Southwest Climate Outlook

New Mexico Drought 7

Monsoon rain substantially improved drought conditions across the state. However, drought lingers and a wet winter is needed to sustain recent improvements.

Monsoon Summary 10

The monsoon will go down in the books as a good one for most of the Southwest. The big winners were northern Arizona and southeastern Arizona, but above-average rain fell in many other regions, too. Precipitation was more scant around the metropolitan areas.

Precipitation Outlook 12

Long-term drying trends for parts of the Southwest provide hints that this winter may experience below-average precipitation. There is high uncertainty in this forecast, in part because neither an El Niño nor a La Niña event is expected to be present.

Blooming fields in Buffalo Park near Flagstaff reflect an active monsoon summer in which precipitation has measured more than 15 inches, about twice the average, at the Flagstaff airport. Photo taken on September 18, 2013, by Dan Ferguson.

September

Vol 12 Issue 9

SEP 2013

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Tweet September's SW Climate

Monsoon recap: storms dodged cities but soaked elsewhere; drought much improved. SW still needs wet winter.

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September Climate Summary

Drought: Another wet month across much of the Southwest has led to substantial improvements in short-term drought conditions.

Temperature: The last 30 days were generally warmer than average and the summer is turning out to be one of the warmest on record in many areas.

Precipitation: Subtropical moisture drenched New Mexico on its way to Colorado in recent weeks, and most of the Southwest has benefitted from an active monsoon.

ENSO: ENSO-neutral conditions are expected to persist through the fall season and most likely through next winter and spring.

Forecasts: Outlooks call for enhanced chances for above-average temperatures and below-average precipitation through the winter; both are based, in part, on long-term trends.

Climate Snapshot: The monsoon officially ends on September 30, but for all intents and purposes its last gasp has already passed. Atmospheric circulation is now drawing dry air from the West. In coming weeks, some southerly moisture may be sucked from the south as if the monsoon were revving back up, but these intermittent episodes are common in this monsoon-winter transition period. There is no reason, however, to lament the ending of the monsoon. It delivered enough storms to much of the Southwest to drive precipitation to above-average levels for only the fifth time since 2000. The rain has dramatically improved drought conditions, particularly by reducing acute short-term drought. At the start of the monsoon on June 18, nearly 90 percent of New Mexico and 22 percent of Arizona were classified with extreme or exceptional drought. Now, about 6 and 2 percent of New Mexico and Arizona, respectively, are classified with extreme and exceptional drought. There is some indication that this winter will deliver below-average rain and snow, however. These outlooks are based on long-term drying trends but are far from conclusive. Without a strong signal from the El Niño-Southern Oscillation—the climatologist's best statistical tool for seasonal forecasts uncertainty is high. ENSO-neutral conditions often do not steer the jet stream, which ferries storms into the region, to either a more northerly or southern trajectory like La Niña and El Niño events do. There is, however, more certainty that temperatures will be above average in coming months, based, at least in part, on long-term trends that are evident at many spatial scales.

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.

Online Resources

Temperature maps
www.hprcc.unl.edu/maps/current/

Temperature and precipitation trends
www.cpc.ncep.noaa.gov/trndtext.shtml

Notes

The water year begins on October 1 and ends on September 30 of the following year. We are in the 2013 water year as of October 1, 2012. 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.

Temperature

DATA THROUGH SEPTEMBER 18, 2013

Data Source: High Plains Regional Climate Center

Temperatures since the water began on October 1 reflect topography; the lower deserts have been warmer than higher elevations across the Colorado Plateau (*Figure 1a*). The higher elevations of western northern and central New Mexico also have experienced cool temperatures. Average temperatures in most of Arizona and New Mexico have been within one degree of average, with some notable exceptions in eastern New Mexico, small areas of northern New Mexico in the Sangre de Cristo Mountains, and western Pima County in Arizona (*Figure 1b*). During the last winter, cold winter storms passed more frequently through northern portions of both states than southern regions, helping drive down average conditions. The past few months as a whole were above average, with weather stations at the airports in Tucson, Phoenix, Flagstaff, El Paso, and Albuquerque all recording temperatures within their warmest five summers on record. The June–August period was also the seventh and 12th warmest on record for New Mexico and Arizona, respectively.

In the past 30 days, temperatures in northern New Mexico were mostly between 2 and 6 degrees F warmer than average. In southern regions, although temperatures were above average, their deviations were less than they were in regions to the north (*Figures 1c–d*). The north-south temperature gradient likely would have been greater had it not been for recent rainfall from the subtropical moisture that moved up into Colorado in mid-September and cooled many parts of the higher elevations. In Arizona, temperatures were both above and below average, with cooler temperatures in regions with more rainfall.

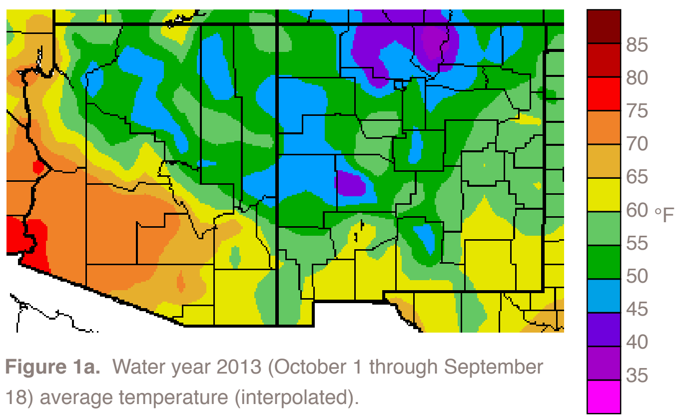


Figure 1a. Water year 2013 (October 1 through September 18) average temperature (interpolated).

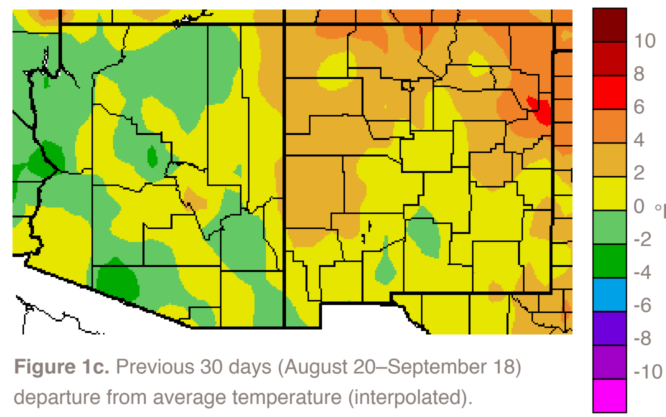


Figure 1c. Previous 30 days (August 20–September 18) departure from average temperature (interpolated).

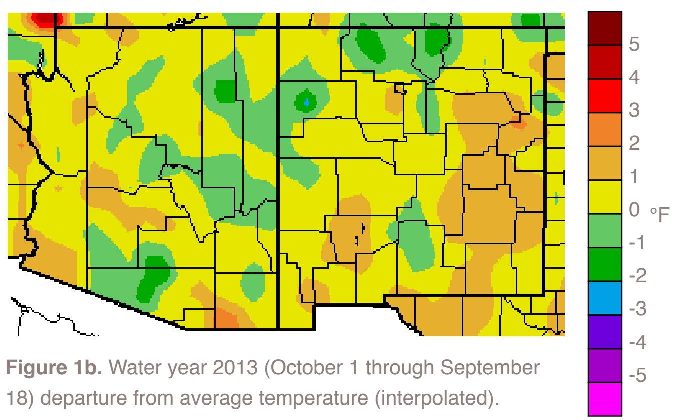


Figure 1b. Water year 2013 (October 1 through September 18) departure from average temperature (interpolated).

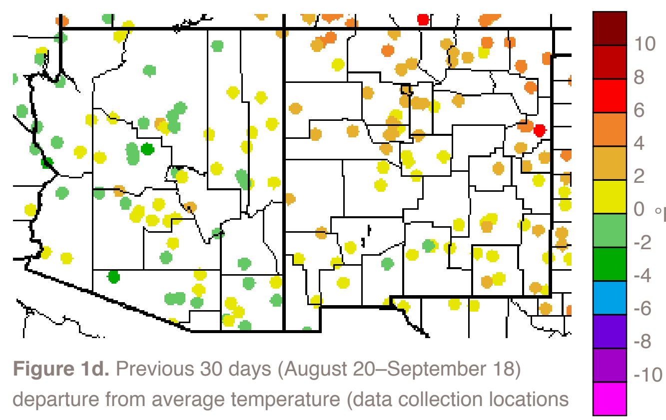


Figure 1d. Previous 30 days (August 20–September 18) departure from average temperature (data collection locations only).

Precipitation

DATA THROUGH SEPTEMBER 18, 2013

Data Source: High Plains Regional Climate Center

Winter precipitation, which brought more rain and snow to the higher elevations of central Arizona and northern New Mexico (albeit below average in New Mexico), and the monsoon, which is historically heterogeneous in space, hascontributed to the high geographic variability during the 2013 water year. Higher elevations in Arizona and parts of the lower Colorado River Valley have been wetter than average since October 1, while high elevations in northwestern New Mexico have been dry (*Figures 2a–b*). The wet conditions along the western border of Arizona are due in part to moisture from several tropical storms during the monsoon that moved north along the Baja coast.

Many locations in both states received a large fraction of their water year precipitation in the past 30 days, as large plumes of subtropical moisture moved north from Mexico and lingered over the Southwest before moving into Colorado (*Figure 2c–d*). Despite high rainfall in the last 30 days in New Mexico that was between 150 and 800 percent of average, the precipitation deficit that accumulated over the water year was large enough that it continues in many regions. Nonetheless, rain in the last 30 days, combined with earlier summer rains, helped improve drought conditions across Arizona and the Southwest (see Arizona and New Mexico Drought Statuses). However, drought is still present in most of the Southwest, and winter precipitation will go a long way to sustaining these improvements or worsening conditions. Based on long-term trends, there is some evidence that parts of the Southwest will experience a fourth consecutive winter with below-average precipitation (see Precipitation Outlook).

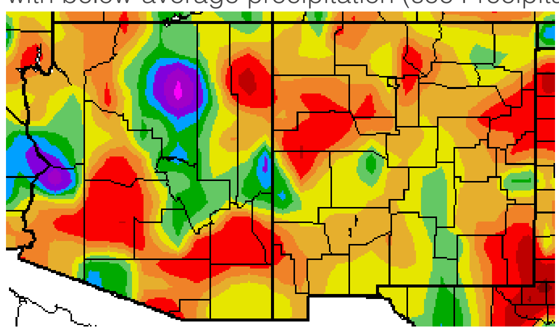
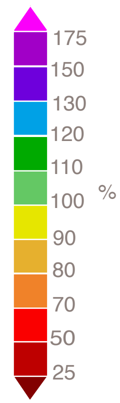



Figure 2a. Water year 2013 (October 1–September 18) percent of average precipitation (interpolated).

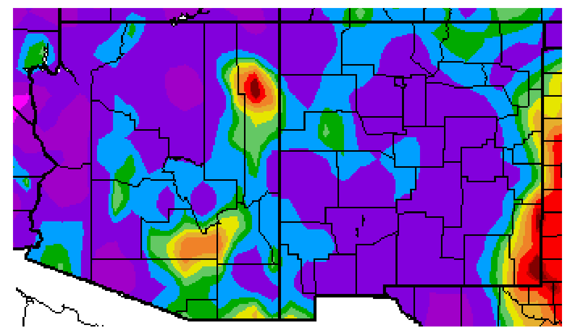
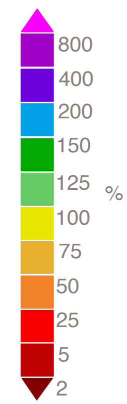



Figure 2c. Previous 30 days (August 20–September 18) percent of average precipitation (interpolated).

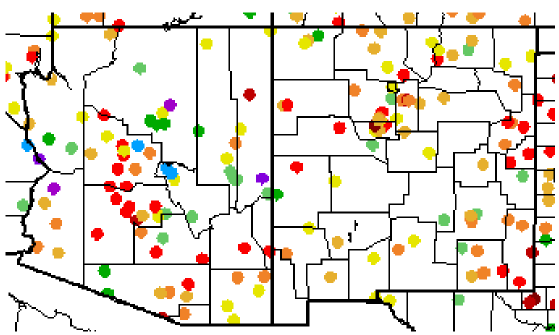
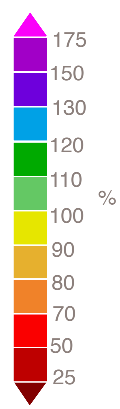



Figure 2b. Water year 2013 (October 1–Septemeber 18) percent of average precipitation (data collection locations only).

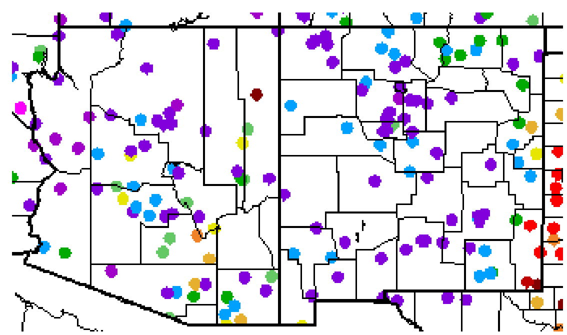
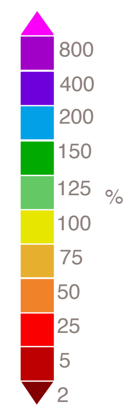



Figure 2d. Previous 30 days (August 20–September 18) percent of average precipitation (data collection locations

Online Resources

Precipitation maps
www.hprcc.unl.edu/maps/current/

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

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.

Online Resources

The weekly U.S. Drought Monitor
www.drought.gov/drought/

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.

U.S. Drought Monitor

DATA THROUGH SEPTEMBER 17, 2013

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

The Four Corners states of Arizona, Utah, New Mexico, and Colorado observed the biggest improvements in drought conditions during the past 30 days in the western U.S. Monsoon moisture interacting with several slow moving tropical and upper level low pressure systems brought record rainfall to much of the Southwest, delivering much needed relief to short-term drought conditions across the region. Large parts of Utah and Colorado were upgraded from severe to moderate drought classifications, while most of the extreme drought was erased from Arizona and New Mexico (*Figure 3*). Dry conditions north and west of the Four Corners states, however, kept drought conditions firmly in place across much of California, Nevada, and southern Oregon and Idaho. Overall, some level of drought covers about 81 percent of the western U.S., a slight improvement from the 87 percent noted in mid-August. The area under extreme or exceptional drought also fell from 20 percent in mid-August to 8 percent in mid-September.

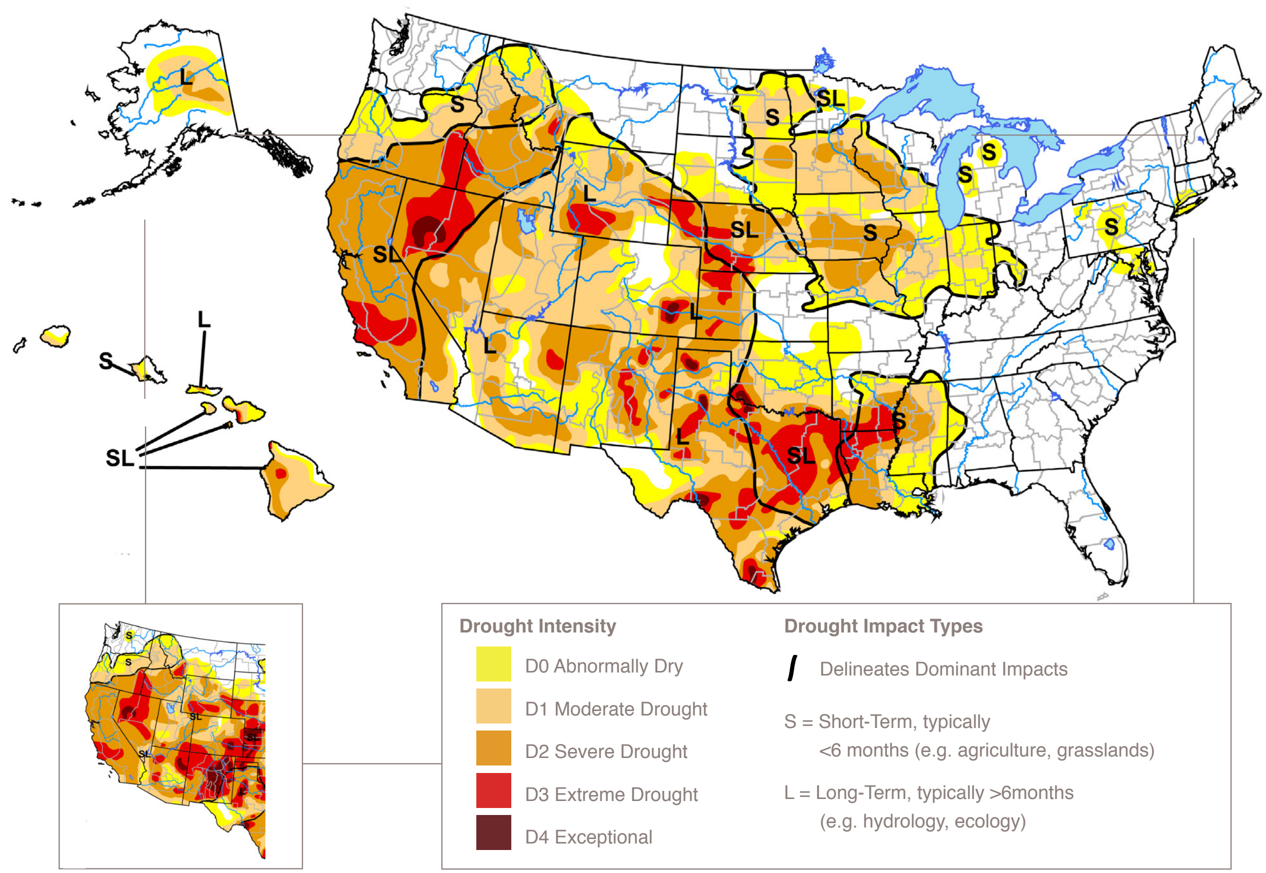


Figure 3. Drought Monitor data through September 17, 2013 (full size), and August 13, 2013 (inset, lower left).

Online Resources

Current drought status map
www.droughtmonitor.unl.edu/DM_state.htm?AZ,W

Monthly short-term and quarterly long-term Arizona drought status maps
www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm

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.

Arizona Drought Status

DATA THROUGH SEPTEMBER 17, 2013

Data Source: U.S. Drought Monitor

Several bouts of widespread monsoon activity associated with incursions of tropical moisture led to substantial improvements in short-term drought conditions in much of Arizona during the past 30 days. The U.S. Drought Monitor now classifies some parts of Arizona as drought free (*Figures 4a–b*). The largest improvements in northern and western parts of the state received most of the precipitation over the month, experienced. Many areas classified with either severe or extreme drought in mid-August have now improved to the moderate drought or abnormally dry categories. Overall, precipitation amounts were between 150 and 200 percent of average across these areas. However, the monsoon did not soak all of the state. Parts of central Arizona, including the Tucson metro area, fell behind in precipitation and have remained stuck at the severe drought level.

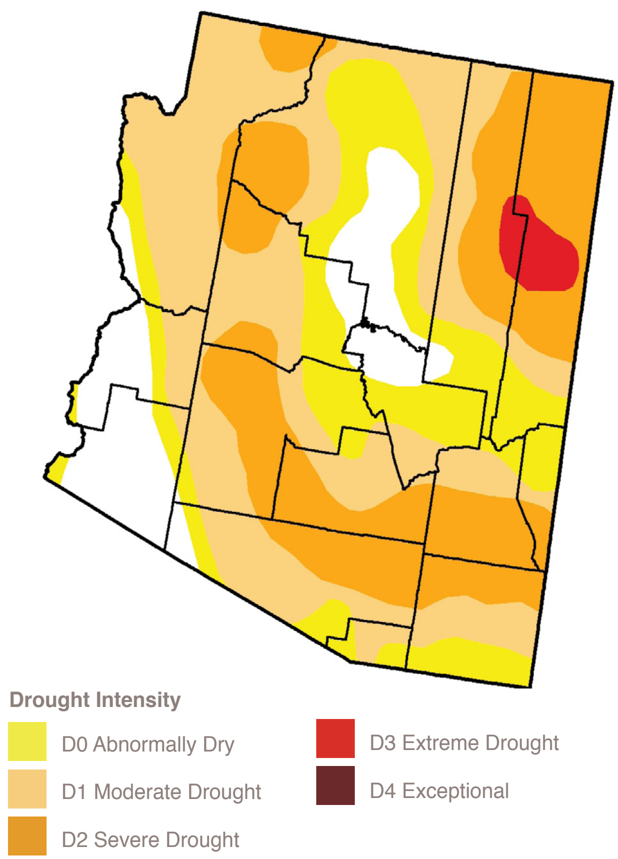


Figure 4a. Arizona drought map based on data through September 17.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	12.81	87.19	66.82	30.35	1.94	0.00
Last Week (09/10/2013 map)	3.43	96.57	74.04	41.52	15.49	1.94
3 Months Ago (06/18/2013 map)	0.00	100.00	92.49	72.23	22.25	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 (09/11/2012 map)	0.00	100.00	100.00	32.65	6.89	0.00

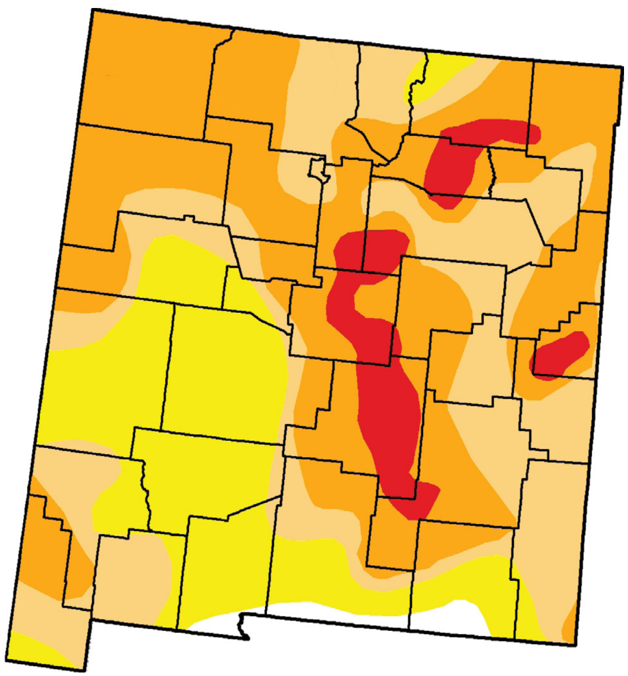
Figure 4b. Percent of Arizona designated with drought conditions based on data through September 17.

New Mexico Drought Status

DATA THROUGH SEPTEMBER 17, 2013

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

The monsoon has delivered much needed rainfall to New Mexico. In the last 30 days, above-average precipitation fell in almost all of the state, with many areas seeing rainfall totals of two to three times the average for this time of year. Several slow moving upper level disturbances sparked heavy precipitation events in mid-September that led to flash flooding and several dam breaks in northern and central parts of the state. While these events were damaging, they have contributed to a second consecutive month of substantial improvements in short-term drought conditions. On June 18, more than 90 percent of New Mexico was classified with extreme or exceptional drought. This number fell to 66 percent in mid-August. In the most recent update of the U.S. Drought Monitor, published on September 17, only about 6 percent of New Mexico was classified with these drought categories (*Figures 5a–b*). Also, much of the southwestern quarter of the state is now just abnormally dry, which is not considered a drought classification. These areas were tagged as severe to extreme over the past year.



Drought Intensity

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

Figure 5a. New Mexico drought map based on data through September 17.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	1.64	98.36	74.94	45.75	6.44	0.00
Last Week (09/10/2013 map)	0.37	99.63	96.96	77.61	45.88	8.55
3 Months Ago (06/18/2013 map)	0.00	100.00	100.00	98.49	90.18	44.13
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 (09/11/2012 map)	0.00	100.00	100.00	62.40	12.35	0.66

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

Online Resources

Current drought status map

www.droughtmonitor.unl.edu/DM_state.htm?NM,W

Current Drought Status Reports

www.nmdrought.state.nm.us/MonitoringWorkGroup/wk-monitoring.html

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.

Online Resources

Portions of the information provided in this figure can be accessed at NRCS

http://1.usa.gov/19e2BdJ

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).

Arizona Reservoir Volumes

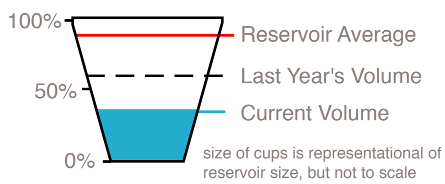
DATA THROUGH AUGUST 31, 2013

Data Source: National Water and Climate Center

Combined storage in Lakes Mead and Powell stood at 45.7 percent of capacity on August 31 (*Figure 6*), a decrease of 395,000 acre-feet from the previous month and about 9 percent lower than one year ago. The water elevation of Lake Powell peaked in mid-June and will continue to decline until spring. Monsoon rainfall has given boosts to some Arizona reservoirs, including the San Carlos Reservoir. Combined storage in the Salt and Verde river basins decreased by about 31,000 acre-feet and currently stands at 54.4 percent of capacity, down by 4.2 percent from last year.

In water-related news, the worst 14-year drought period in the last 100 years has contributed to changes in the amount of water released from Lake Powell to Lake Mead, according to the U.S. Bureau of Reclamation (BOR). Based on the best available projections of reservoir elevations and in accordance with the Interim Guidelines for Lower Basin Shortages and Coordinated Operations for Lake Powell and Lake Mead, the BOR will release 7.48 million acre-feet (maf) from Lake Powell to Lake Mead between October 1, 2013 and September 30, 2014. In recent years, releases amounted to 8.23 maf per year. As a consequence, water levels in Lake Mead will continue to decline, resulting in a 50 percent chance that the water elevation will fall below 1,075 feet above sea-level in the next two years, triggering mandated conservation strategies.

Legend



Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	44%	10,788.0	24,322.0	-414.0
2. Lake Mead	47%	12,289.0	26,159.0	19.0
3. Lake Mohave	96%	1,735.9	1,810.0	19.1
4. Lake Havasu	98%	603.8	619.0	13.9
5. Lyman	12%	3.5	30.0	0.4
6. San Carlos	2%	1.8	875.0	6.6
7. Verde River System	62%	177.4	287.4	0.4
8. Salt River System	53%	1,080.0	2,025.8	-31.1

*thousands of acre-feet

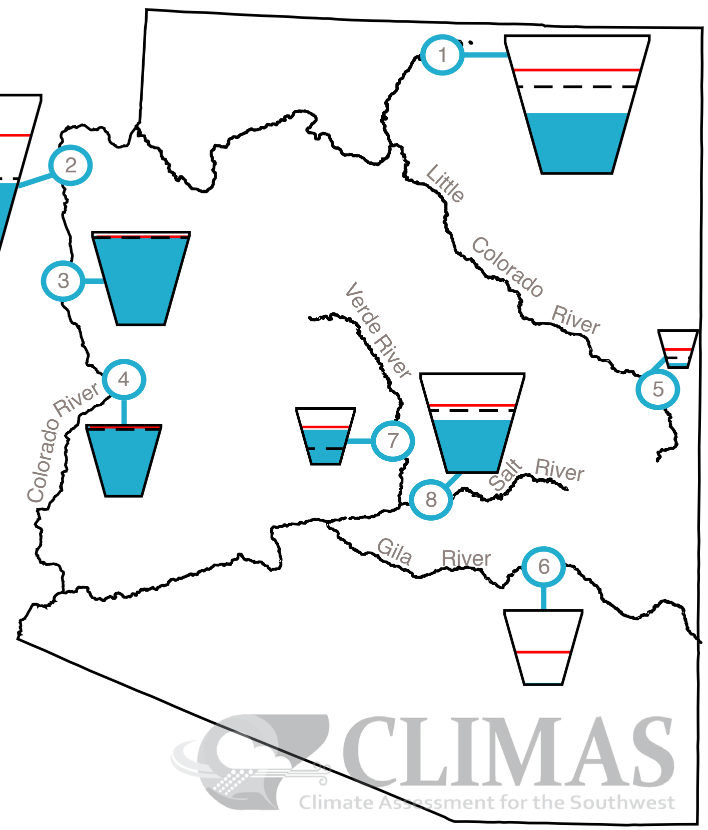


Figure 6. Arizona reservoir volumes for the end of August as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

Online Resources

Portions of the information provided in this figure can be accessed at NRCS

www.wcc.nrcs.usda.gov/wsf/reservoir/resv_rpt.html

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).

New Mexico Reservoir Volumes

DATA THROUGH AUGUST 31, 2013

Data Source: National Water and Climate Center

Combined water storage in the 15 New Mexico reservoirs reported here was 15.9 percent of capacity—a combined decline of 0.6 percent—and only 36.3 percent of average as of August 31 (*Figure 7*). New Mexico total reservoir storage decreased by 54,000 acre-feet in the last month, primarily as a result of decreases in Navajo and Heron reservoirs in northern New Mexico and Caballo Reservoir on the Rio Grande. Storage in several New Mexico reservoirs increased during the last month due to much needed summer monsoon precipitation. However, Elephant Butte Reservoir is still at an exceedingly low 4.1 percent of capacity. These reservoir levels reflect the effect of two consecutive years of extremely low snowpack in the mountain ranges in northern New Mexico and southern Colorado from which most of the water originates. Based on long-term drying trends, there are slightly enhanced probabilities that precipitation will be below average (see Precipitation Outlook). A third consecutive dry winter would further strain water supplies; this summer irrigators drawing water from Elephant Butte Reservoir received only 3 inches of water per acre. When the reservoir is flush, farmers receive 36 inches per acre.

Legend

Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	51%	864.0	1,696.0	-23.1
2. Heron	21%	84.5	400.0	-21.5
3. El Vado	11%	21.4	190.3	5.1
4. Abiquiu	12%	145.3	1,192.8	6.5
5. Cochiti	10%	47.1	491.0	0.0
6. Bluewater	6%	2.5	38.5	0.1
7. Elephant Butte	4%	90.9	2,195.0	16.4
8. Caballo	4%	11.8	332.0	-47.7
9. Lake Avalon	28%	1.1	4.0	-1.3
10. Brantley	0%	4.6	1,008.2	-1.3
11. Sumner	4%	4.1	102.0	-0.4
12. Santa Rosa	3%	11.0	438.3	2.6
13. Costilla	11%	1.7	16.0	-0.4
14. Conchas	11%	28.6	254.2	14.7
15. Eagle Nest	28%	21.8	79.0	-1.1

N/A–value not available

* thousands of acre-feet

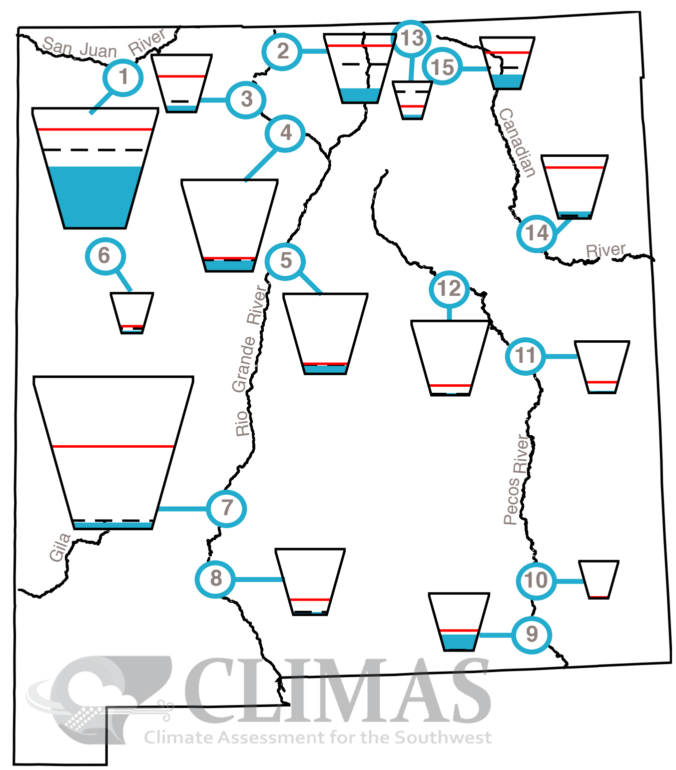


Figure 7. New Mexico reservoir volumes for August as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

Online Resources

Data obtained from High Plains Regional Climate Center
www.hprcc.unl.edu/maps/current/

Notes

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

Average refers to the arithmetic mean of annual data from 1971–2000. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100. Departure from average precipitation is calculated by subtracting the average from the current precipitation.

Monsoon Summary

DATA BETWEEN JUNE 20-SEPTEMBER 17, 2013

Data Source: Western Regional Climate Center

The monsoon is best described by the doggerel "it rained a lot where people are not." Spatially, much of Arizona and New Mexico received above-average rain. However, the monsoon fizzled over some of the major metropolitan areas in Arizona.

Copious rains fell in the White Mountains of Arizona, the Mogollon Rim area, and around Flagstaff, where precipitation totals have exceeded 10 inches– more than 2 inches above average (*Figures 8a–b*). In these and other areas, precipitation has been largely above 125 percent of average (*Figure 8c*). Flagstaff is likely to experience at least the second wettest monsoon on record, and if more rain falls before September 30 – the date the National Weather Service defines as the end of the monsoon – it could rank as the wettest. Southeast Arizona also experienced bountiful rain. July was the wettest on record for Douglas, where more than 10 inches of rain fell. Like Flagstaff, the June15–September 30 period will go in the record books as the second wettest or wettest monsoon. Rain missed many places in the densely populated areas, most notably in Tucson. The NWS rain gauge at the Tucson International Airport has tallied only 3.74 inches through September 15; average monsoon precipitation at this station is about 6 inches. In addition to widespread rain, warmer-than-average temperatures have characterized the 2013 monsoon, particularly minimum temperatures. Tucson, Phoenix, and Flagstaff all had their second warmest monsoon on record. The monsoon was also active in New Mexico, where more than 125 percent of average rain fell in many parts of the state.

The summer storms have helped improve drought conditions. About 90 percent of New Mexico was classified with extreme and exceptional drought conditions on June 18. That number fell to about 6 percent on September 17 (see New Mexico Drought Status). Drought in Arizona also markedly improved. About 30 percent of the state is now classified with severe and extreme drought, down from about 72 percent on June 18 (see Arizona Drought Status).

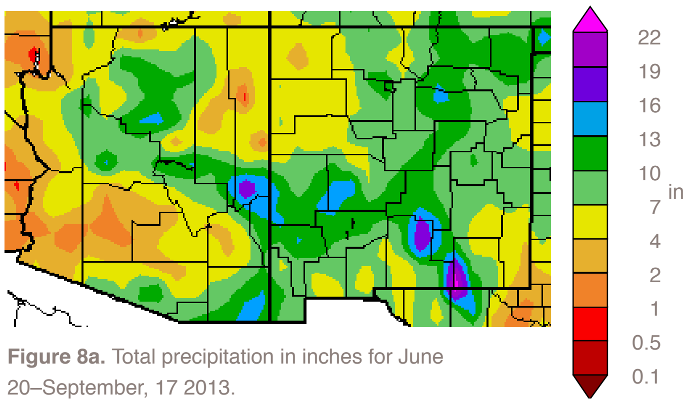


Figure 8a. Total precipitation in inches for June 20–September, 17 2013.

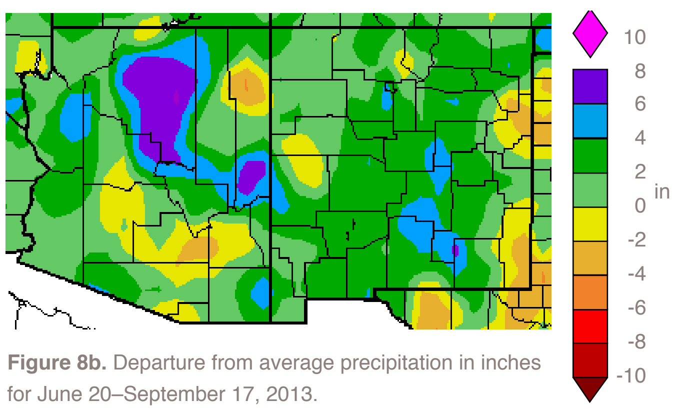


Figure 8b. Departure from average precipitation in inches for June 20–September 17, 2013.

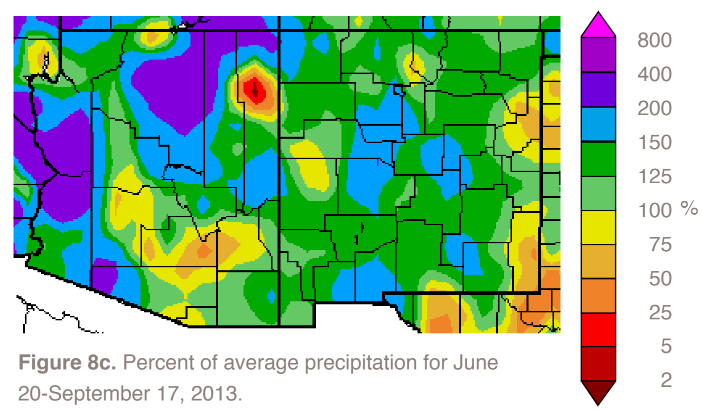


Figure 8c. Percent of average precipitation for June 20-September 17, 2013.

Online Resources

CPC forecasts
www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.php

Seasonal temperature forecast downscaled to the local scale
www.weather.gov/climate/l3mto.php

IRI forecasts
iri.columbia.edu/climate/forecast/net_asmt/

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 a 33.3 percent 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 40.0–49.9 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.

Temperature Outlook

FORECAST PERIOD: OCTOBER 2013–MARCH 2014

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in September 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 October through March (*Figures 9a–d*). These forecasts are based largely on dynamical models, but long-term trends are also used. In recent decades, many areas in Arizona and New Mexico have experienced above-average temperatures. For the October–December period, experimental 2-class temperature forecasts indicate a 60–65 percent chance that temperatures will be above average, and the most likely range of temperature anomalies is between 0.2 and 0.6 degrees F in all of Arizona and New Mexico.

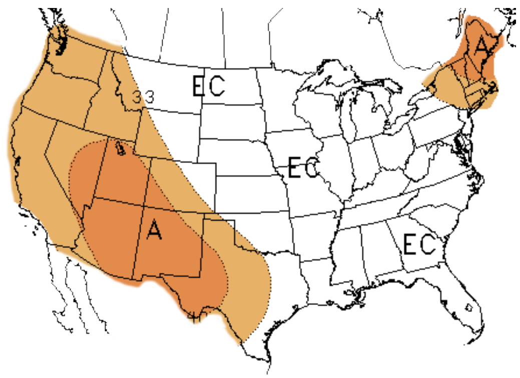


Figure 9a. Long-lead national temperature forecast for October–December 2013.

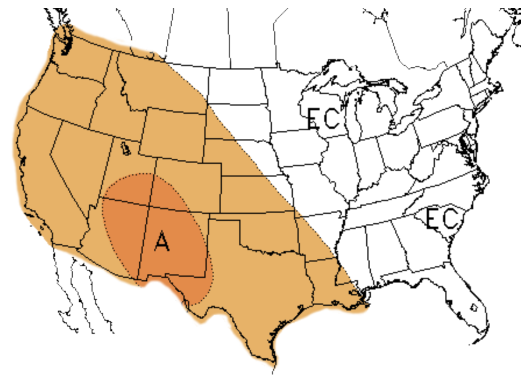


Figure 9b. Long-lead national temperature forecast for November 2013–January 2014.

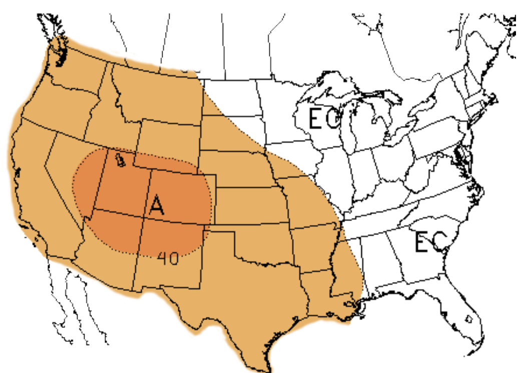


Figure 9c. Long-lead national temperature forecast for December 2013–February 2014.

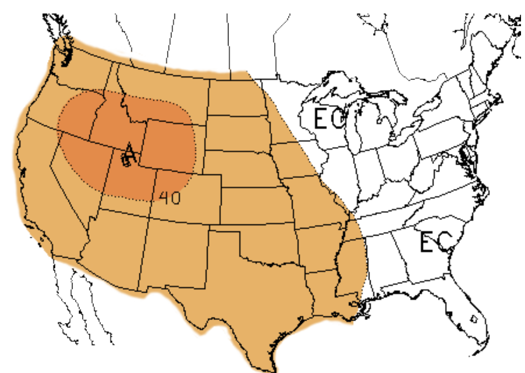


Figure 9d. Long-lead national temperature forecast for January-March 2014.

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.

Online Resources

CPC forecasts

www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.php

Seasonal temperature forecast downscaled to the local scale

www.weather.gov/climate/l3mto.php

IRI forecasts

iri.columbia.edu/climate/forecast/net_asmt/

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 a 33.3 percent 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 40.0–49.9 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.

Precipitation Outlook

FORECAST PERIOD: OCTOBER 2013–MARCH 2014

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal precipitation outlooks issued by the NOAA-Climate Prediction Center (CPC) in September call for equal chances that precipitation will be above, below, or near average for the Southwest during the October–December period (*Figure 10a*). This forecast in part reflects the expectation that the El Niño-Southern Oscillation (ENSO) will remain in a neutral state. ENSO-neutral conditions, however, have been accompanied by both above- and below-average rain and snow in Arizona and New Mexico, which makes forecasting based on ENSO alone difficult. The possibility that remnants of Pacific Ocean storms and hurricanes that could waft into the region add uncertainty in the October–December outlooks. It is difficult projecting the frequency of these events as well as their storm tracks. For seasons spanning November–March period, the CPC is calling for increased chances for below-average precipitation even though ENSO is expected to remain neutral during the winter (see ENSO Status; *Figures 10b–d*). These forecasts are based primarily on decadal drying trends.

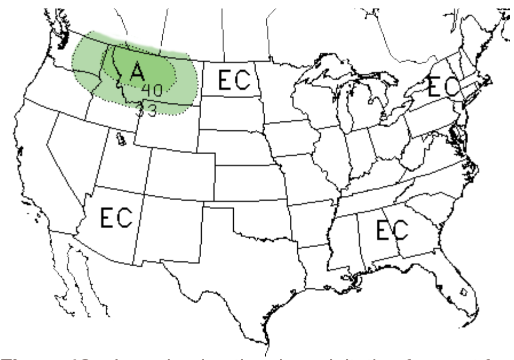


Figure 10a. Long-lead national precipitation forecast for October–December 2013.

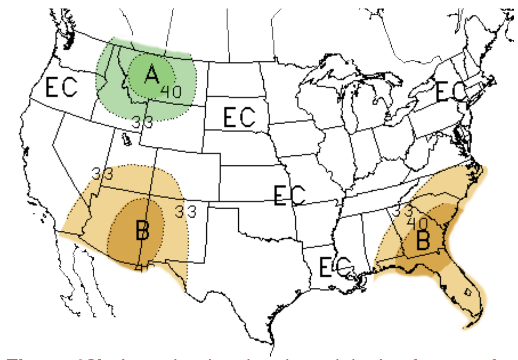
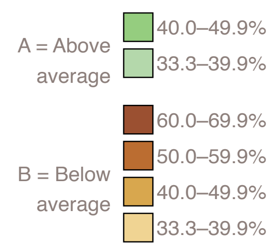


Figure 10b. Long-lead national precipitation forecast for November 2013-January 2014.



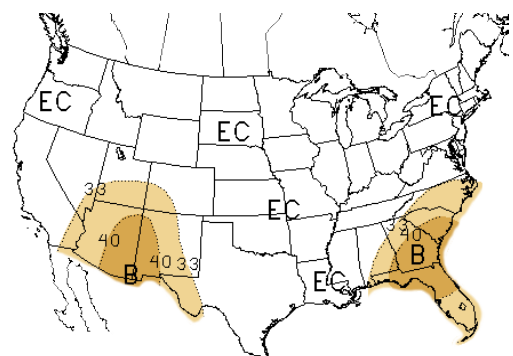


Figure 10c. Long-lead national precipitation forecast for December 2013-February 2014.

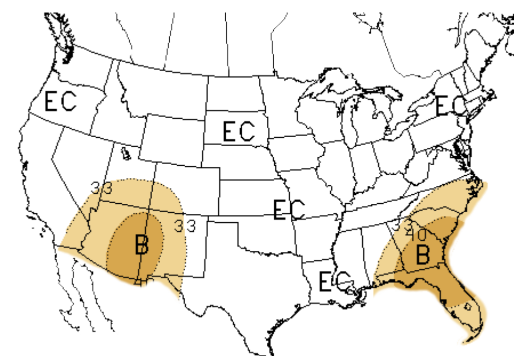


Figure 10d. Long-lead national precipitation forecast for January-March 2014.

EC = Equal chances. No forecasted anomalies.

Online Resources

More information

www.cpc.ncep.noaa.gov/products/expert_assessment/sdo_summary.html

Medium- and short-range forecasts

www.cpc.ncep.noaa.gov/products/forecasts/

Soil moisture tools

www.cpc.ncep.noaa.gov/soilmst/forecasts.shtml

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.

Seasonal Drought Outlook

DATA THROUGH DECEMBER 2013

Data Source: NOAA-Climate Prediction Center (CPC)

This summary is partially excerpted and edited from the August 15 Seasonal Drought Outlook technical discussion produced by the NOAA-Climate Prediction Center (CPC) and written by forecaster A. Artusa.

An active monsoon brought rain to the Southwest, substantially improving drought conditions since June 15. The last month was particularly wet for some of the Southwest, where rainfall exceeded 3 inches across parts of New Mexico, northwestern and central Arizona, north-central Colorado, and southern Utah. Some locations within these areas received more than 8 inches. Despite drought improvements, much of the region is still covered in at least moderate drought, and the CPC expects these conditions to remain in these areas over the next three months (*Figure 11*). This forecast is based in part on the CPC six- to 10-day and eight- to 14-day outlooks, which favor near- to below-median rainfall across most of the Southwest. Also, the CPC 30-day precipitation outlook for October shows equal chances that precipitation will be above, below, or near average over most of the Southwest; the three-month seasonal outlook covering the October–December period also calls for equal chances of above-, below-, or near-average precipitation. While the CPC assigns a moderate to high confidence in this forecast, incursions of moisture from a tropical storm originating in the eastern Pacific Ocean could help further improve drought conditions.

Elsewhere, the Midwest has experienced a return of drought conditions similar to the drought that rapidly developed last summer and decimated crops. Excessive heat and scant precipitation contributed to the recent onset of drought conditions, and precipitation deficits are around 2 to 5 inches in some areas. The precipitation forecast through December calls for equal chances of above, below, and near-average conditions, leading to the expectation that drought will persist.

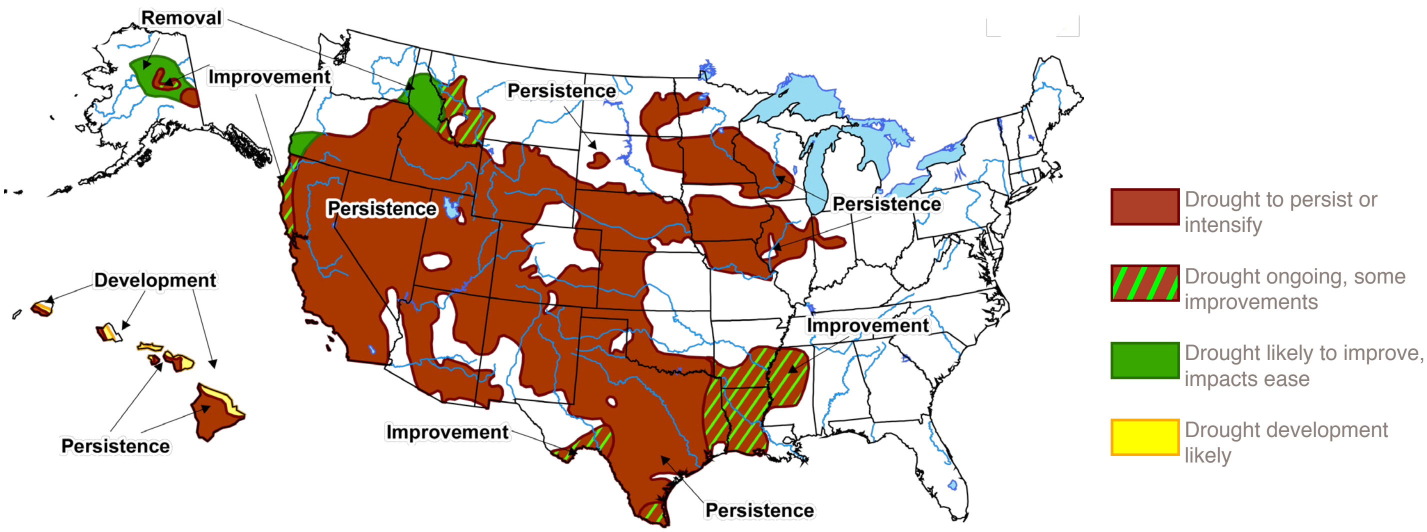


Figure 11. Seasonal drought outlook through December 2013 (released September 19).

Online Resources

Technical discussion of current El Niño conditions
www.cpc.ncep.noaa.gov/products/analysis_monitoring/enso_advisory/

Information about El Niño and graphics similar to these figures
iri.columbia.edu/climate/ENSO/

Notes

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

El Niño Status and Forecast

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

Near-average sea surface temperatures (SSTs) continue in the tropical Pacific Ocean and the El Niño-Southern Oscillation (ENSO) remains neutral. Atmospheric pressure patterns reflected in the Southern Oscillation Index (SOI) and winds near the surface and at high altitudes are all very close to average for this time of year, which also reflect neutral conditions (*Figure 12a*).

Official sea-surface temperature outlooks issued jointly by the NOAA-Climate Prediction Center (CPC) and International Research Institute for Climate and Society (IRI) suggest the continuation of neutral conditions continuing into spring 2014. The CPC notes that dynamical models show a slight warming trend over the winter season, while statistical models indicate a slight cooling trend. In both cases, there are no dramatic shifts towards El Niño or La Niña. Combined, these models indicate a strong likelihood—greater than 80 percent—that neutral conditions will continue into the January–March period (*Figure 12b*). There are only small chances that an El Niño or La Niña will emerge. The chance that an El Niño event will develop rises to 30 percent by late spring, but confidence is low in this long outlook period.

ENSO-neutral conditions make it difficult to forecast winter precipitation. While La Niña and El Niño events tend to bring drier- and wetter-than-average conditions to the Southwest, respectively, neutral conditions are less definitive. Many parts of the Southwest have experienced three consecutive dry winters during which La Niña was present twice, and last winter experienced a neutral event. Another winter with below-average precipitation would further stress reservoir storage, which is very low on the Rio Grande and is approaching thresholds on the Colorado that trigger forced water conservation strategies.

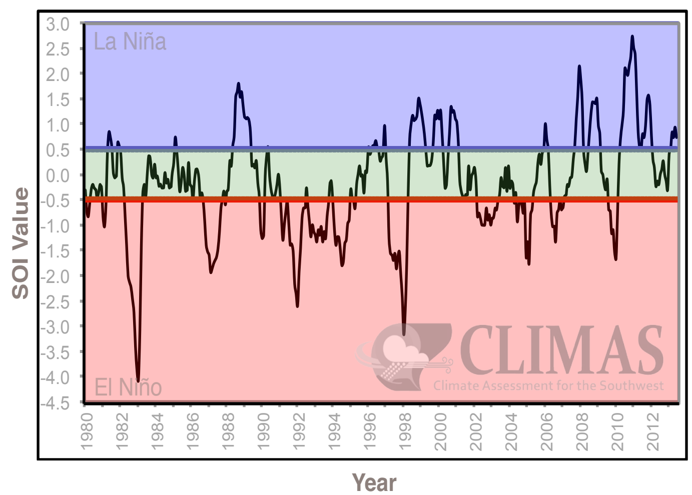


Figure 12a. The standardized values of the Southern Oscillation Index from January 1980–August 2013. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red), respectively. Values between these thresholds are relatively neutral (green).

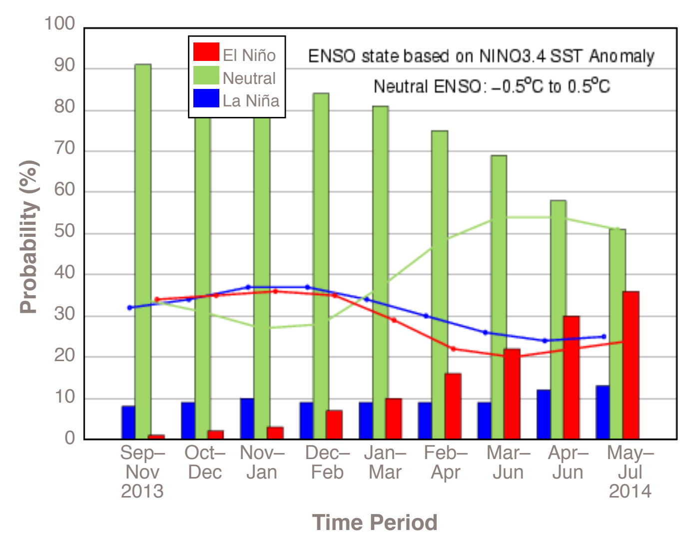


Figure 12b. IRI probabilistic ENSO forecast for the Niño 3.4 monitoring region (released September 19). Colored lines represent average historical probability of El Niño, La Niña, and neutral conditions.