Southwest Climate Outlook

New Mexico Drought 7

Eighty-six percent of New Mexico is experiencing extreme or exceptional drought conditions. Despite some improvements, precipitation deficits have mounted over the past two years and it will take several seasons of average to above-average precipitation to substantially improve drought.

Monsoon Summary 11

The monsoon kicked off around July 1 in parts of the Southwest and has delivered copious rains to southeast Arizona, parts of the Mogollon Rim region, and the west-central mountains of New Mexico. A favorable position of the monsoon high has helped steer moisture into the region and push storms off the mountains into the lower elevations. However, the monsoon has been spotty, as always.

ENSO 16

Forecasts call for about a 70 percent chance that ENSO-neutral conditions will persist through the 2014 spring. The chances of an El Niño developing in coming months are very small. However, statistical and dynamical models are disagreeing substantially on the fate of ENSO, which leads to a lower confidence in the forecasts this month.

Stars swirl around the iconic saguaro cactus. Photo: Tonia Graves.

July

Vol 12 Issue 7

JUL 2013

READ ONLINE

Tweet July's SW Climate Snapshot

Monsoon brings some drought relief to SW but NM still drought epicenter in US; water supply very low.

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Contents

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July Climate Summary

Drought: Monsoon rains helped improved drought conditions in a few areas in the Southwest, but the majority of Arizona and New Mexico continued to experience at least severe drought.

Temperature: June was exceptionally hot in Arizona and New Mexico, but the onset of the monsoon in early July helped suppress high temperatures in southern regions of both states.

Precipitation: While monsoon rainfall has been copious in some areas, it has not been enough to compensate for deficits accumulated during the winter; most of the Southwest has experienced less than 70 percent of average precipitation since October 1.

ENSO: ENSO-neutral conditions are present in the Pacific Ocean and are expected to remain through the winter.

Forecasts: Temperatures are expected to be above average in coming months, while precipitation forecasts for the monsoon call for increased chances for wetter-than-average conditions in the southern Arizona and New Mexico border region.

Snapshot: The monsoon began around July 1 in southern regions of Arizona and New Mexico and has been active in parts of the Southwest. Above-average rain in the last month will likely improve short-term drought conditions and will be reflected in coming U.S. Drought Monitor Updates. Currently, however, due to precipitation deficits that have accumulated over the past year, most of the Southwest is classified with severe drought. New Mexico continues to be the epicenter of drought in the West with about 86 percent of the state experiencing extreme or exceptional drought. New Mexico has been experiencing some level of extreme or exceptional drought since March 2011. The dry conditions in recent years have caused reservoir storages to decline across both states. The 2013 water year inflow into Lake Powell is projected to be 41 percent of average; inflow for the 2012 water year was only 45 percent of average. In New Mexico, storage on the Rio Grande is at its lowest level since the early 1970s and irrigation allotments in the Elephant Butte Irrigation District and the El Paso Water Improvement District 1 have already stopped. This is causing farmers and urban centers to pump more groundwater and drill more wells. Monsoon rains—which have slightly increased chances for being better than average in coming months—will help lower water demand for some sectors, but will likely do little to improve overall water supply. The upcoming winter rain and snow will be crucial for reservoirs, as it was in 2011 when copious winter snows caused streamflows to be 145 percent of average and boosted the low reservoir storage in lakes Mead and Powell. Forecasts for winter precipitation, however, are uncertain in part because an ENSO-neutral event is likely—precipitation during ENSO-neutral winters does not substantially favor dry or wet conditions.

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.

Temperature

DATA THROUGH JULY 17, 2013

Data Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 have been warmest in the southern deserts and coolest in higher elevations, and temperatures have been within a few degrees Fahrenheit of average for most of the Southwest (Figures 1a–b). The coldest region has been in the Sangre de Cristo Mountains in northern New Mexico. While temperatures during January and February were below average, conditions in the last three months were the opposite. The April–June period ranked as the 11th and 16th warmest (out of 119) in Arizona and New Mexico, respectively.

The last 30 days were particularly warm as a result of a strong ridge of high pressure that brought an extreme heat wave to the Southwest and caused record-high temperatures across the region. Maximum temperatures along the lower Colorado River valley reached the low 120s and Phoenix hit 119 degrees F. Tucson also experienced its warmest June on record; the high temperature each day eclipsed 99 degrees F. Between June 18 and July 17, temperatures were 2–4 degrees F warmer than average in western Arizona and New Mexico and across eastern New Mexico (Figures 1c–d). The high temperatures increased water demand, especially in west-central New Mexico where drought became exceptional.

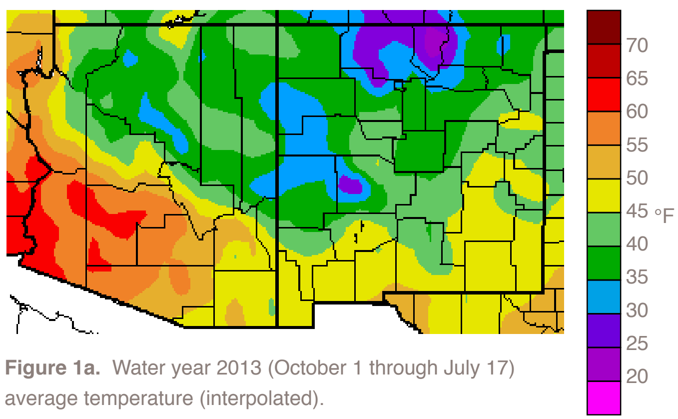


Figure 1a. Water year 2013 (October 1 through July 17) average temperature (interpolated).

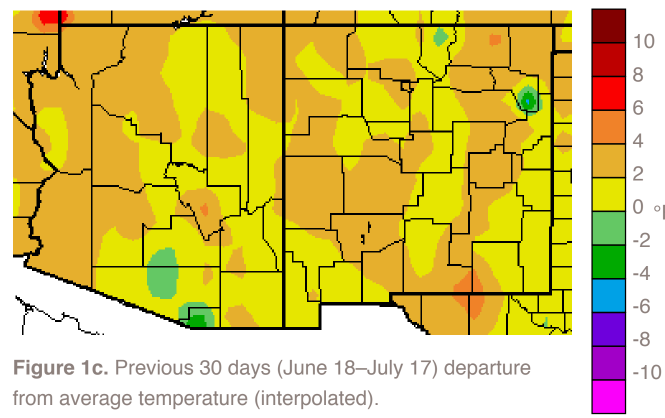


Figure 1c. Previous 30 days (June 18–July 17) departure from average temperature (interpolated).

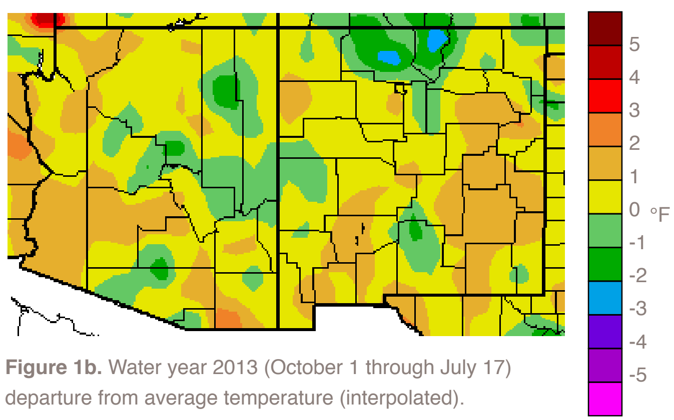


Figure 1b. Water year 2013 (October 1 through July 17) departure from average temperature (interpolated).

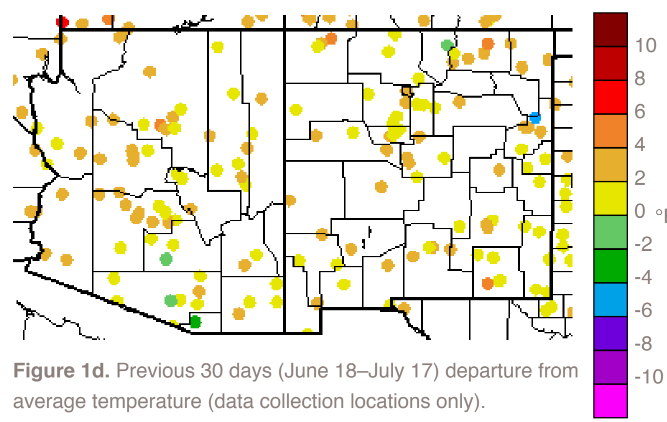


Figure 1d. Previous 30 days (June 18–July 17) departure from average temperature (data collection locations only).

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.

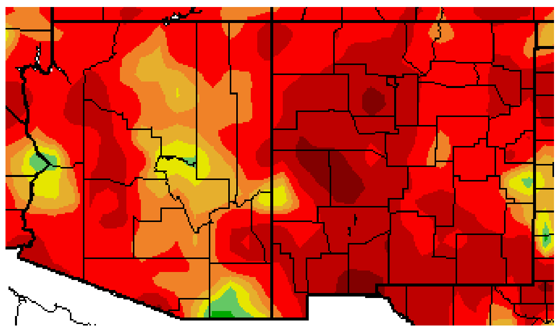
Precipitation

DATA THROUGH JULY 17, 2013

Data Source: High Plains Regional Climate Center

Despite the onset of the monsoon in parts of the Southwest, summer precipitation thus far has not compensated for dry conditions that mounted this winter. Consequently, with the exception of a few isolated regions such as southeast and central Arizona, most of Arizona and New Mexico have experienced less than 70 percent of their October 1–July 17 precipitation (Figures 2a-b). The near-average precipitation in central Arizona is due to the winter precipitation, but southeastern Arizona benefitted from some very recent monsoonal rainfall. New Mexico is fairing worse than Arizona. Most of central portions of the state have received only up to 50 percent of average rain and snow since October 1. This has contributed to extremely low water supplies on the Rio Grande (see New Mexico Reservoir Volumes).

During the past 30 days, eastern Arizona has received 150 to 400 percent of average precipitation due to an active monsoon that began around July 1 in southern regions of both states (Figures 2c–d; see Monsoon Summary). The monsoon has also delivered above-average rain to west-central New Mexico, but amounts have not been enough to compensate for the dry winter months. The onset of monsoon rain helped quell fires in parts of the region (see Fire Summary).



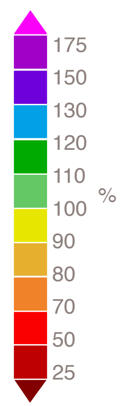
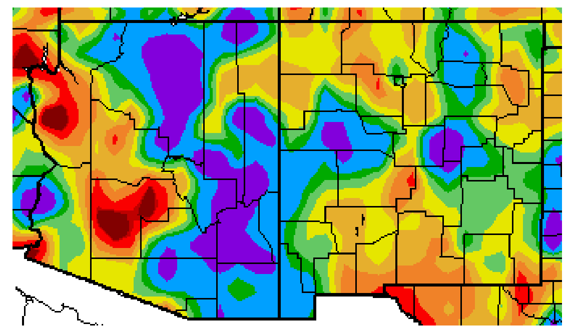


Figure 2a. Water year 2013 (October 1–July 17) percent of average precipitation (interpolated).



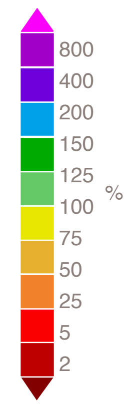
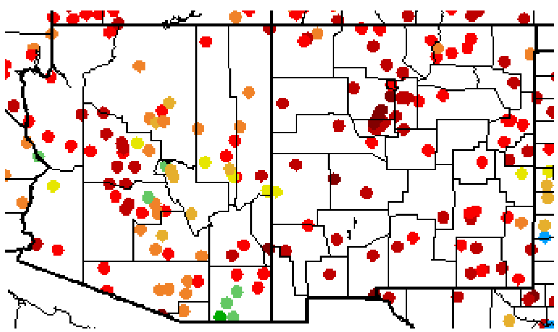


Figure 2c. Previous 30 days (June 18–July 17) percent of average precipitation (interpolated).



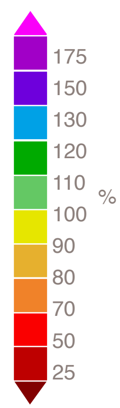
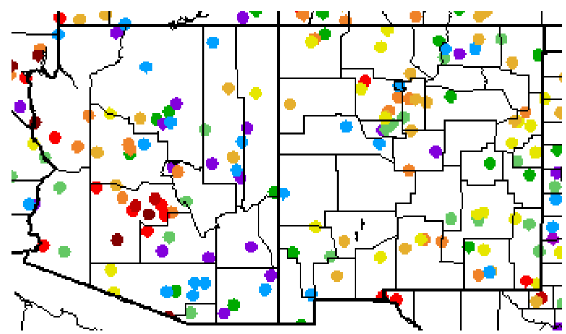


Figure 2b. Water year 2013 (October 1–July 17) percent of average precipitation (data collection locations only).



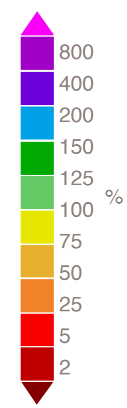


Figure 2d. Previous 30 days (June 18–July 17) percent of average precipitation (data collection locations only).

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 JULY 16, 2013

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

Drought across the West remained largely unchanged since mid-June. The most extreme conditions continue to be in New Mexico, where about 90 percent of the state is classified with extreme or exceptional drought (see New Mexico Drought Status).

In the last 30 days, a large ridge of high pressure dominated the weather pattern across the western U.S. While this helped deliver some monsoon moisture to Arizona and New Mexico, it left most other states dry. Areas where drought conditions worsened included parts of northern Nevada, southern Idaho, and Wyoming, where less than 50 percent of average precipitation fell in the last month. Overall, 85 percent of the western U.S. is experiencing at least moderate drought, with 59 percent categorized as severe or worse (Figure 3). One month ago, 51 percent of the West was classified with severe drought or worse. In coming months, the expectation is that drought will improve in the Southwest, but largely persist or intensify elsewhere in the West (see Seasonal Drought Outlook).

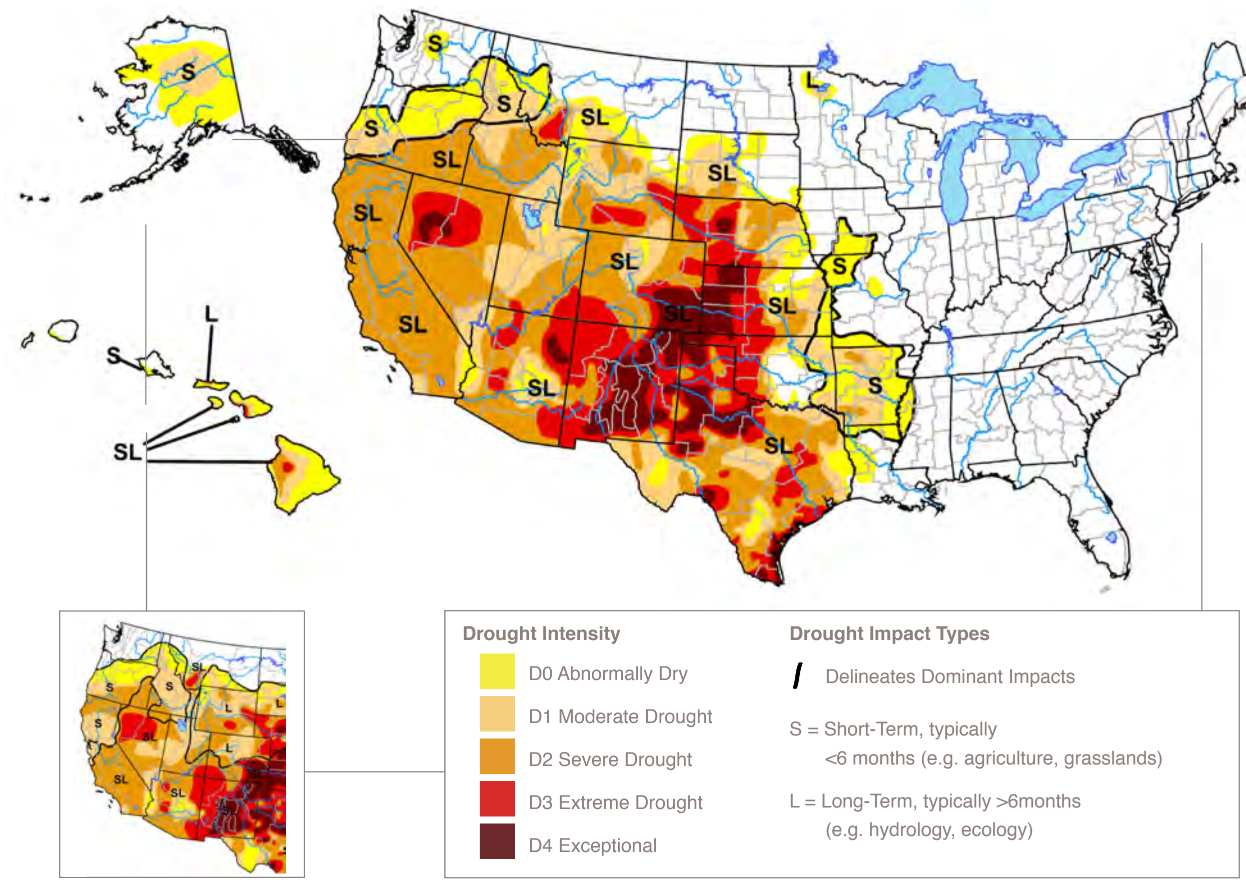


Figure 3. Drought Monitor data through July 16, 2013 (full size), and June 18, 2013 (inset, lower left).

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 JULY 16, 2013

Data Source: U.S. Drought Monitor

Drought conditions across much of Arizona remain largely unchanged from one month ago. Although monsoon precipitation in some areas has been copious, storms have been spotty and infrequent. Short-term drought conditions, however, are expected to improve in coming months as total monsoon precipitation increases (see Seasonal Drought Outlook).

Currently, about 92 percent of Arizona is experiencing moderate drought or a more severe drought category, according to the July 16 update of the U.S. Drought Monitor (Figures 4a–b). About 26 percent of the state is also experiencing extreme or exceptional drought. The most substantial change occurred on the Navajo Nation and Hopi lands where the authors of this month's U.S. Drought Monitor increased extreme and exceptional drought as a consequence of many drought impact reports, including wells drying, horses dying, and negative impacts to crops. The conditions prompted the Navajo Nation to declare a drought emergency, allowing it to appeal for federal aid.

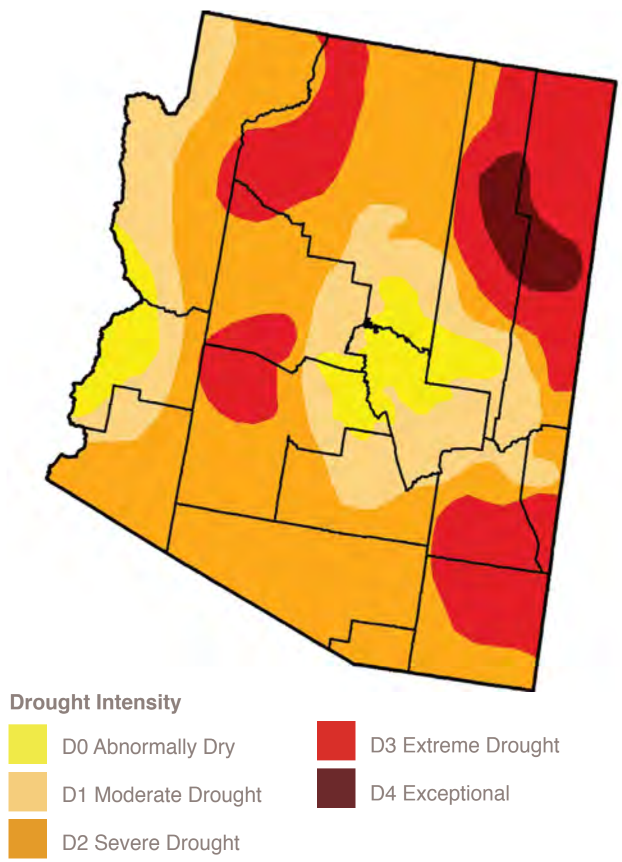


Figure 4a. Arizona drought map based on data through July 16

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	92.46	72.77	26.46	3.04
Last Week (07/09/2013 map)	0.00	100.00	92.46	72.77	27.36	3.04
3 Months Ago (04/16/2013 map)	2.64	97.36	82.64	43.98	5.63	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 (07/10/2012 map)	0.00	100.00	100.00	94.07	26.33	0.00

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

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.

New Mexico Drought Status

DATA THROUGH JULY 16, 2013

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

Early monsoon precipitation brought some relief to parts of New Mexico, but drought conditions continue to be dire across much of the state. The U.S. Drought Monitor shows that all of New Mexico is experiencing at least moderate drought, with 86 percent of the state experiencing extreme or exceptional drought conditions (Figures 5a–b). Areas that experienced drought improvements were largely in parts of west-central and southeast New Mexico, where precipitation in the last 30 days was as much as two to three times average. However, large precipitation deficits have accumulated over several years across much of the state. Consequently, it will take several seasons of average to above-average precipitation to recover. Widespread extreme and exceptional drought has persisted since about March 2011.

Drought impacts continue to be reported across the state, including emergency declarations in two towns due to lack of municipal water and many farmers having to drill new and deeper wells—at high cost—in order to secure irrigation water (The Digital Journal, July 18).

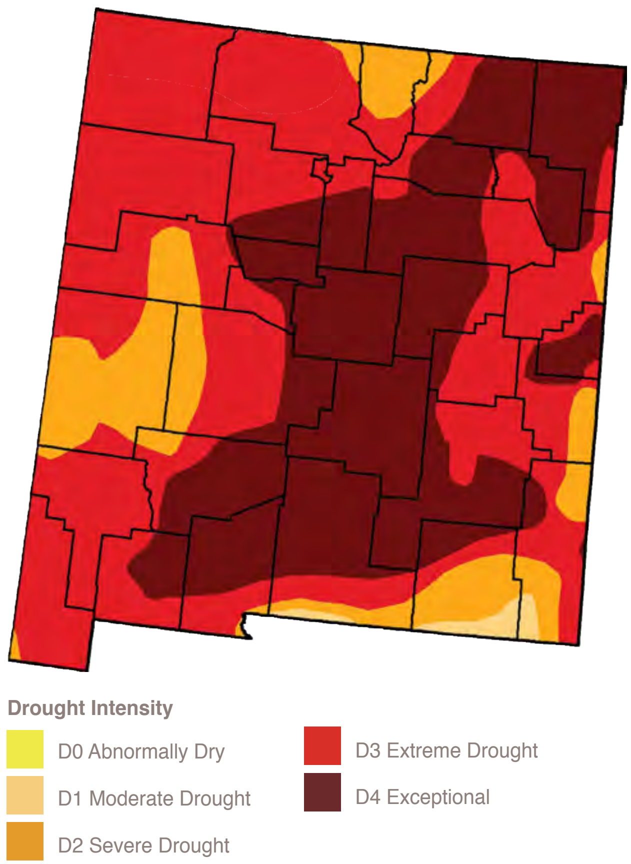


Figure 5a. New Mexico drought map based on data through July 16.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	98.92	86.07	37.98
Last Week (07/09/2013 map)	0.00	100.00	100.00	98.92	90.91	42.43
3 Months Ago (04/16/2013 map)	0.00	100.00	98.68	93.95	58.73	4.36
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 (07/10/2012 map)	0.00	100.00	99.79	79.76	25.98	0.00

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

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 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

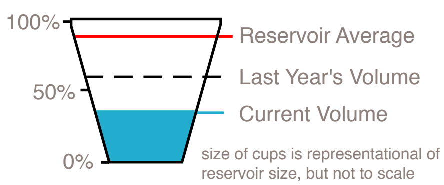
DATA THROUGH JUNE 30, 2013

Data Source: National Water and Climate Center

Combined storage in lakes Mead and Powell stood at 47.6 percent of capacity as of June 30 (Figure 6), a decrease of 168,000 acre-feet from the previous month and roughly 9 percent lower than it was one year ago. Lake Powell elevation peaked in mid-June, and will continue to decline until spring 2014. Water year 2013 inflow to Lake Powell is forecasted to be 41 percent of average, which will be the second consecutive year of below-average inflow. Projected total Colorado River Basin storage for the end of water year 2013 is 45 percent of capacity. Elsewhere in Arizona, reservoir storage declined. Combined storage in the Salt and Verde river basins decreased by about 82,300 acre-feet. Reservoir storage in these basins is around 85 percent of average and 58 percent of capacity, down 1 percent from last year.

In water-related news, Arizona senators John McCain and Jeff Flake are urging elected officials in the Verde River watershed to develop a long-term management plan that protects groundwater supplies and riparian habitat (Verde Independent, July 2). The impetus for their advocacy is a recent USGS report that shows declining groundwater levels and future river flows in the watershed.

Legend



Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	48%	11,757.0	24,322.0	47.0
2. Lake Mead	47%	12,276.0	26,159.0	-215.0
3. Lake Mohave	95%	1,711.1	1,810.0	-9.9
4. Lake Havasu	95%	588.7	619.0	-5.6
5. Lyman	9%	2.8	30.0	-1.5
6. San Carlos	0%	0.3	875.0	-0.2
7. Verde River System	60%	172.9	287.4	-9.9
8. Salt River System	57%	1,160.6	2,025.8	-72.4

*thousands of acre-feet

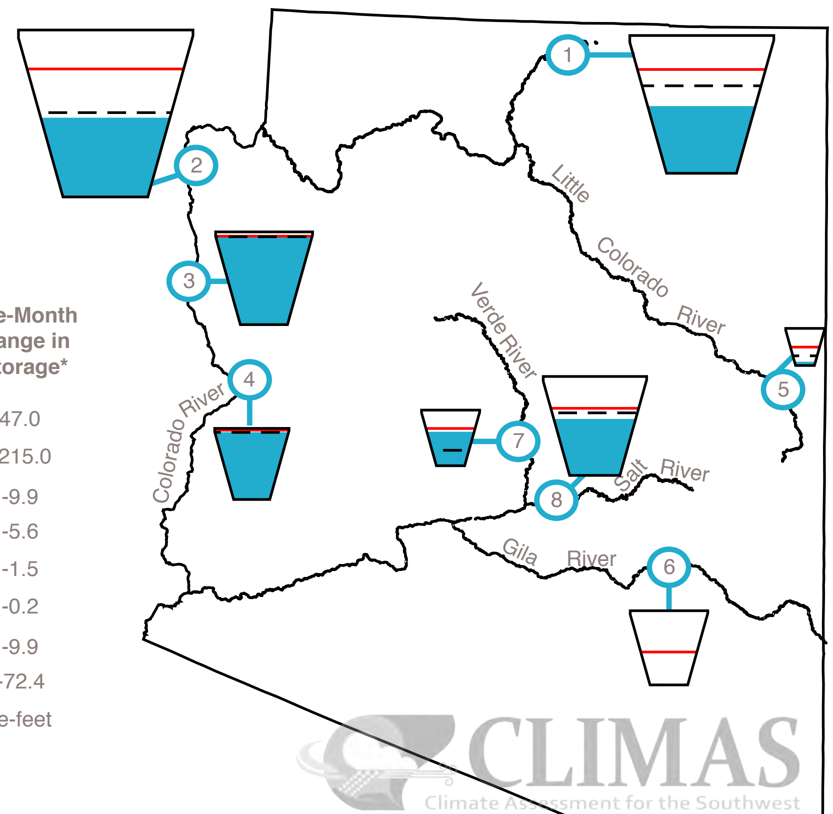


Figure 6. Arizona reservoir volumes for the end of June as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

New Mexico Reservoir Volumes

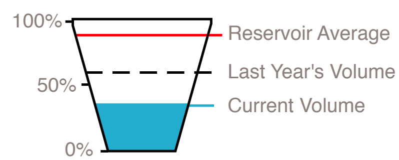
DATA THROUGH JUNE 30, 2013

Data Source: National Water and Climate Center

Combined water storage in the 15 New Mexico reservoirs reported here was about 36 percent of average and only 17 percent of capacity as of June 30 (Figure 7). One year ago, combined reservoir storage was about 26 percent full. Due to a dry winter, many reservoirs have experienced declines from last year. For example, reservoir storage on the Pecos River is about half what it was in June 2012.

During the summer, many reservoirs usually experience declines as a result of withdrawals for irrigation. Elephant Butte and Caballo reservoirs, the major reservoirs on the lower New Mexico Rio Grande, currently contain only 3 and 6 percent of capacity, respectively, a decline from 9 and 11 percent one month ago. Elephant Butte storage is at its lowest level since the early 1970s and irrigation in the Elephant Butte Irrigation District ended in mid-July after only about 6 weeks. This marks one of the shortest irrigation seasons on record. The El Paso Water Improvement District 1, which also draws water from the Elephant Butte Reservoir that supplies urban and agriculture needs, issued a notice of drought emergency due to low water allocations. The low reservoir levels in part reflect two consecutive years of scant snow in the headwater mountain ranges in northern New Mexico and southern Colorado.

Legend



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

Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	56%	955.4	1,696.0	-34.7
2. Heron	31%	124.6	400.0	-8.3
3. El Vado	11%	21.8	190.3	-19.2
4. Abiquiu	11%	125.4	1,192.8	-16.6
5. Cochiti	10%	47.3	491.0	-0.8
6. Bluewater	6%	2.5	38.5	-0.3
7. Elephant Butte	3%	70.4	2,195.0	-123.2
8. Caballo	6%	21.5	332.0	-14.6
9. Lake Avalon	40%	1.6	4.0	NA
10. Brantley	0%	4.7	1,008.2	NA
11. Sumner	3%	2.9	102.0	NA
12. Santa Rosa	1%	3.3	438.3	0.7
13. Costilla	19%	3.0	16.0	-1.1
14. Conchas	0%	0.0	254.2	0.0
15. Eagle Nest	30%	23.4	79.0	NA

N/A–value not available

* thousands of acre-feet

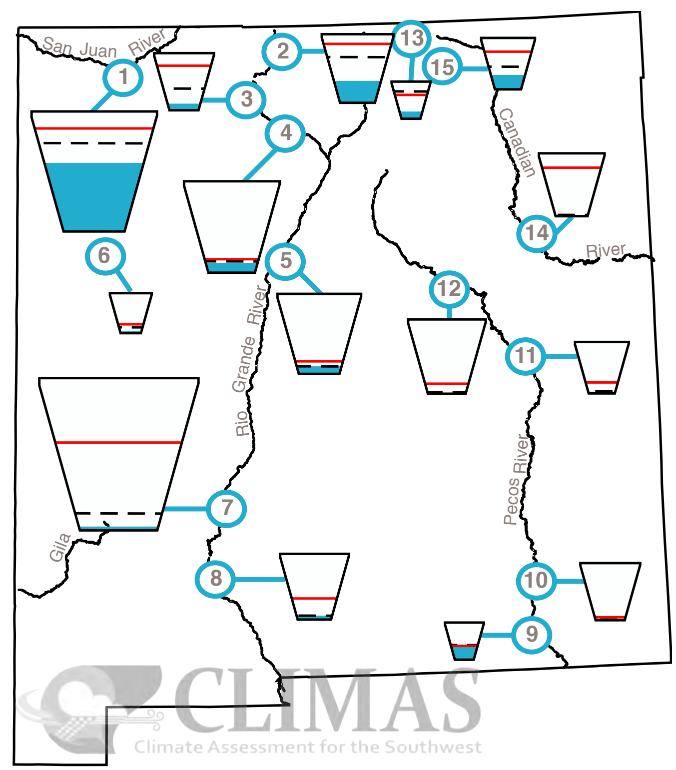


Figure 7. New Mexico reservoir volumes for June as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

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).

Online Resources

Data obtained from the Southwest Coordination Center

gacc.nifc.gov/swcc/predictive/intelligence/daily/ytd_large_wf.pdf

gacc.nifc.gov/swcc/predictive/intelligence/ytd_historical/ytd/wf/large_fires/swa_ytd_large_fires.htm

Notes

The fires discussed here have been reported by federal, state, or tribal agencies during 2013. The figures include information both for current fires and for fires that have been suppressed. The table shows year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. The two figures indicate the approximate locations of past (in 2013) and present "large" wildland fires in Arizona and in New Mexico. A "large" fire is defined as a blaze covering 100 acres or more in timber or 300 acres or more in grass or brush.

Southwest Fire Summary

DATA THROUGH: JULY 16, 2013

Source: Southwest Coordination Center

A decrease in fire activity accompanies the onset of the monsoon. Many areas in Arizona have experienced between 2 and 3 inches of rain since the monsoon officially began on June 15, which is generally more than 150 percent of average (see Monsoon Summary). Consequently, fire activity is low in Arizona. While precipitation in New Mexico, particularly in the southwestern corner, has been less than in Arizona, fire activity is also currently low. As of July 16, only 6 and 21 fires have burned this year in New Mexico and Arizona, respectively, charring a total of 185,422 acres in New Mexico and 84,752 acres in Arizona (Figure 8a; Figures 8b–c are updated only through June 26). While these totals are both below average for this time of year, the 2013 fire season has been tragic. Low humidity, high temperatures and extremely dry and dense fuels created a worst-case fire scenario near Prescott, Arizona. On June 30, a passing thunderstorm abruptly reversed the wind direction and trapped 19 firefighters between two ridges; these men ultimately lost their lives in the Yarnell Fire.

Fire risk was downgraded to level 2 on July 13. Level 2 risk occurs when firefighting resources such as personnel and equipment are sufficiently available within the Southwest to combat large wildland fires. A level 4 risk, which was present from June 3 to July 9, occurs when large fire behavior and threats to life and property are high. In coming months, fire risk will likely not increase unless an unusually long break in the monsoon brings hot and dry conditions. Between 2000 and 2012, for example, only about 10 percent of the acres burned during the calendar year occurred after July.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	901	34,903	339	58,213	1,240	93,116
NM	491	45,355	308	161,023	799	206,378
Total	1,392	80,258	647	219,236	2,039	299,494

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of July 16, 2013.

Figure 8b. Arizona large fire incidents as of June 26, 2013.

Figure 8c. New Mexico large fire incidents as of June 26, 2013.

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 16-JULY 15, 2013

Data Source: Western Regional Climate Center

The monsoon kicked off around July 1 in southeast Arizona, and has delivered copious rains there, to parts of the Mogollon Rim region, and to the west-central mountains of New Mexico (Figure 9a). Rain has been scant, however, in western and central Arizona, around Phoenix, and in southwest New Mexico. The monsoon high has been generally located in a good position to help steer moisture in the middle atmosphere from the east and push storms off the mountains into the lower elevations. Also, a few surges of near-surface moisture from the Gulf of California have arrived. Many locations in southeast Arizona have experienced above-average rain, including the Douglass airport where about 8 inches have fallen through July 17 (the historical average is 1.58 inches; Figures 9b–c). At the Tucson International Airport, 1.65 inches have fallen through July 17, which is 0.69 inches above average for this time of year. Phoenix International Airport, however, has not received any substantial precipitation this summer. For the past two weeks, the amount of water vapor in the air, as measured by the dew point temperature, generally has been above average. The same period has been marked by frequent atmospheric instability, near-surface moisture, and sufficiently strong steering flows—three ingredients needed for widespread rainfall—but not always at the same time or place. These conditions have developed more synchronically at higher elevations and close to the U.S.-Mexico border where large mesoscale convective systems have spilled over into Arizona.

The monsoon, as always, has been spotty, with higher elevations often experiencing more rain than the valleys—topography often helps initiate rainfall by forcing air upwards, where it cools, condenses, and is squeezed like a sponge. For example, a storm on July 13 produced more than 2 inches of rainfall on Mount Lemmon, north of Tucson, while surrounding valleys were drier.

Where it has fallen, the monsoon precipitation has helped improve short-term drought conditions. Range and croplands in the Southwest have greened up in the last two weeks, and the rain has helped quell fire risk (see Recent Fire Summary).

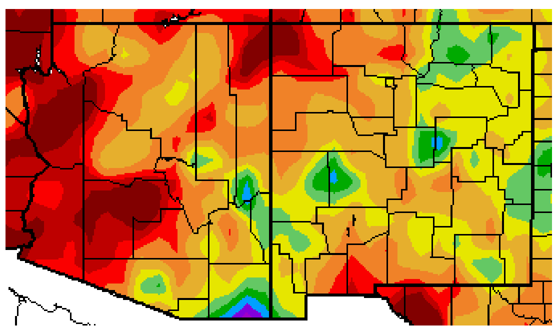
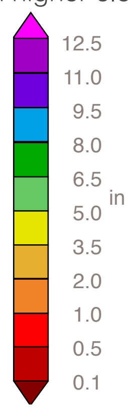



Figure 9a. Total precipitation in inches for June 16–July 15, 2013.

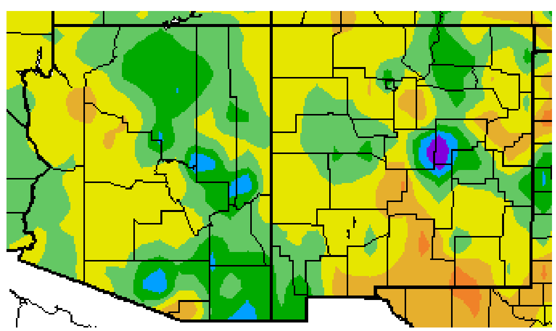
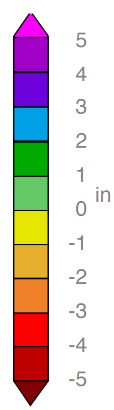



Figure 9b. Departure from average precipitation in inches for June 16–July 15, 2013.

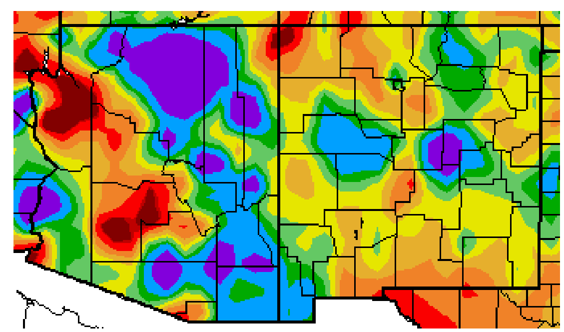
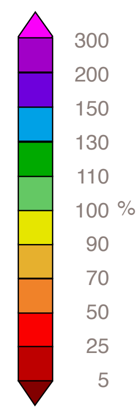



Figure 9c. Percent of average precipitation for June 16–July 15,2013.

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 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.

Temperature Outlook

FORECAST PERIOD: AUGUST 2013–JANUARY 2014

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in July 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 August through January (Figures 10a–d). Temperatures are most likely to be 0.6–1.5 degrees F above average in most of Arizona, with slightly lower anomalies expected in New Mexico. The expected temperature anomalies increase from east to west, with the largest in northwest Arizona. The seasonal forecasts presented here are based on statistical and dynamical models and are largely consistent with decadal warming trends.

The monsoon also plays a role in the seasonal forecasts. The highest probabilities for above-average temperatures are found in the southwest corner of Arizona, where monsoon precipitation is low. Monsoon rainfall, where it occurs, often decreases daily temperatures because increased cloud cover accompanies rain. The rains also moisten soils, increasing evaporation that cools the near-surface atmosphere. Increased moisture, however, can also elevate nighttime temperatures.

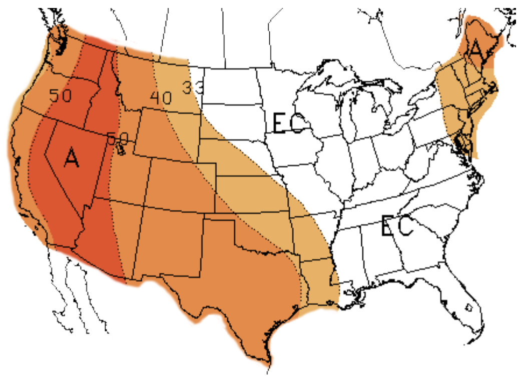


Figure 10a. Long-lead national temperature forecast for August–October 2013.

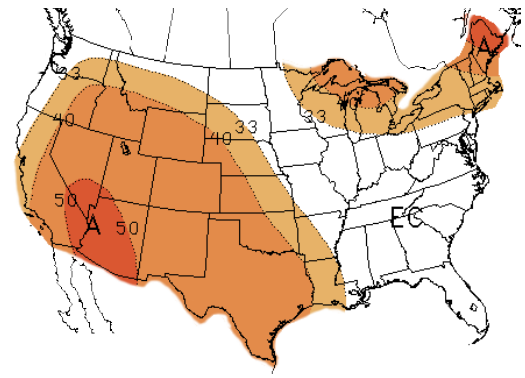


Figure 10b. Long-lead national temperature forecast for September–November 2013.

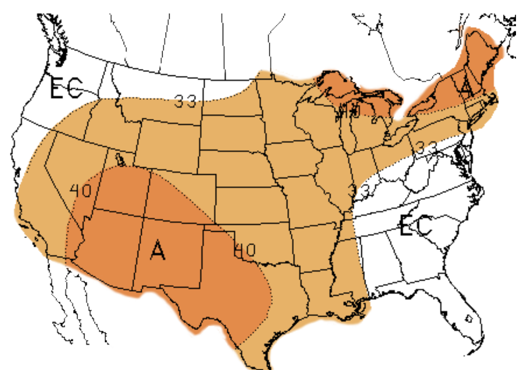


Figure 10c. Long-lead national temperature forecast for October–December 2013.

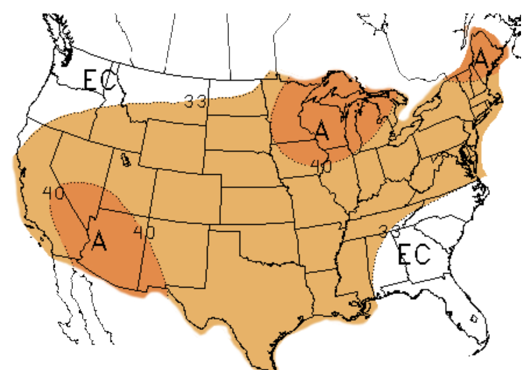


Figure 10d. Long-lead national temperature forecast for November–January 2014.

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 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.

Precipitation Outlook

FORECAST PERIOD: AUGUST 2013–JANUARY 2014

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal precipitation outlooks issued by the NOAA-Climate Prediction Center (CPC) in July call for slightly increased chances for above-average precipitation in western New Mexico and eastern Arizona during the August–October periods (Figure 11a). This region, particularly in southwest New Mexico and southeast Arizona, is where the monsoon is most vigorous. This region is also off to a good start to the monsoon, with many areas experiencing above-average rain (see Monsoon Summary). However, forecasting the monsoon is difficult because many phenomena can influence the amount of rain that falls, including the El Niño Southern Oscillation (ENSO) and tropical hurricane activity. In September, for example, monsoon precipitation can be boosted by incursion of moisture driven by tropical storms, and this year there is some indication that hurricane activity will be above average.

For the 3-month seasons following the August–October period, the CPC forecasts equal chances that precipitation will be above, below, or near average (Figures 11b–d). These forecasts reflect uncertainty in the fate of ENSO which exerts a large influence on Southwest precipitation during the winter. The current forecast calls for ENSO-neutral conditions (see El Niño Status and Forecast), which can deliver either above- or below-average rain to Arizona and New Mexico (whereas La Niña and El Niño events tend to deliver below-average and above-average precipitation, respectively).

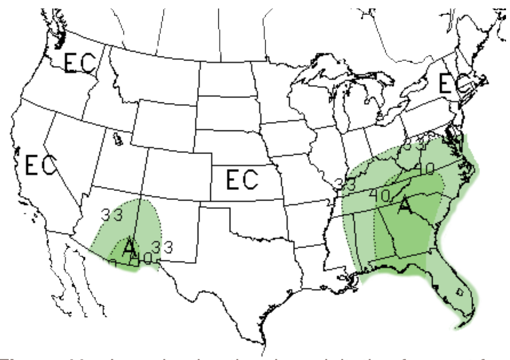


Figure 11a. Long-lead national precipitation forecast for August–October 2013.

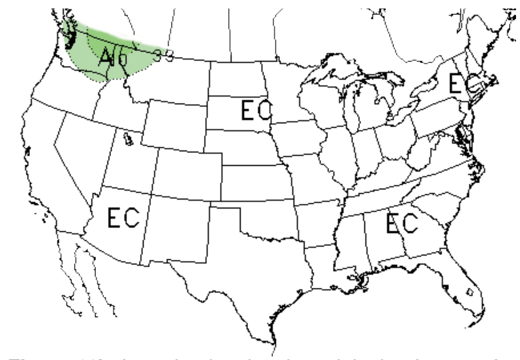


Figure 11b. Long-lead national precipitation forecast for September–November 2013.

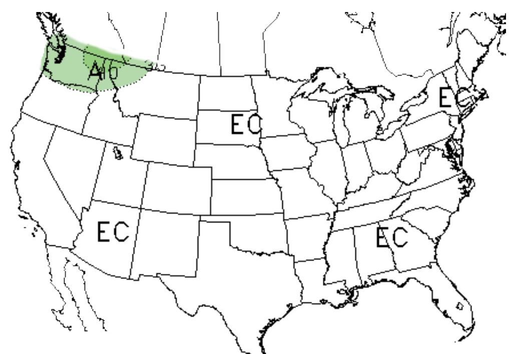


Figure 11c. Long-lead national precipitation forecast for October–December 2013.

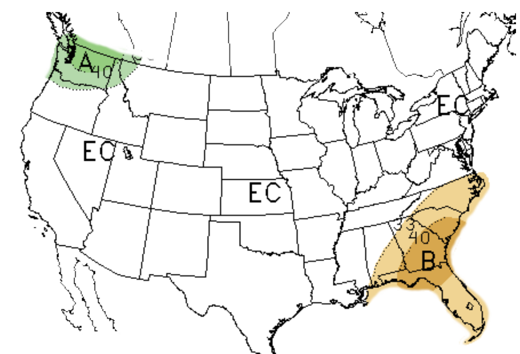


Figure 11d. Long-lead national precipitation forecast for November–January 2014.

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

B = Below average: 60.0–69.9%; 50.0–59.9%; 40.0–49.9%; 33.3–39.9%

EC = Equal chances. No forecasted anomalies.

Online Resources

More information
www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.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 OCTOBER 2013

Data Source: NOAA-Climate Prediction Center (CPC)

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

Drought is expected to improve in coming months in eastern Arizona, all of New Mexico, and southern portions of Utah and Colorado (Figure 12). While precipitation historically wanes from August to October, conditions remain favorable and can be boosted by incursions of moisture from tropical storm activity in the eastern Pacific Ocean. On average, 35 to 45 percent of the annual precipitation across central and eastern Arizona, New Mexico, and south-central Colorado falls during this 3-month period.

Drought improvement is also favored because the 6- to 10-day and 8- to 14-day forecasts indicate increased chances for above-average precipitation. The seasonal forecasts for August and the August–October period also indicate elevated chances for above-average precipitation in eastern Arizona and western New Mexico. The CPC assigns a high confidence in the forecast for drought improvement from central Arizona east across New Mexico, and a moderate confidence elsewhere.

Across the Intermountain West and the northern half of the Rockies, the CPC expects drought to persist. The 6- to 10-day forecasts favor below-average precipitation in northern sections of the Intermountain West and Rockies. Historically, August–October tends to be dry across northern sections of Utah and Nevada, and throughout Idaho. The CPC assigns a high confidence for this forecast in northern regions of the Intermountain West and Great Plains.

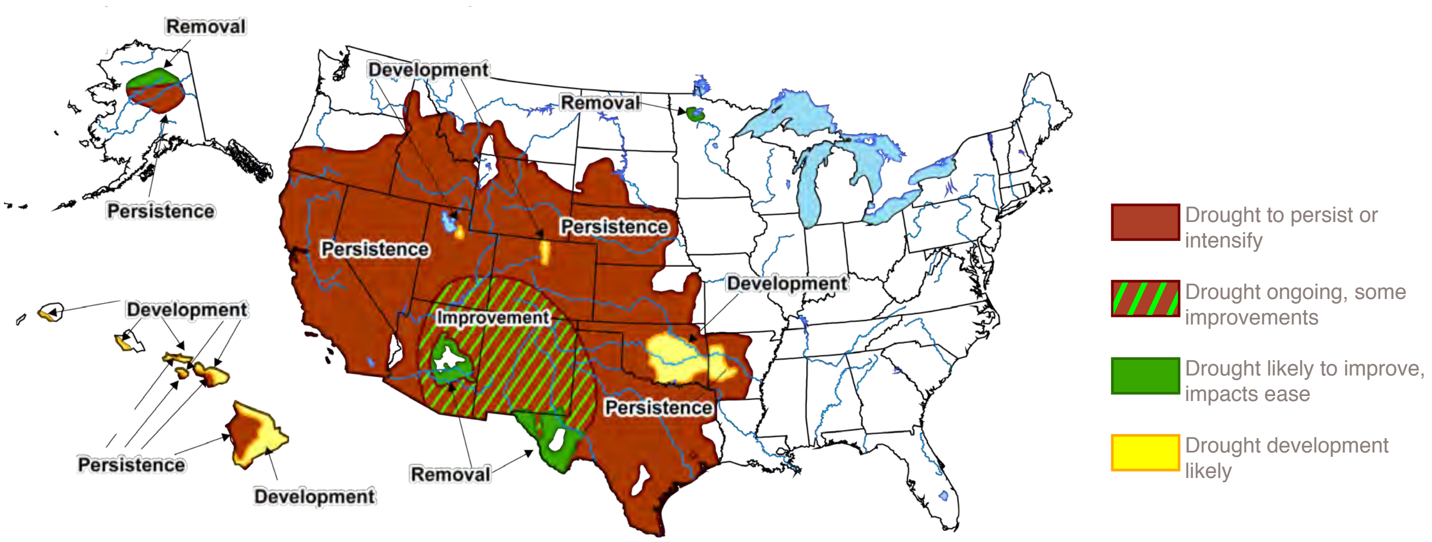


Figure 12. Seasonal drought outlook through October 2013 (released July 18).

Online Resources

National Wildland Fire Outlook
www.predictiveservices.nifc.gov/outlooks/outlooks.htm

Southwest Wildland Fire Outlook
gacc.nifc.gov/swcc/predictive/outlooks/seasonal/Fire_Season_Potential_and_Outlook.htm

Notes

The National Interagency Coordination Center at the National Interagency Fire Center produces seasonal wildland fire outlooks each month. They are subjective assessments that synthesize information provided by fire and climate experts throughout the United States. The forecast (Figure 13) considers observed climate conditions, climate and weather forecasts, vegetation health, and surface-fuels conditions in order to assess potential for fires greater than 100 acres.

Wildland Fire Outlook

FORECAST PERIOD: AUGUST 2013

Sources: National Interagency Coordination Center, Southwest Coordination Center

The onset of monsoon precipitation in southern portions of Arizona and New Mexico occurs around July 1; to the north, summer rains begin later in July. Consequently, the forecast for July called for significant fire potential to be normal in southern regions and above normal in the north. Significant fire potential refers to the likelihood that a wildland fire will require additional resources from outside the area in which the fire originated.

Through the first half of July, above-average precipitation fell in many areas in eastern Arizona, including a large swath in northern Arizona (see Precipitation). This helped quell fire activity and risk for new ignitions in those areas. Precipitation in New Mexico, although scant in the southwest corner, also helped reduce fire risk in much of the state. Through July 15, the number of acres burned in both states was below average despite dry conditions in months preceding the height of the fire season (see Southwest Fire Summary). Now that the monsoon has arrived, the expectation is that the risk for significant fires will be normal (Figure 13). Historically, the peak fire season occurs in June and July, with smaller, more infrequent fires occurring in months that follow. For example, only about 10 percent of the acres burned during the calendar years between 2000 and 2012 occurred after July.

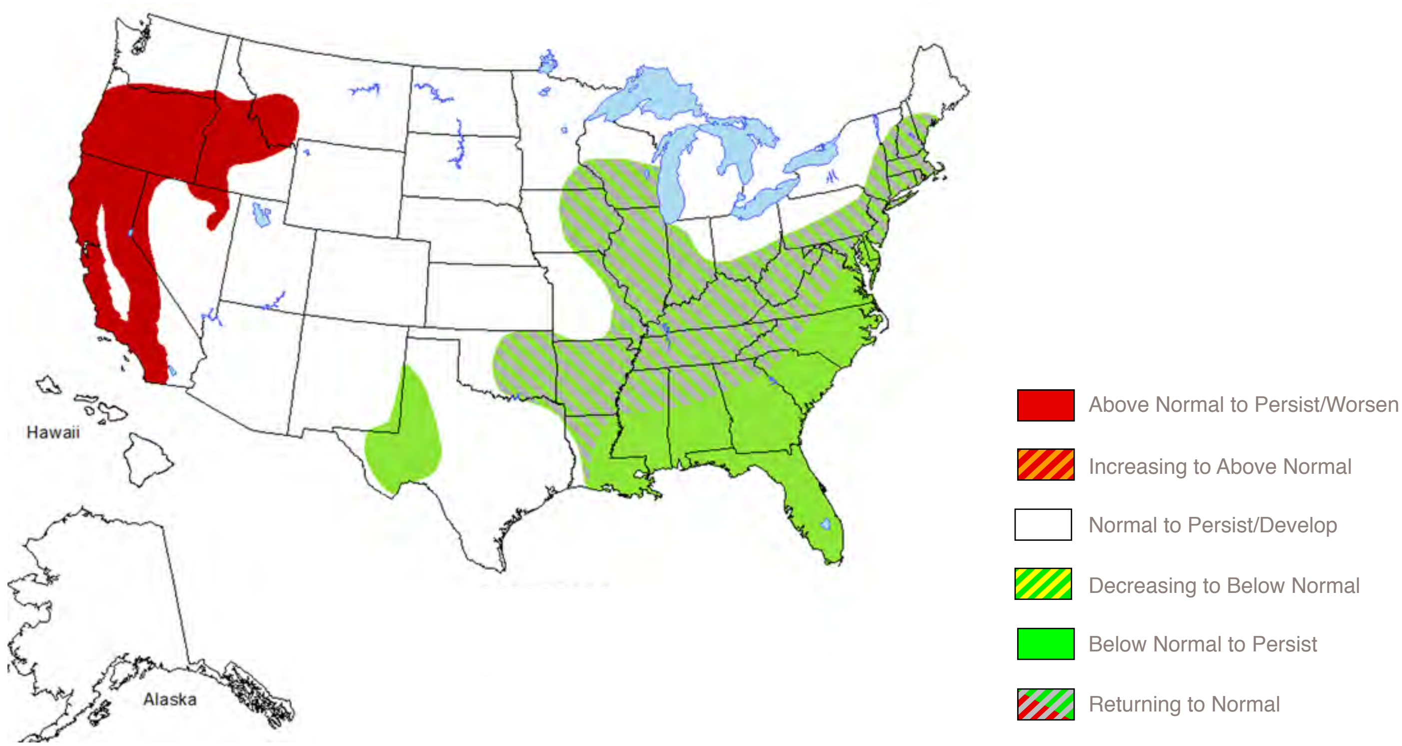


Figure 13. National wildland fire potential for fires greater than 100 acres for August 2013.

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 June 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)

Sea surface temperatures (SST) in the tropical Pacific Ocean are similar to one month ago and are near average across much of the equatorial region. This indicates that ENSO neutral conditions have persisted into July. The NOAA Climate Prediction Center (CPC) noted that although there was some cooling of SSTs to slightly below-average conditions in the eastern Pacific region, the change was small and relatively short lived. Upper- and lower-level winds are also near average, which provides additional evidence that neutral conditions are firmly in place. The Southern Oscillation Index (SOI), a measure of the atmospheric component of ENSO, increased slightly but remains in neutral conditions (Figure 14a).

Official SST outlooks issued jointly by the CPC and International Research Institute for Climate and Society (IRI) continue to indicate that neutral conditions are likely to persist in coming months (Figure 14b). There is a about a 70 percent chance that neutral conditions will persist through the 2014 spring, while there is only about a 20 and 10 percent chance that La Niña and El Niño conditions, respectively, will develop later this fall. However, the CPC notes that statistical and dynamical models are disagreeing substantially over the fate of ENSO this fall, with some forecasting a La Niña while others point towards an El Niño event. This leads to lower forecast confidence this month; confidence will likely increase in coming months as the fate of ENSO usually becomes clearer as the summer progresses.

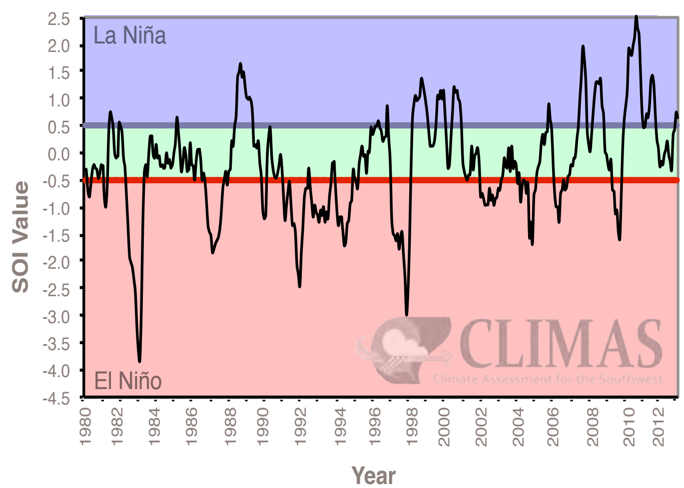


Figure 14a. The standardized values of the Southern Oscillation Index from January 1980–June 2013. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red), respectively. Values between these thresholds are relatively neutral (green).

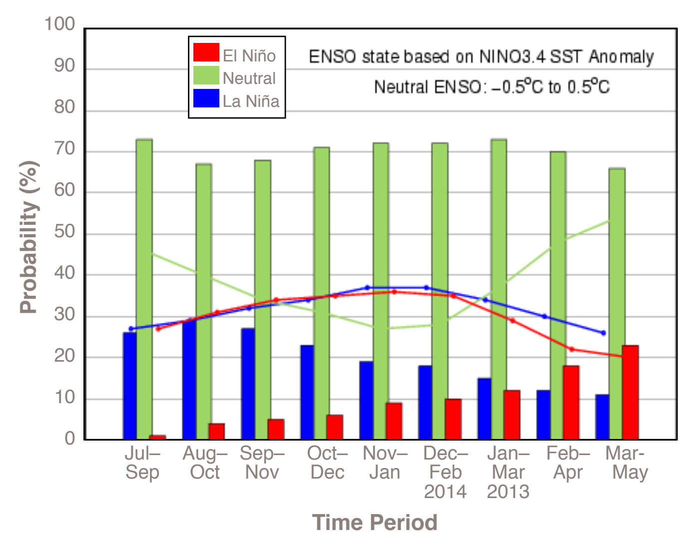


Figure 14b. IRI probabilistic ENSO forecast for the Niño 3.4 monitoring region (released July 18). Colored lines represent average historical probability of El Niño, La Niña, and neutral conditions.