no guarantee that a wet monsoon will be wet enough to rid the region of short-term drought conditions.

"The Southwest needs a big precipitation event," Svoboda said. "An average monsoon season, like the one last year, is not going to be good enough. We don't want to see damage from tropical storms, but those are the events that will make a dent in the drought."

Temperature (through 5/18/11)

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 are averaging between 55 and 65 degrees Fahrenheit in the southwest deserts and along the Arizona-California border; 50 to 55 degrees F in southeastern Arizona and along the New Mexico-Mexico border; 40 to 50 degrees F in central and northeastern New Mexico; and 30 to 50 degrees F across the Colorado Plateau and the northwestern quarter of New Mexico *(Figure 1a)*. These temperatures are within 1 degree F of average across the Colorado Plateau and along the Arizona-California border; temperatures in central Arizona and the eastern half of New Mexico generally have been 0–2 degrees F warmer than average. Otero, Eddy, and Roosevelt counties in southeastern New Mexico have been 1–4 degrees F warmer than average, as has Gila County in central Arizona. Temperatures in southwestern New Mexico and central Navajo and Apache counties and northern Mohave County in Arizona have been 0–2 degrees F cooler than average *(Figure 1b)*.

Temperatures during the past 30 days have been slightly cooler than average (0–2 degrees F) across the northern and western counties of both states, and slightly warmer than average in the southern and eastern counties. The coolest areas were across the northern counties *(Figures 1c–d)*. Cooler temperatures are the result of the continuation of the La Niña pattern present this winter that pushed storms north but allowed cold air to spread into the Southwest.

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 May 18) average temperature.

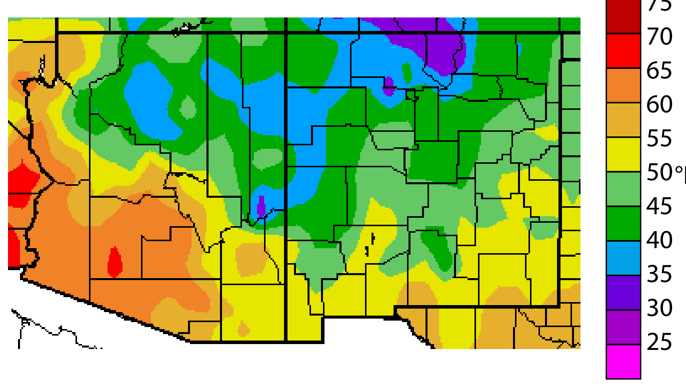


Figure 1b. Water year '10–'11 (October 1 through May 18) departure from average temperature.

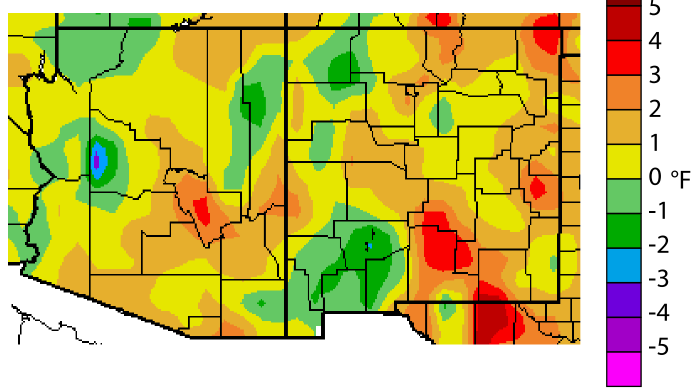


Figure 1c. Previous 30 days (April 19–May 18) departure from average temperature (interpolated).

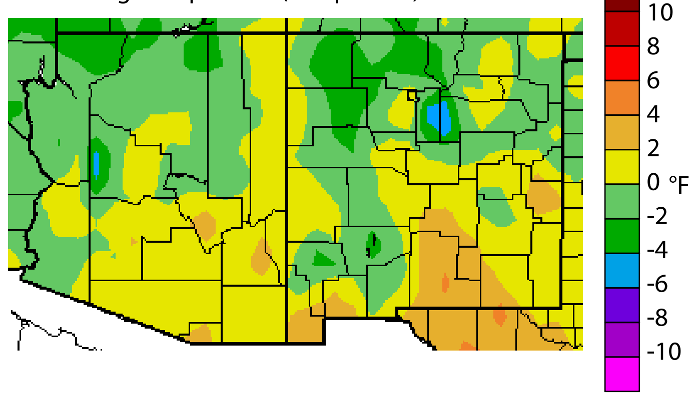
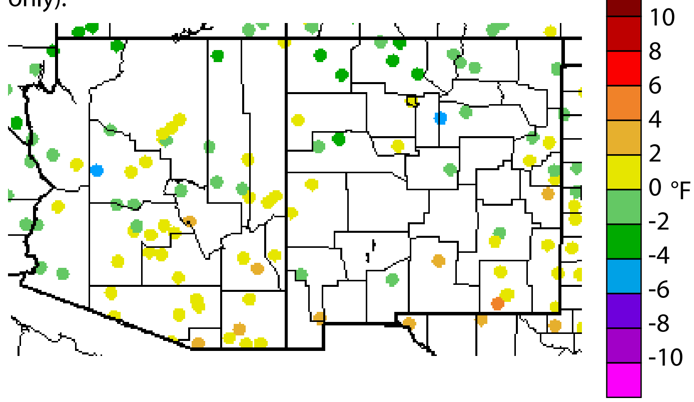


Figure 1d. Previous 30 days (April 19–May 18) departure from average temperature (data collection locations only).



Precipitation (through 5/18/11)

Data Source: High Plains Regional Climate Center

Since the water year began on October 1 most storms have passed north of Arizona and New Mexico with a few traversing across central Arizona and New Mexico. However, those few storms have brought little precipitation to the southern half of the two states as the La Niña winter circulation pattern continued into May *(Figures 2a-b)*. The southeastern third of Arizona and the southern half of New Mexico have received less than 50 percent of average precipitation through mid-May. The northwestern third of Arizona and the eastern end of the Navajo Nation in New Mexico have received 100–200 percent of average.

The last 30 days have brought less than 2 percent of average precipitation to the southern half of both states. While late April and early May tend to be dry, the southern counties in both states have seen no storms this year. The wettest area is the Sangre de Cristo Mountains in north-central New Mexico, which has received 150–800 percent of average precipitation *(Figures 2c–d)*. Arizona's wet spots are in western Mohave County with 150–400 percent of average precipitation. The northern third of Arizona and the northeastern corner of New Mexico have received 25–100 percent of average. The dry conditions are exacerbating the drought and the elevated wildfire risk in the southern counties of both states.

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 May 18) percent of average precipitation (interpolated).

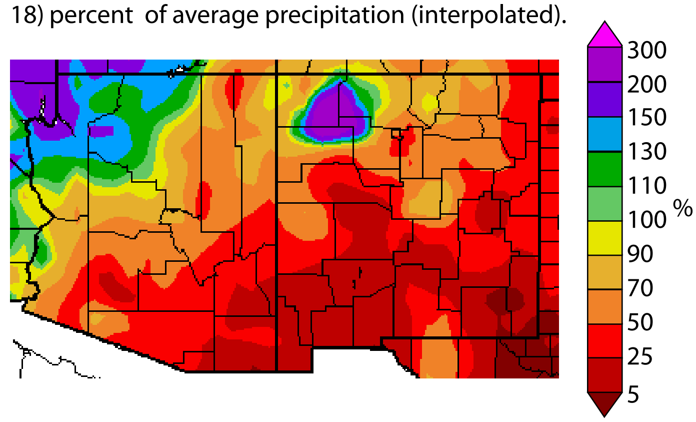


Figure 2b. Water year '10–'11 (October 1 through May 18) percent of average precipitation (data collection locations only).

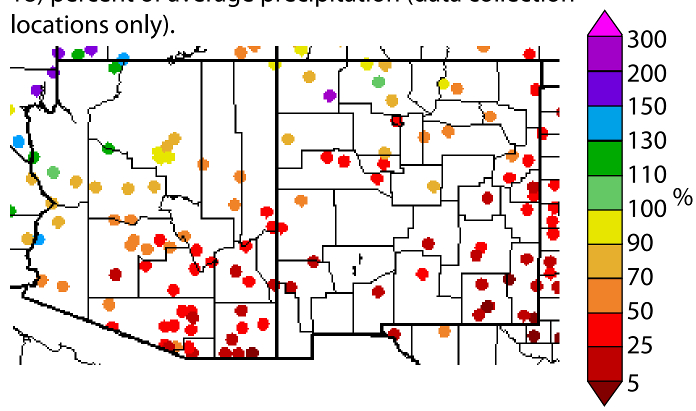


Figure 2c. Previous 30 days (April 19–May 18) percent of average precipitation (interpolated).

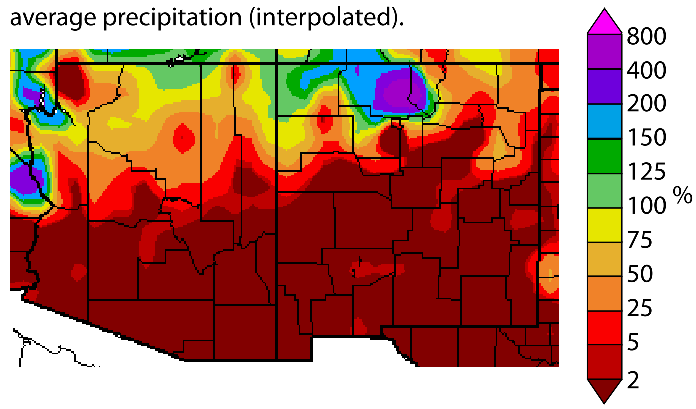
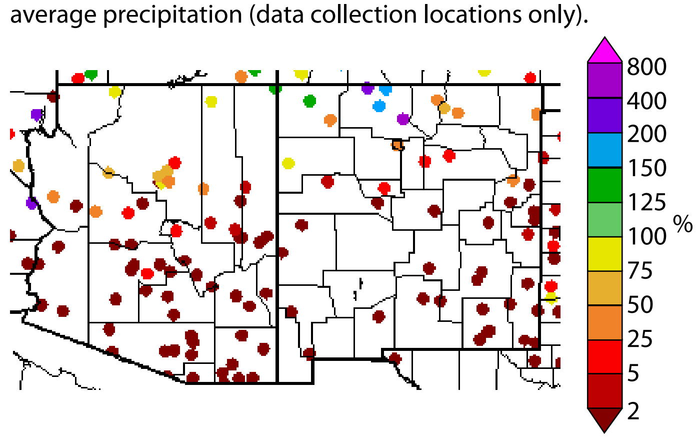


Figure 2d. Previous 30 days (April 19–May 18 percent of average precipitation (data collection locations only).



U.S. Drought Monitor (data through 5/17/11)

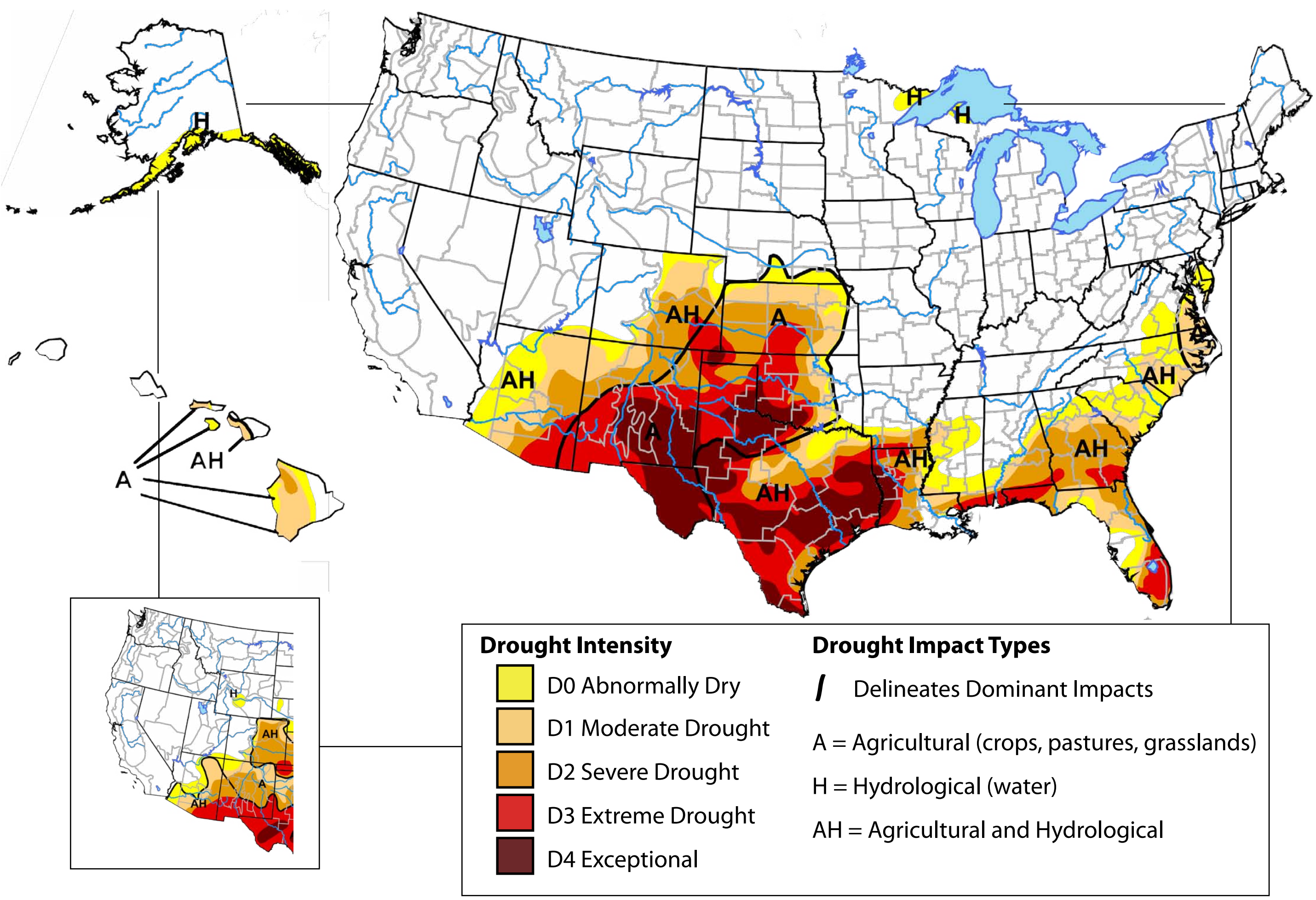
Data Sources: U.S. Department of Agriculture, National Drought Mitigation Center, National Oceanic and Atmospheric Administration

A wet weather pattern continued across much of the western U.S. over the past 30 days, helping to keep short-term drought conditions at bay *(Figure 3)*. These spring storms, however, dodged most parts of Arizona and New Mexico. Much of the West Coast, interior West, and northern Rockies observed precipitation amounts in excess of 150 percent of average. The May 17 update of the U.S. Drought Monitor shows 76 percent of the western U.S. is drought free, which is the same percentage as last month. Drought conditions have continued to intensify across the Southwest. Exceptional drought conditions cover most of southeastern New Mexico, and a new area of severe drought crept into southeast Colorado. Texas is also mired in large areas classified with extreme and exceptional drought. Exceptional is the most intense drought category and is reserved for events that occur once in every 50 years.

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 David Miskus, NOAA/NWS/NCEP/CPC.

Figure 3. Drought Monitor data through May 17, 2011 (full size), and April 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 5/17/11)

Data Source: U.S. Drought Monitor

Drought conditions continued to intensify and expand slightly over the past 30 days across Arizona *(Figure 4a)*. According to the May 17 update of the U.S. Drought Monitor, 86 percent of Arizona is classified with abnormally dry conditions or a more severe drought category compared with 74 percent in mid-April *(Figure 4b)*. Moderate drought conditions constituted the largest expansion in area from one month ago and currently span about 58 percent of Arizona, up from about 49 percent. This expansion largely occurred across central Arizona in Gila, Pinal, and Maricopa counties, where previously only abnormally dry conditions were observed. A couple of late winter storms brought rain and snow to far northern Arizona but only wind to the southeast and other parts of the state with the driest conditions.

Figure 4a. Arizona drought map based on data through May 17, 2011.

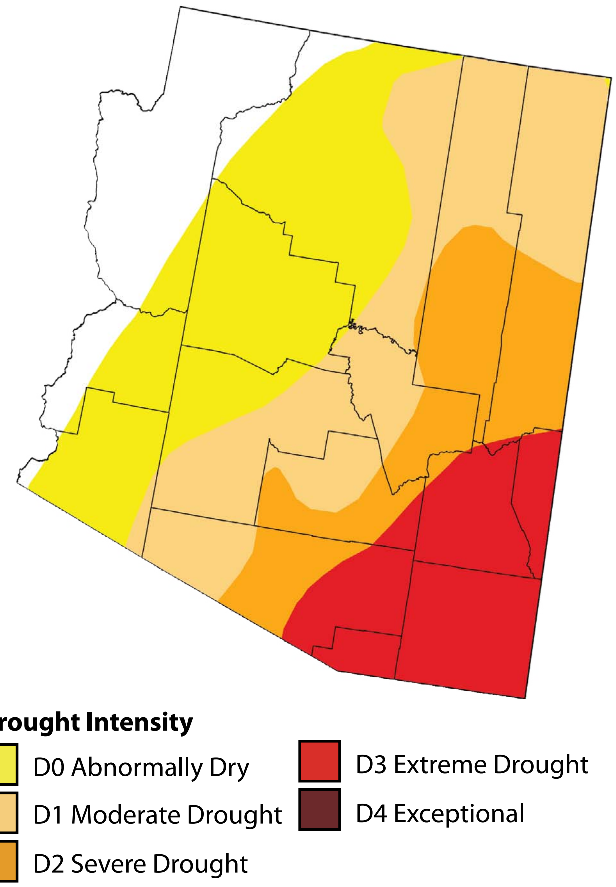


Figure 4b. Percent of Arizona designated with drought conditions based on data through May 17, 2011.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	13.83	86.17	58.25	31.54	15.59	0.00
Last Week (05/10/2011 map)	13.83	86.17	57.90	31.54	15.59	0.00
3 Months Ago (02/15/2011 map)	29.07	70.93	40.88	12.59	0.00	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 (05/11/2010 map)	43.04	56.96	14.43	2.66	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 5/17/11)

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

The drought situation continues to rapidly deteriorate across New Mexico after another month of exceptionally dry weather *(Figure 5a)*. Almost all of New Mexico is classified under some level of drought, with moderate drought or a more severe drought category covering 97 percent of the state *(Figure 5b)*. The remaining 3 percent, located in the northwest corner, has abnormally dry conditions. According to the May 17 update of the U.S. Drought Monitor, the area classified with exceptional drought conditions jumped to 31 percent, up from 0 percent in mid-April. Exceptional is the most intense drought category and is reserved for events that occur once in every 50 years. All of southern New Mexico is observing extreme or exceptional drought conditions as a result of precipitation totals during the past six months that were less than 10 percent of average. Impacts include increased fire activity, low irrigation water allocations, and poor range conditions.

Figure 5a. New Mexico drought map based on data through May 17, 2011.

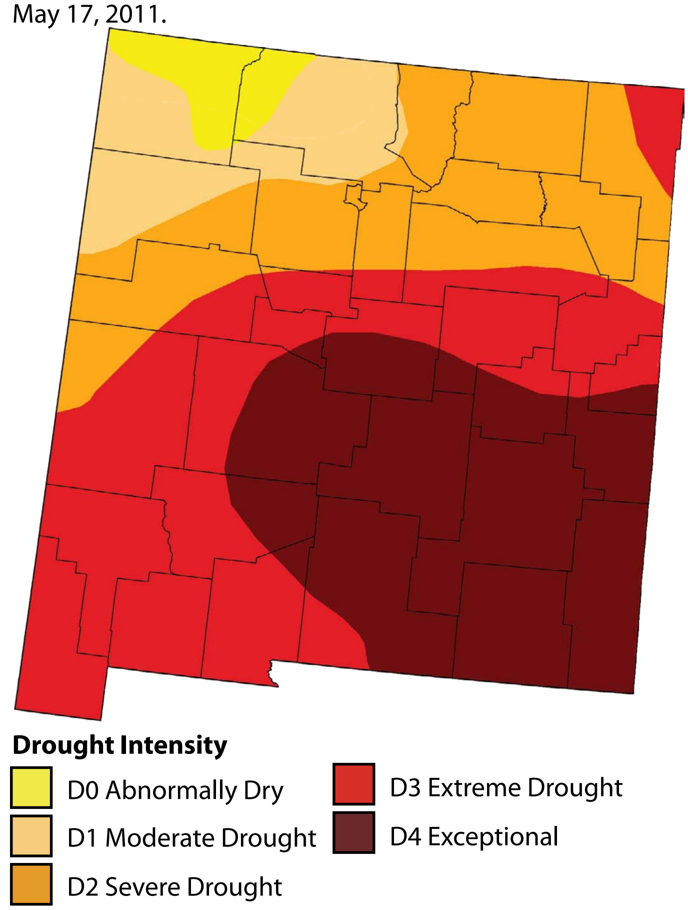


Figure 5b. Percent of New Mexico designated with drought conditions based on data through May 17, 2011.

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	96.66	87.36	64.59	31.67
Last Week (05/10/2011 map)	0.00	100.00	96.59	87.36	61.02	30.14
3 Months Ago (02/15/2011 map)	7.79	92.21	52.89	22.86	0.00	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 (05/11/2010 map)	79.29	20.71	0.02	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 4/30/11)
Data Source: National Water and Climate Center

During the last month, combined storage in Lakes Mead and Powell increased by 63,000 acre-feet. As of May 1, combined storage was at 47.6 percent of capacity, which is 2.1 percent less than a year ago *(Figure 6)*. However, above-average precipitation and snowpack in the Upper Colorado River Basin are projected to generate 145 percent of average April–July unregulated inflow to Lake Powell by the end of July. Storage in other reservoirs within Arizona's borders decreased slightly in April, including a decrease of about 56,000 and 20,000 acre-feet in the Verde River Basin and San Carlos Reservoir, respectively.

In water-related news, a water rights settlement between Navajo Nation, the Hopi Tribe, and 30 other entities, including the state, major water providers, and cities and ranchers is threatened due to its high cost and an unfavorable political climate (Associated Press, May 17). The settlement would give Navajo Nation 31,000 acre-feet of water from the Lower Colorado River Basin, plus a portion of flows from the Little Colorado River and groundwater from beneath the reservation.

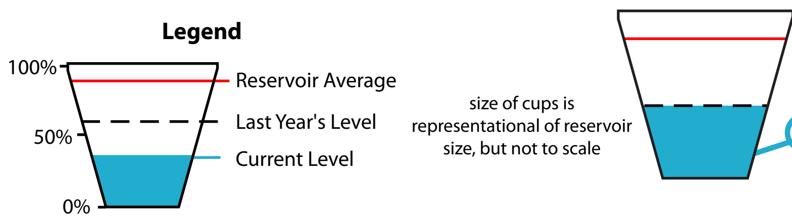
Notes:

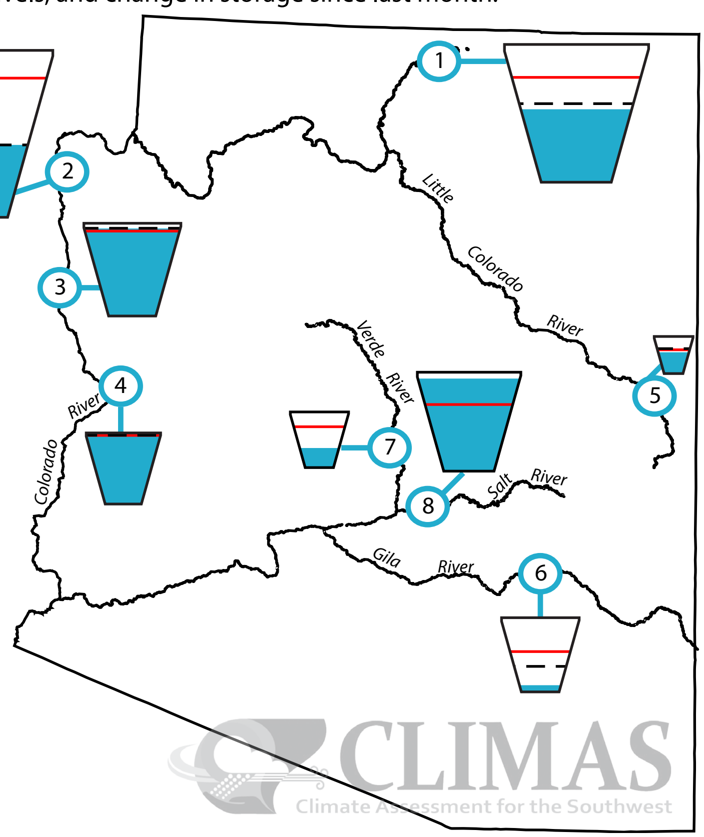
The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 April 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	53%	12,933.0	24,322.0	112.0
2. Lake Mead	43%	11,121.0	26,159.0	-49.0
3. Lake Mohave	94%	1,700.6	1,810.0	-4.4
4. Lake Havasu	95%	588.3	619.0	7.1
5. Lyman Reservoir	57%	17.0	30.0	-0.7
6. San Carlos	9%	75.5	875.0	-19.5
7. Verde River System	35%	99.6	287.4	-55.8
8. Salt River System	94%	1,906.3	2,025.8	9.9

*** thousands of acre-feet**

On the Web:

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

New Mexico Reservoir Levels

(through 4/30/11)

Data Source: National Water and Climate Center

Total reservoir storage in New Mexico declined by 24,700 acre-feet in April, primarily as the result of an 85,300 acre-foot decrease in Elephant Butte Reservoir storage. Pecos River Basin storage declined by 9,300 acre-feet during the last month *(reservoirs 9–12 in Figure 7)*; storage in New Mexico's Canadian River Basin reservoirs also declined *(reservoirs 14–15)*. Storage in Navajo Reservoir increased during April and exceeds the long-term average.

The declines in streamflow and reservoir storage in the Rio Grande Basin are affecting irrigators in southern New Mexico (*Las Cruces Bulletin*, April 29). Southern New Mexico farmers have been hit by a double-whammy of decreased snowpack in the southern Colorado and northern New Mexico mountains that feed the Rio Grande, and a lack of winter precipitation locally. As a result farmers are supplementing irrigation through expensive groundwater pumping and decreasing the number of acres they will farm this year.

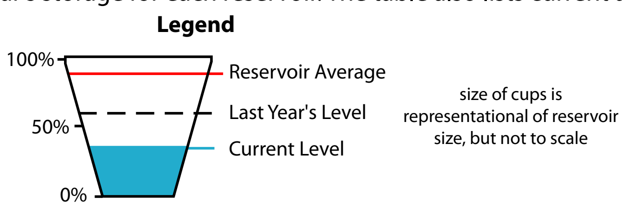
Notes:

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.

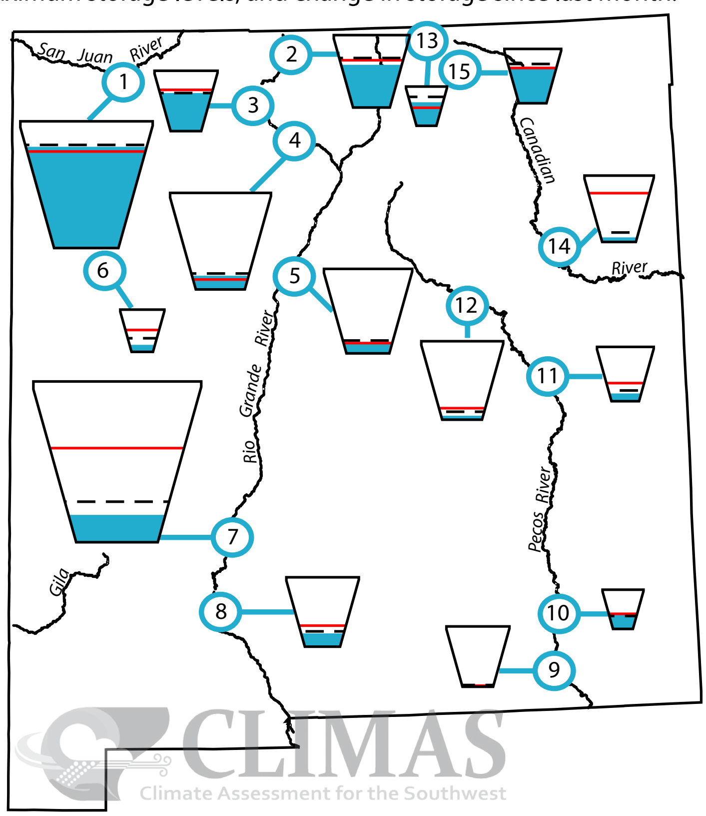
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Wayne Sleep, wayne.sleep@nm.usda.gov.

Figure 7. New Mexico reservoir levels for April 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	80%	1,357.4	1,696.0	31.3
2. Heron	59%	235.8	400.0	11.5
3. El Vado	63%	119.4	190.3	11.2
4. Abiquiu	14%	165.3	1,192.8	-9.2
5. Cochiti	11%	51.6	491.0	-1.2
6. Bluewater	17%	6.4	38.5	-0.3
7. Elephant Butte	17%	381.1	2,195.0	-85.3
8. Caballo	19%	64.2	332.0	30.1
9. Brantley	2%	22.2	1,008.2	-7.1
10. Lake Avalon	40%	1.6	4.0	0.6
11. Sumner	14%	14.6	102.0	-2.3
12. Santa Rosa	5%	22.0	438.3	-0.5
13. Costilla	59%	9.5	16.0	0.6
14. Conchas	7%	19.0	254.2	-2.6
15. Eagle Nest	64%	50.8	79.0	-1.5

*** thousands of acre-feet**



On the Web:

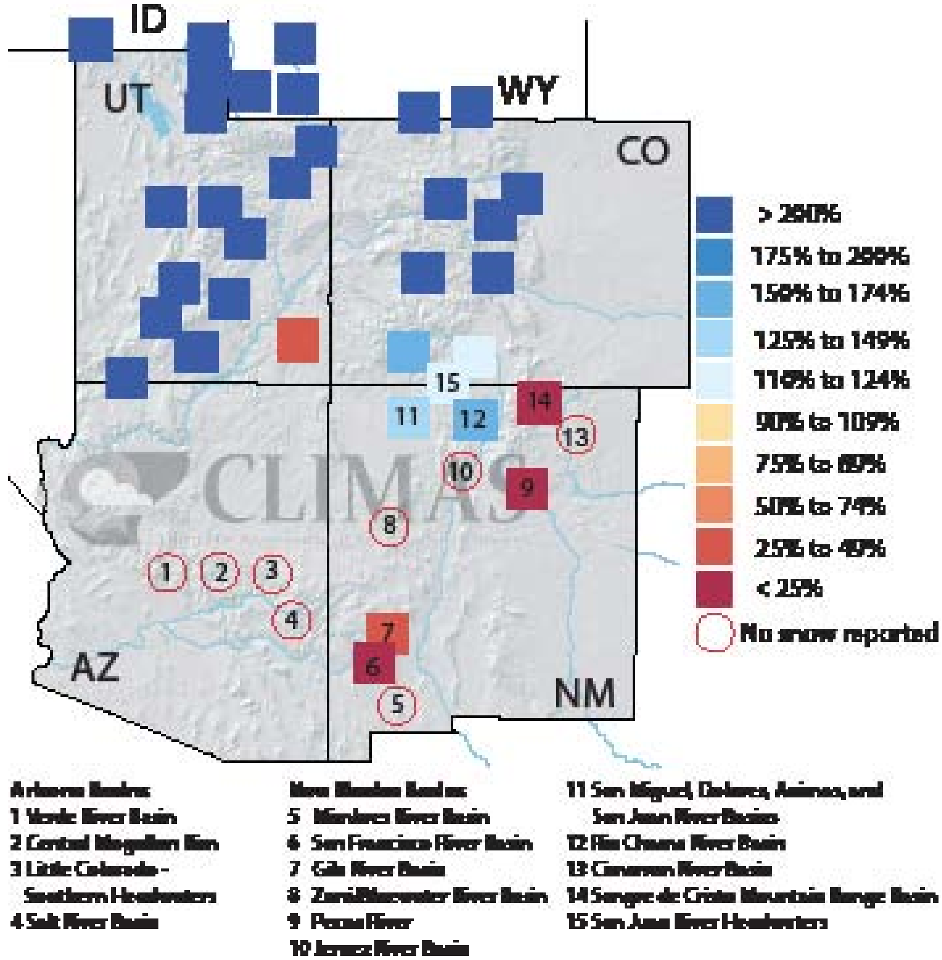
Portions of the information provided in this figure can be accessed at the NRCS website
http://www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

Southwest Snowpack (updated 5/23/11)

Data Sources: National Water and Climate Center, Western Regional Climate Center

Snowpack is nonexistent in the Arizona basins *(Figure 8)*. Snowpack remains at or below average in most of the basins in New Mexico with the exception of several northern basins. River basins in states to the north of Arizona and New Mexico that supply most of the water in the Colorado River and Rio Grande are experiencing above-average to near-average snow water equivalent (SWE). For example, SNOTEL sites in the Upper Colorado River Basin were at 202 percent of average as of May 19. SWE in the headwaters of the Upper Rio Grande measured 98 percent of average, and SWE in the Animas River Basin was about 144 percent of average. Accumulated winter precipitation in these three basins is 132, 99, and 105 percent of average, respectively. While precipitation has been above average in many places in Colorado and Utah since the water year began on October 1, precipitation has been below average at many SNOTEL monitoring stations located in Arizona and New Mexico as a result of the moderate to strong La Niña event.

Figure 8. Average snow water equivalent (SWE) in percent of average for available monitoring sites as of May 23, 2011.



Notes:

Snowpack telemetry (SNOTEL) sites are automated stations that measure snowpack depth, temperature, precipitation, soil moisture content, and soil saturation. A parameter called snow water content (SWC) or snow water equivalent (SWE) is calculated from this information. SWC refers to the depth of water that would result by melting the snowpack at the SNOTEL site and is important in estimating runoff and streamflow. It depends mainly on the density of the snow. Given two snow samples of the same depth, heavy, wet snow will yield a greater SWC than light, powdery snow.

This figure shows the SWC for selected river basins, based on SNOTEL sites in or near the basins, compared to the 1971–2000 average values. The number of SNOTEL sites varies by basin. Basins with more than one site are represented as an average of the sites. Individual sites do not always report data due to lack of snow or instrument error. CLIMAS generates this figure using daily SWC measurements made by the Natural Resource Conservation Service.

On the Web:

For color maps of SNOTEL basin snow water content, visit http://www.wrcc.dri.edu/snotelanom/basinswe.html

For NRCS source data, visit http://www.wcc.nrcs.usda.gov/snow/

For a list of river basin snow water content and precipitation, visit http://www.wrcc.dri.edu/snotelanom/snotelbasin

Southwest Fire Summary
(updated 5/20/11)
Source: Southwest Coordination Center

The Southwest has experienced extremely high fire activity since the beginning of the year, particularly in southeastern and southern New Mexico and southeastern Arizona *(Figures 9a–c)*. Live fuels such as grasses, shrubs, and trees have been extremely dry as a result of short-term drought conditions that began around November. Record low temperatures in February also contributed to the build-up of fire fuels because the hard freezes killed many plants and desiccated many others that survived the freezes. Strong winds also have heightened fire danger across the Southwest in recent months.

Predictive Services at the Southwest Coordination Center reports more than 500 fires have charred nearly 350,000 acres in New Mexico since January 1. The number of acres burned this year already has surpassed New Mexico's annual average of 242,000. Arizona has not burned as badly as New Mexico. Almost 77,000 acres have burned so far, most of which are located in the southeastern corner of the state. Fire activity this year has been more severe than last year in both states. By May 2010, only 3,800 acres in Arizona and 13,350 acres in New Mexico had burned.

Most fires have been caused by human activity this year, including the Miller fire, the largest fire in the Southwest to date this season. The blaze started on April 28 in the Gila National Forest, 25 miles north of Silver City, NM. As of May 23, it had burned more than 81,000 acres and was less than 50 percent contained. Due to difficult terrain, this fire may not be fully contained until the end of August.

Figure 9a. Year-to-date wildland fire information for Arizona and New Mexico as of May 18, 2011.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	487	76,745	1	135	488	76,880
NM	498	325,398	10	22,542	508	347,940
Total	985	402,143	11	22,677	996	424,820

Figure 9b. Arizona large fire incidents as of May 20, 2011.

Figure 9c. New Mexico large fire incidents as of May 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

Temperature Outlook
(June 2011–November 2011)

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA–Climate Prediction Center (CPC) in May 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. These outlooks are the first to use the 1981–2010 period to calculate the average, as opposed to the 1971–2000 period. This has an impact on trends because the observed warming in the last 10 years is now rolled into the average. For the June–August and July–September 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 in western New Mexico *(Figures 10a–b)*. These forecasts are based in part on the decadal trends. For forecasts issued for the three- and four-month lead times, temperatures in most of Arizona and the western and southern portions of New Mexico have greater than a 40 percent probability of being similar to those of the warmest 10 years in the climatological record, with some areas having probabilities of greater than 50 percent *(Figures 10c–d)*.

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 June–August 2011.

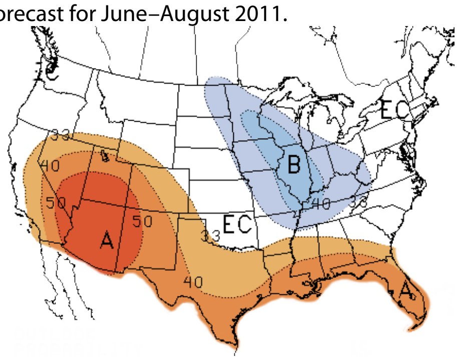


Figure 10b. Long-lead national temperature forecast for July–September 2011.

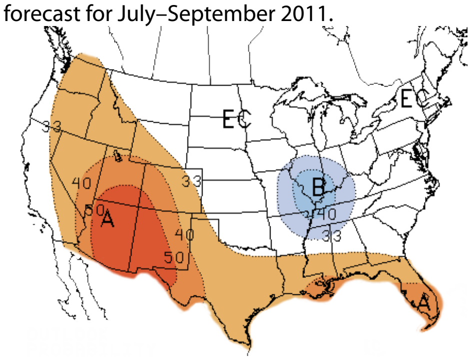


Figure 10c. Long-lead national temperature forecast for August-October 2011.

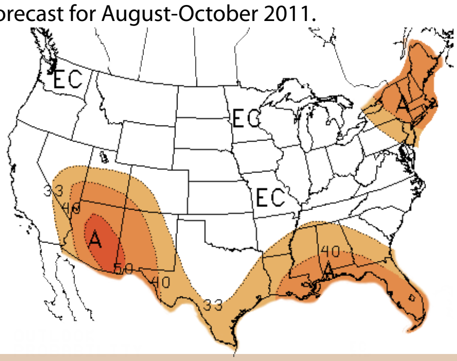
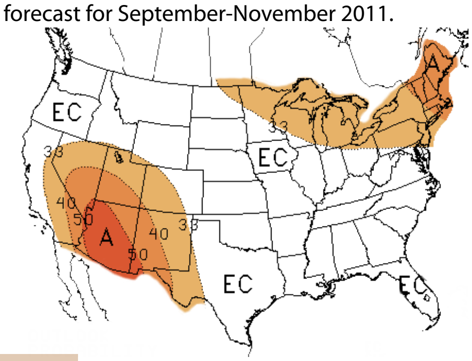


Figure 10d. Long-lead national temperature forecast for September-November 2011.



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

(June 2011–November 2011)

Data Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (CPC) forecasts an equal likelihood of near-average, above-average, and below-average precipitation in the Southwest during the summer and into the fall *(Figures 11a–d)*. This equal chances forecast is based in part on the difficulty in projecting the monsoon, which typically begins in early July and ends in late September. As the monsoon approaches, more accurate forecasts of the monsoon season will become available. Research on the monsoon indicates that a dry winter generally is followed by a wet monsoon. However, this pattern has not always held true.

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 June-August 2011.

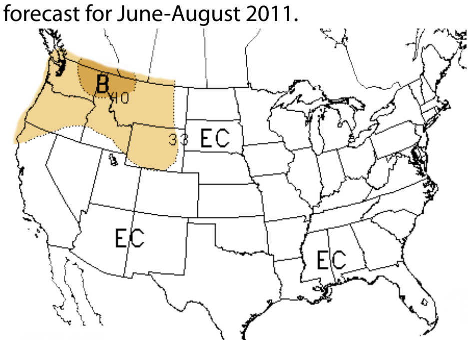
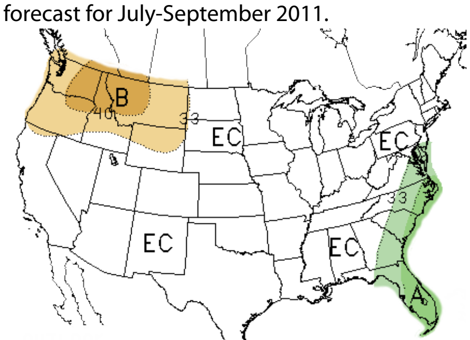


Figure 11b. Long-lead national precipitation forecast for July-September 2011.



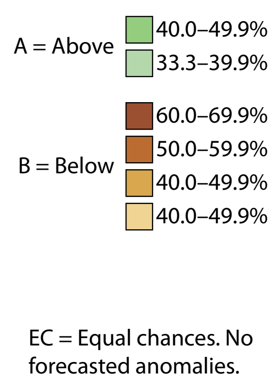


Figure 11c. Long-lead national precipitation forecast for August-October 2011.

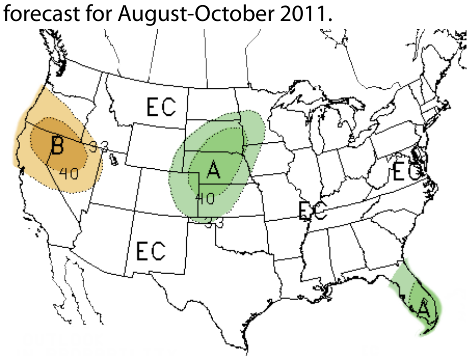
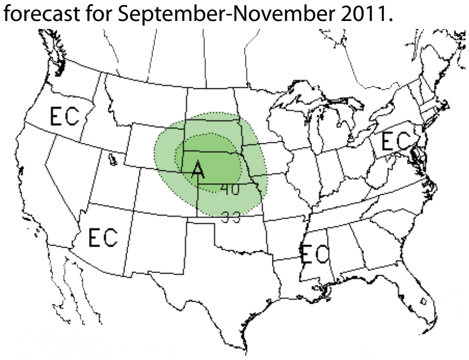


Figure 11d. Long-lead national precipitation forecast for September-November 2011.



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 August)

Data Source: NOAA–Climate Prediction Center (CPC)

This summary is excerpted and edited from the May 17 Seasonal Drought Outlook technical discussion produced by the NOAA–Climate Prediction Center (CPC) and written by forecaster R. Tinker.

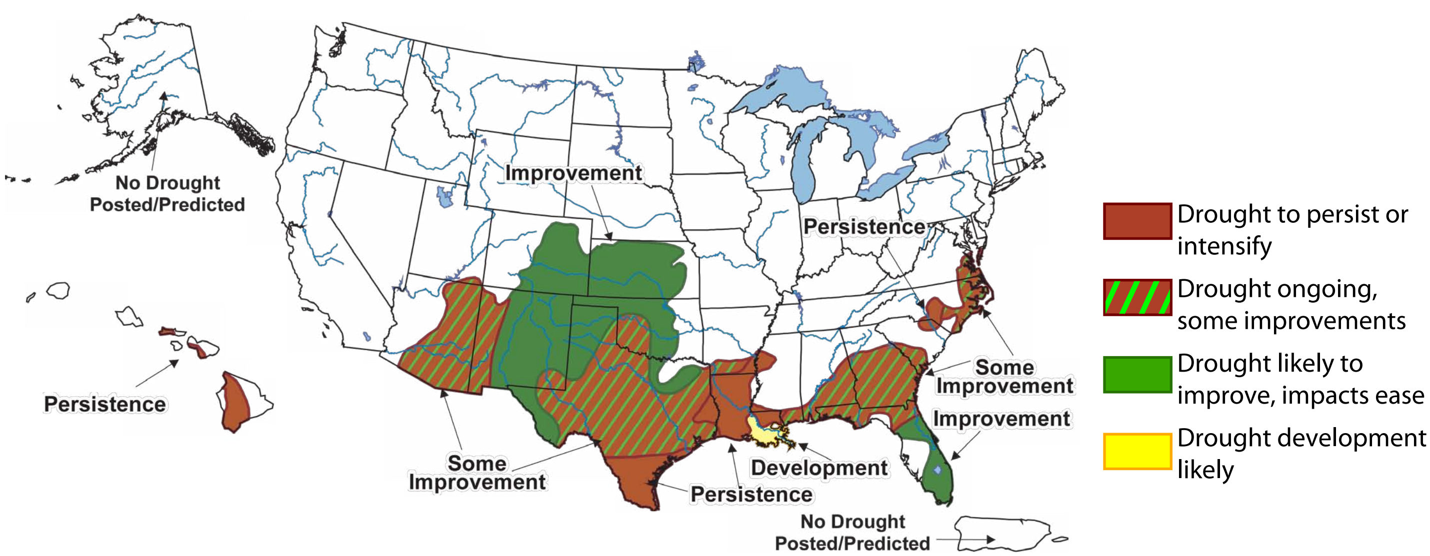
Drought covers the Southwest from western New Mexico through central Arizona. Little or no rain is expected through the end of May, which is common for this time of year. The June–August period tends to be wetter, and as a result the forecast calls for some drought improvement *(Figure 12)*. However, seasonal forecasting for monsoon precipitation is often inaccurate, which makes confidence in the forecast for the Southwest low.

Elsewhere in the U.S., the southern half of the Great Plains states are experiencing the most acute drought conditions in the country. Even though dry conditions started as recently as October, the period since then has brought record dryness to many locations, with some parts of western Texas and eastern New Mexico recording only a few tenths of an inch of rain. Serious and intensifying agricultural impacts and frequently high wildfire danger have been a mainstay for several months now, and longer-term hydrologic impacts have been on the rise. Fortunately, there is an expectation for 1–3 inches of rain in the short-term from eastern and northern Kansas southward through part of northeastern Texas. Elsewhere, however, the odds favor below-average precipitation through the end of the month across Texas and New Mexico. Drought should persist relatively intact in southern Texas, while western and northern parts of this region are headed into their wet season, making it likely that at least some surface moisture improvement will be felt by the end of August. This forecast should not be interpreted as calling for widespread, significant relief. Confidence in the forecasts for the southern half of the Great Plains, however, is low.

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 August (released May 19).



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

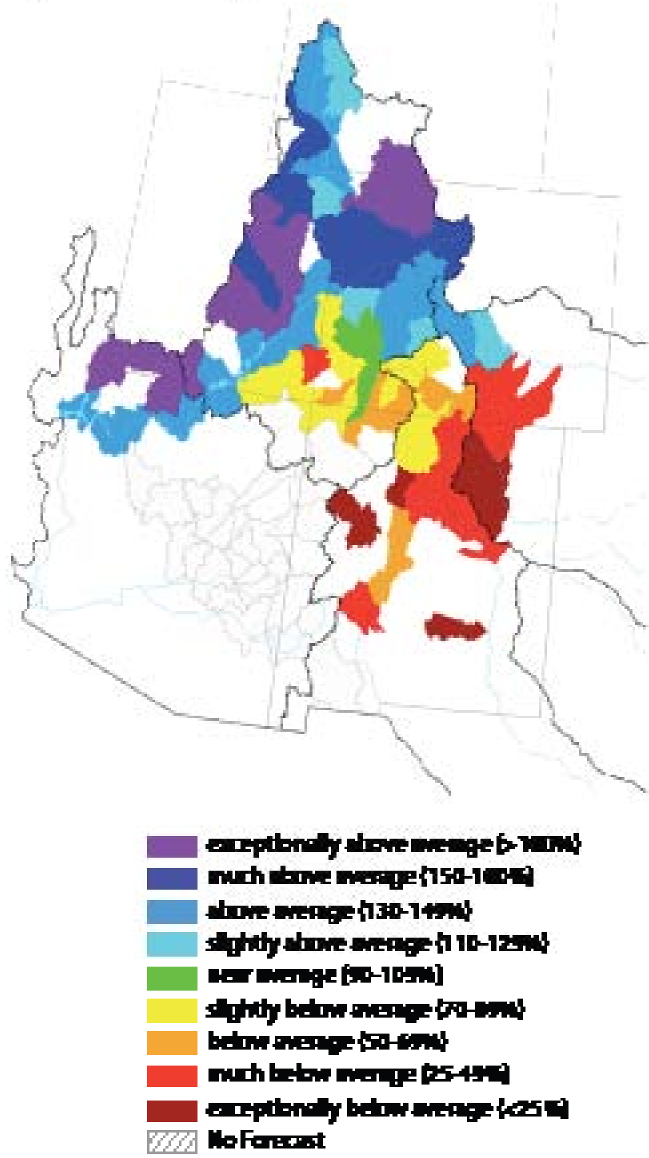
Streamflow Forecast
(for spring and summer)

Source: National Water and Climate Center

This past winter's La Niña event left a dry imprint on the Southwest. The spring–summer streamflow forecast issued May 1 by the Natural Resources Conservation Service (NRCS) for the Southwest predicts below-average flows for all basins in New Mexico and above-average flows for most of the Upper Colorado River Basin *(Figure 13)*. These forecasts are based principally on snow accumulation in the mountains from which most of the water originates. The NRCS and the Colorado Basin River Forecast Center do not issue streamflow forecasts for Arizona after April 1. On April 1, forecasts for the Salt and Upper Gila rivers called for very low probabilities that flows will be near average. Forecasts indicated a 50 percent chance that streamflow in the Salt and Verde rivers during the April–May period will be equal to or less than about 15 and 43 percent of average, respectively.

In New Mexico, many gaging stations are falling into the 10th to 24th percentiles for streamflow, which is considered below average, while some of the mainstream gages are falling into the 25th to 74th percentiles, which is considered average. Some stations along the Pecos and Upper Rio Grande tributaries are reporting well below-average flows, as are some points on the Gila and San Juan rivers. It should be noted that although snowpack levels dropped throughout April, streamflow volumes have not consistently increased accordingly, indicating sublimation and infiltration losses are occurring.

Figure 13. Spring and summer streamflow forecast as of May 1 (percent of average).



Notes:

Water supply forecasts for the Southwest are coordinated between the National Water and Climate Center, part of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and the Colorado Basin River Forecast Center (CBRFC), part of NOAA. The forecast information provided in Figure 12 is updated monthly by the NWCC. Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions. The coordinated forecasts by NRCS and NOAA are only produces for Arizona between March and April, and for New Mexico between March and May.

The NRCS provides a range of forecasts expressed in terms of percent of average streamflow for various exceedance levels. The forecast presented here is for the 50 percent exceedance level, and is referred to as the most probable streamflow. This means there is at least a 50 percent chance that streamflow will occur at the percent of average shown in Figure 12. The CBRFC provides a range of streamflow forecasts in the Colorado Basin ranging from short fused flood forecasts to longer range water supply forecasts. The water supply forecasts are coordinated monthly with NWCC.

On the Web:

For state river basin streamflow probability charts, visit
http://www.wcc.nrcs.usda.gov/cgibin/strm_cht.pl

For information on interpreting streamflow forecasts, visit
http://www.wcc.nrcs.usda.gov/factpub/intrpret.html

For western U.S. water supply outlooks, visit http://www.wcc.nrcs.usda.gov/wsf/westwide.html and http://www.cbrfc.noaa.gov

Wildland Fire Outlook

(June–August 2011)

Sources: National Interagency Coordination Center, Southwest Coordination Center

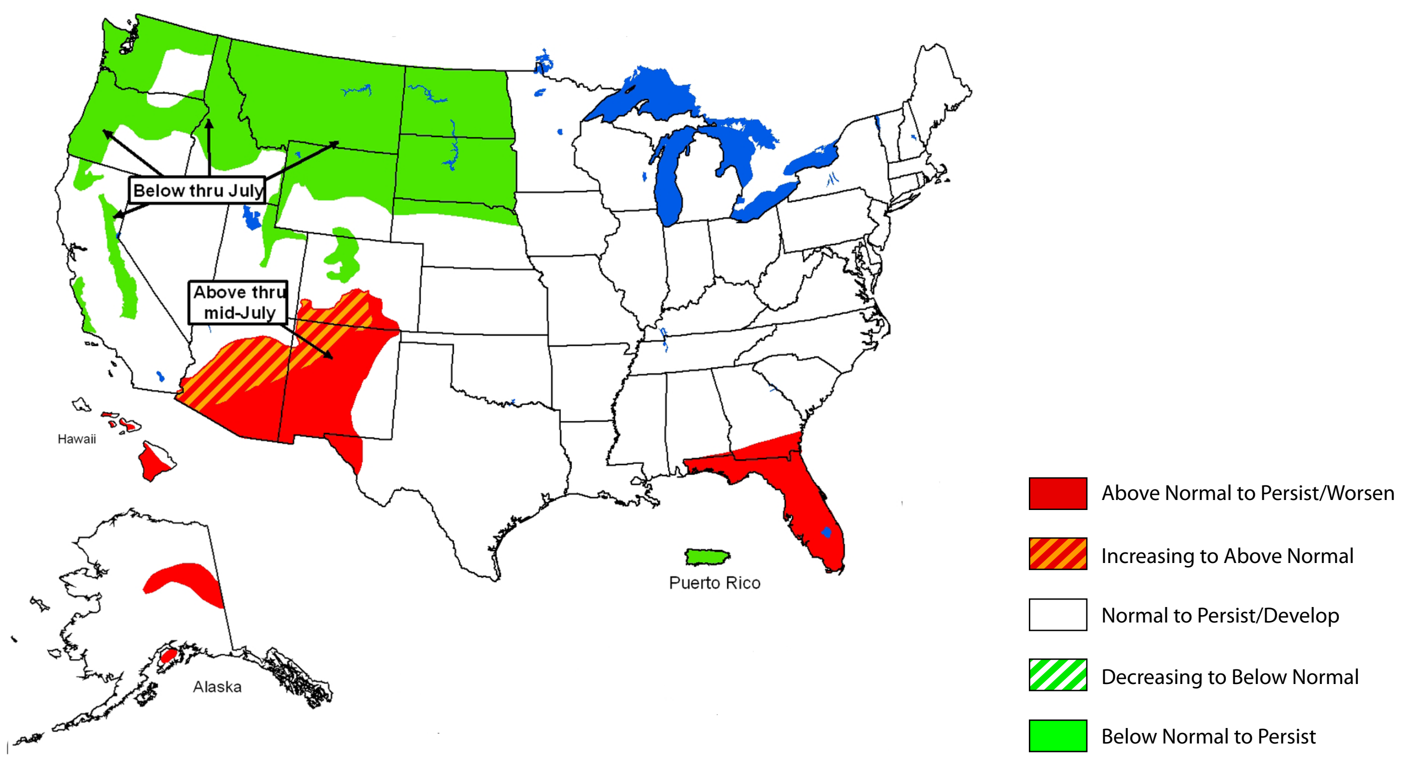
Extreme drought conditions, dry vegetation, above-average temperature forecasts, and intermittent periods of high winds are all factors contributing to above-normal fire potential across most of the Southwest for the June–August period. While southeastern Arizona and southern New Mexico are already experiencing more wildfires than average, Predictive Services at the Southwest Coordination Center expect above-normal significant fire potential to expand across the region in June, including the southern two-thirds of Arizona and the majority of New Mexico *(Figure 14)*. 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.

Dry lightning strikes likely will increase during the weeks leading up to the start of the monsoon, posing even greater chances for increased fire activity. These lightning-caused fires typically peak in mid-June. The onset of the monsoon, expected to occur in early July, could help dampen fire activity. Precipitation outlooks from the NOAA–Climate Prediction Center (CPC) currently show equal chances for above-, below-, or near-average precipitation for June through August, so it is difficult to predict how strong the monsoon season will be. However, there is reason to expect above-average precipitation this summer, as research suggests dry winters are generally followed by wet monsoons in the Southwest (see this month's feature article for more about the 2011 monsoon).

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 14. National wildland fire potential for fires greater than 100 acres (valid June–August 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)

The La Niña event that drove record dry conditions across parts of southeast Arizona and much of New Mexico this past winter has officially come to an end. The NOAA–Climate Prediction Center (NOAA–CPC) reports that sea surface temperatures (SSTs) have warmed to near-average levels across much of the eastern Pacific Ocean and are indicative of a return to ENSO-neutral conditions. The International Research Institute for Climate and Society (IRI) also notes that the Southern Oscillation Index (SOI) rapidly shifted from near-record levels in April to near-average values as of mid-May in concert with the warming SSTs *(Figure 15a)*. The shift in the SOI indicates the atmosphere is rapidly adjusting back to an ENSO-neutral circulation pattern and that the lagging effects and impacts of the recent La Niña event may be short-lived.

IRI notes this is a particularly difficult time of year to develop longer-range ENSO forecasts, but short-term forecasts consistently point toward the persistence of ENSO-neutral conditions through at least the summer. IRI forecasts predict a 57 percent chance that neutral conditions will continue through the June–August period, with a 22 percent chance that La Niña conditions will return and a 21 percent that an El Niño event will develop *(Figure 15b)*. These forecast probabilities remain relatively constant through next fall and winter. Some models have hinted at the possibility of a weak El Niño developing later this summer or fall, but forecast confidence is very low. ENSO-neutral conditions provide very little forecast guidance through the summer season in Arizona and New Mexico; this is reflected in the equal chances July–September precipitation outlook recently posted by NOAA–CPC *(see Figures 11a–d)*.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through March 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 15a. The standardized values of the Southern Oscillation Index from January 1980–March 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).

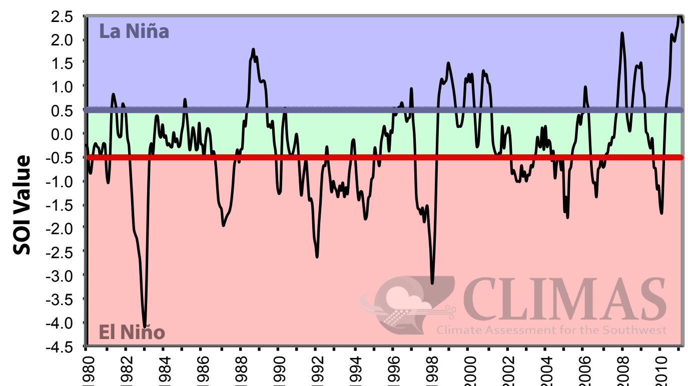
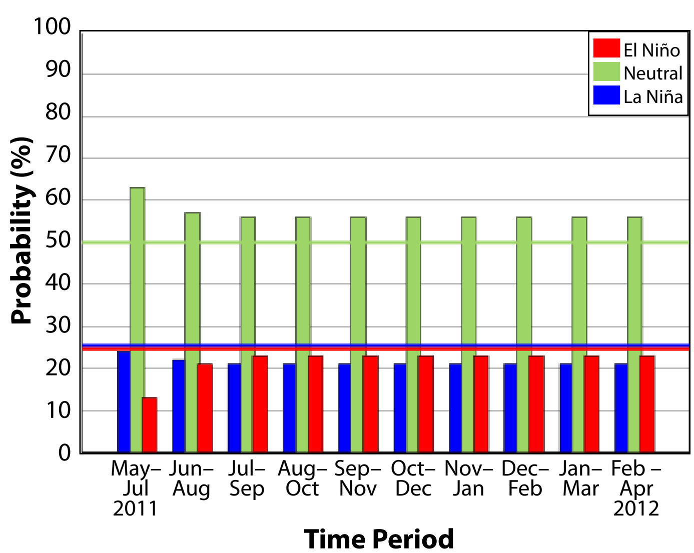


Figure 15b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released May 19). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(June 2011–November 2011)

Data Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook.

Comparisons of observed temperatures for June–August to forecasts issued in May for the same period suggest that forecasts have been substantially more accurate than a forecast of equal chances (i.e., a 33 percent chance that temperatures will be above, below, or near average) in most of Arizona *(Figure 16a)*. NOAA–Climate Prediction Center (CPC) forecasts for this season are based in part on recent trends in warming for this season. For the July–September period, forecasts have been better than equal chances in all of Arizona but not as good as equal chances in New Mexico *(Figure 16b)*. For the August–October period, forecasts generally have been more accurate in most of Arizona and less accurate than equal chances in New Mexico *(Figure 16c)*. For the four-month lead time, forecasts have been only slightly more accurate than equal chances in southeastern Arizona *(Figure 16d)*. While bluish hues suggest that CPC historical forecasts have been more accurate than equal chances, caution is advised to users of the seasonal forecasts for regions with reddish colors.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the warmest, coolest, or normal temperatures for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine. The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories. The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 16a. RPSS for June-August 2011.

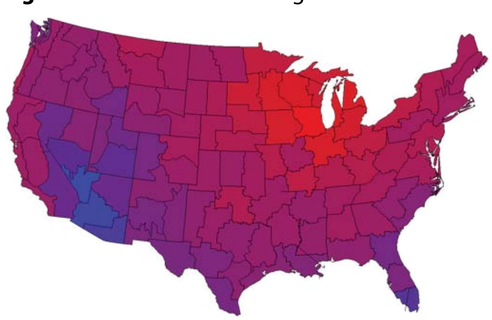


Figure 16b. RPSS for July-September 2011.

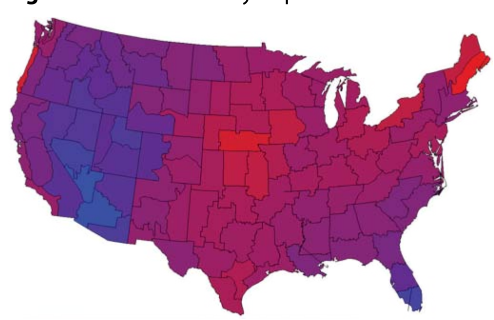


Figure 16c. RPSS for August-October 2011.

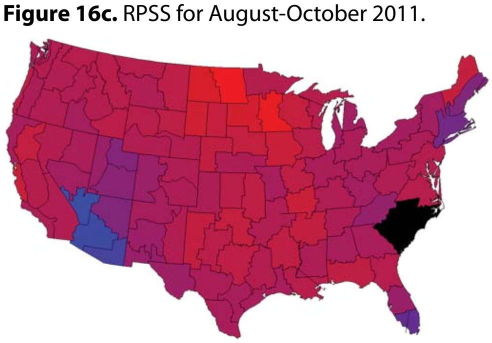
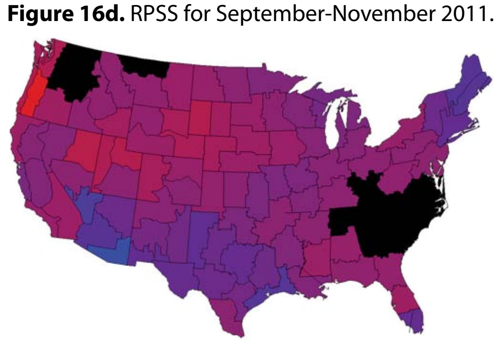
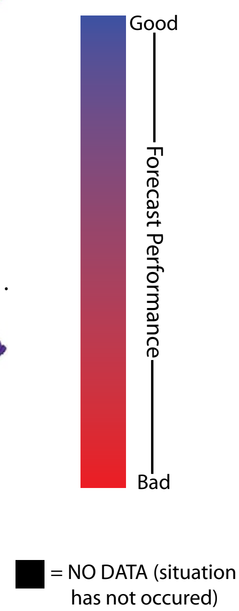


Figure 16d. RPSS for September-November 2011.





On the Web:

For more information on the Forecast Evaluation Tool, visit http://fet.hwr.arizona.edu/ForecastEvaluationTool/

For a CLIMAS publication that explains how to use the Forecast Evaluation Tool, visit http://www.climas.arizona.edu/feature-articles/november-2005

Precipitation Verification
(June 2011–November 2011)

Data Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook

Comparisons of observed precipitation for June–August to forecasts issued in May for the same period suggest that forecasts are slightly more accurate than equal chances in all of Arizona and New Mexico *(Figure 17a)*. While most regions have positive Rank Probability Skill Score (PRSS) values, they are very low, indicating that the historical accuracy of the forecasts has been only marginally better than equal chances. For the July–September period, which covers the monsoon, forecasts have been less accurate than equal chances, especially in regions most influenced by the monsoon, such as southwest New Mexico and southeast Arizona *(Figure 17b)*. This implies that the current forecasts for this period may not be a useful tool for decision making. For the three-month lead time, which also spans part of the monsoon period, forecasts have been similar to or less accurate than equal chances in both states *(Figure 17c)*. The four-month lead time forecast has shown better accuracy than equal chances in Arizona *(Figure 17d)*. Regions with bluish hues suggest that the NOAA–Climate Prediction Center (CPC) forecasts historically have been more accurate than equal chances. However, caution is advised to users of the CPC seasonal outlooks for regions where the verification maps display reddish hues.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the wettest, driest, or normal precipitation for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine. The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories. The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 17a. RPSS for June-August 2011.

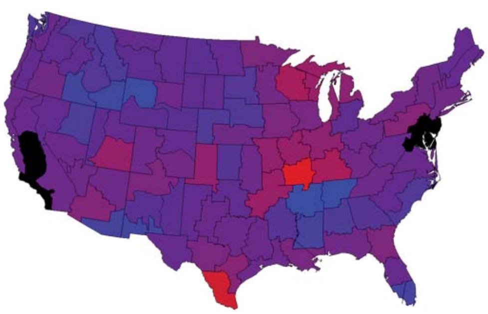
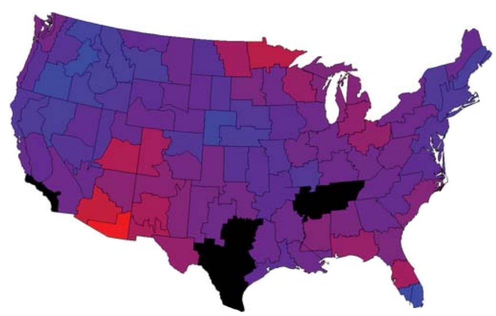


Figure 17b. RPSS for July-September 2011.



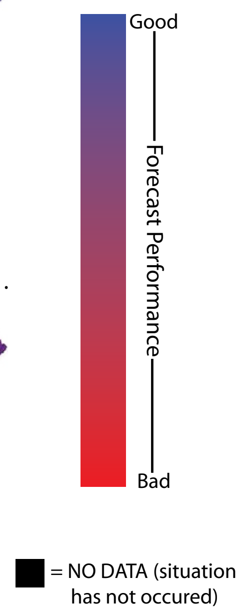


Figure 17c. RPSS for August-October 2011.

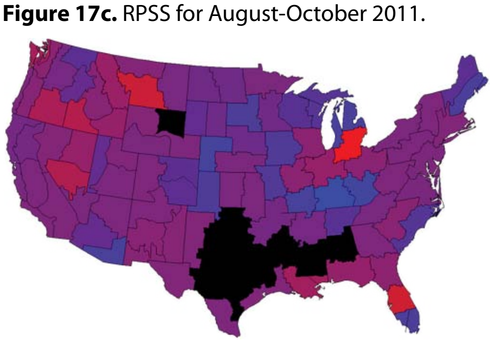
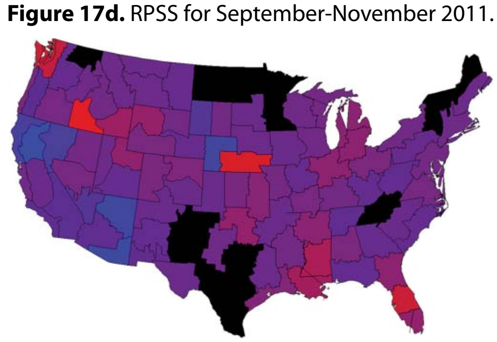


Figure 17d. RPSS for September-November 2011.



On the Web:

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