April 24, 2013

# Southwest Climate Outlook

Vol. 12 Issue 4

Chaparral vegetation, found mostly in California and Baja California, has adapted to drought. In the King Range National Conservation Area in northern California, the evening's last light reveals a dead-looking landscape, although these trees have actually just dropped leaves to reduce water loss during the summer dry season. Photo: Benjamin Blonder.

Would you like to have your 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...

# April Climate Summary

**Drought:** Severe and extreme drought covers 43 and 94 percent of Arizona and New Mexico, respectively—an increase in the extent of drought in both states in the past month.

**Temperature:** Temperatures have been 1–5 degrees Fahrenheit above average in most of Arizona and New Mexico, with even warmer temperatures in southwest New Mexico.

**Precipitation:** Most of Arizona and New Mexico have experienced precipitation deficits ranging from 0.25 to 1.0 inches in the last 30 days, and much of both states has experienced less than 70 percent of average precipitation.

**ENSO:** ENSO-neutral conditions still hold sway in the Pacific Ocean and are expected to remain through the summer.

**Climate Forecasts:** Warming trends and other indicators suggest warmer-than-average conditions are in store for the May–July period in the Southwest; forecasts also call for below-average precipitation in northern Arizona and in all of New Mexico, but with higher uncertainty.

**The Bottom Line:** Precipitation since January 1 in Arizona and New Mexico has been a case of the good, the bad, and the ugly. The Mogollon Rim region of Arizona has benefitted from near- to above-average rain and snow and drought conditions there have improved, making it the only region in all of Arizona and New Mexico without at least abnormally dry conditions. Precipitation outside the Mogollon Rim region, however, has been largely less than 70 percent of average. New Mexico has fared the worst. Precipitation has measured less than 50 percent of average in most areas, and extreme drought conditions have expanded from 12 percent on November 6 to about 59 percent on April 18. For both states, the November–March period marks the third consecutive winter in which total precipitation was below average. Conditions this winter prompted fire managers to expect elevated chances of significant fire risks in May. The Upper Colorado River Basin and upper Rio Grande also experienced dry conditions this winter, resulting in below-average streamflow projections. For example, streamflows for the Colorado River are likely to be around 34 percent of average for the April–July period. If this projection comes to pass, it will mark the fourth lowest flow since Lake Powell became operational. The third lowest was recorded last year. Streamflow forecasts for the Rio Grande call for less than 33 percent of average. Dry conditions will be the norm until the monsoon begins, usually in late June or early July. Without the presence of a strong El Niño or La Niña—neutral conditions currently hold sway—forecasting the monsoon's onset likely will be no better than flipping a coin. However, temperature forecasts for the early summer call for increased chances for warmer-than-average conditions, based in part on trends in recent decades.

## RCPs: The New Drivers of Climate Models

Most of us have seen projections of future temperature changes, usually in the form of a red-colored map conveying widespread global warming. These projections are always tied to seemingly inane codes like A1B or A1FI. Odd acronyms aside, these codes are key for interpreting climate model results. They are climate narratives that represent different amounts of energy within the climate system, which results from unique evolutions of greenhouse gases in the atmosphere through time. As the newest generation of climate models churns out updated projections, get ready for a new set of codes called Representative Concentration Pathways, or RCPs.

There are four RCPs: 2.6, 4.5, 6 and 8.5. The numbers correspond to the added watts per square meter projected for 2100, predominantly as a consequence of increased greenhouse gases (GHGs) in the atmosphere. RCP 8.5, for example, corresponds to GHG concentrations greater than 1,370 parts per million (ppm), while RCP 2.6 has around 490 ppm. We are currently at 397 ppm. Together, these four pathways bracket plausible GHG emission trajectories published in the scientific literature. The new RCPs replace those used in the past, which were last updated in 2000, to account for advances in scientific understanding. Also, the new RCPs enable the exploration of different climate policies that correspond to different RCPs, which help evaluate the costs and benefits of long-term climate goals.

Read more at (free access): http://link.springer.com/article/10.1007/s10584-011-0148-z



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**Gigi Owen**
*CLIMAS Assistant Staff Scientist*

**Nancy J. Selover**
*Arizona State Climatologist*

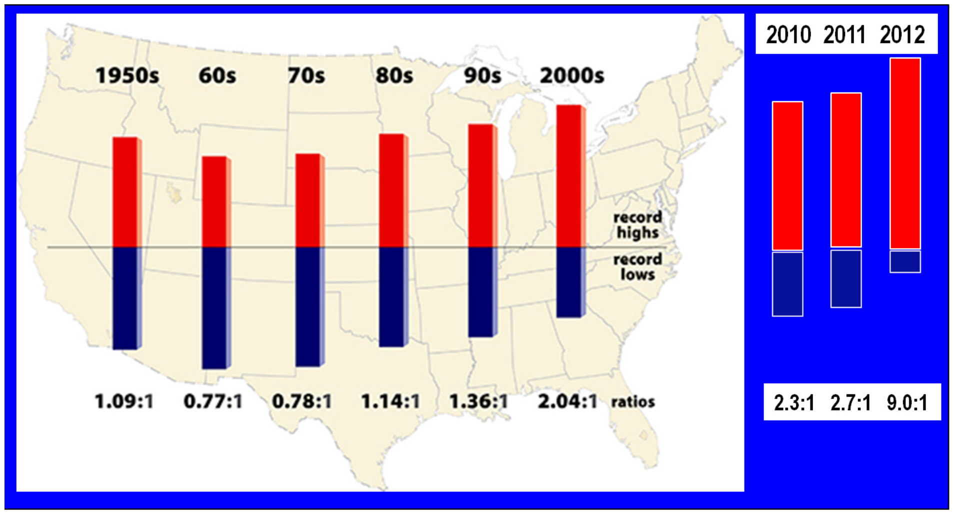
**Jessica Swetish**
*CLIMAS Publications Assistant*

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.

# The New Normal

by Kevin Trenberth

*The following commentary is the speech delivered by Kevin Trenberth, director of the National Center for Atmospheric Research (NCAR) Climate Analysis Section, at the NOAA 37th Climate Diagnostics and Prediction Workshop in Fort Collins convened October 22–25, 2012. This article was originally published in the Global Energy and Water Exchanges Newsletter in February 2013.*




The ratio of record daily highs (red) to record daily lows (blue) at about 1,800 weather stations in the 48 contiguous United States from January 1950 to September 2009 (Meehl et al., GRL, 2009). Updated at right using NOAA data through June 2012; from climatecommunication.org

The answers I frequently get to the question "What is climate?" are commonly along the lines of "the average weather" or "climate is what we expect and weather is what we get." Firstly, those are statistical statements, and secondly, an average is obviously dependent upon the time of the average. If it is a very "long-term" average to avoid interannual variability, then by definition there is no climate change. This conundrum was recognized back in the 1970s when it was proposed that we speak about "climate states." This perhaps relates to what is now commonly known as a "base period." The classic base period is a 30-year period (as defined by the World Meteorological Organization) that traditionally gets updated. Hence we went from the 1961–1990 normal to the 1971–2000 normal, and now 1981–2010 is the "New Normal."

For the U.S., the new normal is about 0.3°C warmer than the previous normal in minimum temperature and 0.1°C for maximum temperature overall. Globally, the new normal for sea-surface temperatures (SSTs) is over 0.3°C warmer in many places, although some regions have cooled. We must remember that the new normal vs. the old is actually the 2000s minus the 1970s divided by three. So, an overall change of about 0.2°C is actually a warming between those decades of 0.6°C.

Too little attention has been paid to the fact that the normals are now changing a lot (i.e., climate change is happening). When we speak about how anomalous the recent climate has been, we often fail to factor in the differences associated with the new normal. This clearly colors perceptions about the degree to which things are indeed anomalous or abnormal.

Given all of these considerations, how then can we talk about climate change in a more enlightened way? We have "climate dynamics" as a growing field, and the climate is indeed continually varying and changing. Therefore, I suggest that simply using statistics is not good enough. Instead I suggest that we think about and define climate in a different way, and we do this from a physical standpoint.

"Weather" happens in the atmosphere. Most of it is internal to the atmosphere and arises from instabilities, whether it is convective instability that gives rise to clouds and thunderstorms, or baroclinic instability that leads to major cyclones and anticyclones, cold and warm fronts, and all the associated day-to-day weather.

"Climate" happens when the atmosphere interacts non-trivially with the rest of the climate system and externalities. The climate system consists not just of the atmosphere, but also the oceans, land, land-surface water, and cryosphere. The externalities include the orbit of the Earth around the sun, changes in the sun, changes in the Earth (e.g., continental drift), changes in the composition of the atmosphere, and anthropogenic effects. The diurnal cycle is a climate phenomenon and so is the annual cycle of the seasons. The El Niño–Southern Oscillation (ENSO) is a climate phenomenon as it is inherently a coupled phenomenon.

The atmosphere is always being conditioned by climate influences. Hurricanes are treated as a weather phenomenon, but it is increasingly clear that the cold wake churned up behind a hurricane through strong winds, causing mixing and huge surface fluxes that produce evaporative cooling of the ocean, play a vital role in the hurricane's subsequent development and track. Therefore, is a hurricane really a climate phenomenon or a weather phenomenon? What about the Madden-Julian Oscillation?

All storms interact with the Earth's surface, but for years we have run atmospheric models with specified fixed SSTs for numerical weather prediction (NWP). This means that we are indeed dealing with weather. However, increasingly the evidence suggests that this is actually a limitation in NWP and that having the

*continued on page 4*

# The New Normal, continued

SSTs respond and feed back into weather systems is essential, especially for second week weather forecasts and those beyond.

**Issues of attribution and how we talk about it**

All too often we hear meteorologists say, "it was due to the jet stream," "it was a thunderstorm that stalled," "it was the blocking anticyclone," or "it was tropical storm Irene," and so on. The explanation is given in terms of the weather phenomenon. That is, in fact, not an explanation or attribution at all! Instead, it is a description of the other aspects of the event: a more complete description of the phenomenon. The flood was due to the storm and the drought was due to the blocking anticyclone, etc.

As an explanation, the question should be, "why did that weather phenomenon behave the way it did?" In particular, what influences external to the atmosphere were playing a role and what climate factors were in play? Why did the blocking anticyclone last as long as it did and why was it so intense? Why was there enough rain in this weather system to cause flooding? As soon as we ask these different kinds of questions, we can talk sensibly about attribution and causes through the external influences on the weather. The main cause we can point to is almost always anomalous SSTs and the predominant influence of ENSO on anomalous weather patterns.

For example, we can say that the reason we had "snowmaggedon" in Washington, DC in 2010 is: (1) we had winter and there was plenty of cold continental air; (2) there was a storm in the right place; and (3) the unusually high SSTs in the tropical Atlantic Ocean (1.5°C above normal) led to an exceptional amount of moisture flowing into the storm, which resulted in very large snow amounts. It is this last part that then relates to anomalous external influences on the atmosphere.

**Human effects on climate and weather**

Without doubt, the SSTs in the Atlantic Ocean were warmer by about 0.5°C due to human influences, and so by itself that led to a 4 percent increase in moisture flowing into the storm. There is a lot of natural variability, and the Atlantic Multidecadal Oscillation and other things are in play, at times adding to and at times subtracting from the human component. Human-induced climate change occurs on long timescales, and 20 years is a reasonable estimate for noticeable significant changes. Once we realize that, it becomes clear that the proper way to think about this is that there is an underlying new normal of a warmer background that the shorter-term variability is superposed upon. Of course, this is linear thinking and some effects are clearly nonlinear, but it works quite well and clears the mind on how to talk about and think of human influences.

How big is the human component? The natural flow of energy through the climate system is equivalent to about 240 $Wm^{-2}$. The carbon dioxide radiative forcing is about 1.6, greenhouse gas forcing is about 3, and net forcing with aerosols is about 1.6 $Wm^{-2}$. Water vapor feedback roughly doubles that, so the net value is 1–2 percent of the natural flow. Of course the system has responded and the water vapor feedback is part of that response, so that the net imbalance in energy at the top of the atmosphere is closer to 1 $Wm^{-2}$ or less than 1 percent. It is small on a day-to-day basis and negligible, but it is always in one direction. It builds up in time and accumulates; hence the main effect on climate and weather is not the instantaneous effect but the changed environment in which all weather systems are operating in the "new normal." In particular, the main memory is in the oceans, and the oceans have warmed by 0.5°C since the 1970s and the atmosphere above the oceans is warmer and moister as a result. On average the water vapor has increased by 4 percent since the 1970s over the oceans.

Since all storms reach out about four times the radius of their precipitating area to grab moisture and bring it into the storm, most storms are influenced by ocean changes. The storms are bigger in winter and a storm dumping snow in the Ohio River valley is bringing in moisture from 3500 km away from the Gulf of Mexico and the subtropical Atlantic. In summer the storms are smaller and there is greater dependence on land moisture and recycling.

What does the science community say? "You can't blame a single event on climate change." As a result the media loses interest and the public immediately turns off. What nonsense! When we break records like we did in 2012 in the U.S., at a rate of nine hot records to one cold one for the first 6 months, it is a clear signal of climate change. Just because we zoom in on one of those records or events doesn't make it otherwise. The odds are that most of these records would not have occurred without climate change! It won't be the same this year, but the odds are that similar events will occur somewhere (currently it seems in Australia). We are experiencing climate change in action.

We can talk about it in terms of changing odds, as many others have done. The odds have increased for these kinds of extremes to occur. But we can also talk about it in physical terms. In particular, we have a new normal! The environment in which all weather events occur is different than it used to be. All storms, without exception, are different. Even if 95 percent of them look just like the ones we used to have, they are not the same.

In that respect, another way of looking at it is to regard the new normal as a shift in the seasons. The amplitude of the annual cycle of SSTs is only 2°C in the Southern Hemisphere and up to 5°C in the Northern Hemisphere. So a 0.6°C increase is like moving the seasons by 1–3 weeks toward summer. The resulting weather is familiar but it occurs at a somewhat different time of year. In 2012 we had June temperatures in March in the U.S.! This means that we may be missing the core winter and in summer we venture into unknown territory.

*This commentary is intended to provide food for thought and encourage readers to think seriously about how to better communicate these issues of changing climate and changing risk of extremes with climate change.*

# Temperature (through 4/17/13)

**Data Source: High Plains Regional Climate Center**

Since the start of the 2013 water year on October 1, temperatures have reflected elevation differences, with the warmest conditions occurring in the southwest deserts and the coolest conditions in the higher elevations of Arizona and New Mexico (*Figure 1a*). The coldest temperatures were reported in the Sangre de Cristo Mountains of northern New Mexico. Across most of Arizona and western New Mexico, temperatures have been within 1 degree Fahrenheit of average (*Figure 1b*). This is the typical winter temperature pattern, even though this winter saw high month-to-month variability. For example, while warmer-than-average conditions prevailed in December, March, and the first half of April, temperatures during January and February were below average.

During the past 30 days, only one significant storm system passed through the Southwest, and it was a relatively warm system. Consequently, temperatures were near average in New Mexico and 2–4 degrees F warmer than average for most of Arizona (*Figures 1c–d*). The warmer-than-average spring, however, does not necessarily portend a warmer-than-average summer. Summer temperatures are moderated by precipitation, and it is too early to project how the monsoon will play out. Nonetheless, warming trends in recent decades suggest elevated chances for above-average temperatures this summer if the monsoon is not vigorous (see page 13).

## Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2012, we are in the 2013 water 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 1981–2010. 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 2013 (October 1 through April 17) average temperature.

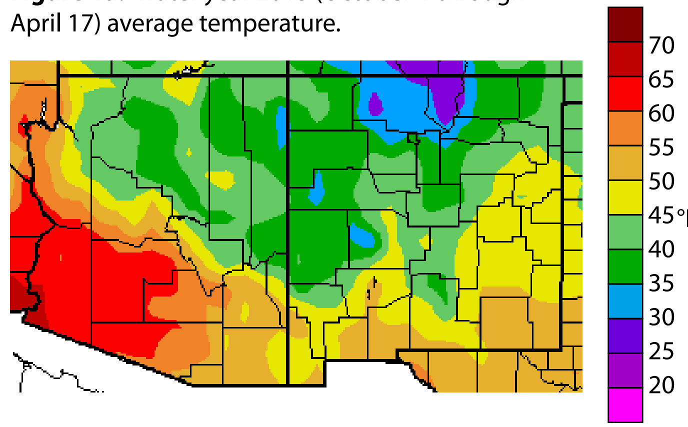



**Figure 1b.** Water year 2013 (October 1 through April 17) departure from average temperature.

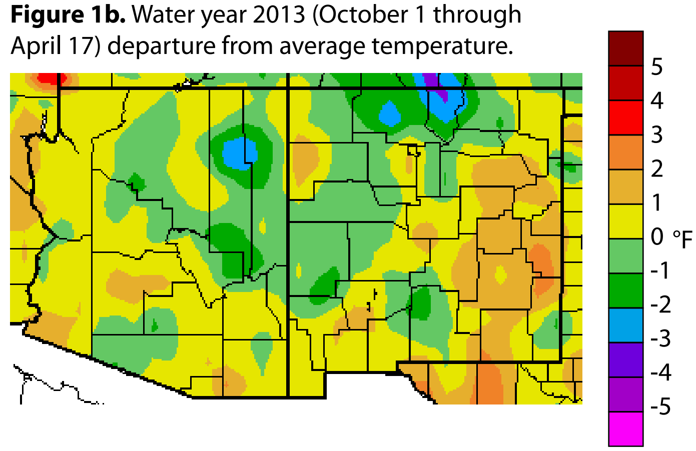



**Figure 1c.** Previous 30 days (March 19–April 17) departure from average temperature (interpolated).

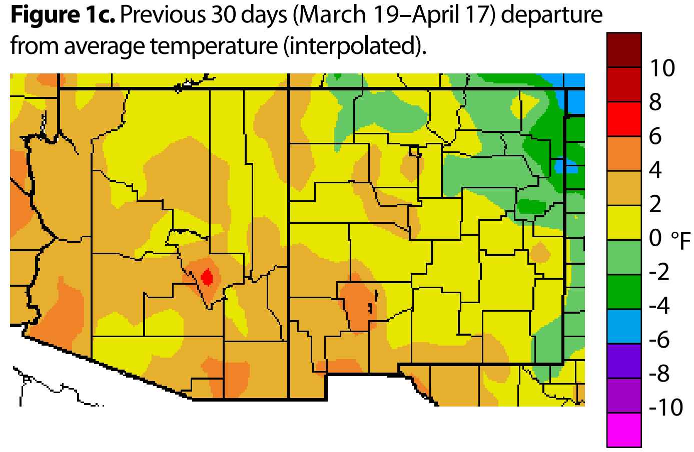
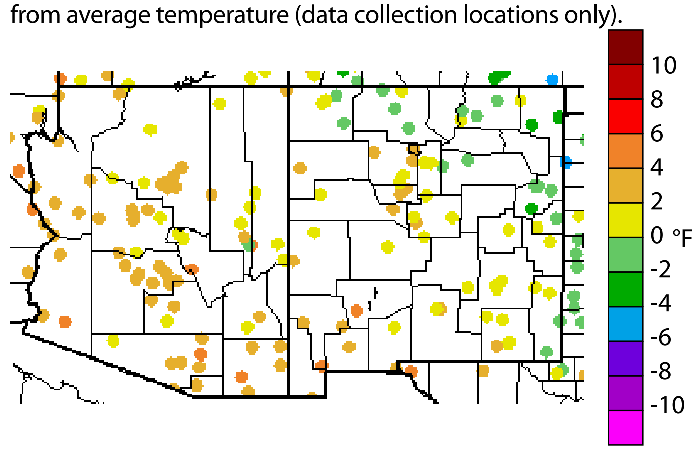



**Figure 1d.** Previous 30 days (March 19–April 17) departure from average temperature (data collection locations only).



# Precipitation (through 4/17/13)

**Data Source: High Plains Regional Climate Center**

The 2013 water year, which began on October 1, has been extremely dry in the Southwest, particularly across New Mexico, where precipitation has been less than 50 percent of average. Numerous other areas have received less than 25 percent of average (*Figures 2a–b*). Arizona has fared slightly better, with rain and snow largely amounting to less 70 percent of average. Also, there have been some wetter-than-average regions in Arizona, but they have been very localized in Gila County. Much of the rain and snowfall deficits occurred early in the water year when winter storms were few and far between. The storms that did waft over Arizona frequently bypassed New Mexico.

In the past 30 days, only one significant storm passed over the region, and it dropped most of its precipitation on the Mogollon Rim and the Colorado Plateau of Arizona and New Mexico (*Figures 2c–d*). Eastern New Mexico and western Arizona received less than 2 percent of average precipitation this past month. The path of storm systems continues to remain north of the two states. Even though the past 30 days have been drier than average in the Southwest, this period is historically dry, and scant precipitation translated into precipitation deficits of less than 1 inch in most of the Southwest. Also, recent storms blanketed parts of the Upper Colorado River Basin in snow, which will help boost spring streamflows slightly.

**Figure 2a.** Water year 2013 (October 1 through April 17) percent of average precipitation (interpolated).

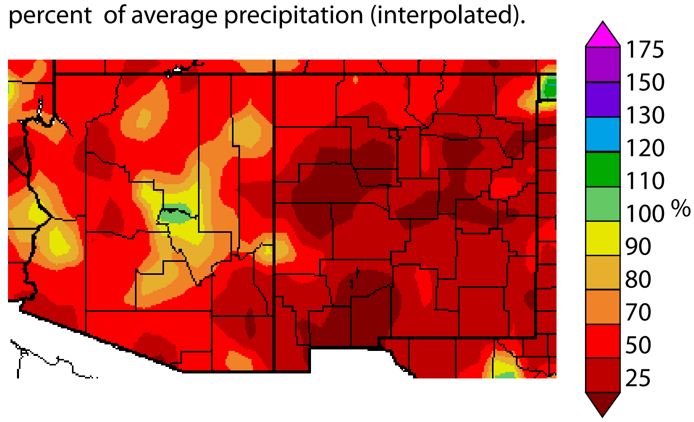



**Figure 2b.** Water year 2013 (October 1 through April 17) percent of average precipitation (data collection locations only).

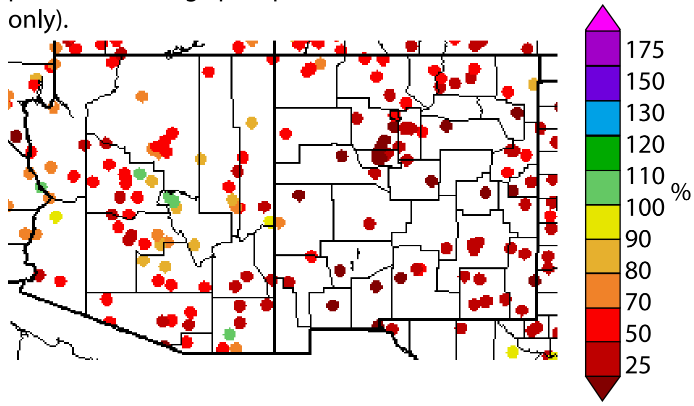



**Figure 2c.** Previous 30 days (March 19–April 17) percent of average precipitation (interpolated).

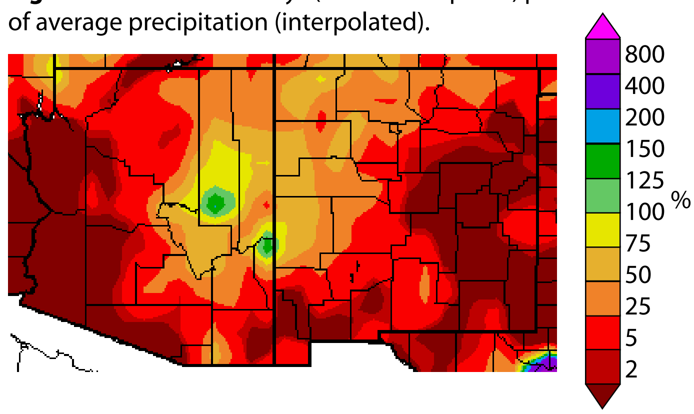
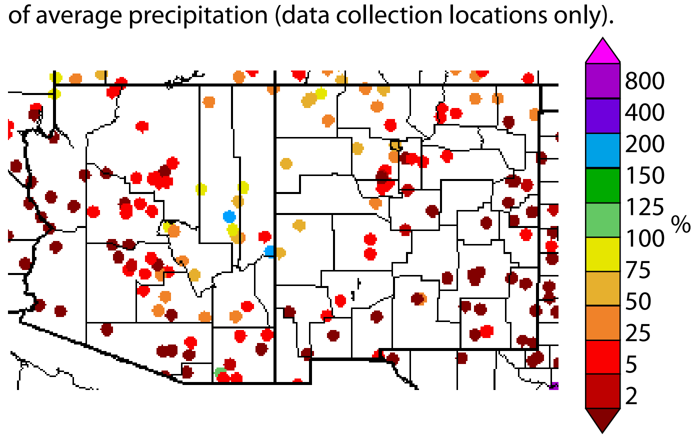



**Figure 2d.** Previous 30 days (March 19–April 17) percent of average precipitation (data collection locations only).




## Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2012, we are in the 2013 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 1981–2010. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100.

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

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

## On the Web:

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

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

# U.S. Drought Monitor (data through 4/16/13)

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

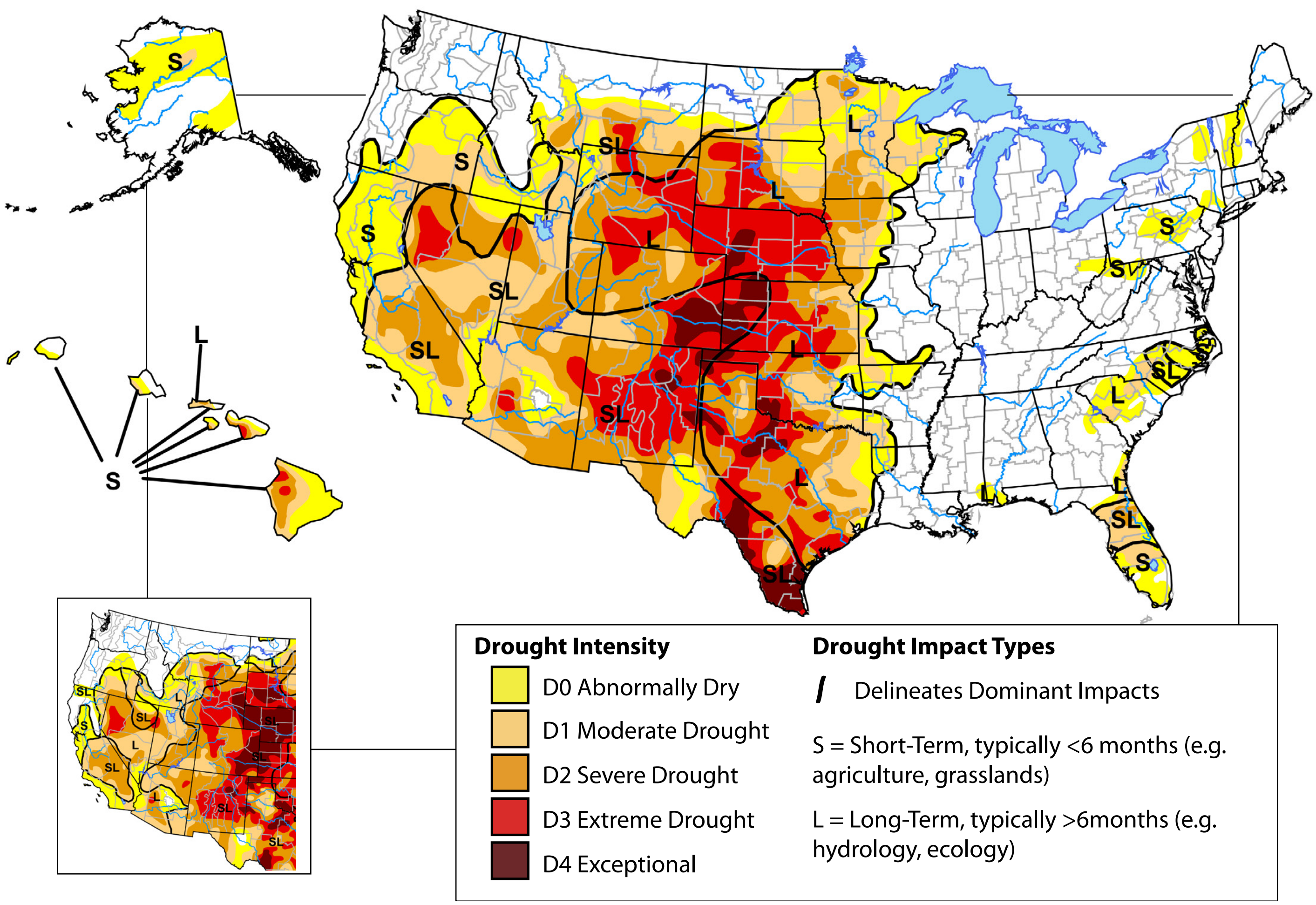
Several late winter storms moved through the intermountain West over the past month, bringing much-needed snow to high elevation areas. This helped improve short-term drought conditions across parts of Utah, Colorado, and Wyoming, where extreme drought conditions persisted for much of the winter. Currently, moderate or more severe drought covers 64 percent of the 11 western continental states (*Figure 3*). The total area classified with moderate, severe, and extreme drought has remained relatively constant for 11 consecutive months, although the spatial patterns have changed. In the West, the most severe drought conditions are in New Mexico, Colorado, and Wyoming. Drought conditions expanded and intensified south of the storm track in western California and across parts of Arizona and New Mexico, where precipitation deficits continue to mount from a relatively dry winter. Elsewhere, average to above-average winter precipitation has kept the Northwest and northern Rockies drought-free, while moderate to severe drought generally has lingered in much of the rest of the western U.S. since the fall.

## 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.

**Figure 3.** Drought Monitor data through April 16, 2013 (full size), and March 19, 2013 (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 4/16/13)

**Data Source: U.S. Drought Monitor**

Most of Arizona experienced above-average temperatures and below-average precipitation in the past month (see pages 5 and 6). A cold winter storm wafted through the Southwest in early April, dropping rain and snow on parts of central Arizona along the Mogollon Rim, but the rest of the state was left largely dry. As a result of recent dry weather and precipitation deficits that have been mounting through the winter, short-term drought conditions expanded and intensified across southeast Arizona in the last month. Severe drought conditions have replaced moderate drought across all of Cochise County and much of Graham and Greenlee counties, according to the April 16 U.S. Drought Monitor (*Figures 4a–b*). In these regions, winter precipitation totals are between 25 and 50 percent of average, exacerbating even longer-term deficits that have been accumulating over the past three years. Overall, moderate drought covers about 39 percent of Arizona and more than 44 percent of the state is classified with severe or extreme drought. Last month, either severe or extreme drought covered 30 percent of Arizona. The central Mogollon Rim area continues to be drought-free, however, drought forecasts for coming months indicate that drought may develop there (see page 15).

**Figure 4a.** Arizona drought map based on data through April 16.

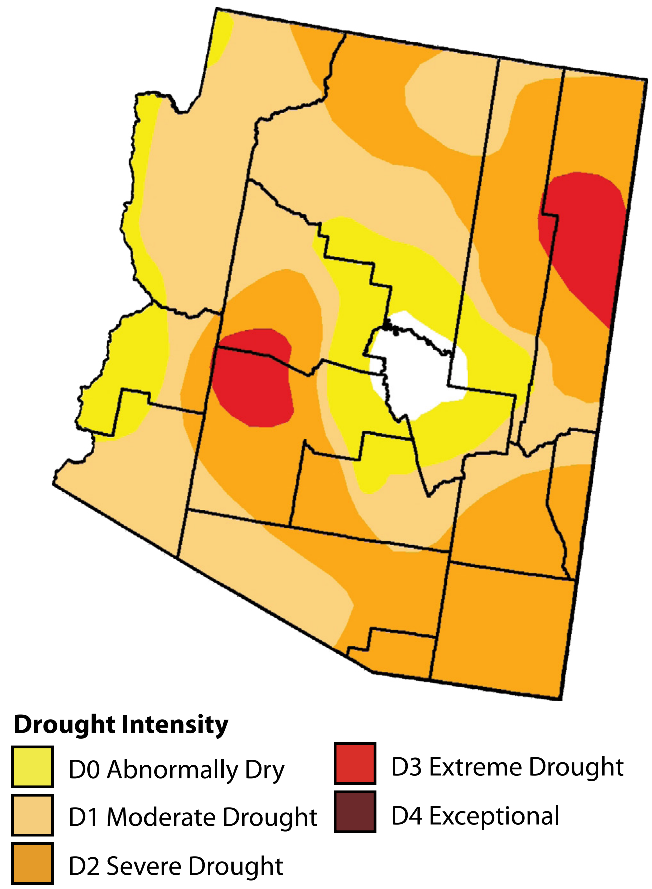



**Figure 4b.** Percent of Arizona designated with drought conditions based on data through April 16.

*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| Current | 2.64 | 97.36 | 82.64 | 43.98 | 5.63 | 0.00 |
| Last Week (04/09/2013 map) | 3.06 | 96.94 | 81.30 | 41.15 | 5.63 | 0.00 |
| 3 Months Ago (01/15/2013 map) | 0.00 | 100.00 | 97.82 | 37.86 | 8.84 | 0.00 |
| Start of Calendar Year (01/01/2013 map) | 0.00 | 100.00 | 97.91 | 37.78 | 8.68 | 0.00 |
| Start of Water Year (09/25/2012 map) | 0.00 | 100.00 | 100.00 | 31.93 | 5.67 | 0.00 |
| One Year Ago (04/10/2012 map) | 0.00 | 100.00 | 93.82 | 62.21 | 12.61 | 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 4/16/13)**

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

Most of New Mexico has received less than 50 percent of average precipitation since October 1, and dry conditions continued in the last 30 days as most of the region received less than 50 percent of average (see page 6). While one winter storm did clip the northwest corner of the state, providing much-needed precipitation there—up to an inch in some locations—the event missed most of the state. Despite scant rain and snow in most of New Mexico, drought conditions remain largely unchanged from one month ago, partially because conditions are already at severe and extreme levels. Extreme drought conditions, however, did expand across parts of west-central New Mexico in areas that missed out on the one winter storm. As of April 16, moderate or more severe drought covered about 99 percent of New Mexico, with extreme or exceptional drought—the two most severe drought categories—covering about 58 percent of the state (*Figures 5a–b*). The last time moderate or a more severe drought category did not blanket some regions was at the end of 2010. With the winter now over, drought relief will not come until the monsoon rains begin in earnest, typically in early July.

**Figure 5a.** New Mexico drought map based on data through April 16.

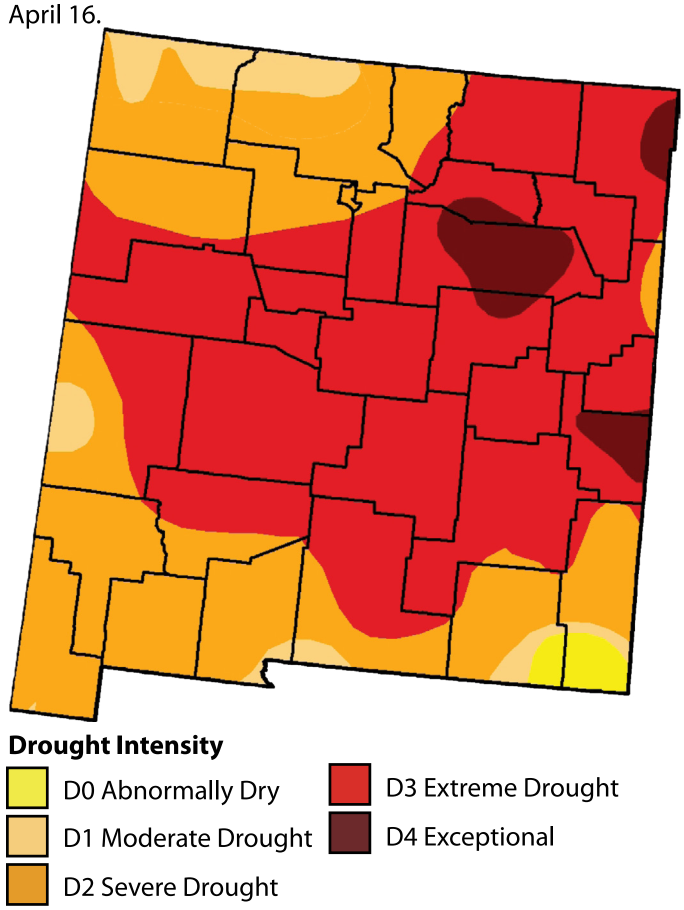



**Figure 5b.** Percent of New Mexico designated with drought conditions based on data through April 16.

*Drought Conditions (Percent Area)*

| | None | D0-D4 | D1-D4 | D2-D4 | D3-D4 | D4 |
|---|---|---|---|---|---|---|
| Current | 0.00 | 100.00 | 98.68 | 93.95 | 58.73 | 4.36 |
| Last Week (04/09/2013 map) | 0.00 | 100.00 | 98.68 | 93.30 | 58.73 | 4.36 |
| 3 Months Ago (01/15/2013 map) | 0.00 | 100.00 | 98.45 | 92.97 | 31.76 | 0.97 |
| Start of Calendar Year (01/01/2013 map) | 0.00 | 100.00 | 98.83 | 94.05 | 31.88 | 0.97 |
| Start of Water Year (09/25/2012 map) | 0.00 | 100.00 | 100.00 | 62.56 | 12.25 | 0.66 |
| One Year Ago (04/10/2012 map) | 0.00 | 100.00 | 80.46 | 58.60 | 24.94 | 9.03 |

## 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 Volumes

## (through 3/31/13)

**Data Source: National Water and Climate Center**

Combined storage in lakes Mead and Powell stood at 49.8 percent of capacity as of March 31 (*Figure 6*), a decrease of 578,000 acre-feet from the previous month and almost 10 percent less than it was one year ago. Storage in the two reservoirs will continue to decrease until late spring snowmelt begins in earnest. The April–July inflow into Lake Powell is expected to be only about 34 percent of average, which would be the fourth lowest inflow since Lake Powell became operational in 1963 and slightly more than last year's inflow. Storage in most other Arizona reservoirs reported in Figure 6 increased in March, which is typical for this time of year, while storage in San Carlos Reservoir decreased slightly. Storage in the combined Salt and Verde basin system is at 62.6 percent of capacity, down almost 4 percent from last year. However, this is only 6 percent below average, and well within the range for robust water deliveries to the Phoenix metropolitan region.

In water-related news, the U.S. Bureau of Reclamation (BOR) projects a 65 percent chance that the water-level elevation in Lake Powell will decrease enough in the next year to lower water releases to the Lower Colorado River Basin in 2014 (*Arizona Daily Star*, April 16). The decreased release, called the mid-elevation release tier, would not result in shortages to Arizona cities. However, BOR states there is a 35 percent chance that the Central Arizona Project will experience a shortage by 2016.

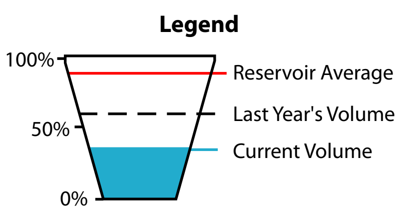
## Notes:

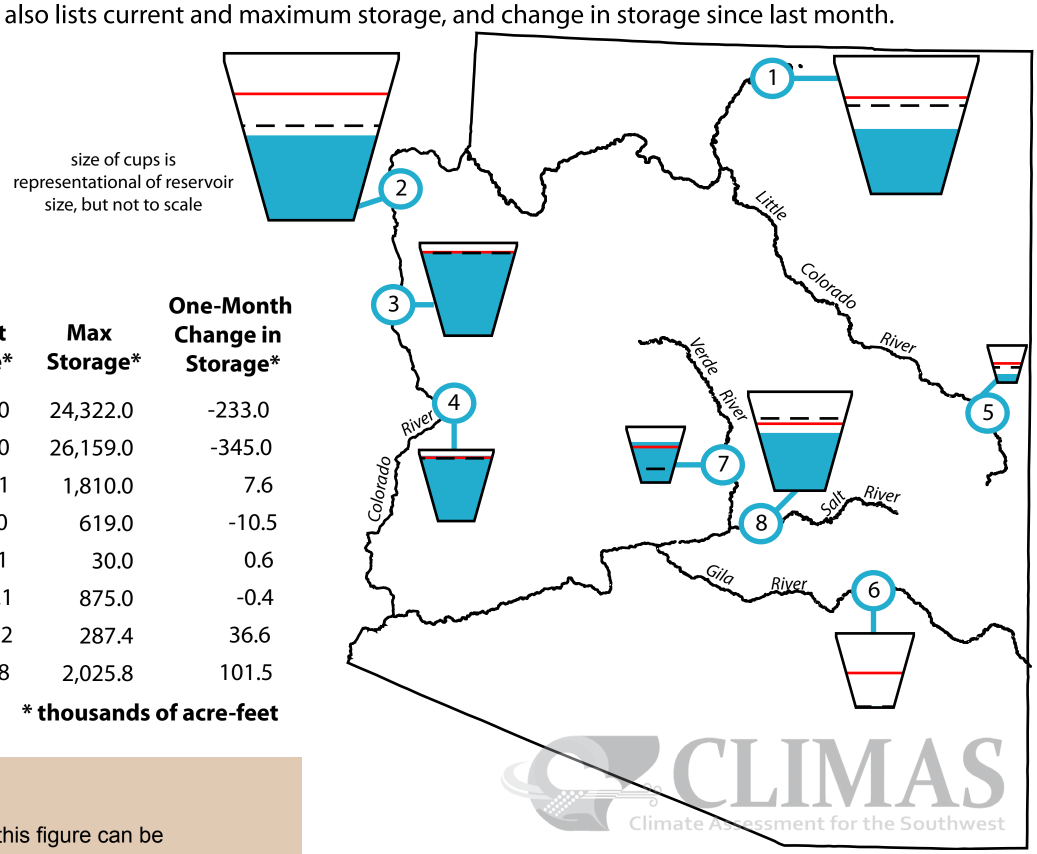
The map gives a representation of current storage for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. Note 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 (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage 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 Resources Conservation Service (NRCS).

**Figure 6.** Arizona reservoir volumes for March as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.




| Reservoir Name | Capacity | Current Storage* | Max Storage* | One-Month Change in Storage* |
|---|---|---|---|---|
| 1. Lake Powell | 48% | 11,658.0 | 24,322.0 | -233.0 |
| 2. Lake Mead | 51% | 13,465.0 | 26,159.0 | -345.0 |
| 3. Lake Mohave | 92% | 1,673.1 | 1,810.0 | 7.6 |
| 4. Lake Havasu | 92% | 572.0 | 619.0 | -10.5 |
| 5. Lyman | 17% | 5.1 | 30.0 | 0.6 |
| 6. San Carlos | 1% | 11.1 | 875.0 | -0.4 |
| 7. Verde River System | 79% | 226.2 | 287.4 | 36.6 |
| 8. Salt River System | 60% | 1,220.8 | 2,025.8 | 101.5 |

*** 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

# New Mexico Reservoir Volumes

## (through 3/31/13)

**Data Source: National Water and Climate Center**

Combined water storage in New Mexico's reservoirs increased slightly compared to one month ago, primarily due to an increase of about 23,000 acre-feet in the level of Elephant Butte Reservoir (*Figure 7*). Reservoir storage often increases during this time of year as snow begins to melt in the higher elevations. Nevertheless, reservoir volumes throughout New Mexico are well below average as a result of low winter snowpacks in southern Colorado and northern New Mexico this winter and the previous two. As of March 31, combined storage on the four reservoirs on the Pecos River was about 30,100 acre-feet, which is well below its average of 111,800 acre-feet and about 2,300 acre-feet less than it was one year ago. It will take several years of above-average rain and snow to improve the situation on both the Pecos River and the Rio Grande.

In water-related news, the Middle Rio Grande Conservancy District, New Mexico's largest irrigation district, is curtailing deliveries to some of its farmers due to ongoing drought (*Albuquerque Journal*, April 16). Also, Texas has filed a lawsuit with the U.S. Supreme Court claiming that New Mexico farmers are taking more than their share of water from the Rio Grande.

## Notes:

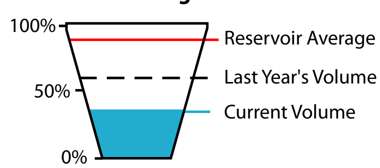
The map gives a representation of current storage for reservoirs in New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. 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 (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage 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 Resources Conservation Service (NRCS).

**Figure 7.** New Mexico reservoir volumes for March as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

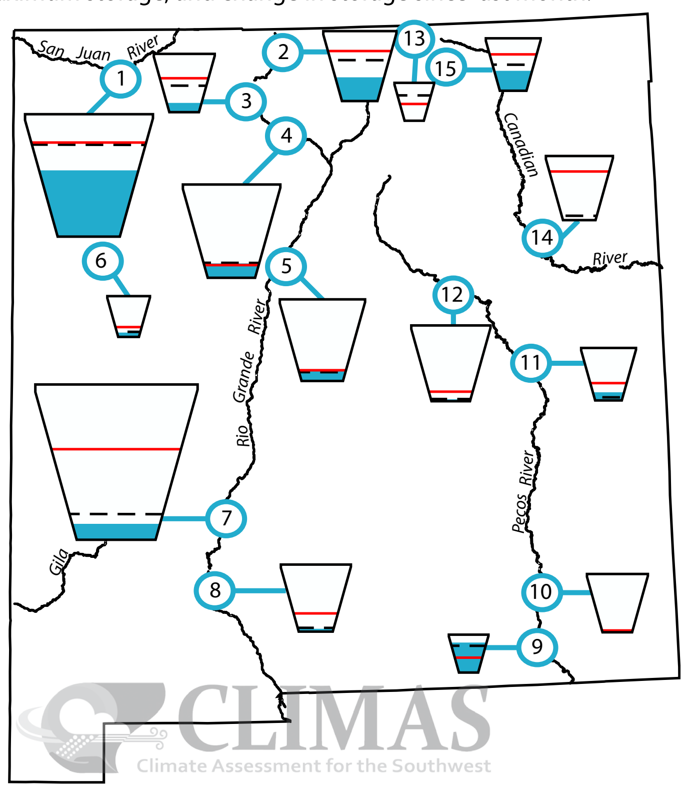
**Legend**




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

| Reservoir Name | Capacity | Current Storage* | Max Storage* | One-Month Change in Storage* |
|---|---|---|---|---|
| 1. Navajo | 55% | 934.2 | 1,696.0 | -2.8 |
| 2. Heron | 34% | 134.5 | 400.0 | -9.7 |
| 3. El Vado | 15% | 28.7 | 190.3 | 10.4 |
| 4. Abiquiu | 14% | 169.2 | 1,192.8 | 1.3 |
| 5. Cochiti | 10% | 47.9 | 491.0 | -7.3 |
| 6. Bluewater | 8% | 3.2 | 38.5 | -0.1 |
| 7. Elephant Butte | 10% | 220.2 | 2,195.0 | 13.8 |
| 8. Caballo | 3% | 10.6 | 332.0 | 0.9 |
| 9. Lake Avalon | 80% | 3.2 | 4.0 | 0.1 |
| 10. Brantley | 1% | 11.7 | 1,008.2 | 4.4 |
| 11. Sumner | 6% | 5.7 | 102.0 | -9.2 |
| 12. Santa Rosa | 1% | 2.8 | 438.3 | -2.0 |
| 13. Costilla | 0% | 0.0 | 16.0 | 0.0 |
| 14. Conchas | 0% | 0.0 | 254.2 | -0.9 |
| 15. Eagle Nest | 38% | 30.0 | 79.0 | 0.5 |

* 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 4/18/13)

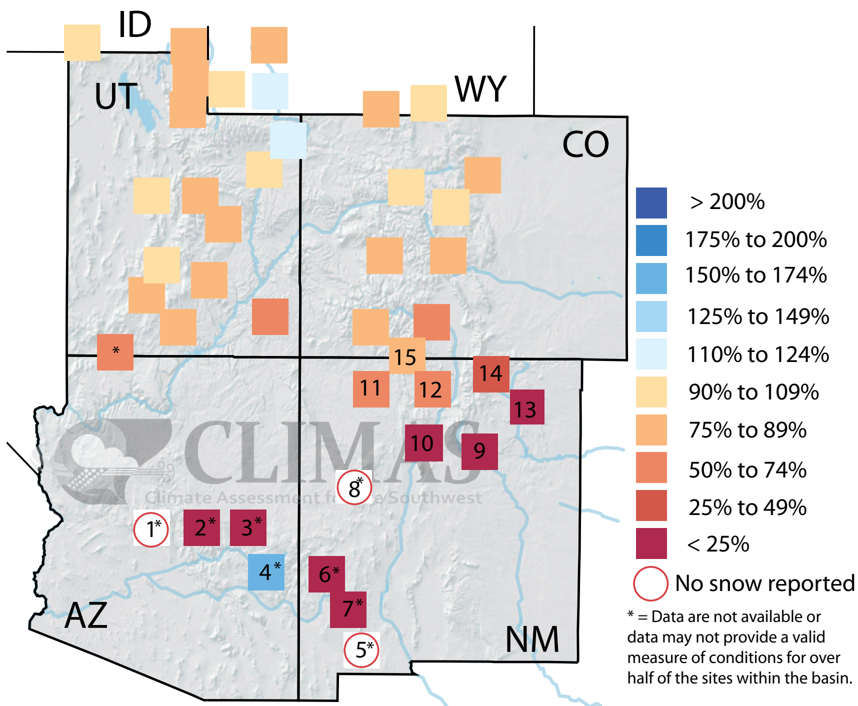
**Data Sources: National Water and Climate Center, Western Regional Climate Center**

A recent storm in the northern sections of the Upper Colorado River Basin helped restock snowpacks there, but precipitation was below average in the southern half of Utah and Colorado and in all of Arizona and New Mexico in the past 30 days (see page 6). Dry conditions in Arizona and New Mexico, however, are the norm for this time of year.

Despite the recent snow, water contained in snowpacks, or snow water equivalent (SWE), is below average in most basins (*Figure 8*). In the Upper Colorado River Basin, snow telemetry (SNOTEL) monitoring stations mostly report that total winter precipitation has been less than 90 percent of average, which is an increase from one month ago. In the headwaters of the Rio Grande in Colorado, the average of 12 SNOTEL stations report 66 percent of average SWE, with the total winter precipitation measuring only 69 percent of average. Below-average precipitation, consequently, is driving low streamflow forecasts for these rivers. The best estimates for spring streamflows in the Rio Grande and Colorado River are less than 50 percent of average (see page 16). The Colorado River may also experience its fourth lowest April–July streamflow since Lake Powell became operational in 1963.

In the Mogollon Rim region of Arizona, SNOTEL monitoring sites have recorded near-average precipitation, but the current SWE values are less than 5 percent of average. Numerous days of much above-average temperatures in mid-March helped rapidly melt these snowpacks, as well as those in many other regions in Arizona. The only exception to below-average SWE in Arizona is in the upper Salt River Basin in the White Mountains, where recent snows helped boost snowpacks there. For Arizona and New Mexico, low SWE values in mid-April suggest that the landscape may desiccate sooner than average, which, in turn, would elevate fire risk in these areas. Also, SWE values in April are not as good an indicator of water supply as total accumulated precipitation because even small snowfall amounts can greatly boost the percent of SWE.

**Figure 8.** Average snow water equivalent (SWE) in percent of average for available monitoring sites as of April 18, 2013.




**Arizona Basins**
1 Verde River Basin
2 Central Mogollon Rim
3 Little Colorado - Southern Headwaters
4 Salt River Basin

**New Mexico Basins**
5 Mimbres River Basin
6 San Francisco River Basin
7 Gila River Basin
8 Zuni/Bluewater River Basin
9 Pecos River Basin
10 Jemez River Basin
11 San Miguel, Dolores, Animas, and San Juan river basins
12 Rio Chama River Basin
13 Cimarron River Basin
14 Sangre de Cristo Mountain Range Basin
15 San Juan River Headwaters

## 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 equivalent (SWE) is calculated from this information. SWE refers to the depth of water that would result from 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 SWE than light, powdery snow.

This figure shows the SWE for selected river basins, based on SNOTEL sites in or near the basins, compared to the 1981–2010 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 SWE measurements made by the Natural Resources 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

# Temperature Outlook
## (May–October 2013)

**Data Source: NOAA-Climate Prediction Center (CPC)**

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in April call for increased chances that temperatures will be similar to the warmest 10 years in the 1981–2010 period for the three-month seasons spanning May through October (*Figures 9a–d*). However, the CPC notes that accuracy in the temperature outlooks is lowest in late spring and late fall for the lower 48 states; the highest accuracy is in late winter and summer. These forecasts were based primarily on dynamical models and are largely consistent with decadal trends. Substantial soil moisture deficits over much of the West also are consistent with an increased chance of above-average temperatures during the upcoming three-month seasons. If temperatures are above average for the May–July period, the magnitude of the anomaly is likely to be between 0.6 and 1.5 degrees F in the northern half of Arizona and New Mexico. Seasonal forecasts that span the monsoon also call for warmer-than-average conditions. There is likely less confidence in these forecasts because monsoon precipitation is difficult to project in April, and summers with high precipitation often have cooler temperatures than those with less rain.

## 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 three-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 9a.** Long-lead national temperature forecast for May–July 2013.

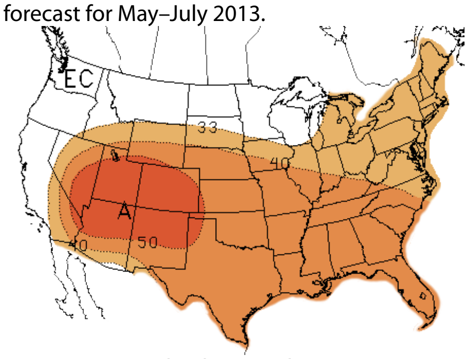



**Figure 9b.** Long-lead national temperature forecast for June–August 2013.

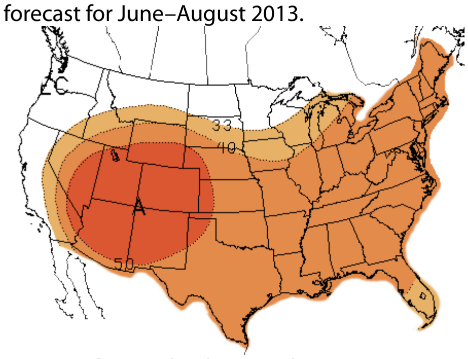



**Figure 9c.** Long-lead national temperature forecast for July–September 2013.

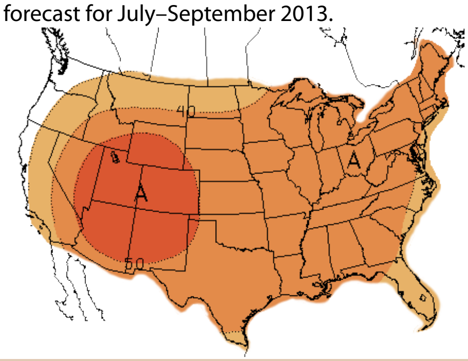
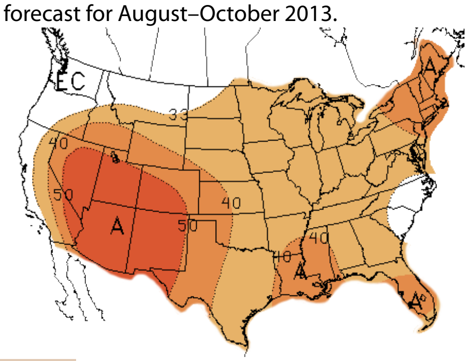



**Figure 9d.** Long-lead national temperature forecast for August–October 2013.




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

B = Below average: 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
## (May–October 2013)

**Data Source: NOAA-Climate Prediction Center (CPC)**

The seasonal precipitation outlooks issued by the NOAA-Climate Prediction Center (CPC) in April call for increased chances that precipitation during the May–July period will be below average across many parts of the Southwest except in southern regions (*Figure 10a*). May and June, however, are historically dry; therefore, below-average rainfall, should it occur, will not amount to much. Seasonal forecasts that overlap the monsoon show increased chances of below-average precipitation for most of New Mexico and parts of southeast Arizona (*Figures 10b–d*). The CPC noted last month that dynamical models show a continuation of the tendency for below-median precipitation in parts of the Southwest monsoon region through summer, which is likely still the case this month. However, forecasting monsoon precipitation is difficult and these outlooks should be viewed cautiously. One of the models the CPC relies on (NMME) has shown no forecast skill in the Southwest for the July–August period. When a strong El Niño or La Niña is present, forecast accuracy increases. This year, however, ENSO conditions are neutral.

### 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 10a.** Long-lead national precipitation forecast for May–July 2013.

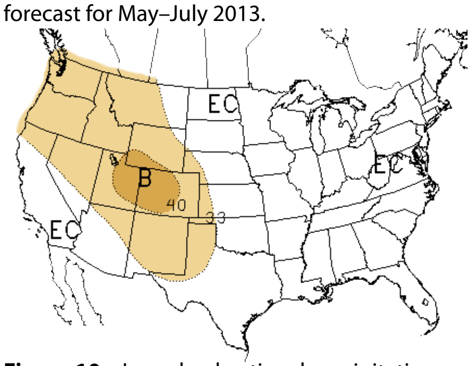



**Figure 10b.** Long-lead national precipitation forecast for June–August 2013.

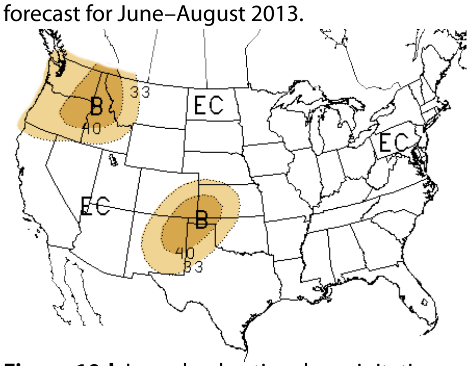



**Figure 10c.** Long-lead national precipitation forecast for July–September 2013.

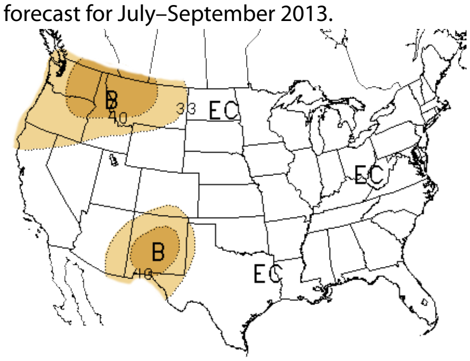
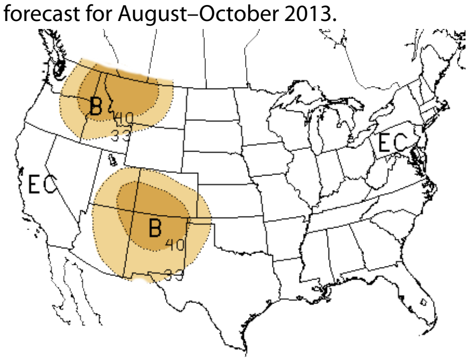



**Figure 10d.** Long-lead national precipitation forecast for August–October 2013.




A = Above average: 40.0–49.9%; 33.3–39.9%

B = Below average: 60.0–69.9%; 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
(note that this website has many graphics and may load slowly on your computer)

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

# Seasonal Drought Outlook
## (through July 2013)

**Data Source: NOAA–Climate Prediction Center (CPC)**

*This summary is partially excerpted and edited from the April 18 Seasonal Drought Outlook technical discussion produced by the NOAA-Climate Prediction Center (CPC) and written by forecaster A. Artusa.*

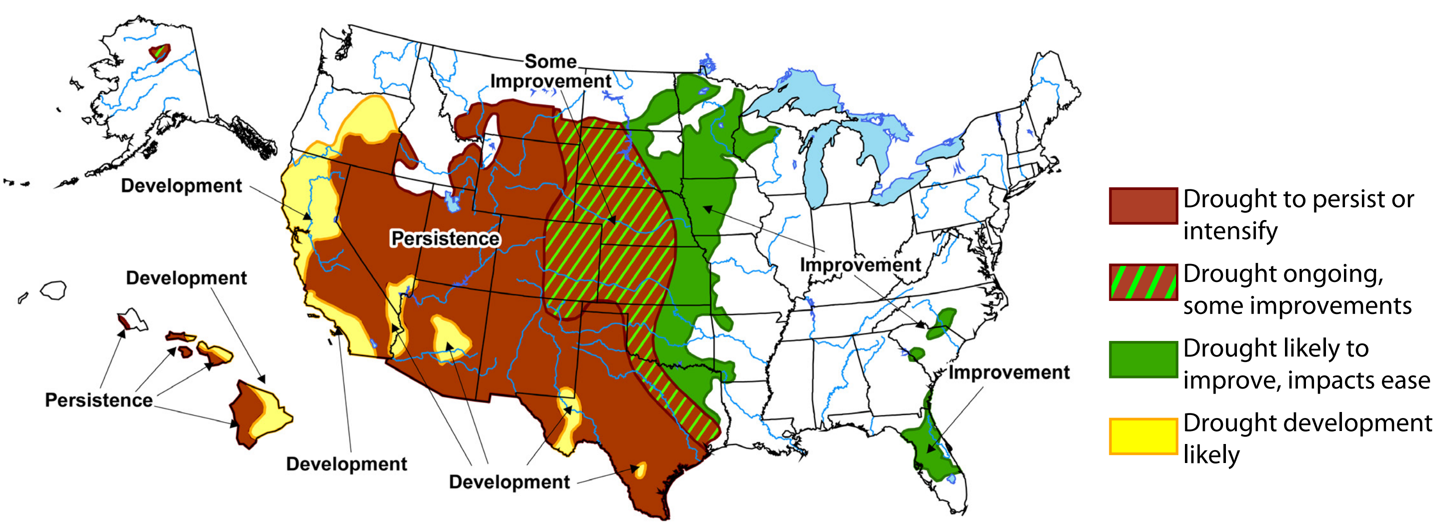
Drought is expected to persist for most of the Southwest as a result of below-average snowpacks, which generally contain less than 75 percent of average snow water content as of April 18, and below-average streamflow forecasts for spring and summer, according to the NOAA-Climate Prediction Center (CPC). Also, there are increased chances for below-average precipitation and above-average temperatures for the May–July period in many parts of the Southwest, which favors drought persistence as well (see pages 13 and 14). The small region in central Arizona around the Mogollon Rim, which is currently drought-free, is expected to develop drought conditions in coming months. However, drought impacts emerge more vigorously when deficits of rain and snow are large, and the low historical occurrence of precipitation in May and June in this region precludes this from occurring.

Elsewhere, drought is projected to improve as a result of recent wet conditions across the Colorado Front Range, where snowpack in the higher elevations has increased by as much as 18 inches between April 15 and April 22. Short-term forecasts also call for more precipitation in this region. The recent and projected wet conditions, as well as the lack of a dry signal in forecast tools for the May–July period, suggest some improvement across eastern Colorado and parts of northeast New Mexico. The CPC assigns a moderate to high confidence in the drought forecast for these areas.

### 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 July 2013 (released April 18).




### On the Web:

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

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

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

# Streamflow Forecast
## (for spring and summer)

**Source: National Water and Climate Center**

The spring–summer streamflow forecast for the Southwest, issued on April 1 by the Natural Resources Conservation Service (NRCS), calls for well-below-average flows in all river basins in Arizona and New Mexico and the Upper Colorado River and Rio Grande basins (*Figure 12*). Projected streamflows for the April–May period in the Southwest have nearly all decreased since last month—the result of dry conditions in March. Moreover, the below-average forecasts reflect in large part the scant precipitation that has fallen this winter throughout the region. In Arizona, the April 1 forecasts call for only a 50 percent chance that the Salt River, measured near Roosevelt Lake, and the Gila River, measured at the inflow of San Carlos Reservoir, will exceed 32 and 5 percent of the April–May average, respectively. The 50 percent likelihood can be considered the best estimate. In these probabilistic forecasts, lower likelihoods are accompanied by a higher percent of average streamflows, and vice versa. For example, the Salt River has only a 10 percent chance of exceeding 57 percent of average flows.

For Lake Powell, there is only a 50 percent chance that spring inflow will exceed 34 percent of the 1981–2010 average for April–July, or about 2.4 million acre-feet. The forecast also indicates only a 10 percent chance that Lake Powell inflow will be more than 56 percent of average, providing an indicator that above-average flows are extremely unlikely. These forecasts represent a decrease from one month ago. If the April to July runoff into Lake Powell is around 34 percent of average, it would be the fourth-lowest total since Lake Powell became operational, says NOAA's Colorado River Basin Forecast Center.

In New Mexico, streamflow forecasts are all below average. For the Rio Grande, the best estimates suggest a 50-percent chance hat the Rio Grande will experience less than 50 percent of average flow for the April–July period. This is a slight decrease from estimates made one month ago. Snowpack conditions in the upper Rio Grande headwaters in Colorado are less than 50 percent of the historical average (see page 12).

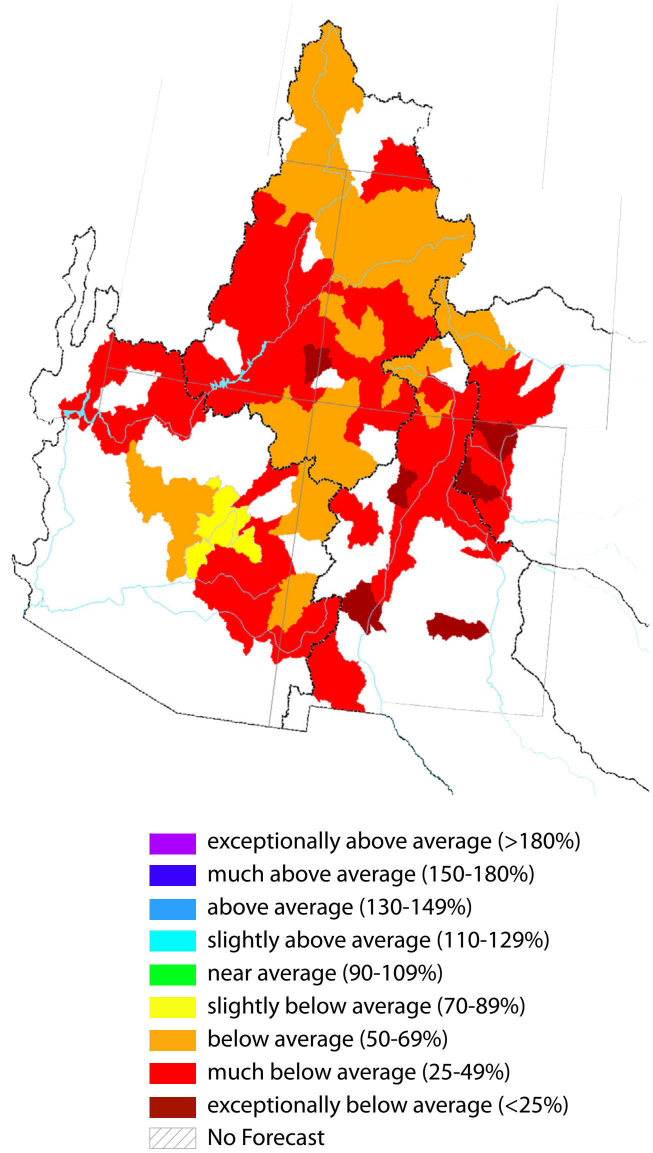
### On the Web:

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
http://www.cbrfc.noaa.gov

**Figure 12.** Spring and summer streamflow forecast as of April 1 (percent of average).




### Notes:

Water supply forecasts for the Southwest are coordinated between the National Water and Climate Center (NWCC), 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 produced for Arizona and New Mexico between January 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 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.

# Wildland Fire Outlook
## (May 2013)

**Sources: National Interagency Coordination Center, Southwest Coordination Center**

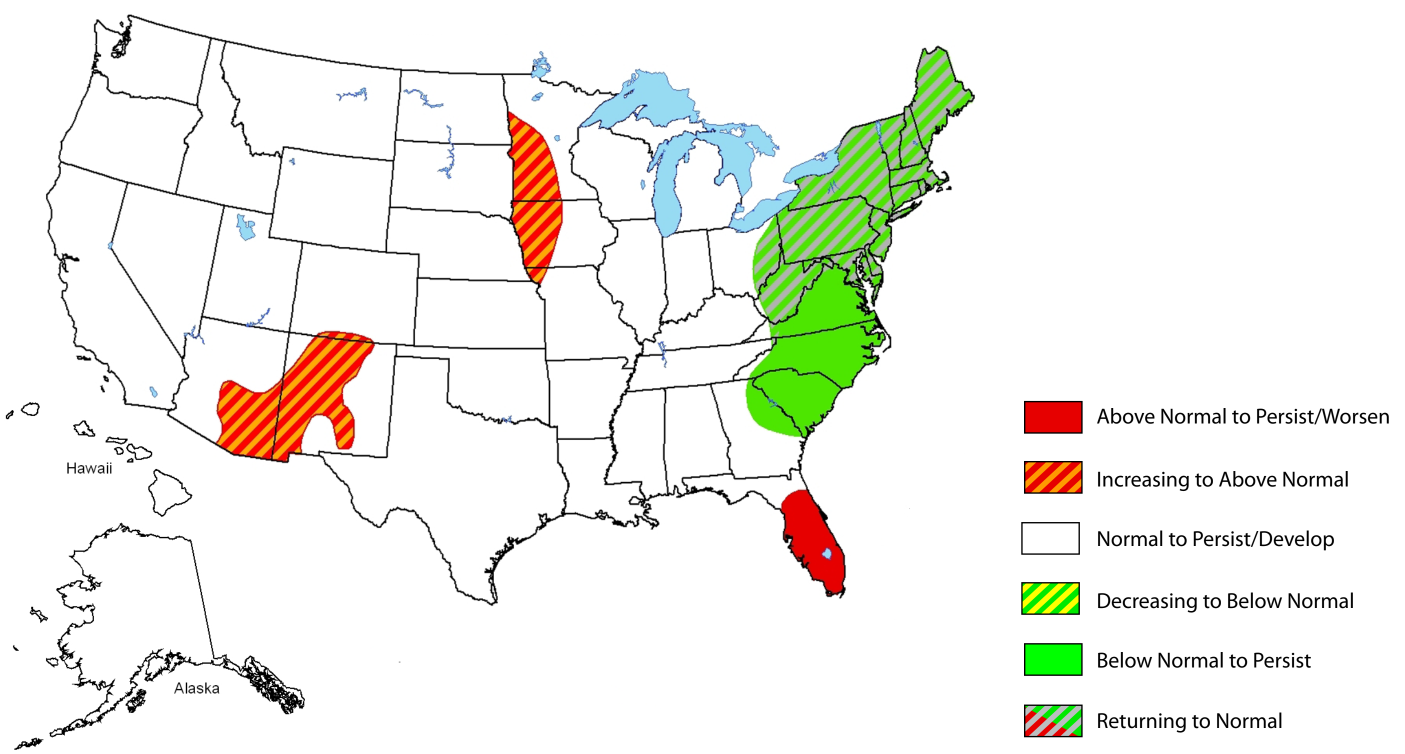
The Southwest likely will experience above-normal significant fire risk in May as a result of expected continued dry conditions, low snowpacks, and the historical occurrence of windy conditions in this month (*Figure 13*). Significant wildfire potential is defined as the likelihood that a wildland fire will require additional fire-fighting resources from outside the area in which the fire originated. Normal significant wildland fire potential is expected for the remaining weeks of April. Despite low snowpack measurements and widespread warmer temperatures, indications suggest that periodic storms will keep significant fire potential at normal levels for the remainder of April.

Although drought conditions continue to be widespread, the fire season likely will not begin earlier than average, and southern regions will become active first, according to the National Interagency Coordination Center. The primary wildland fire season likely will begin in earnest in late May and early June. The fire season is most vigorous in Arizona and New Mexico in June and July up until monsoon rains sufficiently moisten the landscape. At this point, however, it is difficult to forecast the timing of the monsoon's onset; it historically begins around the first week of July for parts of southern Arizona and New Mexico.

### Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. They are subjective assessments that synthesize information provided by fire and climate experts throughout the United States. The forecast (Figure 13) considers 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.

**Figure 13.** National wildland fire potential for fires greater than 100 acres for May 2013.




### On the Web:

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

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

# El Niño Status and Forecast

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

Sea surface temperatures (SSTs) in the equatorial Pacific Ocean did not substantially change in the last month, and ENSO-neutral conditions are still present. In the last 30 days, SSTs remained very close to average across much of the equatorial Pacific basin, with the only notable changes occurring in the eastern Pacific where temperatures rose slightly. The Southern Oscillation Index (SOI) is also indicating neutral conditions (*Figure 14a*). This may have been caused by a relatively fast-moving atmospheric oscillation, called the Madden-Julian Oscillation, which moved across the Pacific Ocean in recent weeks and caused SSTs and wind patterns to change slightly, according to the NOAA-Climate Prediction Center (CPC). The warming is not signaling a shift to El Niño conditions; rather, it is a short-term response to other temporary forces. Wind and precipitation patterns across the Pacific from east to west continue to signal that neutral conditions still hold sway.

Official ENSO outlooks issued jointly by the CPC and the International Research Institute for Climate and Society (IRI) strongly indicate that ENSO-neutral conditions are the most likely outcome during the next several months (*Figure 14b*). There is greater than a 70 percent chance that neutral conditions will persist through July, an increase in odds from 64 percent forecasted last month. Neutral conditions also remain high through the end of the summer. The CPC notes that longer-lead forecasts—those issued for late summer and beyond—are more uncertain during this month because models have difficulty simulating the initial evolution of ENSO, a modeling phenomena known as the spring predictability barrier. Nonetheless, it is likely that ENSO will not be a major control on weather patterns this summer.

## Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through March 2013. The SOI measures the atmospheric response to SST changes across the Pacific Ocean basin. The SOI is strongly associated with climate effects in the Southwest. Values greater than 0.5 represent La Niña conditions, which are frequently associated with dry winters and sometimes with wet summers. Values less than -0.5 represent El Niño conditions, which are often associated with wet winters.

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

## On the Web:

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

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

**Figure 14a.** The standardized values of the Southern Oscillation Index from January 1980–March 2013. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red), respectively. Values between these thresholds are relatively neutral (green).

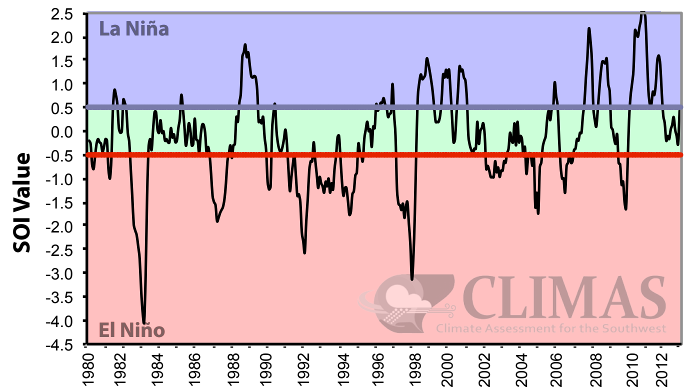



**Figure 14b.** IRI probabilistic ENSO forecast for the Niño 3.4 monitoring region (released April 22). Colored lines represent average historical probability of El Niño, La Niña, and neutral conditions.