June 24, 2010

Southwest Climate Outlook

Vol. 9 Issue 6

CLIMAS researchers and partners have produced a wealth of valuable Southwest-focused climate information during the last decade, including 96 issues of the Southwest Climate Outlook. To help ensure easy access to existing and new information, we recently revamped our Web presence.

On the new site you will find information about past and ongoing CLIMAS projects, a new and growing Tools section that points to Web resources we've helped create, a new section about the climate of our region, a more accessible library, and much more. The new CLIMAS site will continue to evolve over time, so check back often.

We invite you to explore the new site, www.climas.arizona.edu, and let us know what you think.

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: macaulay@email.arizona.edu

In this issue...

The monsoon season officially began on June 15 in Arizona, prepping people for the intense thunderstorms, flooding, and high winds that accompany the towering cumulous clouds. While moisture from the Gulf of California has yet to waft into the region, the National Weather Service...

The NOAA–Climate Prediction Center (NOAA–CPC) long-lead temperature outlooks show an increased likelihood of above-average temperatures in the Southwest for the summer and early winter seasons...

The warm sea surface temperatures (SSTs) present across the equatorial Pacific Ocean associated with this past winter's El Niño have recently and quickly dissipated at first into neutral conditions and lately, during the past several weeks, into borderline La Niña conditions...

The information in this issue is available on the Web: http://climas.arizona.edu/outlooks/swco

June Climate Summary

Drought– Drought conditions have remained steady in Arizona but have worsened in New Mexico. Dry and unusually warm weather during the past 30 days caused the area of abnormally dry and moderate drought conditions across northern Arizona to expand eastward into eastern and central New Mexico.

Temperature– While spring generally has been cooler than average, temperatures have been 0–5 degrees F above average in eastern Arizona and much of New Mexico in the past 30 days.

Precipitation– Spring is historically the driest time of the year and storms that passed over the region in the past 30 days contained little moisture. Most of New Mexico and Arizona have received less than 75 percent of average precipitation, while many southern regions have received less than 5 percent of average.

ENSO– The NOAA–Climate Prediction Center issued a La Niña Watch, which means that conditions are favorable for a La Niña event to form within the next three months. A rapid shift toward cooler-than-average sea surface temperatures in the equatorial Pacific Ocean during the past month helps indicate a developing La Niña event.

Climate Forecasts– Temperature outlooks show an increased likelihood of above-average temperatures in the Southwest for the summer and fall. It is unclear how the monsoon season will unfold, and precipitation forecasts state equal chances of below-, near-, or above-average rainfall. During the fall, there are increased chances for below-average precipitation.

The Bottom Line– Many parts of the Southwest have experienced dry and hot weather, particularly eastern New Mexico where temperatures have been around 5 degrees F warmer than average. Many parts of the Southwest also have received less than 5 percent of average rainfall, helping to prime the region for fire activity. The Monsoon forecast suggests that storms will arrive on time or slightly later than the historical average, according to the National Weather Service.

America's Climate Choices: Three new reports address climate change research and action

The National Academies of Sciences released three reports On May 19 that are part of a comprehensive study of climate change emphasizing why the U.S. should reduce greenhouse gas emissions and develop a national strategy to adapt to the inevitable impacts of climate change. The reports show that climate change science is strong, but the nation also needs the scientific community to expand upon its understanding of why climate change is happening and focus on when and where the most severe impacts will occur and what we can do to respond, said Ralph J. Cicerone, president of the National Academy of Sciences. In addition to the reports, two additional studies will be released later this year. They will provide information to enable effective responses to climate change by examining how to best provide decision makers with information on climate change, and an overarching report that will offer a scientific framework for shaping the policy choices underlying the nation's efforts to confront climate change. Read the reports at: http://americasclimatechoices.org/.

Table of Contents:

SWCO Staff:

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

The 2010 North American Monsoon Forecast: A roundtable discussion with three monsoon experts

By Zack Guido

You can listen to the entire roundtable discussion by downloading the mp3 audio file on our Web site: www.climas.arizona.edu/feature-articles/june-2010. The following transcript is a slightly abridged version of the discussion.

The monsoon season officially began on June 15 in Arizona, prepping people for the intense thunderstorms, flooding, and high winds that accompany the towering cumulous clouds. While moisture from the Gulf of California has yet to waft into the region, the National Weather Service expects rains to begin around or slightly later than the average start date which tends to occur in the first week of July, but there is considerable uncertainty about the amount of precipitation the region will receive.

Figure 1. Monsoon rains historically arrive in southern Arizona around the first week in July. They are often spotty and localized, delivering copious rains to one region while missing others. Figure courtesy of University Corporation for Atmospheric Research

On June 11, CLIMAS staff scientist Zack Guido discussed the causes, forecast, and future of the monsoon with three monsoon experts: Eric Pytlak, science and operations officer at the National Weather Service in Tucson; Chris Castro, assistant professor at the department of atmospheric sciences at the University of Arizona; and Dave Gutzler, professor of earth and planetary sciences at the University of New Mexico.

Monsoon Basics

Question: What is the monsoon and how does it work in the Southwest?

Eric Pytlak: The North American monsoon is basically a large-scale climate weather pattern where two things go on, one at the upper levels [in the atmosphere] and one at the lower levels. In the upper levels, the subtropical high develops over Mexico in late May and early June. [It subsequently] strengthens and moves north into the United States. By early to mid-July it's centered over New Mexico but moves around a bit, where one day it might be out in Oklahoma, the next day it might be in the Four Corners. That high steers mid- and upper-level moisture and disturbances into the [Southwest] region.

On top of that, the land surface over Mexico and the Southwest heats up more than the oceans. The pressure difference between the land and the ocean causes wind to blow off the tropical Pacific Ocean on a daily basis. Eventually, you see moisture off the Gulf of California coast flowing into Sonora and eventually into Arizona [beginning on average around the first week in July].

New Mexico is slightly different because they don't have the Gulf of California influence, but they are more prone to the Gulf of Mexico influence. So between those two water bodies and the hot land surface, a series of events falls into place where, basically, Arizona and New Mexico receive tropical winds blowing from the east for a couple of months. So the storms move from west to east instead of from east to west.

Q: Are some areas in the Southwest more prone to monsoon rainfall than others?

Pytlak: Half of the annual rainfall in southern Arizona comes from the monsoon. North of Phoenix, especially into southern Utah, monsoon influence is about 20–30 percent of their annual rainfall.

Dave Gutzler: The complement to saying that the monsoon is more important in the southern halves of Arizona and New Mexico is that winter storms become more prevalent and more important as you get up to the Utah and Colorado borders.

Also, in New Mexico, the state is bisected by north–south trending mountains. On the eastern plains, moisture comes up from the Gulf of Mexico in the spring, so you don't have the dry spring conditions in the eastern third of New Mexico that

continued on page 4

The 2010 North American Monsoon Forecast, continued

you have across southern Arizona and southwestern New Mexico. This part of the state is out of what we think of as the monsoon-dominated region.

Q: How do El Niño and La Niña conditions shape the character of the monsoon on a seasonal basis?

Chris Castro: The sub-tropical ridge of high pressure, or the monsoon ridge, starts to evolve in Mexico in May and June and then moves into the Southwest by mid- to late July. This high is centered approximately over the Four Corners region at the end of July or beginning of August. Conditions in the Pacific Ocean tend to modulate the evolution and positioning of that ridge. In years when you have El Niño-like conditions, the ridge is depressed to the south and monsoon onset is delayed, at least in Arizona. In contrast, in more La Niña-like conditions, that ridge tends to develop early and is a little north and east of its average position [over the Four Corners region]. In this case, you have a wet and early monsoon.

Q: Are there other conditions that help forecasters understand how the monsoon may evolve?

Pytlak: One piece of the monsoon science that has held up over the past 20 to 30 years is that if above-average precipitation persists into the summer months, particularly June across the upper Midwest and anywhere from Texas northward into South Dakota, the monsoon high has a harder time moving north out of Mexico. The wet soil, while it makes the humidity extremely high, also keeps surface temperatures down. Snowpack also plays a role. If above-average snowpack exists in Colorado or Utah, for example, it takes time and energy to melt the snow, which can also delay that shift of the high north.

Q: What are the current moisture and snowpack conditions?

Pytlak: This year we had a normal snowpack in Colorado and Utah, but we have way above-normal [precipitation] conditions over the Midwest right now, and that, actually, is somewhat typical of the lingering effects of an El Niño like we had this winter. A monsoon after an El Niño winter, particularly a strong event [like the one we experienced this winter], tends to be a little weak.

But this year we have an interesting situation. Moisture conditions in the atmosphere are looking El Niño-like across the U.S. [suggesting a weak monsoon], while conditions in the western Pacific Ocean are starting to look very La Niña, [which would favor a stronger monsoon]. The question is which one is going to win out.

2010 Monsoon Forecast

Q: What is the official forecast from the National Oceanic and Atmospheric Administration?

Pytlak: First of all we are going to have a hotter-than-usual summer. We're expecting the monsoon high to move north a little late and be a little stronger, which is an expectation based on the climatological trend—the Southwest has been heating up over the past 20 years. Those longer-term trends are part of the forecast we have pretty high confidence in. Right now we're saying equal chances of above- or below-average precipitation this summer because of the contradictions that we're seeing—[a switch to La Niña conditions

continued on page 5

Figure 2. The intense monsoon rain storms often cause streets to flood. Photo courtesy of Ashley Coles.

The 2010 North American monsoon Forecast, continued

will enhance the monsoon, while wet conditions over the Midwest will suppress it]. Having said that, in the past years where we've gone from a strong or moderate El Niño to a La Niña very rapidly, we tend to have pretty average summer rainfall.

Q: Is equal chances a forecast for near-normal rainfall or is it a "we don't know" forecast?

Gutzler: It's a forecast of climatological probabilities. So that's not the same as a forecast of near normal. It's really important to make that distinction—it's very confusing to a lot of people.

The [NOAA]-Climate Prediction Center lumps all the summers into the top-third, bottom-third, and middle-third of either temperature or precipitation. So, if you were just rolling dice, there would be a one-third chance that the upcoming forecast period would be either above, below, or near normal. When they forecast equal chances, they are saying they have no basis for changing those odds.

Q: Are there conditions that may cause NOAA to revise that forecast one way or the other?

Pytlak: I don't expect the forecast to change, unlike last year when we said, "Wow, things are changing really fast, we're going through this rapid El Niño–La Niña evolution," and we were changing our forecast on the fly. This year all of us are just kind of hanging on the equal chances forecast because of the uncertainties out there, and we haven't seen the uncertainties clear up.

So far, what we are seeing in the long-range models is confirming what we were suspecting last month: there's no sign that the monsoon moisture is going to arrive early in Arizona and New Mexico. We're expecting pretty much an on-time start, or maybe a little late.

Q: What conditions would facilitate an early arrival of monsoon rains?

Pytlak: First of all, I would like to see the Plains really dry out. Right now, there are floods from Colorado all the way across Iowa into Indiana and Ohio. It's not going to dry out in the next two weeks up there.

Q: Do tropical Pacific Ocean storms influence the monsoon season, and what is the forecast for these storms?

Pytlak: Right now the official forecast is for a below-average season in the Pacific. This is because we're pretty confident that a La Niña is going to develop, which will mean colder-than-normal water temperatures over the west coast of Mexico. Now, tropical systems can play a significant role in the monsoon, but it is very hard to project the effect of these storms because you need the right storm to move into the right place at the right time to be picked up by the right storm system and turned toward Arizona or New Mexico. That's a forecasting problem; if we see it one week in advance we are probably doing pretty good.

Climate Change and the Future Monsoon

Q: How will climate change affect future monsoon seasons?

Pytlak: My thought is that we don't have the model resolution in the Intergovernmental Panel on Climate Change (IPCC) to really make a firm determination one way or another, but we're getting there. Between IPCC 5, which is starting to be worked on now, and Chris's work downscaling climate models, I think we're going to have a better understanding of what we might expect in a few years.

Q: Is there a theoretical basis for the monsoon changing one way or another?

Gutzler: In a nutshell, the canonical paradigm is that warm climates tend to promote strong monsoons. [In warmer climates] the whole hydrologic cycle ramps up, the tropical oceans become a little warmer, and it's easier to generate a monsoon of stronger intensity, with all else being equal. Now, the current generation of global climate models doesn't come to any consensus as to what the expectation is for a changed monsoon.

Castro: My additional comment would be that a major conclusion in the last IPCC report [published in 2007] was that during the last 30 years, approximately since 1980, we have been experiencing anthropogenic climate change. One of those trends is an increase in temperature…, which has been the most rapid in the Southwest. Another tendency which has been observed in precipitation records is an increase in precipitation intensity. If you take those observations and superimpose them on the climatological evolution of the monsoon, you might project that the period before the monsoon might become hotter and drier. Then once you get a monsoon, which is influenced by the natural variability that we've discussed, the monsoon may experience more intense precipitation. If you look at the intense monsoons in 2006, 2007, and 2008, they seem to fit that pattern, at least anecdotally.

Temperature (through 6/16/10)

Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 have largely averaged between 40 and 50 degrees Fahrenheit across the Colorado Plateau in northern Arizona and New Mexico (Figure 1a). The higher elevations of both states have had temperatures between 30 and 40 degrees F. Southern New Mexico averaged between 50 and 55 degrees, while southern Arizona and the lower Colorado River valley averaged 55 to 65 degrees, with some areas of warmer temperatures near Yuma and in southern Maricopa County. Other than a small area of southwestern New Mexico and southeastern Arizona, these temperatures have been 0–2 degrees F cooler than average for the period between October 1, 2009, and June 16, 2010 (Figure 1b). Sierra and Dona Ana counties in southern New Mexico were even cooler, at 2 to 4 degrees F below average. The cool area shown in west central Arizona is the result of a station re-location rather than cooler-than-average temperatures. The lower-than-average temperatures are due to a series of cold fronts resulting from the El Niño circulation pattern. This pattern has eased somewhat in the past 30 days, as eastern New Mexico has been 3–5 degrees F warmer F than average, while western New Mexico has been 1–3 degrees F warmer than average (Figures 1c–d). Cibola, McKinley, Sierra, and Dona Ana counties in New Mexico and western Arizona have been 0–2 degrees F cooler than average in the last 30 days, while eastern Arizona was slightly warmer than average during the past 30 days.

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 '09–'10 (October 1 through June 16) average temperature.

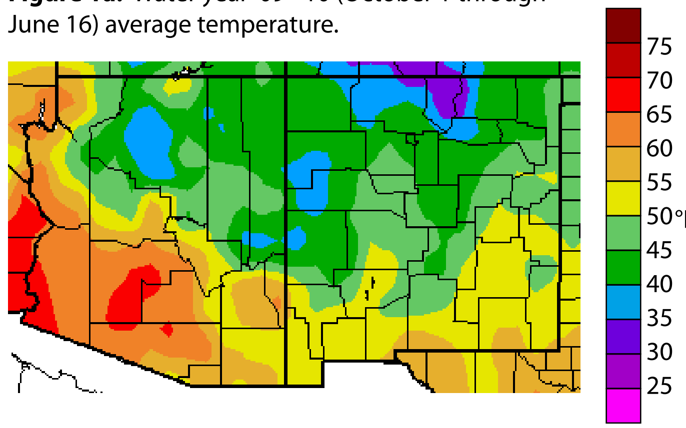


Figure 1b. Water year '09–'10 (October 1 through June 16) departure from average temperature.

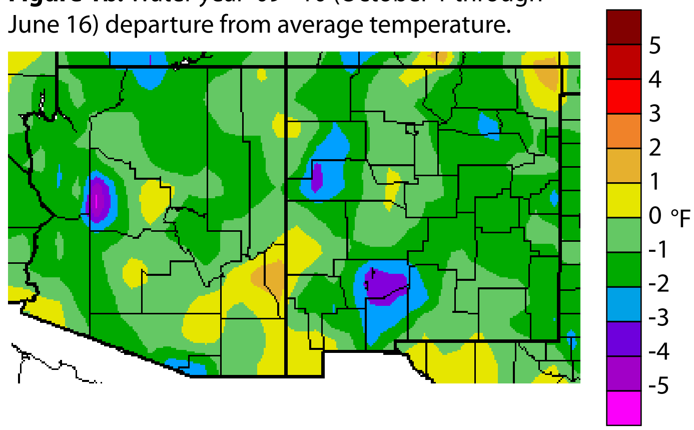


Figure 1c. Previous 30 days (May 18–June 16) departure from average temperature (interpolated).

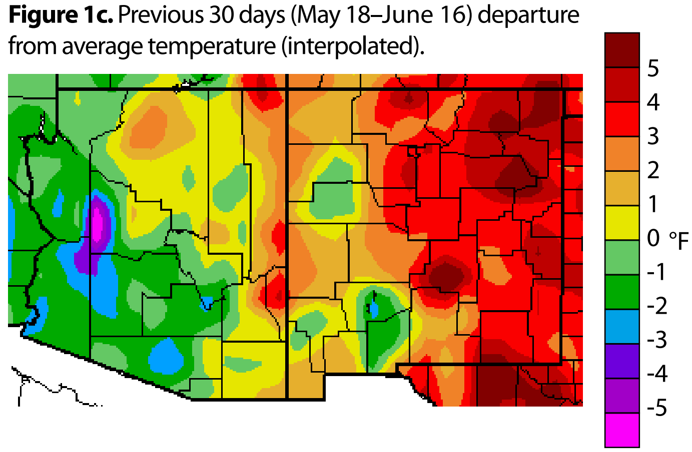
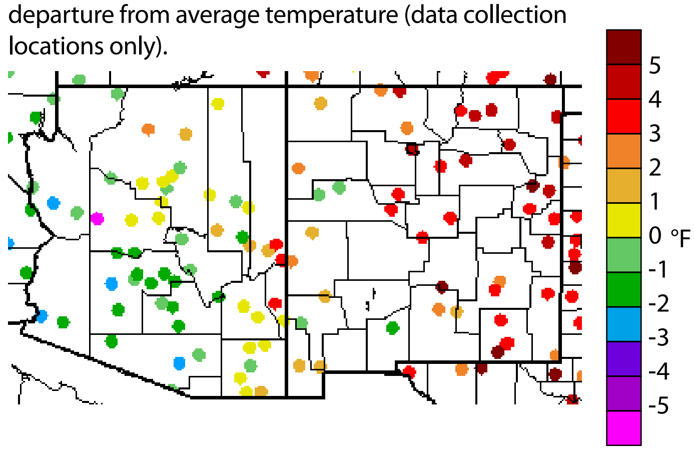


Figure 1d. Previous 30 days (May 18–June 16) departure from average temperature (data collection locations only).



Precipitation (through 6/16/10)

Source: High Plains Regional Climate Center

Storms since the water year began on October 1 have delivered significant amounts of rain and snow to parts of the region. The eastern and southern portions of New Mexico and southern and western Arizona have received 110–300 percent of average, while the Colorado Plateau has received 5–90 percent of average (Figures 2a–b). Some storms moved across southern Utah, staying north of Arizona and New Mexico, while others brought heavy rainfall to the southern California desert and the western third of Arizona before drying out as they passed across Arizona and New Mexico. Other storm tracks dropped south along the front range of the Rockies, catching eastern New Mexico as they moved into Texas.

Spring is normally the driest season in the Southwest. In the past 30 days, some storms passed through the area but contained little moisture. As a result, most of Arizona and the western half of New Mexico have been drier than average, receiving less than 25 percent of average precipitation (Figures 2c–d). Eastern New Mexico was only slightly less dry, receiving 25–75 percent of average precipitation. Southwestern Arizona was the wettest area in the region, experiencing 200–800 percent of average precipitation. However, actual rainfall amounts were less than 0.75 inches in southwestern Arizona; in most areas in this region, precipitation tallied less than a tenth of an inch.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2009, we are in the 2010 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 '09–'10 (October 1 through June 16) percent of average precipitation (interpolated).

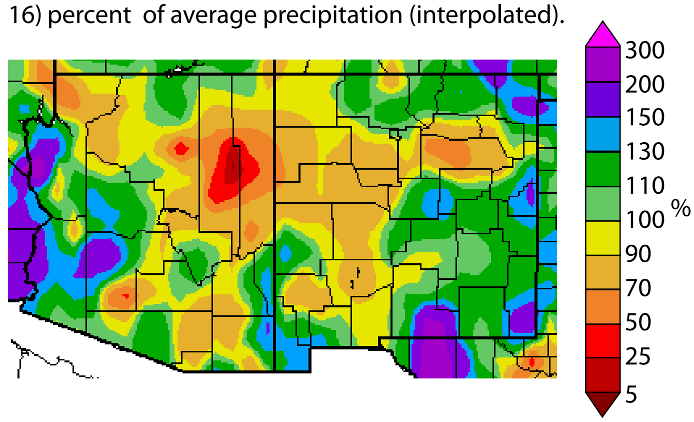


Figure 2b. Water year '09–'10 (October 1 through June 16) percent of average precipitation (data collection locations only).

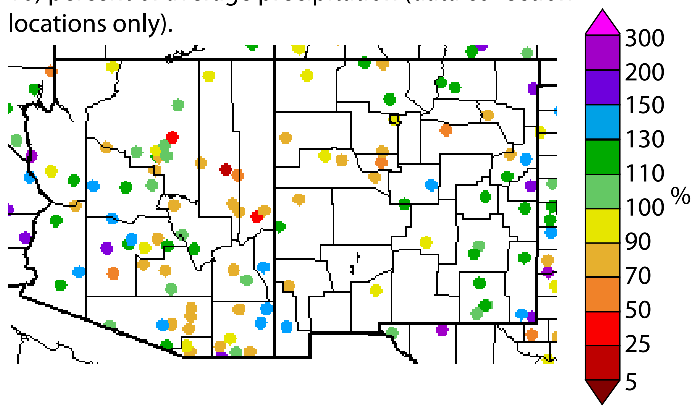


Figure 2c. Previous 30 days (May 18–June 16) percent of average precipitation (interpolated).

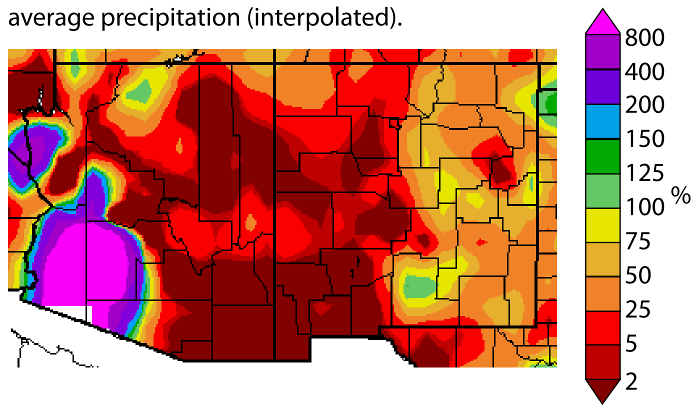
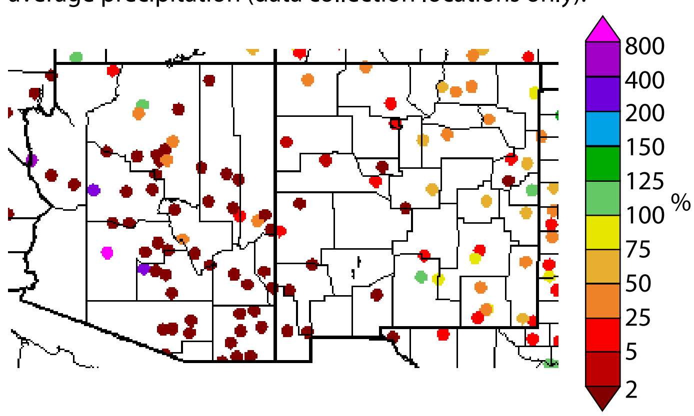


Figure 2d. Previous 30 days (May 18–June 16) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(data through 6/15/10)

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

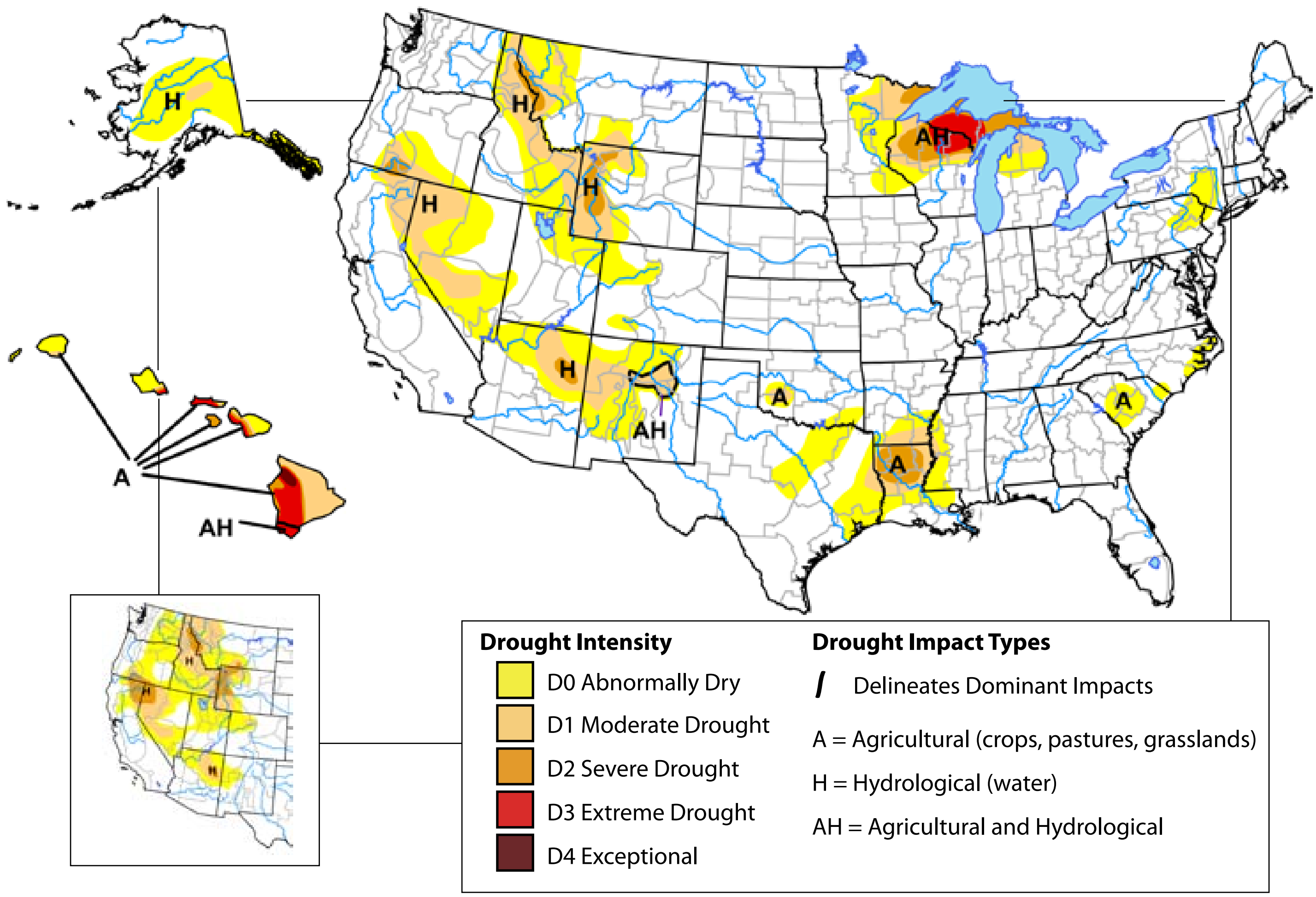
Several rounds of late winter storms were able to bring welcome precipitation to much of the Pacific Northwest and northern Rocky Mountain states (Figure 3). These areas were left high and dry earlier this spring and winter as the storm track shifted south in concert with the El Niño event. Relief also was delivered to parts of northern California and much of the northern Rockies in the past 30 days. Above-average precipitation in these areas has helped ease moderate to severe drought reported in mid-May. The total area in the western U.S. (states west of the Rocky Mountains) experiencing moderate to severe drought conditions fell from 17 percent in mid-May to 13 percent on June 15. The largest improvements in drought conditions were registered in northern California, where drought conditions moved from severe to moderate and in eastern Oregon and Washington and western Idaho, where many areas are now drought-free.

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 Laura Edwards, Western Regional Climate Center.

Figure 3. Drought Monitor data through June 15 (full size), and May 18 (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.unl.edu/dm/monitor.html

Arizona Drought Status

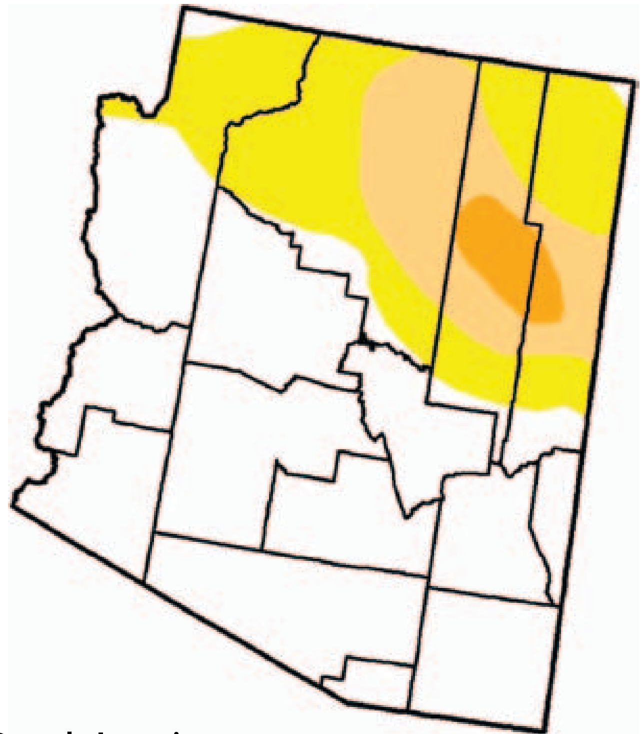
(data through 6/15/10)

Source: U.S. Drought Monitor

The extent of drought conditions across Arizona remained steady during the past month, according to the June 15 update of the National Drought Monitor. The report indicates that about 36 percent of Arizona is abnormally dry or worse, and this area is contained to the northern areas and the Colorado Plateau (Figures 4a–b). Only about 3 percent of the state is currently classified as experiencing severe drought. Even though precipitation amounts have been very low across Arizona over the past 30 days—many areas have not experienced any rain—this time of year is historically dry and therefore these drought conditions have not worsened. However, the dry conditions also have not helped improve drought-stricken areas. Abnormally dry to severe drought conditions remain entrenched across northern Arizona due to longer-term impacts that have built up from an exceptionally dry summer last year and a quick loss of soil moisture this past spring.

Impact reports submitted through Arizona DroughtWatch indicate that significant soil erosion and plant mortality is continuing to occur across parts of northeastern Arizona. Visit www.azdroughtwatch.org to read more detailed impact information and see photographs.

Figure 4a. Arizona drought map based on data through June 15.



Drought Intensity

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

Figure 4b. Percent of Arizona designated with drought conditions based on data through June 15.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	63.8	36.2	14.6	2.7	0.0	0.0
Last Week (06/08/2010 map)	63.9	36.1	14.4	2.7	0.0	0.0
3 Months Ago (03/23/2010 map)	33.0	67.0	24.0	6.4	0.0	0.0
Start of Calendar Year (01/05/2010 map)	0.0	100.0	97.2	71.1	5.1	0.0
Start of Water Year (10/06/2009 map)	1.4	98.6	80.3	10.7	0.0	0.0
One Year Ago (06/16/2009 map)	35.4	64.7	7.2	0.0	0.0	0.0

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 6/15/10)

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

Drought conditions have expanded dramatically across New Mexico over the past 30 days, according to the June 15 update of the National Drought Monitor. Abnormally dry and moderate drought conditions now cover almost half the state, up from just 11 percent on the May 18 Drought Monitor map; currently, 17 percent of the state is experiencing moderate drought (Figures 5a–b). The National Drought Monitor reports that this shift towards worsening drought conditions is due to unusually dry conditions in May and early June accompanied by record high temperatures; the first two weeks of June have been the third warmest on record in Albuquerque since 1892. Precipitation amounts have been less than 25 percent of average over this period across western and central parts of the state, while temperatures in many areas have been more than two degrees F above average. The combination of low precipitation and high temperatures has had a direct impact on pasture and rangeland conditions, according to the Drought Monitor.

Figure 5a. New Mexico drought map based on data through June 15.

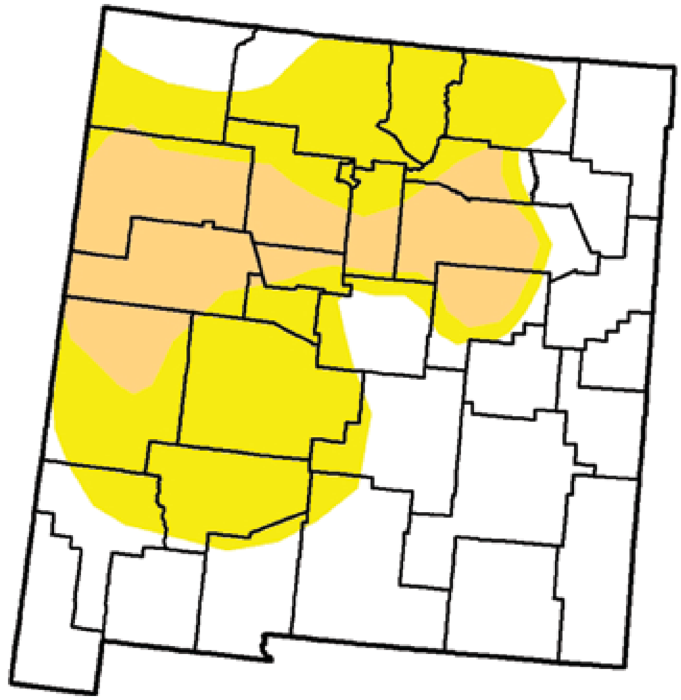


Figure 5b. Percent of New Mexico designated with drought conditions based on data through June 15.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	50.6	49.4	17.3	0.0	0.0	0.0
Last Week (06/08/2010 map)	81.9	18.1	0.0	0.0	0.0	0.0
3 Months Ago (03/23/2010 map)	79.0	21.0	0.0	0.0	0.0	0.0
Start of Calendar Year (01/05/2010 map)	56.9	43.1	10.1	2.3	0.0	0.0
Start of Water Year (10/06/2009 map)	72.2	27.8	3.4	0.0	0.0	0.0
One Year Ago (06/16/2009 map)	38.1	61.9	37.1	10.0	0.0	0.0

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 5/31/10)

Source: USDA-NRCS, National Water and Climate Center

Total storage in the Colorado River Basin (CRB) was 56.7 percent of capacity as of May 24. Storage in Lake Powell increased during the last month, while storage in Lake Mead decreased and combined storage in both reservoirs stands at 50.3 percent of capacity, a decrease of about 1 percent from this time last year (Figure 6). Thanks to an unusually wet late spring in parts of the Upper Colorado River Basin, the CRB Forecast Center increased June forecasts for inflow into Lake Powell from 66 to 79 percent of average. The total storage in Arizona's reservoirs, excluding Lake Powell, decreased in May. However, they are greater than they were last year at this time.

In water-related news, the Yavapai County Board of Supervisors decided to postpone addressing a recommendation from the Upper Verde River Watershed Protection Coalition to establish a groundwater aquifer replenishment district in order for the Prescott area to achieve safe yield (*Prescott Daily Courier*, June 7).

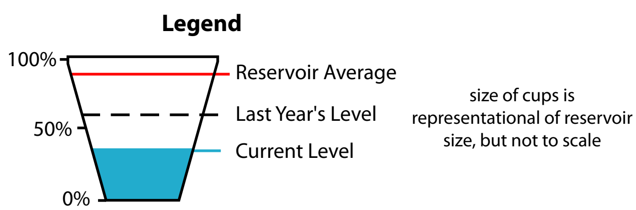
Notes:

The map gives a representation of current storage levels for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage level (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of 4 people for a year. The last column of the table list an increase or decrease in storage since last month. A line indicates no change.

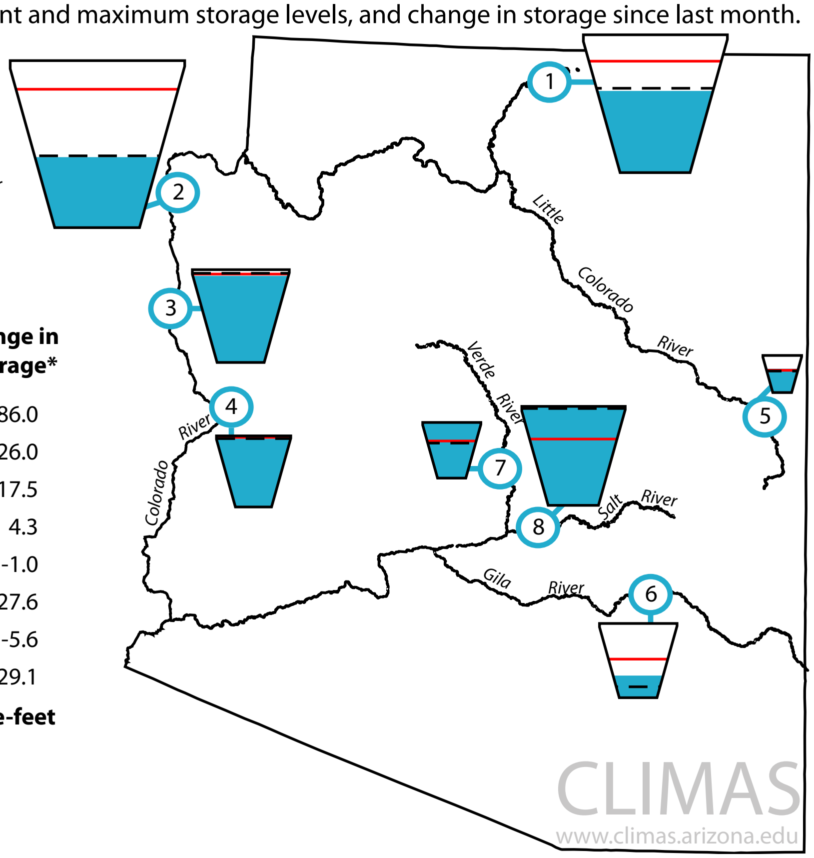
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

Figure 6. Arizona reservoir levels for May 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	59%	14,402.0	24,322.0	586.0
2. Lake Mead	42%	10,987.0	26,159.0	-326.0
3. Lake Mohave	93%	1,679.6	1,810.0	-17.5
4. Lake Havasu	96%	596.1	619.0	4.3
5. Lyman Reservoir	64%	19.1	30.0	-1.0
6. San Carlos	30%	265.8	875.0	-27.6
7. Verde River System	98%	281.0	287.4	-5.6
8. Salt River System	99%	1,996.1	2,025.8	-29.1

*** 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 5/31/10)

Source: USDA-NRCS, National Water and Climate Center

Total reservoir storage in New Mexico increased by about 222,600 acre-feet in May (Figure 7). Overall storage declined in May in the large reservoirs along the Pecos River. Storage in the Canadian River Basin and in the large west and central New Mexican reservoirs such as Navajo and Elephant Butte increased. Total reservoir storage in New Mexico is slightly lower, by about 54,000 acre-feet, compared to one year ago.

In water-related news, county and local water agencies in the Pecos River Basin (PRB) continue to protest a pipeline to deliver water from Fort Sumner to Santa Fe (*Carlsbad Current-Argus*, June 10). The proposed pipeline would import approximately 6,600 acre-feet of water from PRB private wells into Santa Fe County and the Middle Rio Grande. A key concern is that pumping water from the private wells will draw down the PRB water table.

Notes:

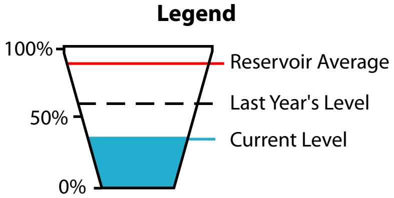
The map gives a representation of current storage levels for reservoirs in New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage level (blue fill) as a percent of total 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 May as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.

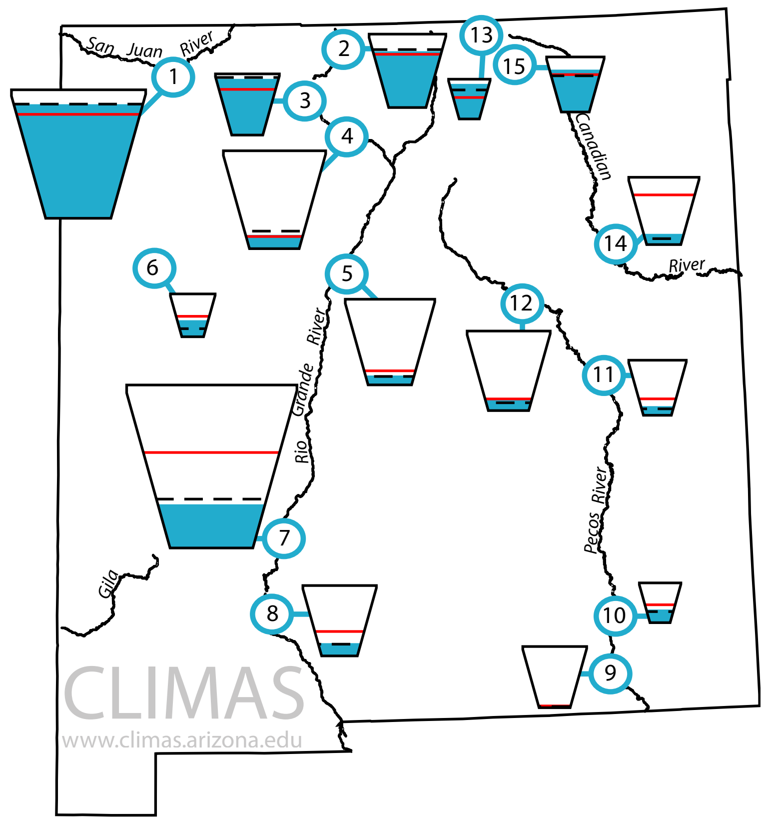
Legend



size of cups is representational of reservoir size, but not to scale

Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	89%	1,505.7	1,696.0	129.2
2. Heron	77%	307.2	400.0	34.1
3. El Vado	92%	174.7	190.3	55.2
4. Abiquiu	14%	169.9	1,192.8	-26.1
5. Cochiti	11%	51.7	491.0	-23.3
6. Bluewater	39%	15.2	38.5	3.0
7. Elephant Butte	27%	600.1	2,195.0	57.6
8. Caballo	18%	58.3	332.0	-13.2
9. Brantley	2%	23.2	1,008.2	-6.4
10. Lake Avalon	33%	1.3	4.0	0.0
11. Sumner	17%	17.2	102.0	-3.3
12. Santa Rosa	14%	61.1	438.3	4.0
13. Costilla	88%	14.1	16.0	4.0
14. Conchas	16%	39.5	254.2	3.8
15. Eagle Nest	77%	61.1	79.0	4.0

*** 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 6/17/10)
Source: Southwest Coordination Center

Dry and warm conditions across New Mexico and most of Arizona have increased the number of fires in the region during the last month. The Southwest Coordination Center (SWCC), an interagency effort to share information and help coordinate fire support, reports that 965 fires have started since January 1 (Figure 8a). The number of fires in the Southwest this year has more than doubled in the past month. Most of these fires were caused by humans rather than lightning.

In Arizona, almost 12,000 acres have burned since January 1. The largest recent fire is the Horseshoe Fire, which ignited on May 26 near the city of Portal in the Coronado National Forest. As of June 16 it had charred more than 2,740 acres (Figure 8b).

Recent conflagrations, including ther Shultz Fire, that are not reflected in Figures 8a–b are burning in the Kaibab National Forest near Flagstaff and have consumed more than 3,400 acres and are rapidly expanding.

New Mexico has seen 70,405 acres go up in flames this year. Recent fires include the South Fork Fire, which has burned more than 9,000 acres since it started on June 10 near the town of Espanola in the Santa Fe National Forest (Figure 8c). Also, the Fort Bliss 2 Fire, caused by human activity, has burned more than 3,000 acres near Las Cruces since June 15.

The warm and dry weather of the past few weeks will likely increase fire activity in the coming month. The monsoon rains will dampen fire activity and are forecast to arrive on time or slightly later than average; for southern Arizona, this means the monsoon will likely arrive in the first week of July or later, according to the National Weather Service in Tucson.

Notes:
The fires discussed here have been reported by federal, state, or tribal agencies during 2010. 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/maps/wf/swa_fire_combined.htm

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of June 16, 2010.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	492	9,338	33	2,627	525	11,965
NM	352	23,908	88	46,497	440	70,405
Total	844	33,246	121	49,124	965	82,370

Figure 8b. Arizona large fire incidents as of June 17, 2010.

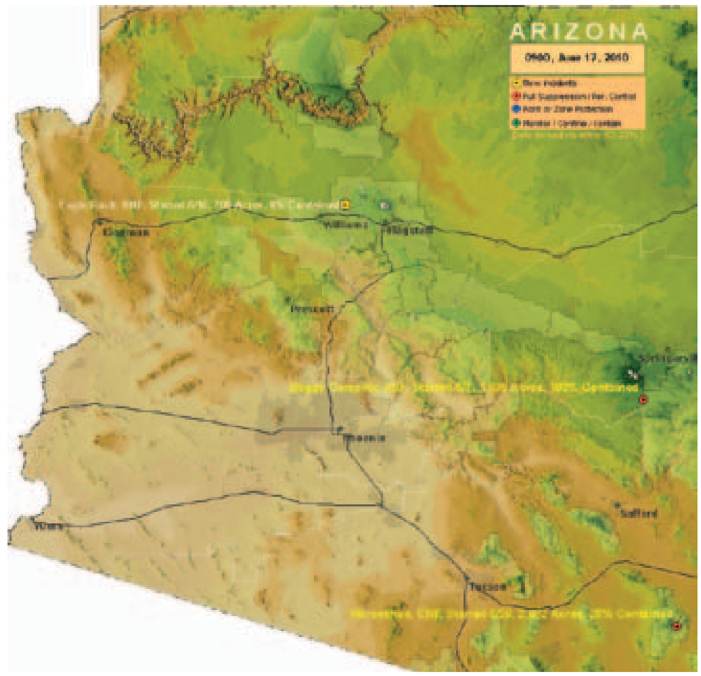
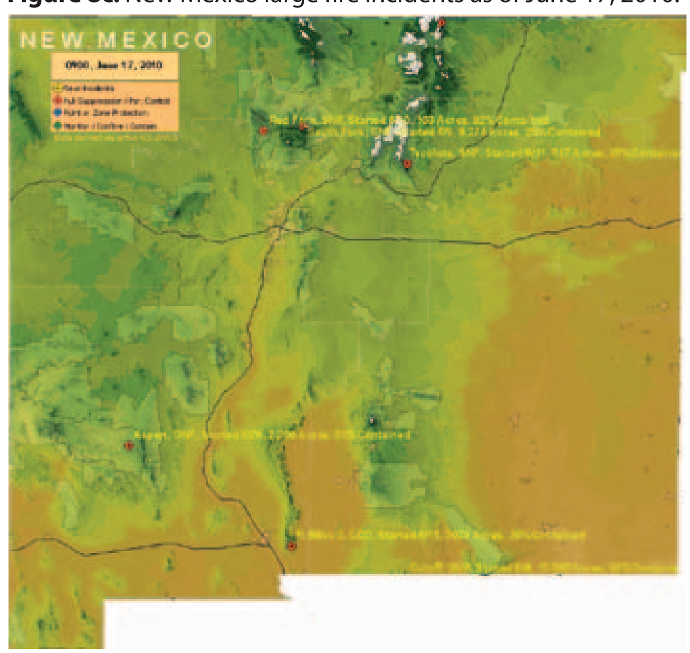


Figure 8c. New Mexico large fire incidents as of June 17, 2010.



Temperature Outlook

(July–December 2010)

Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (NOAA–CPC) long-lead temperature outlooks show an increased likelihood of above-average temperatures in the Southwest for the summer and early winter seasons (Figures 9a–d). The forecast for the monsoon season, the period between July and September, shows a significant probability that temperatures will be above average in most of Arizona and western regions of New Mexico, particularly in northwest Arizona (Figure 9a). For the three-month seasons between August and December, there is greater than a 50 percent chance that temperatures in many parts of Arizona and New Mexico will be similar to the warmest 10 years of the 1971–2000 record (Figures 9b–d). These outlooks for warmer-than-average temperatures are primarily based on the recent strong warming trends in the region for these three month periods.

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 1971–2000 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 9a. Long-lead national temperature forecast for July–September 2010.

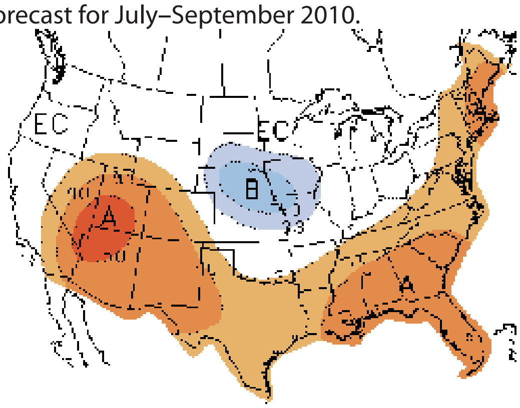
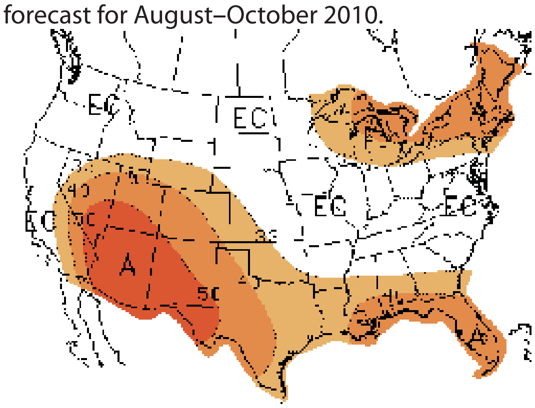


Figure 9b. Long-lead national temperature forecast for August–October 2010.



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

B=Below: 40.0–49.9%; 33.3–39.9%

Figure 9c. Long-lead national temperature forecast for September–November 2010.

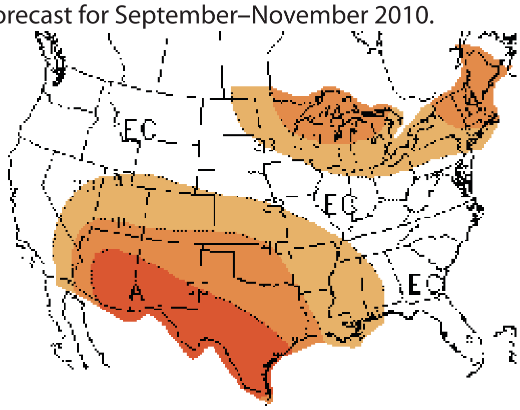
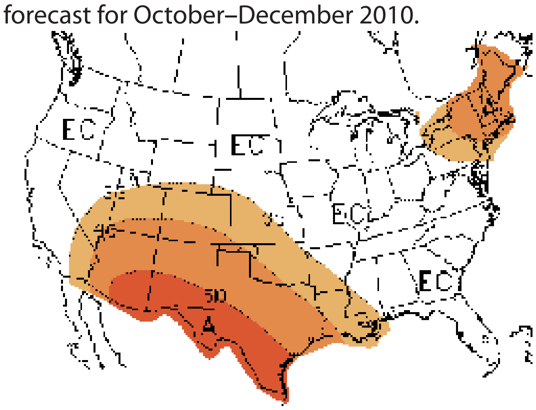


Figure 9d. Long-lead national temperature forecast for October–December 2010.



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
(July–December 2010)
Source: NOAA-Climate Prediction Center (CPC)

There are countervailing precipitation signals in the Southwest for the first half of the monsoon season. On one hand, elevated moisture conditions in the Plains states tend to delay the onset of summer rains. On the other hand, the possibility of a rapid transition to a La Niña event would favor enhanced summer rains. Because it is unclear when the Plains will dry out or if and when La Niña will take hold, the NOAA–Climate Prediction Center (NOAA–CPC) long-lead precipitation outlooks indicate equal chances of above-, near-, and below-average precipitation for the three-month summer season (Figures 10a–b). NOAA–CPC has more confidence that La Niña will develop later in the year, which tends to cause drier-than-average conditions in the Southwest during the winter. This, in conjunction with drying trends for the fall and winter seasons in the Southwest, contribute to a forecast in favor of below-average precipitation in the fall to early winter months (Figures 10c–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 1971–2000 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 10a. Long-lead national precipitation forecast for July–September 2010.

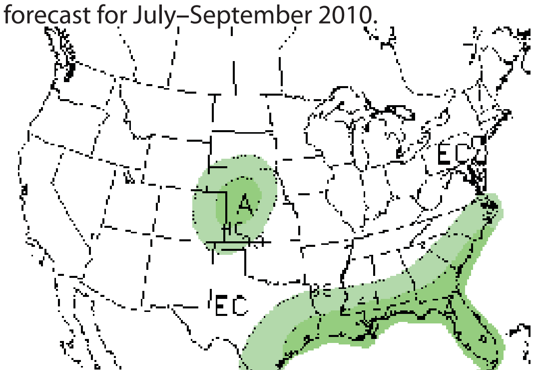
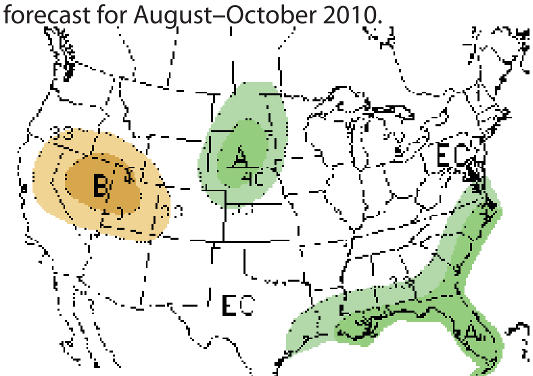


Figure 10b. Long-lead national precipitation forecast for August–October 2010.



B= Below
33.3–39.9%
40.0–49.9%

Figure 10c. Long-lead national precipitation forecast for September–November 2010.

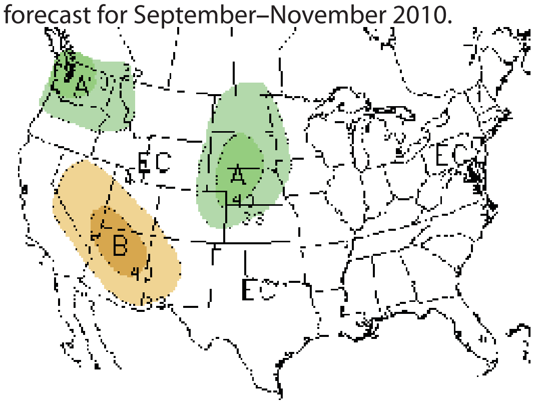
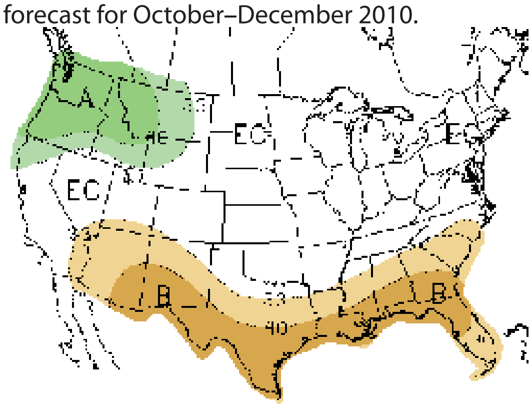


Figure 10d. Long-lead national precipitation forecast for October–December 2010.



A=Above
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
(note that this website has many graphics and June load slowly on your computer)

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

Seasonal Drought Outlook

(through September)

Source: NOAA-Climate Prediction Center (CPC)

This summary is excerpted and edited from the June 17 Seasonal Drought Outlook technical discussion produced by NOAA–Climate Prediction Center and written by forecasters A. Artusa and A. Allgood.

In the Southwest, very little rain has fallen in the northern parts of the Southwest that are currently classified with moderate to severe drought. Changes to these conditions will depend on the character of the monsoon. Current forecasts issued by the NOAA–Climate Predictions Center (NOAA–CPC), however, call for equal chances that precipitation will be below-, near-, or above average. Uncertainty in the forecast is created by countervailing conditions. On the one hand, a rapid transition to a La Niña event, which may or may not occur, could enhance monsoon rains. On the other hand, the current wet conditions in the Plains states favor a delay to the onset of the monsoon. Despite these conditions, the most likely scenario would favor some improvement across the desert Southwest (Figure 11). NOAA–CPC has moderate confidence in the forecast for some improvement in the northern regions of the Southwest.

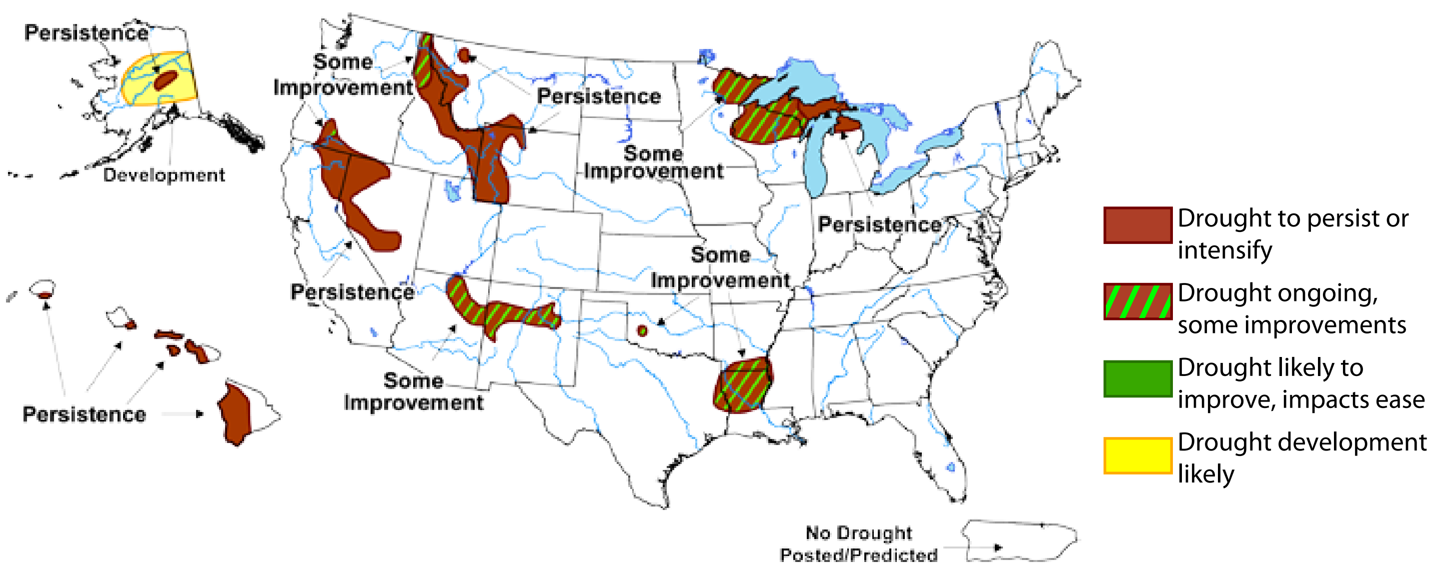
Elsewhere, in the west-central Great Basin, only small amounts of rain have fallen in recent weeks. Because of this, coupled with the summer season being historically hot and dry, drought conditions are expected to persist for nearly all of this area. NOAA–CPC has high confidence in this forecast.

In the northern and central Rockies, abnormally wet conditions have prevailed during the past few weeks and water supply measured at stream gauges generally indicate average streamflows. However, experimental soil moisture forecasts support a slow drying trend over the next few months, and August and September are normally dry. As a result, drought in most of this region is predicted to persist. NOAA–CPC has moderate confidence in this forecast

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 11. Seasonal drought outlook through September (released June 17).



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

(July–September 2010)

Sources: National Interagency Coordination Center, Southwest Coordination Center

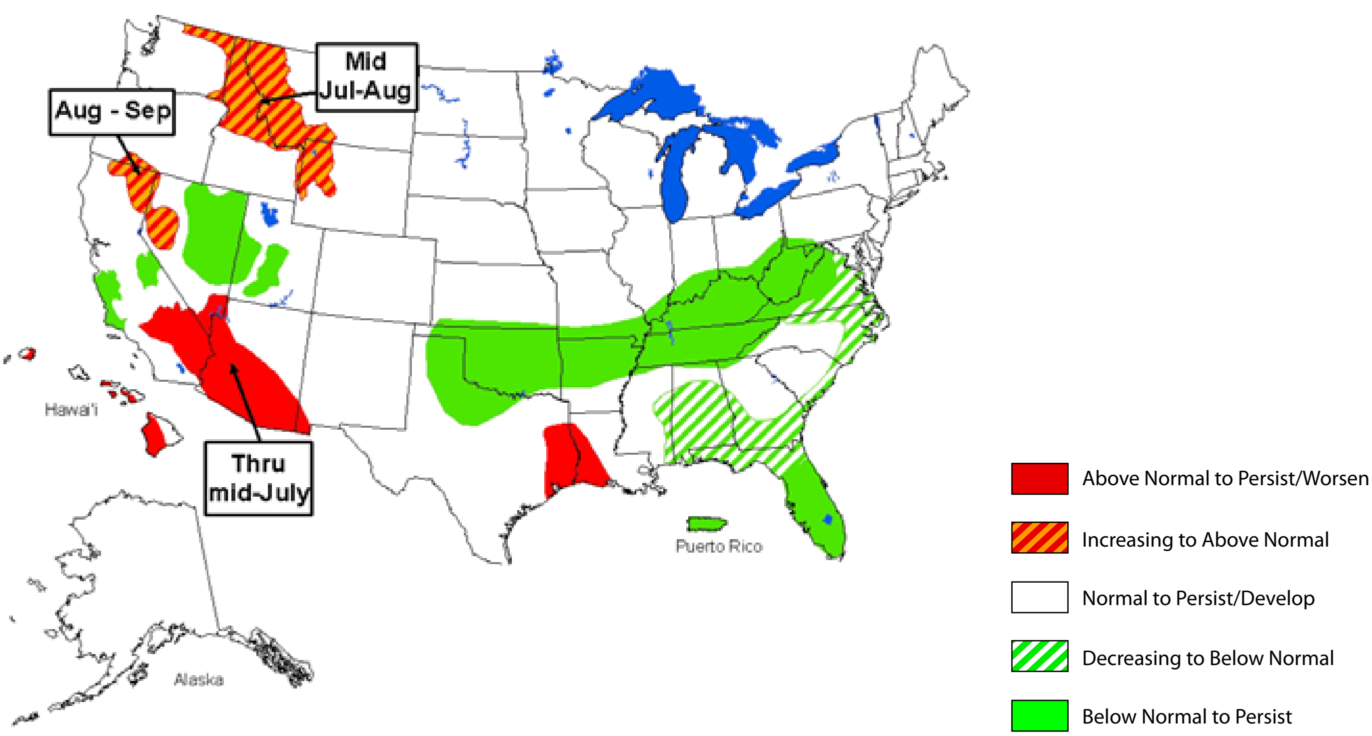
The southern and western parts of Arizona and the southwestern corner of New Mexico show above-average significant fire potential for the mid-July to September period, according to the Southwest Coordination Center (SWCC; Figure 12). The rest of the Southwest will continue to be at normal levels of significant fire potential. Significant fire potential means that it is likely that the suppression of fire will require resources from outside the area in which the fire originates. This time of year often sees increased fire activity because of warm temperatures and scant rains. Currently, the 10-hour fuel moisture index, which represents the moisture content of fine fuels such as grasses, is between 1 and 4 percent for most of the region, except for southeastern New Mexico, according to the U.S. Forest Service. As the monsoon season begins to develop, westward surges of moisture in late June are often accompanied by lightning strikes, which could easily ignite fine fuels that flourished in response to the region's copious winter precipitation. This could increase fire activity in Arizona, according to SWCC.

Once the summer monsoon begins, likely in early to mid-July, fire potential will drop to normal levels. Temperatures for the summer are forecast to be above normal across most of the region, and precipitation is forecast to have equal chances of above-, below-, or near-average levels, according to the NOAA–Climate Prediction Center. The driest conditions are expected to occur in the southeastern part of the region, and the wettest conditions across the northern and western portions.

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 12. National wildland fire potential for fires greater than 100 acres (valid July–September 2010).



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

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

The warm sea surface temperatures (SSTs) present across the equatorial Pacific Ocean associated with this past winter's El Niño have recently and quickly dissipated at first into neutral conditions and lately, during the past several weeks, into borderline La Niña conditions. The NOAA–Climate Prediction Center has issued a La Niña Watch, which means that conditions are favorable for an event to form within the next three months. Southern Oscillation Index (SOI) values were positive again in May, possibly indicating that the atmosphere is settling back down after the impact of El Niño conditions (Figure 13a). A large area of cooler-than-average water lies just below the surface across the equatorial Pacific. This water is expected to break through to the surface over the next couple of months, strengthening the emerging La Niña event. Until this time, atmospheric connections will most likely remain weak but could be established quickly depending on how fast and how intense La Niña conditions develop over the next several months.

Given that borderline La Niña conditions are present across the Pacific and the expectation that the cooler-than-average water below the surface is expected to surface over the summer season, forecast models have shifted dramatically in favor of a La Niña event developing this summer and persisting through next winter. The official forecast from the International Research Institute for Climate and Society (IRI) has increased the chance of La Niña conditions developing during the June–August period from 42 percent last month to 58 percent this month (Figure 13b). The IRI indicates a 41 percent chance for ENSO-neutral conditions to persist during this period and only a 1 percent chance of El Niño conditions returning. A La Niña event becomes even more probable later this summer and fall, with the chance rising to 62 percent.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from June 1980 through December 2009. 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, the 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 13a. The standardized values of the Southern Oscillation Index from January 1980–April 2010. 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).

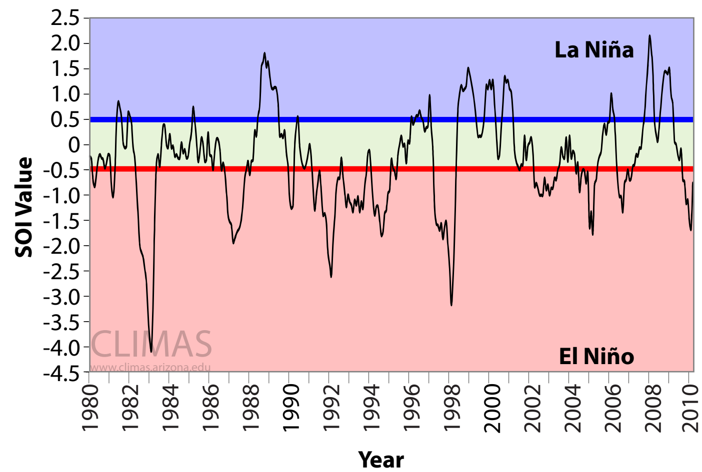
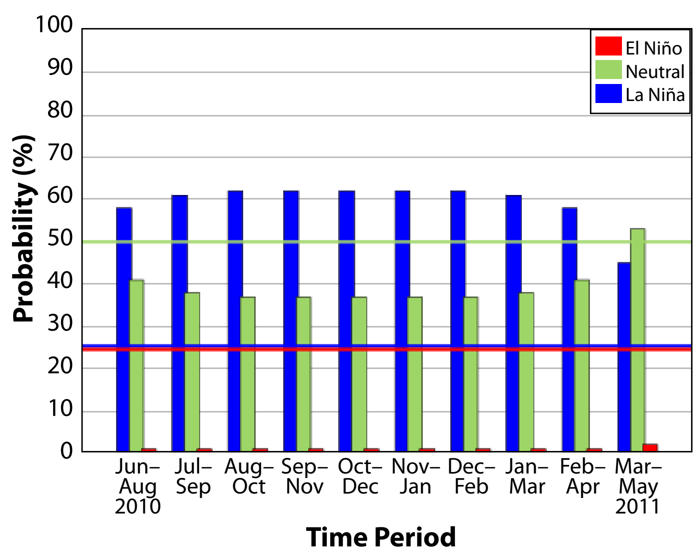


Figure 13b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released June 17). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(July–December 2010)

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 July–September to forecasts issued in June for the same period suggest that in most parts of Arizona forecasts have been more accurate than an equal chances forecast, while forecasts have been less accurate than equal chances in New Mexico (Figure 14a). Forecast skill—a measure of the accuracy of the forecast—is highest in the southern and western regions of Arizona. Skill for the two-month lead time forecasts for the August–October period has only been more accurate than equal chances in Arizona outside the Four Corners region (Figure 14b). The three- and four-month lead time forecasts historically have been more accurate than equal chances in the southern regions of the Southwest, suggesting that forecasts for these periods are more likely to occur (Figures 14c–d). While bluish hues denote more accurate forecasts, 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 14a. RPSS for July–September 2010.

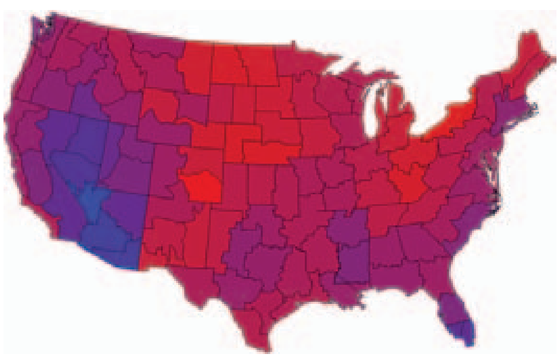


Figure 14b. RPSS for August–October 2010.

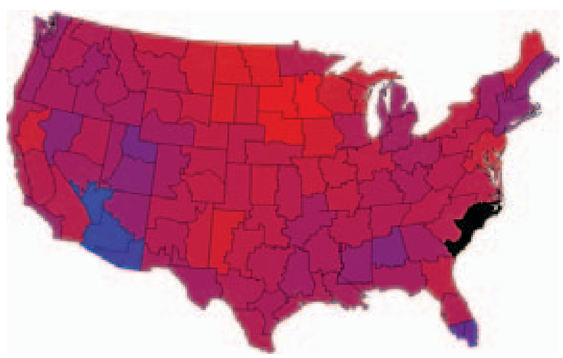


Figure 14c. RPSS for September–November 2010.

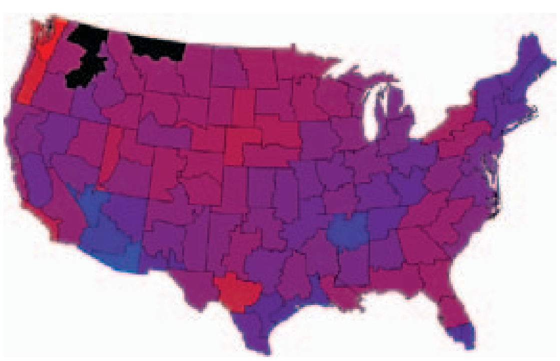
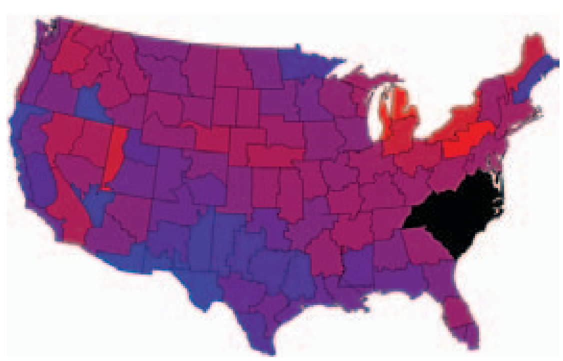
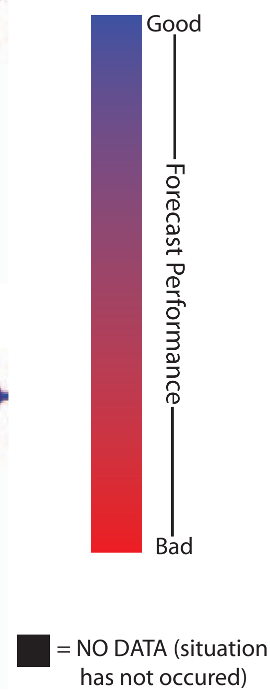


Figure 14d. RPSS for October–December 2010.





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/forecasts/articles/FET_Nov2005.pdf

Precipitation Verification

(July–December 2010)

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 July–September and August–November to forecasts issued in June for the same period suggest that forecasts have been slightly worse than forecasting equal chances (i.e., 33 percent chance that rain will be above-, below-, or near-average) for most of Arizona and New Mexico (Figures 15a–b). The one notable exception is in southeastern Arizona where forecast skill—a measure of the accuracy of the forecast—has been better than equal chances during the August–November period (Figure 15b). These periods coincide with the monsoon season, which is often difficult to project. As the year progresses into the fall and early winter, forecast skill has improved for most areas in Arizona and New Mexico, particularly for the October–December period (Figures 15c–d). Bluish hues suggest that NOAA–CPC historical forecasts have been more accurate than equal chances. However, 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 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 15a. RPSS for July–September 2010.

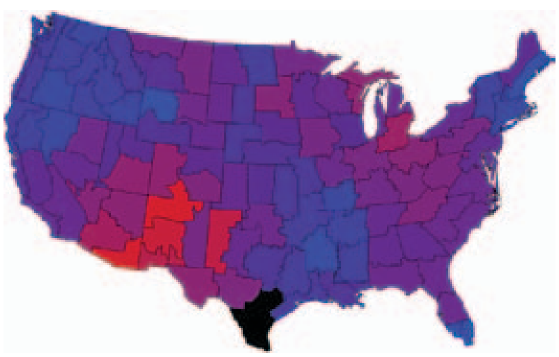


Figure 15b. RPSS for August–October 2010.

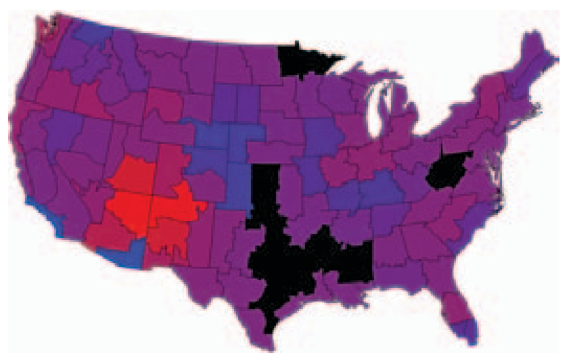


Figure 15c. RPSS for September–November 2010.

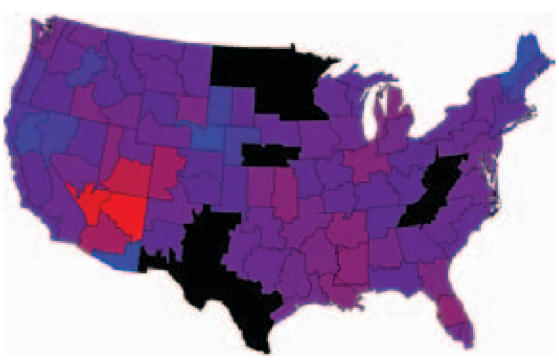
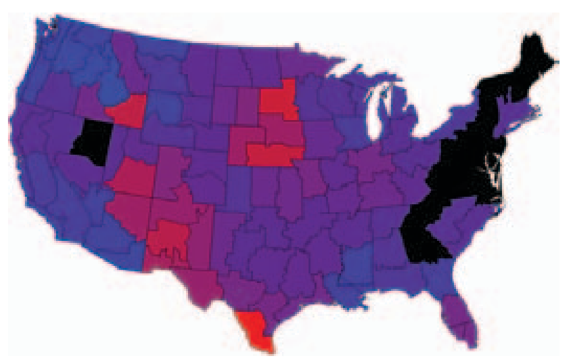


Figure 15d. RPSS for October–December 2010.



= NO DATA (situation has not occured)

On the Web:

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