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Southwest Climate Outlook

Vol. 12 Issue 3

Despite below-average precipitation in many parts of the Southwest, the deserts are beginning to spring into color. Photo: Pacifica Sommers

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In this issue...

March Climate Summary

Drought: Central Arizona is the only region in the Southwest to experience drought improvement in the last 30 days; moderate to severe drought conditions still cover the majority of the region, with drought most intense in New Mexico.

Temperature: Rapid warming in March has led to temperatures that are more than 3 degrees F above average in many regions.

Precipitation: Most of Arizona and New Mexico experienced less than 70 percent of average precipitation in the last 30 days.

ENSO: Neutral conditions remain entrenched in the equatorial Pacific Ocean and are expected to continue through the summer and possibly into next year.

Climate Forecasts: Forecasts for the April–June period call for increased chances for above-average temperatures, in part based on recent trends, and below-average precipitation in northern parts of Arizona and New Mexico.

The Bottom Line: The 2012–2013 winter is nearing an end, and although it is several weeks premature to write this winter's eulogy—early April storms do happen—it appears that Arizona and New Mexico will experience their third consecutive drier-than-average winter. Since January 1, less than 70 percent of average rain and snow fell in nearly all of Arizona except central regions. It was drier in New Mexico, where many areas received less than 50 percent of average precipitation. On March 8, one storm dropped substantial precipitation in Arizona but bypassed New Mexico. This storm helped improve drought conditions in central Arizona, which is now drought-free, but most of the Southwest remains classified with at least moderate drought. It has been about two years since the majority of Arizona was drought-free and about two-and-a-half years for New Mexico. Cold temperatures that helped sustain snowpacks in the mountains around the Southwest throughout much of the winter rapidly warmed in March, particularly in the last two weeks. March temperatures in Arizona, for example, were up to 6 degrees F above average, while temperature anomalies in New Mexico were only slightly lower. The warm conditions have eaten into snowpacks around the region. Nearly every basin in Arizona, New Mexico, Colorado, and Utah has below-average snowpacks, and many monitoring stations in Colorado are in the lowest fifth percentile of their historical records. Consequently, forecasts for watersheds around the region all call for below-average streamflows. This is particularly grim for the Pecos River and the Rio Grande in New Mexico, which already have low stores. Historically, the coming months are dry and windy, and there is some indication that temperatures may be warmer than average.

Temperature's Influence on Sudden Aspen Decline

Protracted drought starting around 2000 has taken a toll on western forests. Sudden Aspen Decline, or SAD, has killed up to 17 percent of aspen forests in Colorado and has laid bare many stands in Arizona and New Mexico. Scientists estimate that SAD may have accelerated around 2002 after a particularly hot and dry summer; and recently published research has identified some of the climate and vegetative controls on SAD.

The research, published in the journal *Global Change Biology* in March, determined that aspen trees primarily draw water from shallow depths regardless of the growing season period or ambient conditions. Aspens sip water, for example, mostly from the top 10 centimeters of the soil prior to monsoon rains and after they begin. Soil moisture and climate data combined showed that SAD is primarily influenced by shallow soil moisture and temperature. The authors concluded that in 2002 aspens were likely exposed to the most extreme shallow moisture stress in the last century as a result of low snowpacks and early snow melt stemming from above-average spring temperatures. This condition was then followed by a prolonged dry spell in a lethal combination that precipitated SAD. The authors also state that long-term increases in spring and summer temperatures due to climate change played a role in the die-off.

Read more at: http://onlinelibrary.wiley.com/doi/10.1111/gcb.12146/abstract

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Recent freeze events: Natural variability or weird weather?

by Melanie Lenart

Recent freezing events highlight how challenging it remains to forecast some aspects of climate with enough accuracy that Southwest farmers, gardeners, and other growers can take steps to respond to it more than a week or two in advance.

When nighttime temperatures drop below 32 degrees F, the outer lettuce leaves may freeze, making them inedible. Photo: Kurt Nolte

Blasts of Arctic air this winter in Yuma, Ariz., for instance, posed challenges to a variety of growers, from those running citrus orchards to farmers cultivating cotton, broccoli, or leafy greens for Yuma's booming winter lettuce industry. These events led to rising food prices.

The southern sweeps of Arctic air raise the question of whether this is just another example of natural climate variability—a plausible prospect—or whether they might relate in a complex and little understood way to the ongoing summertime melting of Arctic sea ice. Either way, it's clear that the distant Arctic can bring a windy chill to southwestern winters even in a world that's generally warming.

Arctic chill

In mid-January, temperatures in Yuma plunged below freezing for several days in a row, putting it among the top six freezing events registered by the Arizona Meteorological Network (AZMET; *Table 1*), a system of high-tech weather stations that help farmers manage their crops.

Other cold sweeps followed, including a late February cold front that brought a dusting of snow and hail to major metropolitan regions in Arizona and New Mexico before winds carried it northeast into the Midwest and eventually New England. These events had one thing in common: they resulted from a shift of Arctic air southward thanks to a climatic pattern called the Arctic Oscillation (AO). It's also known as the North Atlantic Oscillation and Northern Annular Mode, with the names describing different aspects of the climate signal that were later traced back to the Arctic.

Like the El Niño-Southern Oscillation (ENSO), the AO comes with a signature climate, with a pattern based on its averages across the years. Based on an average of 1,945 days, a negative AO typically means slightly cooler-than-average January-March temperatures in southern Arizona and most of New Mexico, with more significant cooling closer to the Arctic.

During a negative AO signal, the Arctic acts like a refrigerator with an open door, allowing cold air to escape to the south, said Michael Crimmins, a University of Arizona Cooperative Extension climate specialist. That cold front can collide with a warm front, lifting moister warm air to heights that promote rain and snow. A positive AO describes winds tightly circling the Arctic, keeping its frigid air contained close to the North Pole.

Shifts into negative AO—with their potential for releasing cold air southward—can occur suddenly, so scientists continue to debate the exact mechanisms that set the AO changes into motion. So far, Crimmins said, prediction skills remain low until about a week in advance.

"Our understanding of the Arctic Oscillation is really poor," he explained. "We don't get it, we can't predict it. There's still argument about how it actually works."

Frozen food

The AO was negative in January when below-freezing Arctic air swept into the Southwest, including Yuma, glazing ripening lettuce heads with frost. Lettuce prices skyrocketed from $8 to

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Recent freeze events, continued

Rank	Dates	Days <45 (°F)	Ave. Temp. (°F)	Min. Temp. (°F)
1	Dec. 22-26, 1990	5	41.2	29.5
2	Dec. 27-31, 1988	5	42.6	27.3
3	Dec. 25-28, 1987	4	41.4	26.4
4	Jan. 12-15, 2013	4	43.8	30.6
5	Jan. 13-15, 2007	3	40.8	22.3*
6	Feb. 2-4, 2011	3	42.2	26.4

*Record low for the station

Table 1. The top six freezing events for Yuma as registered by the Arizona Meteorological Network (AZMET, http://ag.arizona.edu/azmet/index.html) are shown here. Data compiled by Paul Brown and used with permission.

$38 a carton in a matter of days, said Yuma Extension agent Kurt Nolte. The price jump reflected added labor needed to peel off frozen outer leaves and the shortage of quality lettuce from farms struck by the freeze. This affected grocery stores and consumers throughout the U.S., and restaurants in Mexico, Canada, and even Europe.

"It's not like a farmers' market," Nolte said. "It's a very huge industry here." Yuma supplies about 95 percent of the national lettuce market from November through March. During peak periods, Nolte said, as many as 1,000 trucks a day transport greens from Yuma.

Broccoli, cauliflower, and the popular baby green salad varieties also were damaged in the freeze, he said. Meanwhile, Yuma's 18,000 acres of citrus, which largely produce big lemons for the winter market, generally did fine.

Yuma orchard growers weren't so lucky in 2007, when temperatures dropped below 28 degrees Fahrenheit for several consecutive nights—the kind of cold spell that takes a toll on citrus. Yuma lost some 40 percent of its lemon crop, although most of the trees survived to bloom the next season.

Cotton farmers also keep a close eye on winter temperatures. Yuma's growers had to wait until mid-March to plant cotton this year, when soils had warmed up enough from the earlier cold spells to reach the 60 degrees F temperatures needed to avoid damaging cotton sprouts, said Paul Brown, a UA Cooperative Extension specialist in biometeorology who has run AZMET since he launched it in 1987. Cotton farmers have to weigh the risks of another blast of cold against having the monsoon arrive before plants have matured, which creates its own set of problems.

Cold events in a warming world

The blasts of Arctic winds certainly weren't unprecedented for southern Arizona, Brown said. The negative AO pattern, with its cooler winter temperatures, generally indicates that the jet stream has taken on a wavy, meandering form that allows the transport of winds down from Alaska, Canada, and other parts of the Arctic.

In 1987, the first year that Brown began collecting AZMET measurements, freezing temperatures hit the area in late December (*Table 1*). Based on its duration, he ranked it as the third coldest event in the record, although he noted that temperatures actually reached cooler lows in the shorter cold snap of 2007.

Brown indicated that the recent cold events seem to fit in a longer-term record, even if they seem a bit unusual to those who become "normalized" to a warmer climate. For instance, he said, cold events during the early 1960s led to "phenomenal" frost damage to citrus. Freezing temperatures also had an impact in the late 1980s early 1990s.

"Then all of a sudden those winters disappeared for about 15 years. And now they're back," Brown said, referring to potentially damaging freezes. "This has happened three times in the last six years where we've had these pretty serious cold outbreaks."

These freezes may seem unusual in the context of a climate that is warming overall, but they're likely just part of natural climate variability, agreed Martin Hoerling, a National Oceanic and Atmospheric (NOAA) research meteorologist specializing in climate dynamics. The average temperatures for the three-month winter period starting in December in the climate division that includes Yuma and many other areas in the Southwest show a general warming trend.

"The cold spells haven't been eradicated from our climate record," Hoerling said, noting that climate has always varied considerably. Just because temperature is registering an upward trend doesn't mean variability will end, he indicated, adding, "This year is an outlier relative to the longer-term trend."

Despite this trend in many areas of the country, growers must be cautious about planting warmer weather varieties, said Christopher Daly, a climatologist who headed the 2012 revision of the U.S. Department of Agriculture's Plant Hardiness Zone Maps, which are designed to guide those planting perennials such as trees. A plant's survival depends more on the outliers, or extremes, that fall outside of the norm rather than the average temperatures.

"My message has been, as far as plant hardiness goes, is that while the averages have gotten warmer, you can still get that cold snap. All it takes is one

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Recent freeze events, continued

cold snap to kill your plant," Daly said. "People shouldn't be lulled into a false sense of security that we're not going to see cold snaps any more."

Arctic winds remain a wild card

Daly also pointed out that Alaska and the Canadian Arctic will remain a potent source of cold air for Arctic blasts such as the ones witnessed this past winter, regardless of warming temperatures. While average temperatures have been rising faster in Alaska and the rest of the Arctic than the global average, winter temperatures remain low. For instance, even daily highs in winter averaged below 0 degrees Fahrenheit in Barrow, Alaska, located within the Arctic Circle.

Even as scientists gain an understanding of the AO, the factors affecting it may well be shifting as the Arctic loses some of its sea ice. Several papers published since 2008 have suggested that the melting of Arctic sea ice, ironically, could push down winter lows in many parts of the continent. (For more on this, see the link below to the February 2011 *Southwest Climate Outlook*.)

The ice cover shields the atmosphere from the underlying warmer ocean and puts a cap on the evaporation of underlying water that, when airborne, can produce rain or snow. Also, ice tends to reflect sunshine, while water tends to absorb it, thus collecting heat that promotes a continued decrease in sea ice. Some researchers even suggest ice-related changes are helping shift the AO into its cold-exporting negative pattern.

Scientists generally agree that the shift in Arctic ice cover is likely to cause changes in circulation patterns, but debate rages over what those changes are and the possible mechanisms that drive them.

Meanwhile, the dramatic reductions in sea ice really started taking hold only in the last decade (see Figure 1). This short record puts researchers at a serious disadvantage. The longer a climate record, the greater the chances of discerning the complexities of a climate pattern enough to allow predictions and forecasts beyond a week or so.

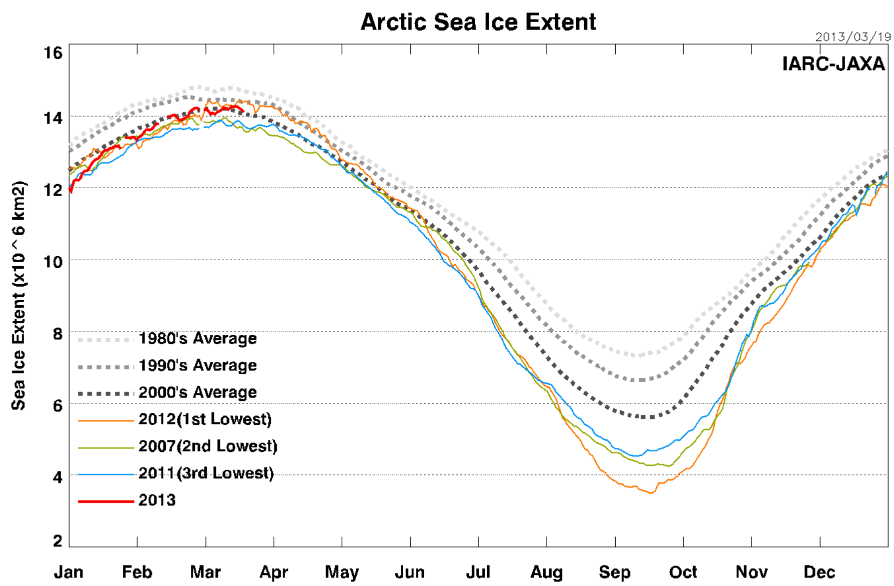


Figure 1. Arctic sea ice is declining, and the rate of its decrease has been picking up in recent years compared to earlier decades, as illustrated by this graphic from the International Arctic Research Center (IARC) in cooperation with the Japan Aerospace Exploration Agency (JAXA). Data available at http://www.ijis.iarc.uaf.edu/en/home/seaice_extent.htm.

If changes in sea ice in the Arctic are affecting the AO, researchers will almost certainly need a longer dataset than what is currently available to figure out what the signal means and how to predict the impacts from the associated changes.

What does this mean for farmers, gardeners, and other growers? They should stay alert for cold snaps even in a generally warming climate. This is likely what they planned to do anyway.

"I'm fairly confident the agricultural community will adapt to climate change as effectively as the environment will allow them in terms of water and extremes," Brown said. "They're a very adaptive group. That's just their nature. If they don't adapt, they don't stay in business very long."

Temperature (through 3/20/13)

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 have been warmest in the southwest deserts of Arizona and coldest in the northern mountains of New Mexico, which is normal and a function of elevation differences (*Figure 1a*). Most temperatures in the Southwest have been within 1 degree Fahrenheit of average except in eastern New Mexico, where temperature anomalies have been slightly higher (*Figure 1b*). While this winter has had numerous cold fronts, in which frigid polar air moved into the Southwest, frequent high pressure ridges have brought clear skies and warm temperatures, and temperature variability has therefore been high. The flip-flopping of high pressure (clear skies) and low pressure (storm systems) that move down the West Coast and cross northeastward through Arizona and New Mexico before crossing the Great Plains is typical of atmospheric circulation during neutral El Niño-Southern Oscillation (ENSO) events.

During the past 30 days, three strong cold fronts and a fourth, weaker one wafted over Arizona and New Mexico, causing temperatures to be 0–4 degrees F colder than average in most locations (*Figures 1c–d*). However, in recent weeks the Southwest has experienced rapid spring warming; temperatures have been 3–6 degrees F above average in many locations. The jet stream in recent weeks also has been farther north, reflecting the transition from the winter weather pattern into spring. Although the coming months are historically dry, it is still possible for late winter and early spring storms to occur, which would lower temperatures during those events.

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 March 20) average temperature.

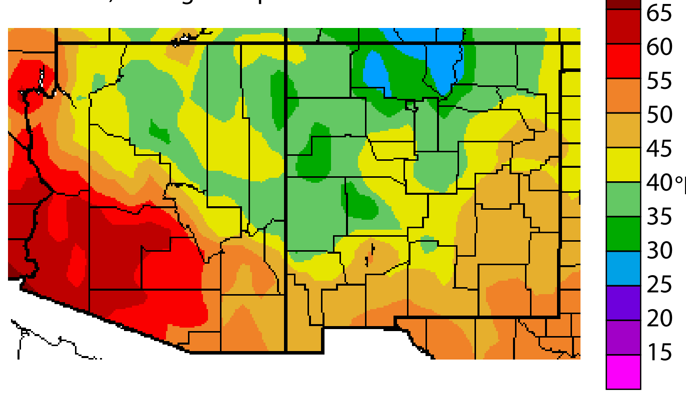


Figure 1b. Water year 2013 (October 1 through March 20) departure from average temperature.

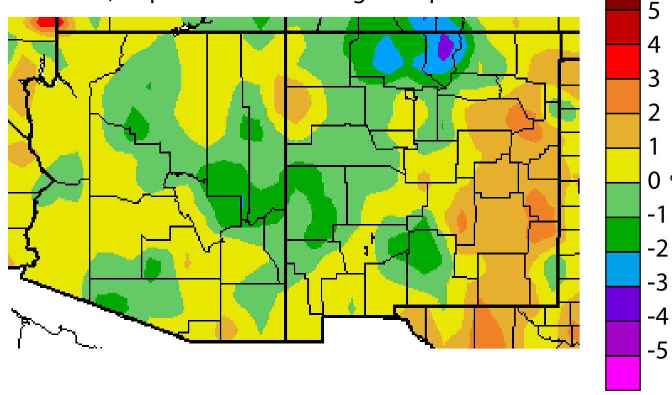


Figure 1c. Previous 30 days (February 19–March 20) departure from average temperature (interpolated).

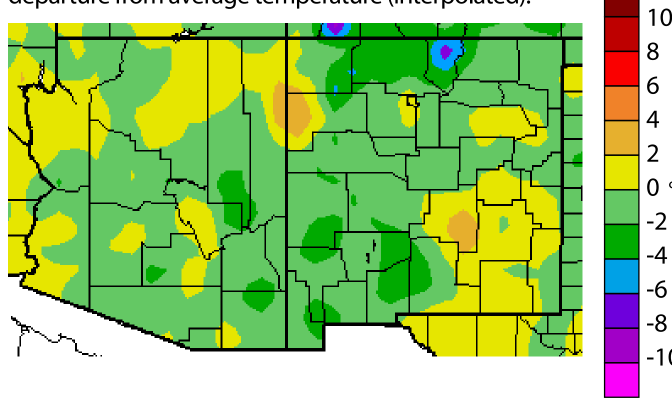
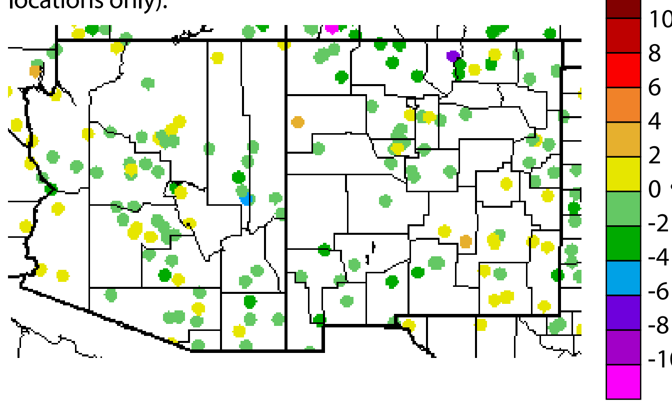


Figure 1d. Previous 30 days (February 19–March 20) departure from average temperature (data collection locations only).



Precipitation (through 3/20/13)

Data Source: High Plains Regional Climate Center

Precipitation since the water year began on October 1 has been very dry in the Southwest, particularly in New Mexico, where rain and snow have been less than 50 percent of average (*Figures 2a–b*). Arizona has fared only slightly better, as most of the state has received less than 70 percent of average. The driest parts have been in areas of central and southwestern New Mexico, where precipitation has amounted to less than 25 percent of average. Only parts of La Paz County, the area around Gila County, and the Mogollon Rim—all in Arizona—and Union County in northeast New Mexico have received above-average precipitation. While numerous low-pressure systems have wafted through Arizona this winter, most of these storms ferried limited moisture, and consequently precipitation totals generally have been low.

Four winter storms passed through Arizona during the past 30 days, and two of these also clipped northern New Mexico. Precipitation from those storms was very localized, especially in New Mexico, and some areas in both states received above-average rain and snow. However, most of both states received less than 70 percent of precipitation between February 19 and March 20 (*Figures 2c–d*). This pattern is similar to the precipitation pattern throughout the entire winter. The highest precipitation in Arizona fell in Gila County and along the Mogollon Rim, with very dry conditions along the California border, in the northeastern corner of the state, and in southwest Graham County. The most recent storm occurred at the beginning of March and brought snow and ice pellets to the Phoenix area.

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

Figure 2a. Water year 2013 (October 1 through March 20) percent of average precipitation (interpolated).

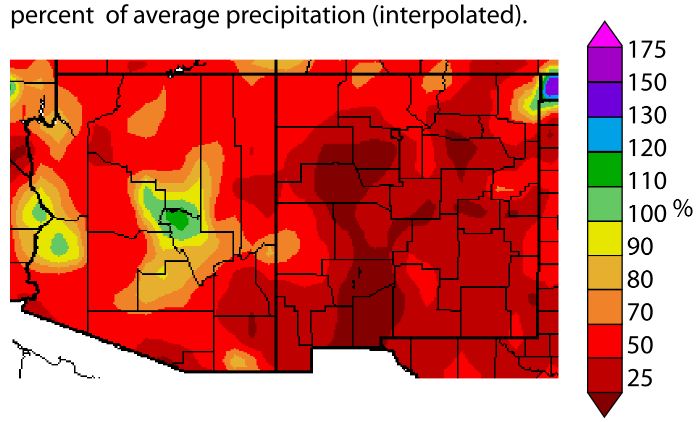


Figure 2b. Water year 2013 (October 1 through March 20) percent of average precipitation (data collection locations only).

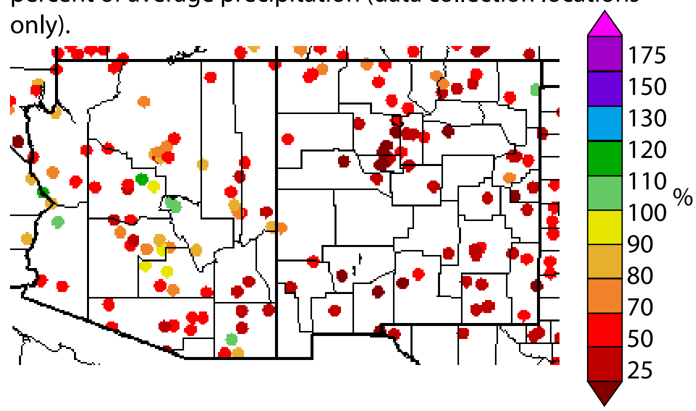


Figure 2c. Previous 30 days (February 19–March 20) percent of average precipitation (interpolated).

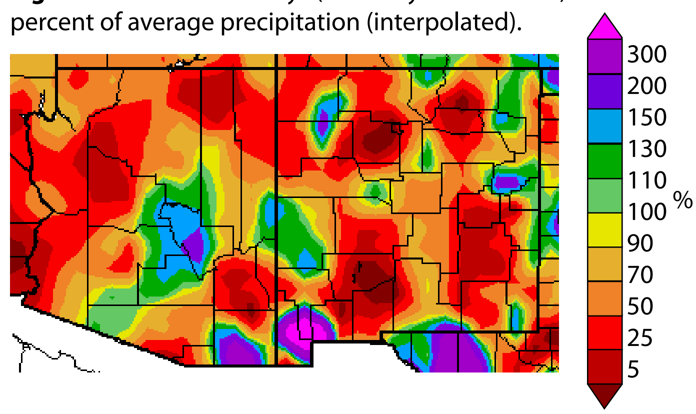
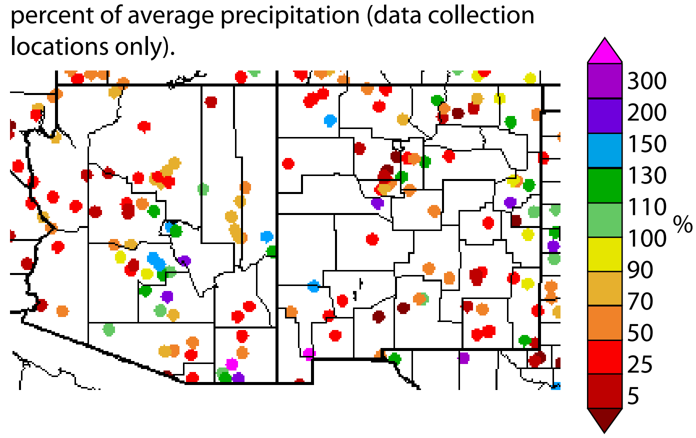


Figure 2d. Previous 30 days (February 19–March 20) percent of average precipitation (data collection locations only).



U.S. Drought Monitor (data through 3/19/13)

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

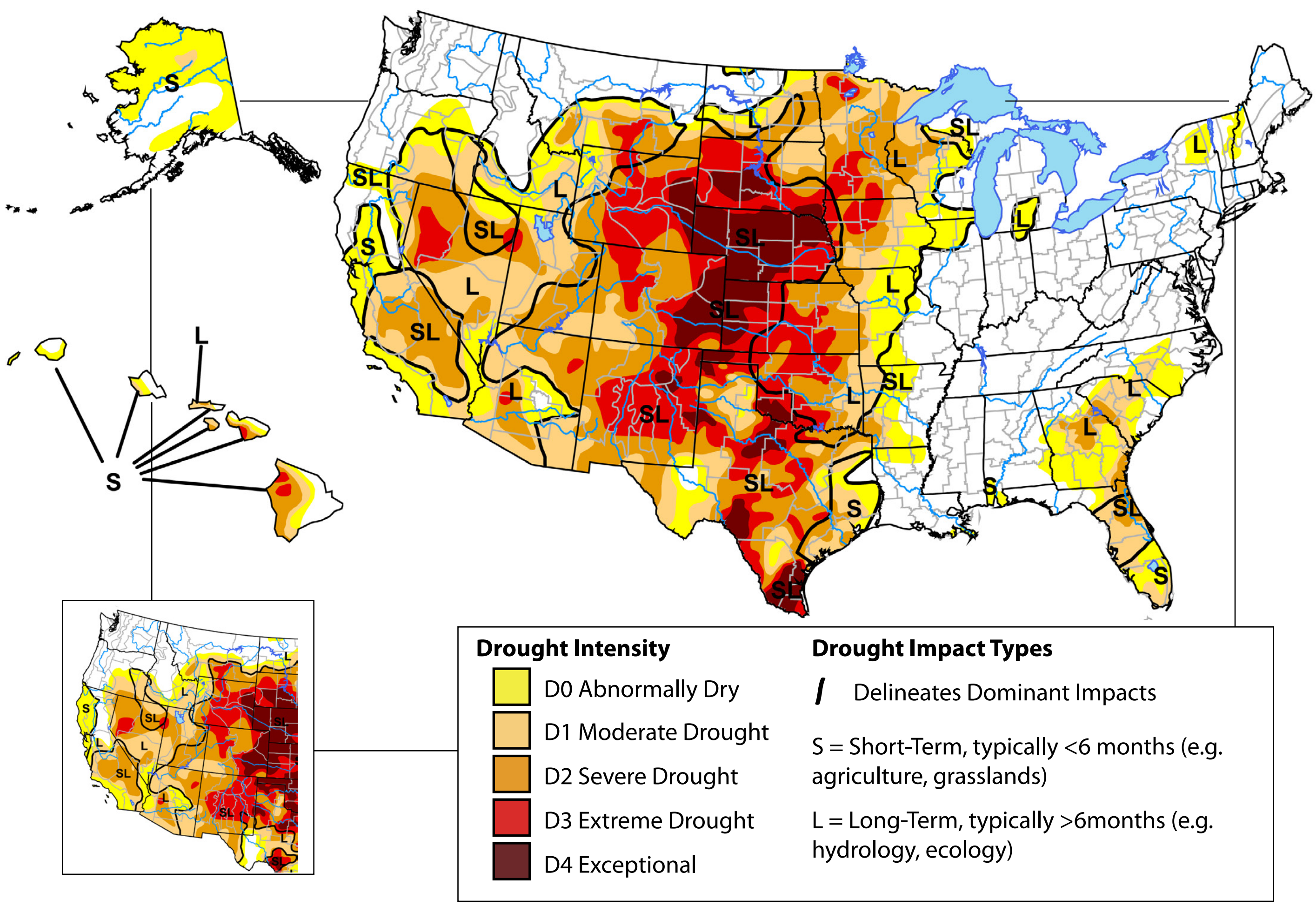
The winter storm track started to move north during the last 30 days, signaling the transition from winter into spring for the Southwest. This transition often occurs at this time of year, although there is some indication that it has been occurring earlier in the year in recent decades. This northward displacement favors precipitation in northern states, and parts of Washington, Idaho, and Montana experienced the bulk of the precipitation in the West, with areas recording above-average rain and snow in the past month. These areas also remain drought-free, according to the March 19 update of the U.S. Drought Monitor (*Figure 3*). Moderate to exceptional drought conditions continue in the rest of the western U.S. south of southern Oregon and Wyoming. Parts of Wyoming, Colorado, and New Mexico, which have had mounting precipitation deficits in the last two years, are still experiencing the most extreme drought conditions. In the last month, the geographic pattern and intensity of drought in the western U.S. did not substantially change. At least moderate drought covers more than 60 percent of the West, with about 25 and 16 percent classified with severe and extreme drought, respectively. In coming months, the seasonal drought forecast suggests that much of the current drought will continue to persist (see page 16). The last time moderate drought covered less than 50 percent of the West was in May 2012, and the last time extreme drought blanketed more area than it currently does was in late 2004, according to the U.S. Drought Monitor.

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 March 19, 2013 (full size), and February 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 3/19/13)

Data Source: U.S. Drought Monitor

Several cold winter storms that produced widespread rain and snow passed through Arizona during the past 30 days, helping erase abnormally dry conditions present in the Mogollon Rim. In this area, winter storms helped push winter season precipitation totals close to average. However, precipitation across the rest of the state was below average.

The March 19 update of the U.S. Drought Monitor shows a state mostly characterized by drought conditions, with about 30 percent of the state classified with severe or extreme drought and nearly 80 percent classified with some drought category (*Figures 4a–b*). These conditions are expected to persist in coming months as the region transitions into the historical dry spring (see page 16). However, because the upcoming period is historically dry, it will also be difficult for precipitation deficits to substantially increase. On the other hand, it will also be difficult for drought conditions to improve unless atypical spring storms waft over the region.

Figure 4a. Arizona drought map based on data through March 19.

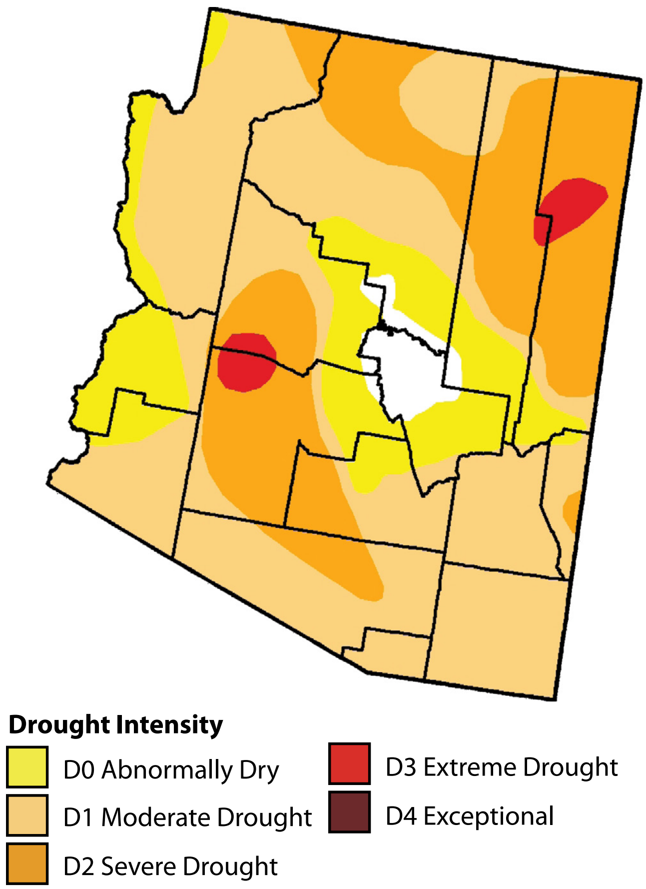


Figure 4b. Percent of Arizona designated with drought conditions based on data through March 19.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	3.06	96.94	80.11	29.72	2.03	0.00
Last Week (03/12/2013 map)	3.06	96.94	80.11	29.72	2.03	0.00
3 Months Ago (12/18/2012 map)	0.00	100.00	97.91	37.78	8.50	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 (03/13/2012 map)	0.47	99.53	92.82	62.25	8.52	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

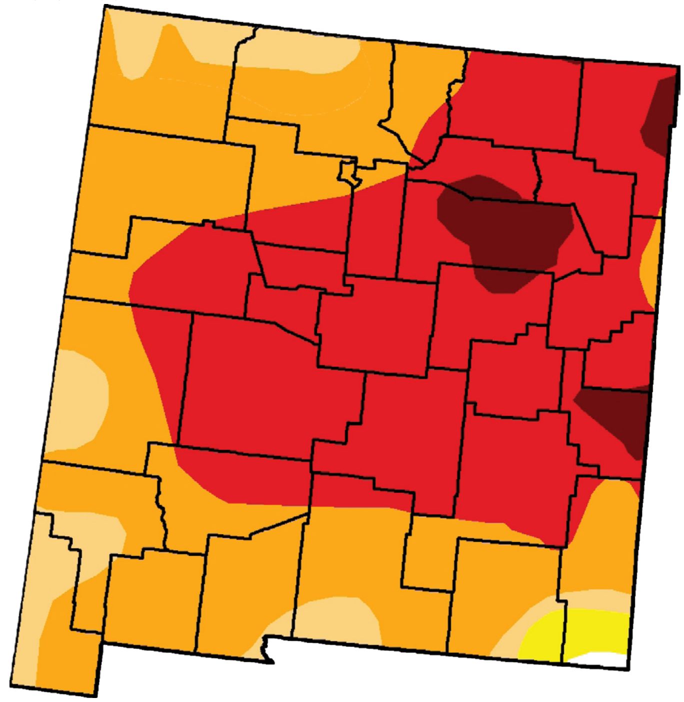
New Mexico Drought Status
(data through 3/19/13)

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

The last 30 days brought below-average precipitation to many parts of New Mexico, keeping severe to extreme drought conditions firmly entrenched (*Figures 5a–b*). While a few winter storms did pass through the state, they delivered only light and spotty precipitation, which did not help short- and long-term precipitation deficits that continue to mount across the state. In the past month, for example, 5 to 50 percent of average precipitation fell across much of the state. In some of the higher elevations in the upper Rio Grande Basin, precipitation deficits in the last month reached nearly 2 inches. Also, parts of the Four Corners region received 0.5 inches below-average precipitation, while many weather stations in the lower Rio Grande Basin around Las Cruces recorded a deficit of around a third of an inch.

Some level of drought covers about 98.5 percent of New Mexico, with extreme drought blanketing about half of the state, according to the March 19 update of the U.S. Drought Monitor. Also, extreme drought intensified into exceptional drought in the past month in parts of the northeast corner of the state—the only regions in both Arizona and New Mexico with an exceptional drought classification. It has been nearly two-and-a-half years since the majority of New Mexico was drought-free.

Figure 5a. New Mexico drought map based on data through March 19.



Drought Intensity

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

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

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.23	99.77	98.47	89.85	49.95	4.25
Last Week (03/12/2013 map)	0.21	99.79	98.49	89.85	49.93	4.25
3 Months Ago (12/18/2012 map)	0.00	100.00	98.83	92.35	23.73	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 (03/13/2012 map)	11.31	88.69	81.79	60.06	24.94	9.13

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 2/28/13)

Data Source: National Water and Climate Center

Combined storage in Lakes Mead and Powell stood at about 51 percent of capacity as of February 28, a decrease of 317,000 acre-feet from the previous month (*Figure 6*) and 9 percent lower than one year ago. Storage in all other Arizona reservoirs reported in Figure 6 increased in February, which is typical for this time of year. However, combined reservoir storage in those reservoirs is about 7.5 percent lower than one year ago. It is likely that decreasing storage on the Colorado River will remain the norm as a result of below-average precipitation, which on average has measured less than 80 percent of average. Outside the Colorado River Basin, total accumulated precipitation through mid-March was close to average in the higher elevations of the Verde River Basin. Despite this, recent warm temperatures have eaten into snowpacks in the Verde Basin and elsewhere and are contributing to forecasts for below-average spring streamflows in all rivers in the Southwest (see page 17).

In water-related news, a proposed plan to build 7,000 homes in Sierra Vista has caused a dispute over groundwater pumping and water rights near the San Pedro River (*The Wall Street Journal*, February 15). The U.S. Bureau of Land Management and some landowners and environmental groups argue that pumping will intercept water that is needed to sustain a stretch of the San Pedro.

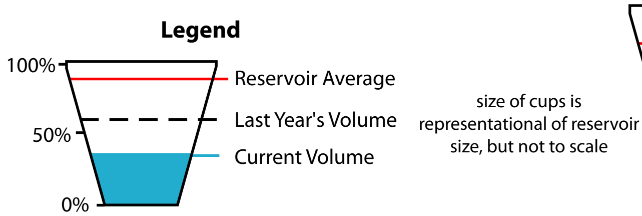
Notes:

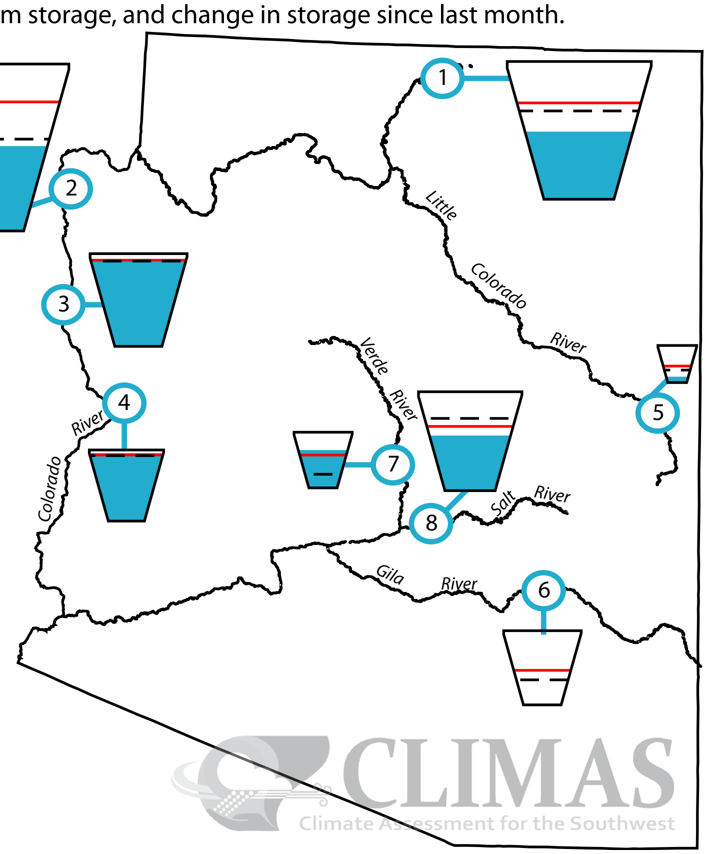
The map gives a representation of current storage for reservoirs in Arizona. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. Note 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 February 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*	Change in Storage*
1. Lake Powell	49%	11.891.0	24,322.0	-299.0
2. Lake Mead	53%	13,810.0	26,159.0	-18.0
3. Lake Mohave	92%	1,665.5	1,810.0	15.7
4. Lake Havasu	94%	582.5	619.0	2.3
5. Lyman	15%	4.5	30.0	0.1
6. San Carlos	1%	11.5	875.0	3.2
7. Verde River System	66%	189.6	287.4	22.4
8. Salt River System	55%	1,119.3	2,025.8	28.2

*** thousands of acre-feet**

On the Web:

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

New Mexico Reservoir Volumes

(through 2/28/13)

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 in the level of Elephant Butte Reservoir (*Figure 7*). Reservoir storage often increases during this time of year as snows begin to melt in the higher elevations.

As of February 28, combined storage on the four reservoirs on the Pecos River was about 1.7 percent of capacity, which is well below average and about 2,300 acre-feet less than one year ago. Reservoirs on the Rio Grande are also extremely low as a result of well-below-average runoff years in 2011 and 2012. Low storage will continue to be a major issue for New Mexico this year because precipitation in the headwaters of the Rio Grande in Colorado—which supplies a large fraction of the total water to the river—was about 70 percent of average through mid-March. Consequently, projections for spring streamflows call for well-below-average flows, with the best estimate suggesting the combined March–July streamflow will be around 55 percent of the historical average (see page 17). Even if several late winter storms douse the Upper Rio Grande Basin, water storage will remain very low; irrigators in the Elephant Butte Irrigation District in southern New Mexico likely will experience another season of reduced allotments. It will take several years of above-average rain and snow to improve the situation on both the Pecos and Rio Grande.

Notes:

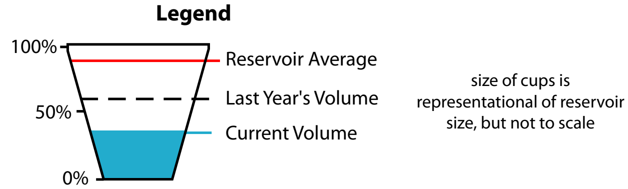
The map gives a representation of current storage for reservoirs in New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity.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

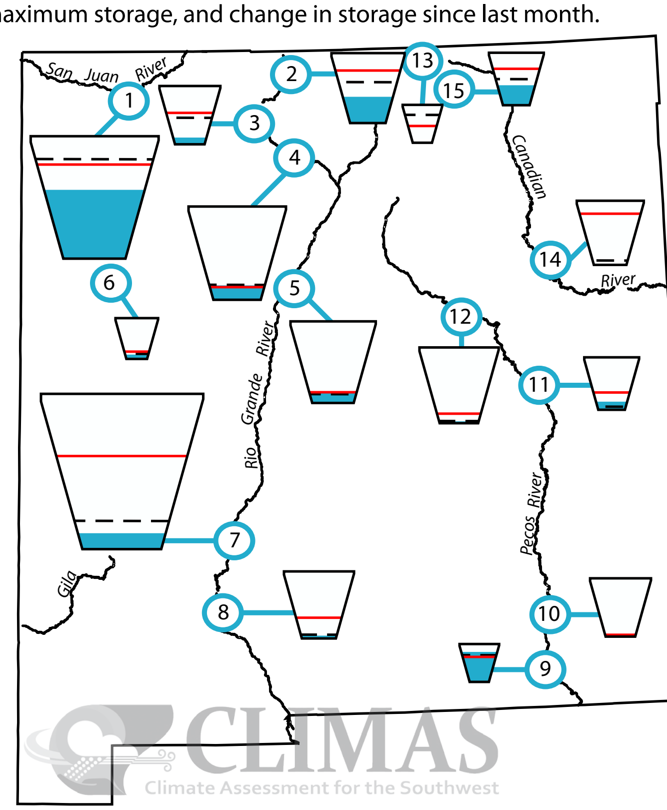
Figure 7. New Mexico reservoir volumes for February as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

Legend



Reservoir Name	Capacity	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	55%	937.0	1,696.0	-10.3
2. Heron	36%	144.2	400.0	-9.6
3. El Vado	10%	18.3	190.3	3.9
4. Abiquiu	14%	167.9	1,192.8	6.2
5. Cochiti	11%	55.2	491.0	-1.1
6. Bluewater	9%	3.3	38.5	0.0
7. Elephant Butte	9%	206.4	2,195.0	23.3
8. Caballo	3%	9.7	332.0	1.3
9. Lake Avalon	78%	3.1	4.0	0.2
10. Brantley	1%	7.3	1,008.2	1.0
11. Sumner	15%	14.9	102.0	2.9
12. Santa Rosa	1%	4.8	438.3	0.0
13. Costilla	0%	0.0	16.0	N/A
14. Conchas	0%	0.9	254.2	-0.6
15. Eagle Nest	37%	29.5	79.0	0.2

*** thousands of acre-feet** **N/A–no storage reported this month**



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

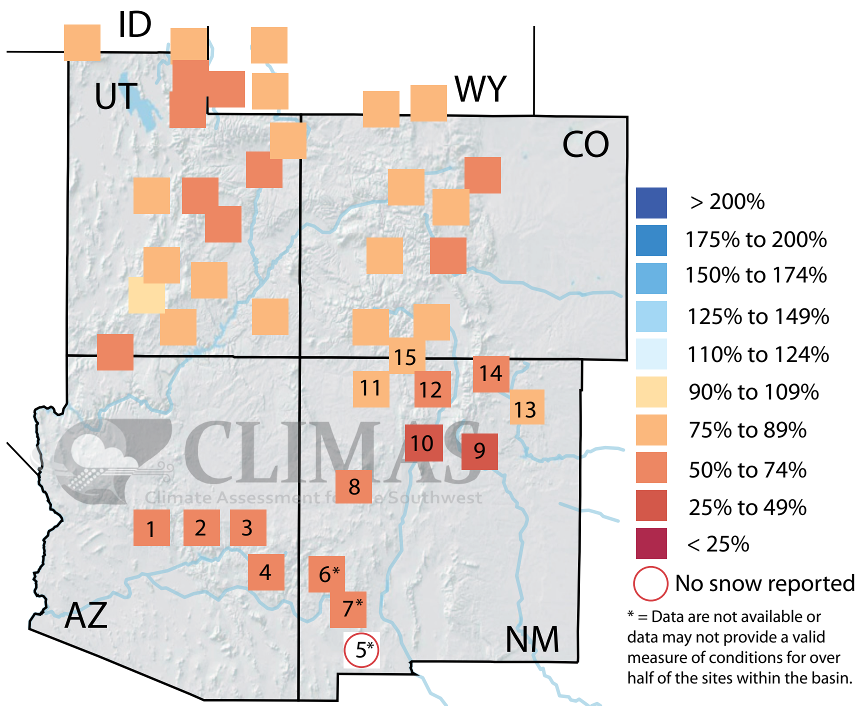
(updated 3/21/13)

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

Precipitation in the last month has been below average in many parts of the higher elevations in Arizona, New Mexico, Colorado, and Utah (see page 7). Temperatures also have been above average in these states (see page 6). The combination of the two has caused water contained in snowpacks, or snow water equivalent (SWE), to be below average in many basins (*Figure 8*). In the Upper Colorado River Basin, snow telemetry (SNOTEL) monitoring stations largely report SWE values of less than 80 percent of average. In these basins, the total accumulated winter precipitation also has been about 80 percent of average. In the headwaters of the Rio Grande in Colorado, the average of seven SNOTEL stations report 72 percent of average SWE. Consequently, the scant snowfall this winter is driving below-average streamflow forecasts for these rivers; best estimates for spring streamflows in the Rio Grande and Colorado River are around 50 percent of average (see page 17).

In Arizona, despite near-average total winter precipitation in the Verde River Basin, the central Mogollon Mountains, and headwaters of the Little Colorado River, current SWE values in these regions are 52, 60, and 60 percent of average, respectively. This likely reflects the very warm recent conditions that have depleted once near-average snowpacks. Incursions of warm temperatures, or an earlier onset of spring, can explain why much below-average SWE can occur amid a winter of near-average total accumulated precipitation. In the past two weeks, for example, average temperatures in Arizona have largely been 3–4 degrees F above average. Warmer-than-average temperatures also have been the norm in Colorado in recent weeks. However, because elevations are higher in Colorado, average temperatures are lower and snowpack conditions remain similar to total accumulated winter precipitation.

Figure 8. Average snow water equivalent (SWE) in percent of average for available monitoring sites as of March 21, 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 by melting the snowpack at the SNOTEL site and is important in estimating runoff and streamflow. It depends mainly on the density of the snow. Given two snow samples of the same depth, heavy, wet snow will yield a greater 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 1971–2000 average values. The number of SNOTEL sites varies by basin. Basins with more than one site are represented as an average of the sites. Individual sites do not always report data due to lack of snow or instrument error. CLIMAS generates this figure using daily 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
(April–September 2013)

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in March 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 April through September (*Figures 9a–d*). Temperature forecasts are based in part on decadal trends and ENSO-neutral events; ENSO-neutral is projected to remain in place through the summer (see page 18). If temperatures are above average for the April–June period, the magnitude of the anomaly is likely to be between 0.4 and 1.5 degrees F in eastern Arizona and New Mexico; temperature anomalies increase from northwest Arizona towards southeast New Mexico. If this forecast holds up, it would continue the above-average temperatures that have characterized this March (see page 6). 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 March, 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 April–June 2013.

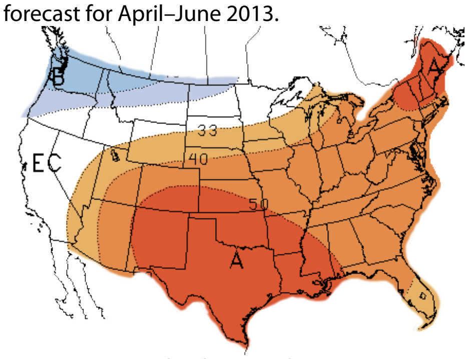


Figure 9b. Long-lead national temperature forecast for May–July 2013.

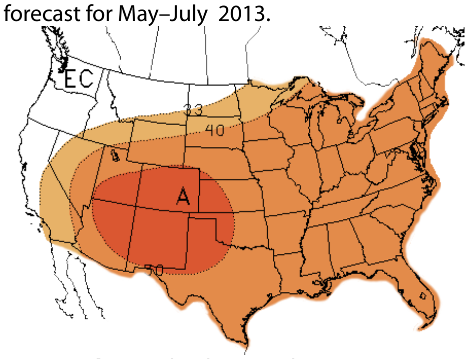


Figure 9c. Long-lead national temperature forecast for June–August2013.

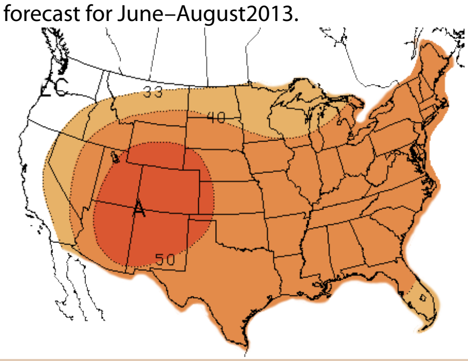
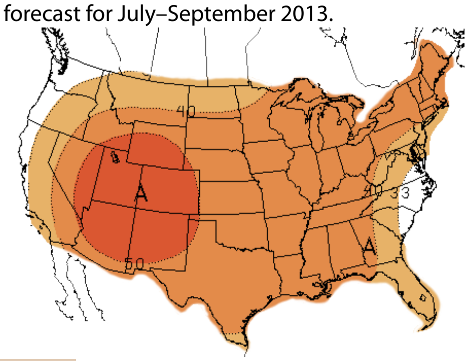


Figure 9d. Long-lead national temperature forecast for July–September 2013.



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
(April–September 2013)
Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal precipitation outlooks issued by the NOAA-Climate Prediction Center (CPC) in March call for increased chances that precipitation during the April–June period will be below average across many parts of the Southwest except in southern regions (*Figure 10a*). The April–June period, however, is historically dry. Most of Arizona and southwestern New Mexico, for example, receive less than 12 percent of their annual precipitation during these months. As a result, below-average precipitation during these months likely will not exacerbate drought conditions. Precipitation anomalies are only expected to be between 0.1 and 0.4 inches if below-average rain and snow occurs. Seasonal forecasts that overlap the monsoon show equal chances for above-, below-, or near-average precipitation for most of Arizona and part of southwest New Mexico (*Figures 10b–d*). The CPC notes, however, that dynamical models show a continuation of the tendency for below-median precipitation in parts of the Southwest monsoon region through summer.

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.

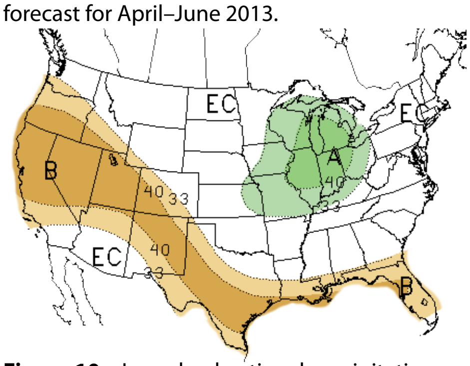


Figure 10a. Long-lead national precipitation forecast for April–June 2013.

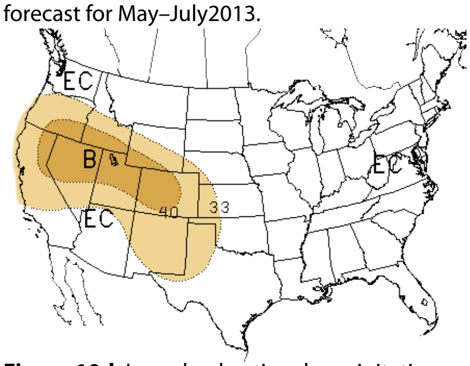


Figure 10b. Long-lead national precipitation forecast for May–July2013.

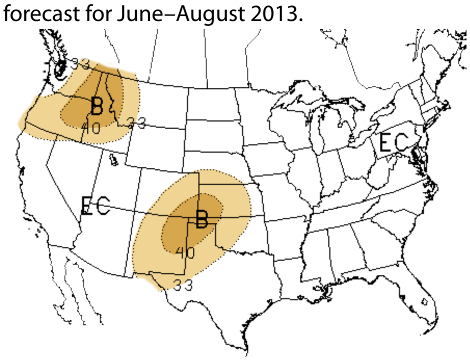


Figure 10c. Long-lead national precipitation forecast for June–August 2013.

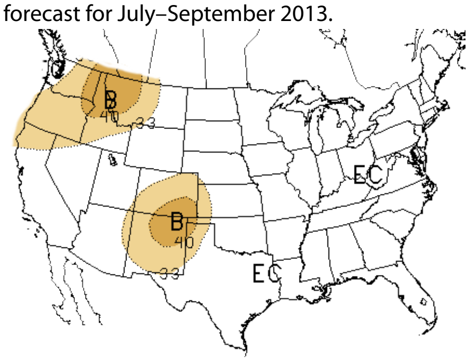
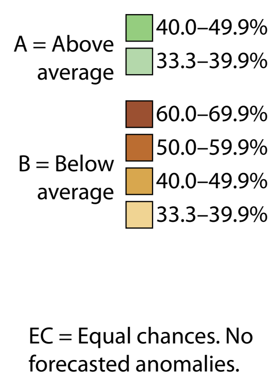


Figure 10d. Long-lead national precipitation forecast for July–September 2013.



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 June 2013)

Data Source: NOAA–Climate Prediction Center (CPC)

This summary is partially excerpted and edited from the March 21 Seasonal Drought Outlook technical discussion produced by the NOAA-Climate Prediction Center (CPC) and written by forecaster B. Pugh.

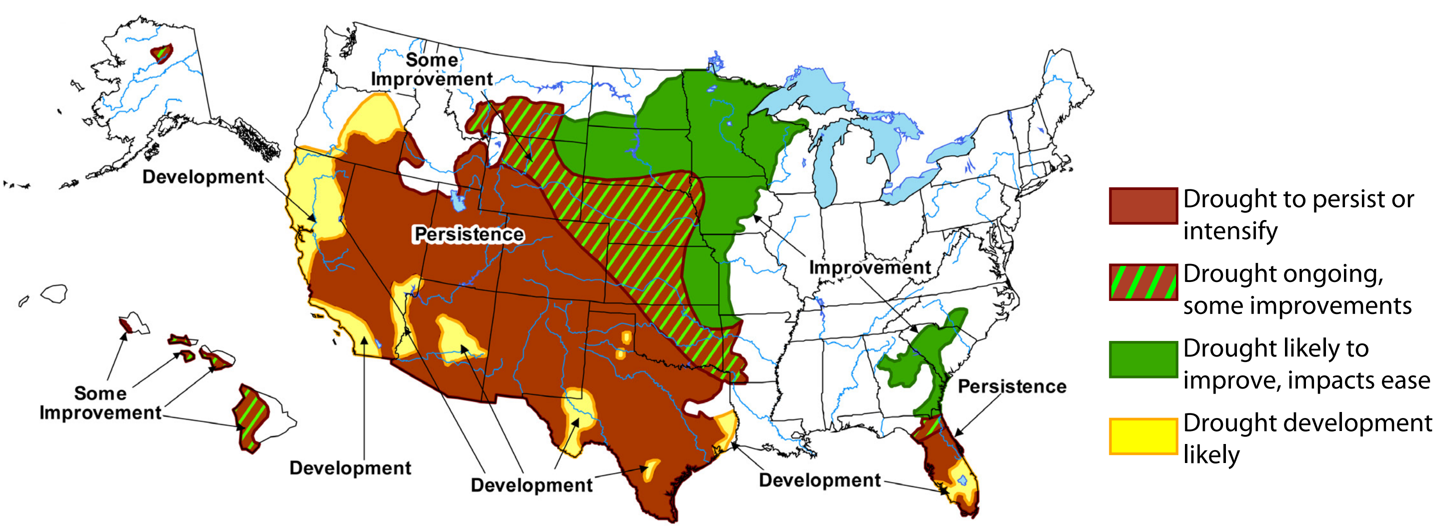
Drought is expected to persist for much of Colorado, New Mexico, Utah, Nevada, and Arizona (*Figure 11*) due to low snow water equivalent values (currently around 75 percent of average; see page 13) and a below-average streamflow forecast (see page 17) for the spring and early summer. Enhanced odds for below-median precipitation and above-average temperatures during April–June also favor persistence. Drought is forecast to develop in some areas in the Southwest, most notably in the central mountains of Arizona. However, snowpack conditions in these regions are near average and the upcoming three-month period is historically dry. Drought impacts in this region, if they emerge, may be caused by rapid snowmelt brought on by increased temperatures. In parts of northeast Colorado, some improvement in drought is forecast as a result of increased chances for precipitation in coming weeks and a lack of a long-term dry signal in the models during this three-month season. The CPC has high confidence in its drought forecast for Colorado, New Mexico, Utah, Nevada, and Arizona.

For the southern High Plains, the CPC also forecasts drought persistence because the monthly and seasonal precipitation outlooks favor below-median precipitation. In addition, there are enhanced chances for above-average temperatures during the April–June period. There are, however, some prospects for improvement across northeast Oklahoma due to expected rainfall in the short term. The CPC assigns moderate confidence to 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 June 2013 (released March 21).



On the Web:

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

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

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

Streamflow Forecast
(for spring and summer)

Source: National Water and Climate Center

The spring–summer streamflow forecast for the Southwest, issued on March 1 by the Natural Resources Conservation Service (NRCS), calls for below-average flows in most river basins in Arizona and New Mexico and in the Upper Colorado River and Rio Grande basins (*Figure 12*). This reflects in large part the scant precipitation that has fallen this winter throughout the region, leading to relatively small snowpacks. As a result, there is 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 39 and 19 percent of the March–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 30 percent chance of exceeding 61 percent of average flows and a very small percent chance of experiencing near-average flows.

For Lake Powell, there is only a 50 percent chance that spring inflow will exceed 43 percent of the 1971–2000 average for April–July, or about 3.1 million acre-feet. The forecast also indicates only a 10 percent chance that Lake Powell inflow will be more than 75 percent of average, providing an indicator that above-average flows are highly unlikely.

Below-average precipitation has fallen this winter in the Rio Grande headwaters in southern Colorado. Consequently, there is a 50 percent chance that the April–July flow in the Rio Grande, measured at Otowi Bridge in New Mexico, will be 55 percent of average. If this occurs, irrigators in the Elephant Butte Irrigation District could experience another season with below-average allotments. As of March 1, Elephant Butte Reservoir contained only 9 percent of its full storage. Also, the projected inflow into the El Vado Reservoir, on the Rio Grande north of Otowi Bridge, is only 54 percent of average; El Vado contained only 10 percent of average storage as of the beginning of March.

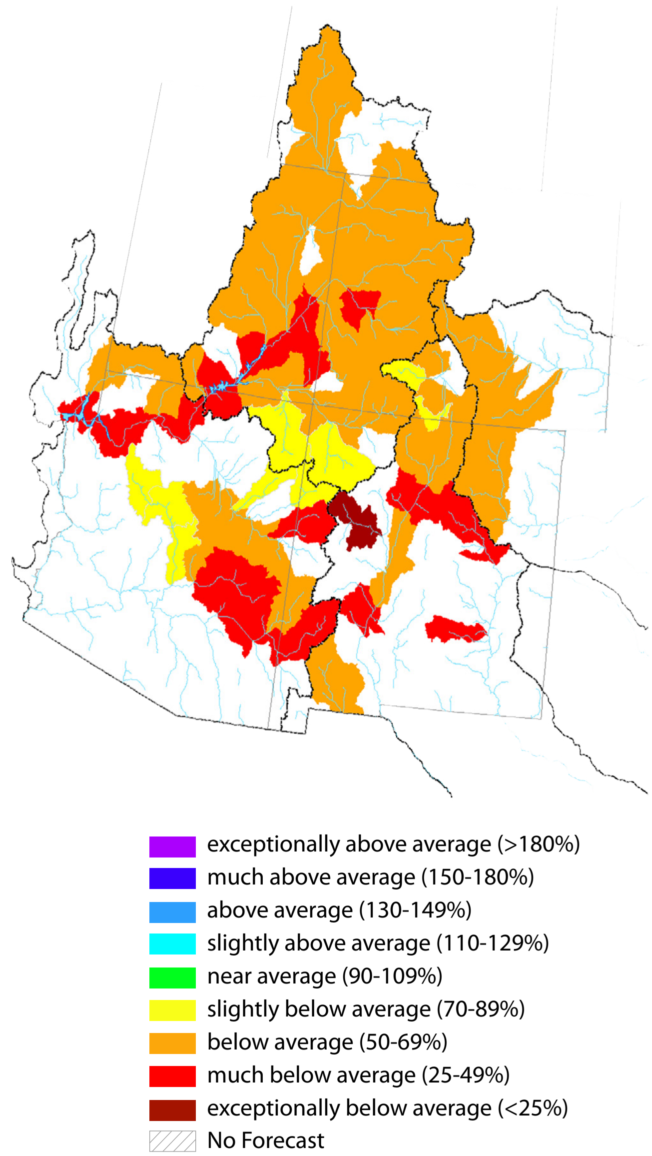
On the Web:

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 March 1 (percent of average).



Notes:

Water supply forecasts for the Southwest are coordinated between the National Water and Climate Center, part of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS), and the Colorado Basin River Forecast Center (CBRFC), part of NOAA. The forecast information provided in Figure 12 is updated monthly by the NWCC. Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences such as reservoirs and diversions. The coordinated forecasts by NRCS and NOAA are only 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 a range of streamflow forecasts in the Colorado Basin ranging from short-fused flood forecasts to longer-range water supply forecasts. The water supply forecasts are coordinated monthly with NWCC.

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 held steady this past month and continue to hover close to average for this time of the year. The International Research Institute for Climate and Society (IRI) states that while the presence of slightly enhanced easterly winds continues along the equator this month—a signal more consistent with borderline La Niña conditions—most other indicators such as the SST pattern point to ENSO-neutral conditions. The Southern Oscillation Index (SOI) is also exhibiting ENSO-neutral conditions (*Figure 13a*).

SST outlooks issued jointly by the NOAA-Climate Prediction Center and IRI continue to point towards a strong likelihood that ENSO-neutral conditions will remain in place through at least the upcoming spring season if not longer (*Figure 13b*). Outlooks issued in mid-March also show that there is greater than a 50 percent chance that neutral conditions will persist through 2013; a majority of both statistical and dynamical models support this. Several dynamical models, however, also point to the possibility that an El Niño will develop in mid-summer. There is low confidence in this scenario at this point due to lack of model agreement and challenges with the spring predictability barrier, which occurs because models have difficulty identifying the initiation of La Niña or El Niño events at this time of year. ENSO forecasts will continue to become more certain later in the spring, but there already appears to be strong agreement among models that neutral conditions will persist.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through February 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 13a. The standardized values of the Southern Oscillation Index from January 1980–February 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).

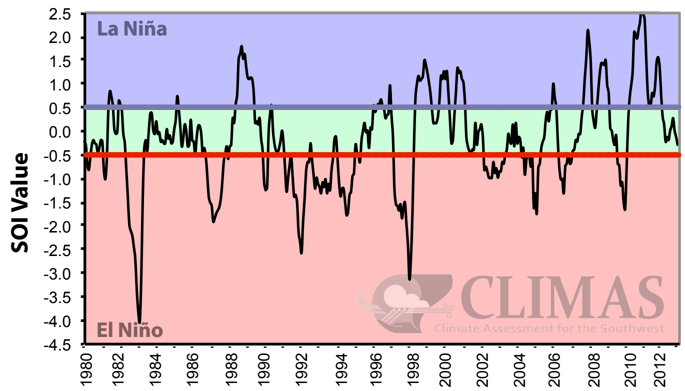


Figure 13b. IRI probabilistic ENSO forecast for the Niño 3.4 monitoring region (released March 21). Colored lines represent average historical probability of El Niño, La Niña, and neutral conditions.