Southwest Climate Outlook

New Mexico Drought 7

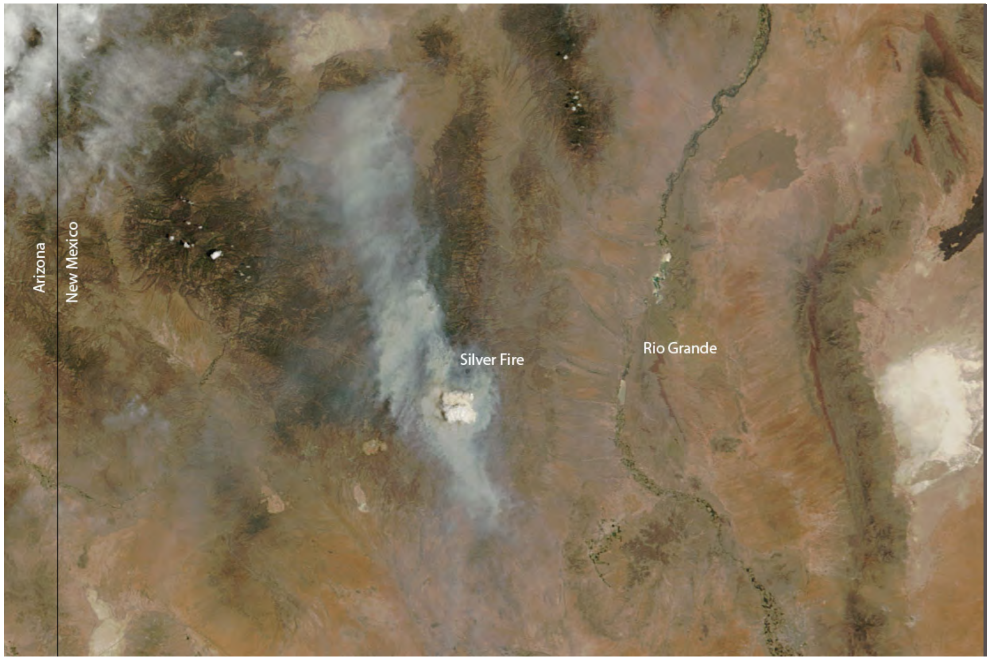
New Mexico has the greatest percentage of area classified with extreme or exceptional drought conditions in the U.S. Although monsoon rain in coming months likely will improve short-term drought conditions, longer-term drought impacts likely will persist.

Fire Summary 10

Widespread and intense drought conditions helped set the stage for elevated fire risk in recent months. Relatively few large blazes have scorched Arizona, however, compared with more active fire seasons in recent years. Fires will continue to start and spread in coming weeks prior to the onset of the monsoon.

Precipitation Outlook 13

Monsoon precipitation is difficult to forecast. While there is some indication that rains may begin in early July, there are equal chances of above-, below-, or near-average rain over the July–September period.



June

Vol 12 Issue 6

JUN 2013

READ ONLINE

The Silver fire has burned more than 70,000 acres around the Gila National Forest in New Mexico, making it the largest fire this year in either Arizona or New Mexico. As of June 23, the total acreage burned in New Mexico and Arizona was below historical averages for those states. About 111,000 acres have burned in New Mexico, while fires have charred about 49,000 acres in Arizona. Fires are expected to consume more acres in coming weeks until monsoon rains sufficiently moisten the landscape. Photo: Taken on June 12; NASA.

Tweet June's SW Climate Snapshot

Xtreme drought covers 90 percent of NM, but fires worse in past yrs. Temp to be above ave, monsoon a guess.

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Contents

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June Climate Summary

Drought: Drought conditions intensified across the Four Corners region of Arizona and New Mexico, in central Arizona, and in southeastern New Mexico.

Temperature: Temperatures were more than 3 degrees F warmer than average across much of Arizona and New Mexico.

Precipitation: Scant rain fell in Arizona, which is normal for this time of year, while rain soaked some parts of eastern New Mexico.

ENSO: ENSO-neutral conditions continue in the tropical Pacific Ocean and are expected to persist through the upcoming fall and winter.

Forecasts: There are no clear signals for either above- or below-average precipitation during the monsoon; temperature forecasts, however, call for increased chances of warmer-than-average conditions.

Snapshot: Record-setting drought in New Mexico in the last 12 months is contributing to intensifying and widespread drought conditions in the state. New Mexico is now the epicenter for drought in the U.S., with extreme or exceptional drought covering about 90 percent of the state. According to some indicators, the last two years in New Mexico have been the most arid during the protracted dry period that began around 2000. Long-term drought impacts such as dwindling water supply are now acutely emerging. For example, low water stores in the Elephant Butte Reservoir—the Rio Grande's largest reservoir—will cut allotments to farmers to only about 3.5 inches of water for every planted acre; when the reservoir is flush with water, farmers receive 36 inches per acre. Moreover, New Mexico's largest fire, the Silver fire, is burning in the Gila National Forest, fueled by dead trees killed by beetle infestations; tree mortality from bark beetles is often more prevalent during drought periods. Although precipitation totals in Arizona were higher than they were in New Mexico this winter, drought conditions are also intense and widespread. Total water year (October–September) precipitation has been above average during only three years since 2000. Similarly, the monsoon has only delivered above-average rainfall in southeast Arizona and southwest New Mexico—the regions in the Southwest that experience the most vigorous monsoon activity—three times since 2000. The monsoon, however, will deliver some precipitation that likely will improve short-term drought conditions in some regions, quelling fires and greening seasonal vegetation. While there are indications monsoon rains will begin on time, usually around July 1 in southern portions of Arizona and New Mexico, it is unclear if total monsoon rainfall will be above or below average over the entire July–September period. Temperature forecasts, however, are more certain. They call for increased chances for warmer-than-average conditions, which would uphold warming trends in recent decades.

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
http://www.hprcc.unl.edu/maps/current/

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

Notes

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2012, we are in the 2013 water year.Water year is more commonly used in association with precipitation; water year temperature can be used to measure the temperatures associated with the hydrological activity during the water year.

Average refers to the arithmetic mean of annual data from 1981–2010. Departure from average temperature is calculated by subtracting current data from the average. The result can be positive or negative.

The continuous color maps (Figures 1a, 1b, 1c) are derived by taking measurements at individual meteorological stations and mathematically interpolating (estimating) values between known data points. The dots in Figure 1d show data values for individual stations. Interpolation procedures can cause aberrant values in data-sparse regions.

These are experimental products from the High Plains Regional Climate Center.

Temperature

DATA THROUGH JUNE 19, 2013

Data Source: High Plains Regional Climate Center

Temperatures since the start of the 2013 water year on October 1 have been mostly within 1 degree Fahrenheit of average across the Southwest (*Figures 1a–b*). The largest temperature anomalies in the region were in the Sangre de Cristo Mountains of northern New Mexico. Although temperatures in the winter were close to average, considerable variability led to large temperature anomalies on weekly timescales, a pattern that is masked in analyses of monthly averages. Also, temperatures in recent months have been much above average in New Mexico, which just recorded its seventh warmest March–May period. Arizona temperatures were near average.

During the past 30 days, temperatures were consistently warmer than average across the Southwest (*Figures 1c–d*). Scant rain, which is typical for this time of year, and low soil moistures helped drive up temperatures. Above-average temperatures are also consistent with warming trends in recent decades.

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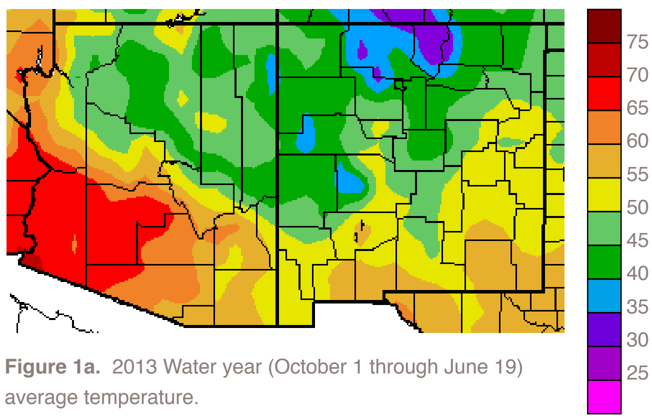

Figure 1a. 2013 Water year (October 1 through June 19) average temperature.

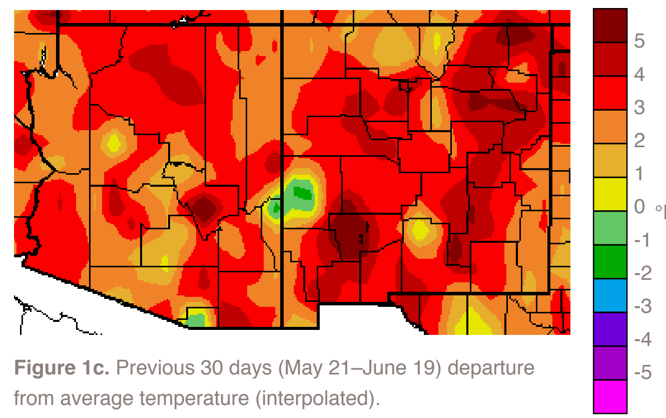

Figure 1c. Previous 30 days (May 21–June 19) departure from average temperature (interpolated).

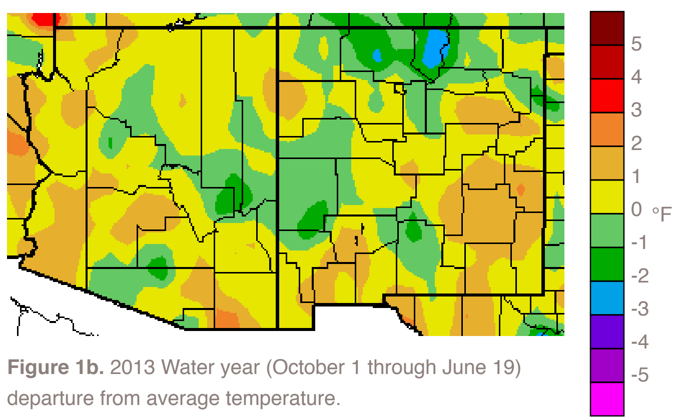

Figure 1b. 2013 Water year (October 1 through June 19) departure from average temperature.

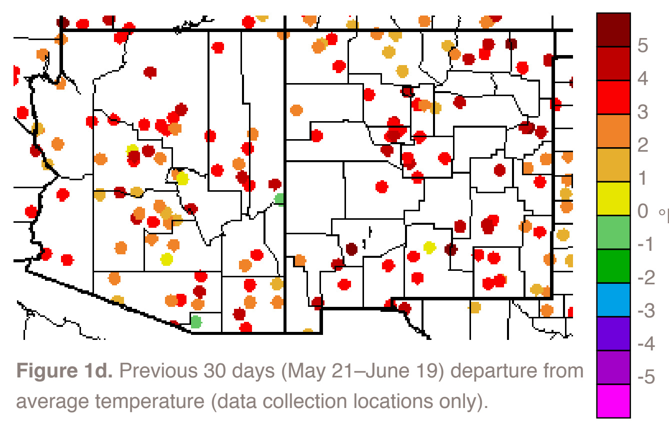

Figure 1d. Previous 30 days (May 21–June 19) departure from average temperature (data collection locations only).

Online Resources

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

National Climatic Data Center monthly precipitation and drought reports for Arizona, New Mexico, and the Southwest region
http://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.

Precipitation

DATA THROUGH JUNE 19, 2013

Data Source: High Plains Regional Climate Center

Drier-than-average conditions in the Southwest during the winter continued into spring and early summer, especially in New Mexico (*Figures 2a–b*). Since the water year began on October 1, New Mexico has received less than 50 percent of average precipitation. The most recent December–May period was the sixth driest on record for New Mexico. Arizona generally fared only slightly better, with most of the state receiving less than 70 percent of average precipitation.

In recent months, high pressure has dominated in the West, forcing storm systems to remain far to the north. Only one county in eastern New Mexico has received average precipitation this water year, and that is largely because of recent precipitation (*Figures 2c–d*). In the last 30 days, with the exception of Cochise County, all of Arizona received less than 5 percent of average rainfall and most of the western half of New Mexico received less than 25 percent. While this time of year is dry for Arizona and New Mexico, the scant rainfall has elevated fire risk. Western New Mexico, southern Colorado, southern Utah, and all of Arizona continue to be quite dry.

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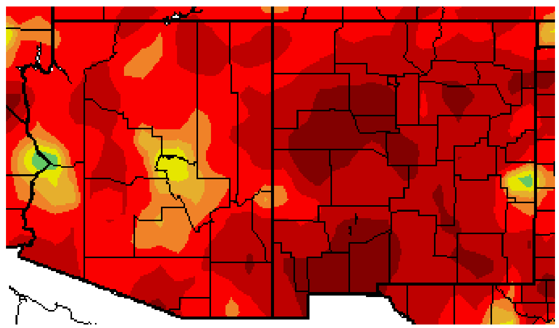
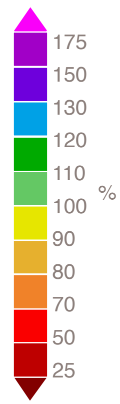

Figure 2a. 2013 Water year (October 1–June 19) percent of average precipitation (interpolated).

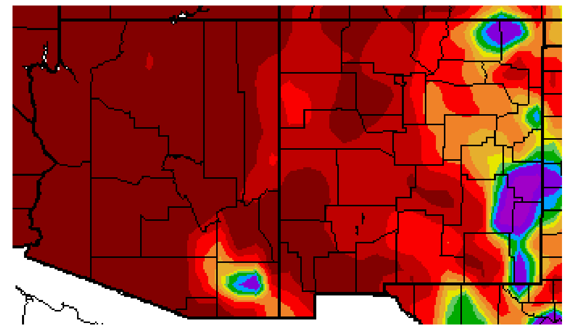
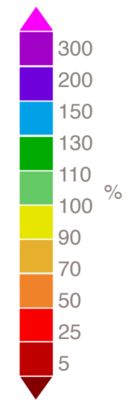

Figure 2c. Previous 30 days (May 21–June 19) percent of average precipitation (interpolated).

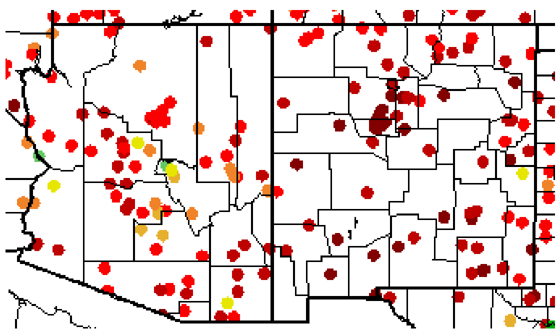
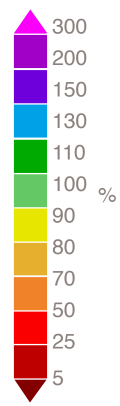

Figure 2b. 2013 Water year (October 1–June 19) percent of average precipitation (data collection locations only).

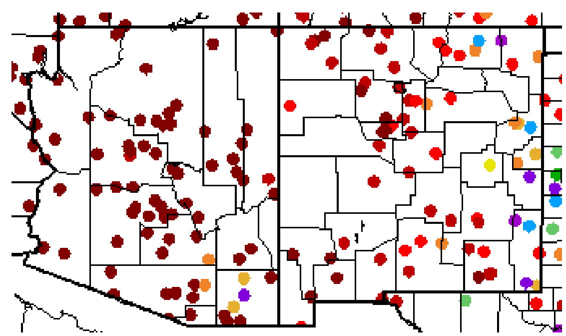
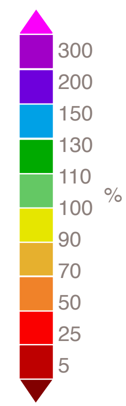

Figure 2d. Previous 30 days (May 21–June 19) percent of average precipitation (data collection locations only).

Online Resources

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor

http://www.drought.gov/drought/

U.S. Drought Monitor

DATA THROUGH JUNE 18, 2013

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

An active late-spring weather pattern dragged several wet storms across the Pacific Northwest and far northern Rocky Mountains over the past 30 days, helping to keep drought conditions at bay in these regions. The rest of the western U.S. has not been as fortunate. Dry and warm conditions have been the norm from Wyoming southward, reinforcing drought conditions already in place. Consequently, drought conditions expanded into parts of Idaho. Severe drought also expanded across parts of northern California and southern Oregon, where precipitation deficits continued to grow. Like last month, some level of drought covers 86 percent of the western U.S., with severe or more intense drought covering more than 50 percent of the region (*Figure 3*).

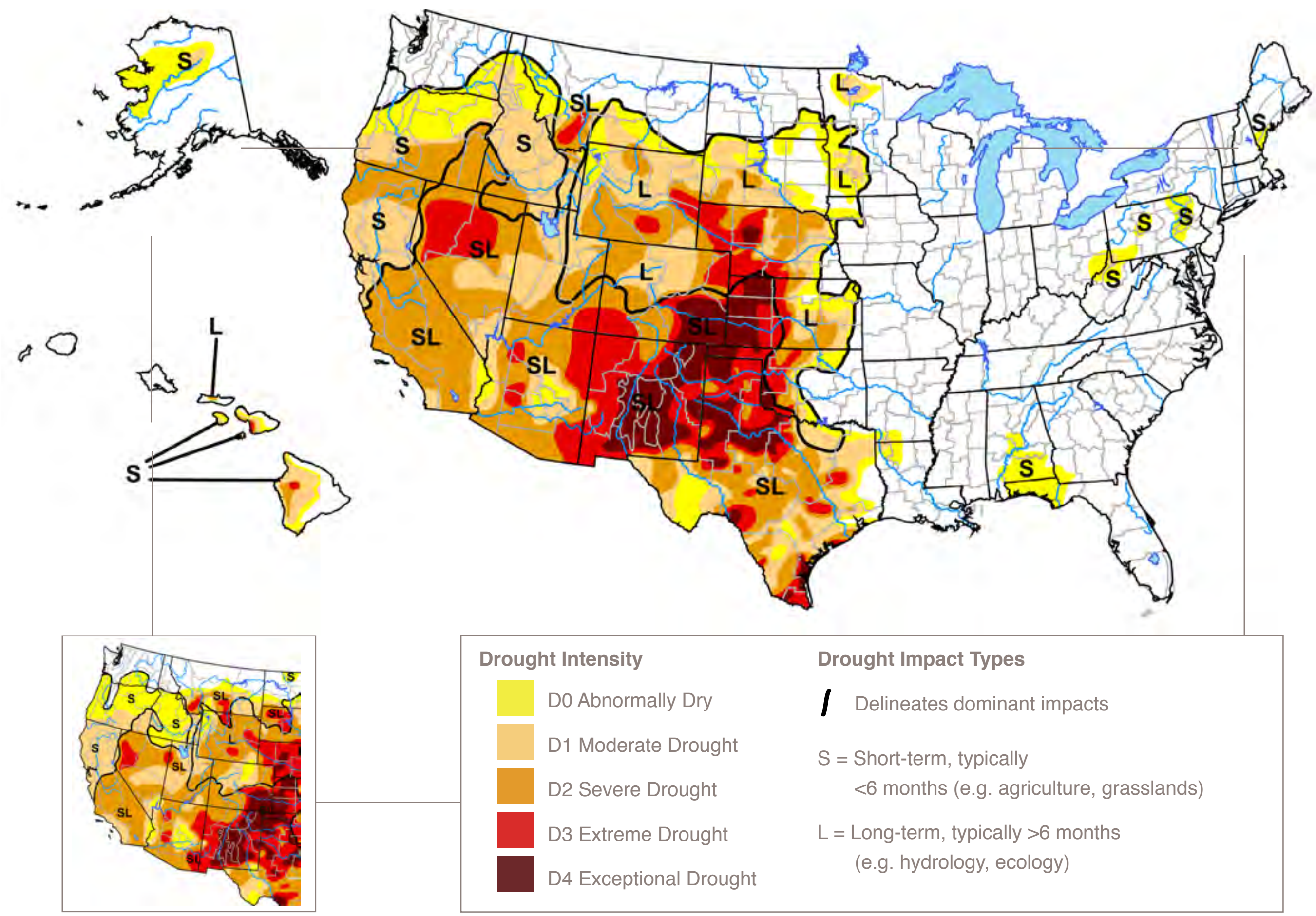

Figure 3. Drought Monitor data through June 18, 2013 (full size), and May 14, 2013 (inset, lower left).

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.

Arizona Drought Status

DATA THROUGH JUNE 18, 2013

Data Source: U.S. Drought Monitor

Drought continues to be widespread and intense in the Southwest. Moderate drought, at the least, covers about 92 percent of Arizona and severe or extreme levels cover more than 70 percent of the state (*Figures 4a–b*). The area exposed to extreme drought increased by about 3 percent in the last month.

In the past 30 days, dry conditions and above-average temperatures caused drought conditions to slightly intensify in the northeastern corner of the state and around the Mogollon Rim. The largest changes in drought status occurred around the Mogollon Rim, which was drought-free just two months ago after above-average precipitation fell across the region in the winter. Sharp deficits in precipitation and warm temperatures have driven the return of moderate drought across the area. The Vegetation Drought Response Index (VegDRI) shows pre- to moderate drought conditions across central Arizona and much of eastern Arizona, reflecting the worsening conditions.

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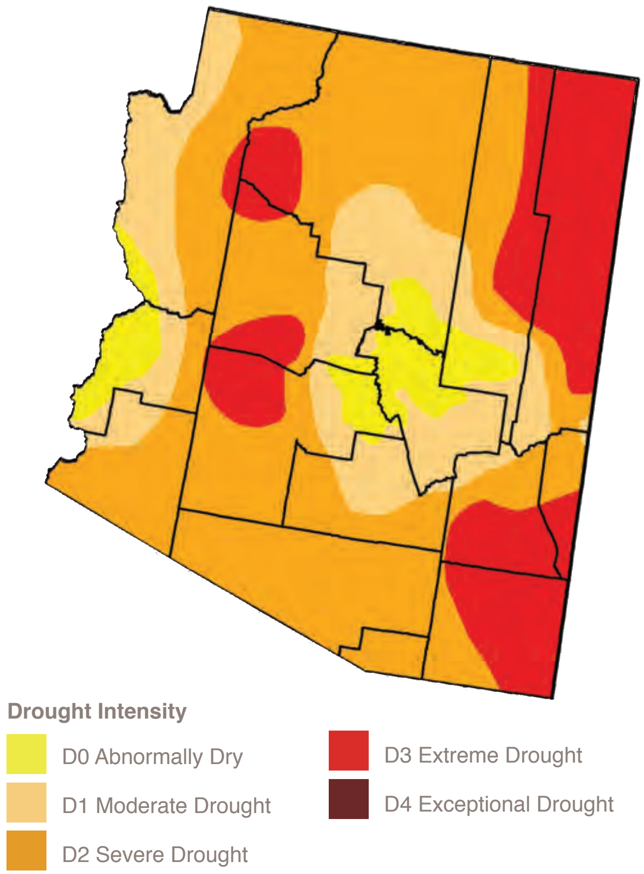


Figure 4a. Arizona drought map based on data through June 18.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	92.49	72.23	22.25	0.00
Last Week (06/11/2013 map)	0.00	100.00	92.49	72.23	19.67	0.00
3 Months Ago (03/19/2013 map)	3.06	96.94	80.11	29.72	2.03	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 (06/12/2012 map)	0.00	100.00	96.08	83.21	16.29	0.00

Figure 4b. Percent of Arizona designated with drought conditions based on data through June 18.

Online Resources

Most current drought status map
http://www.droughtmonitor.unl.edu/DM_state.htm?AZ,W

Monthly short-term and quarterly long-term Arizona drought status maps
http://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.

Online Resources

Most current drought status map
http://www.droughtmonitor.unl.edu/DM_state.htm?NM,W

Most current Drought Status Reports
http://www.nmdrought.state.nm.us/MonitoringWorkGroup/wk-monitoring.html

New Mexico Drought Status

DATA THROUGH JUNE 18, 2013

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

Drought conditions intensified in the last month in New Mexico. Extreme and exceptional drought cover about 46 and 44 percent of the state, respectively (*Figures 5a–b*). The biggest change in the past 30 days was the large expansion of extreme drought overtaking previously severe conditions in the northwest quarter of the state. Almost no precipitation fell across this region in the past 30 days. Extreme and exceptional drought conditions occupy more area than they have since February 2004. Monsoon rains in coming months likely will help improve drought conditions in some regions of New Mexico. However, even an above-average monsoon will not make dramatic drought improvements given the extreme drought conditions.

In drought-related news, several deer and a bear were struck by cars in the mountains east of Albuquerque in the past few weeks. New Mexico Game and Fish officials believe these collisions are related to the animals searching for water, which is harder to come by due to drought (krqu.com, June 19).

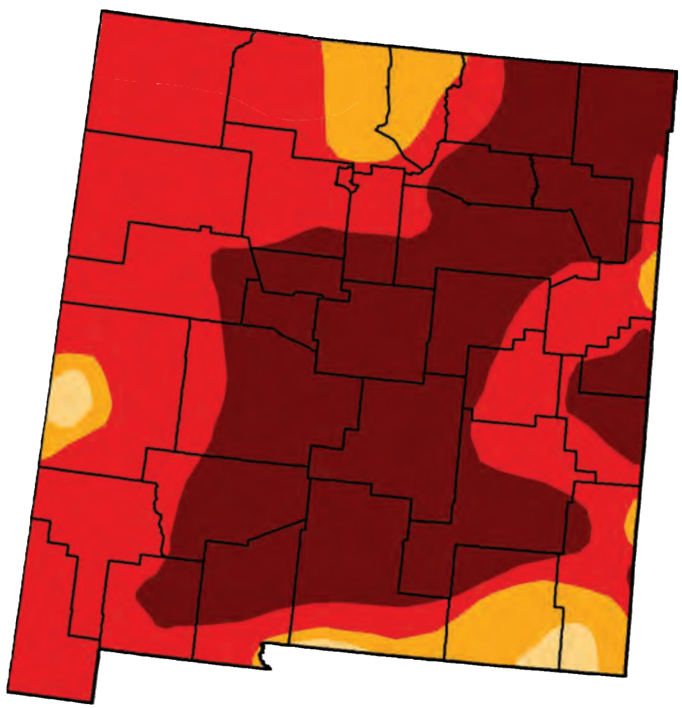


Figure 5a. New Mexico drought map based on data through June 18.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	100.00	98.49	90.18	44.13
Last Week (06/11/2013 map)	0.00	100.00	100.00	98.72	82.10	44.70
3 Months Ago (03/19/2013 map)	0.23	99.77	98.47	89.85	49.95	4.25
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 (06/12/2012 map)	0.00	100.00	99.64	73.03	23.46	0.00

Figure 5b. Percent of New Mexico designated with drought conditions based on data through June 18.

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://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).

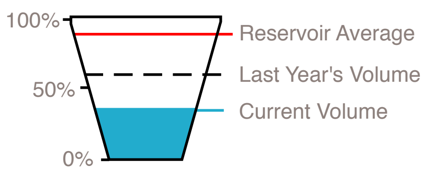
Arizona Reservoir Volumes

DATA THROUGH MAY 31, 2013

Data Source: National Water and Climate Center

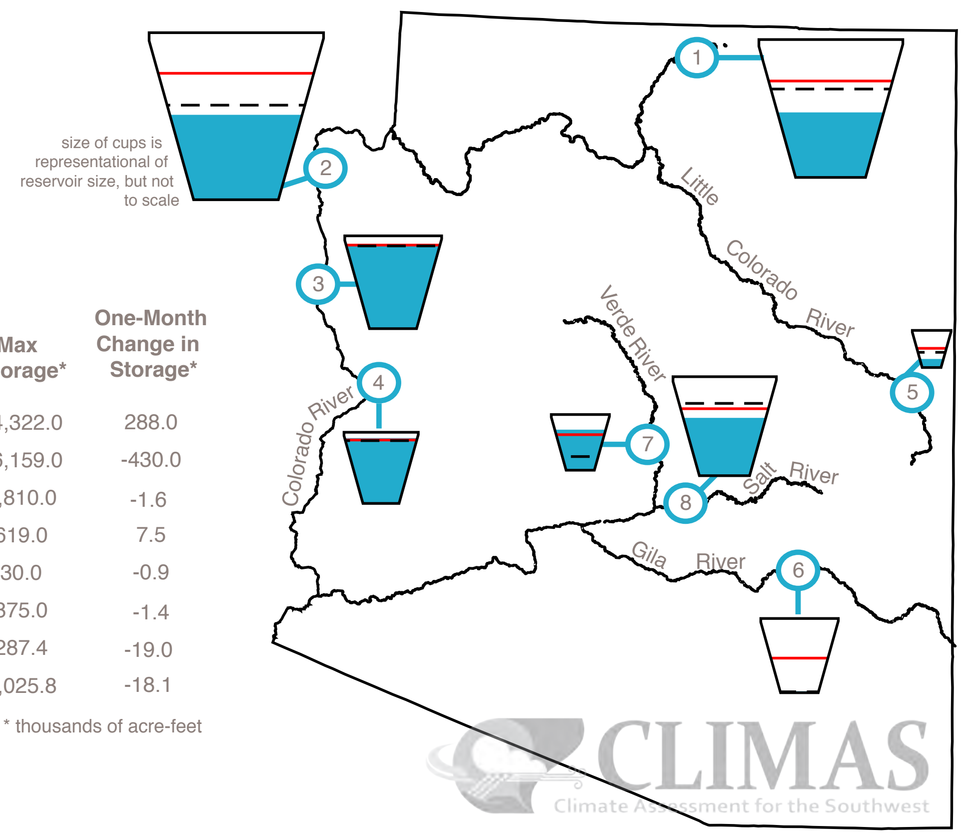
Combined storage in Lakes Mead and Powell stood at 47.9 percent of capacity as of May 31 (*Figure 6*), a decrease of 142,000 acre-feet from the previous month and about 10 percent lower than it was one year ago. Storage in the two reservoirs likely will remain at current levels for a couple of months, as inflow from runoff often matches reservoir releases until the late summer. Levels are then expected to decline. The most recent April–July streamflow forecast for runoff into Lake Powell is expected to be only about 42 percent of average. Elsewhere in Arizona, reservoir storage decreased in most basins. Combined storage in the Salt and Verde river basins decreased by about 37,100 acre-feet. Reservoir storage in these basins is around 90 percent of average and 61 percent of capacity, down 1 percent from last year.

Legend



Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	48%	11,710.0	24,322.0	288.0
2. Lake Mead	48%	12,491.0	26,159.0	-430.0
3. Lake Mohave	95%	1,721.0	1,810.0	-1.6
4. Lake Havasu	96%	594.3	619.0	7.5
5. Lyman	14%	4.3	30.0	-0.9
6. San Carlos	0%	0.5	875.0	-1.4
7. Verde River System	64%	182.8	287.4	-19.0
8. Salt River System	61%	1,233.0	2,025.8	-18.1

* thousands of acre-feet



CLIMAS Climate Assessment for the Southwest

Figure 6. Arizona reservoir volumes for the end of May 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

http://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).

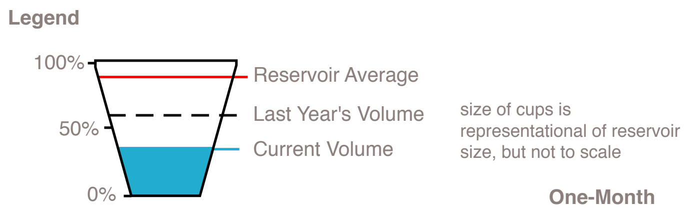
New Mexico Reservoir Volumes

DATA THROUGH MAY 31, 2013

Data Source: National Water and Climate Center

Combined water storage in the 11 New Mexico reservoirs with current data and reported here was about 22 percent of capacity and only 41 percent of average as of May 31 (*Figure 7*). New Mexico total reservoir storage increased slightly, primarily due to spring snowmelt runoff into Navajo Reservoir. Three of the four reservoirs on the Pecos River did not report to USDA-Natural Resources Conservation Service this month. However, there was likely no substantial improvement over last month's storage because precipitation in recent weeks was scant. Current storage in these reservoirs is about 1 percent of capacity and 17 percent of average. One year ago, storage in Pecos River reservoirs was also very low, but about twice that of current storage. On the Rio Grande, Elephant Butte and Caballo reservoirs also are extremely low, measuring only 9 and 11 percent of capacity, respectively. Low New Mexico reservoir levels reflect the effect of two consecutive years of extremely low snowpack in the rivers' headwaters.

In water-related news, tourist visits over Memorial Day weekend to the 35 state parks in New Mexico was down 40.6 percent from last year, resulting in a 41.3 percent drop in revenue (*Carlsbad Current-Argus*, June 15). State park officials point to the severity of ongoing drought, which, for example, has dropped Conchas Lake to its lowest level since 1940, when record-keeping began. Conchas is one of four state park lakes closed to motorized boating as a consequence of drought conditions.



Reservoir Name	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	58%	990.1	1,696.0	61.7
2. Heron	33%	132.9	400.0	-1.0
3. El Vado	22%	41.0	190.3	8.4
4. Abiquiu	12%	142.0	1,192.8	-12.3
5. Cochiti	10%	48.1	491.0	-0.3
6. Bluewater	7%	2.8	38.5	-0.2
7. Elephant Butte	9%	193.6	2,195.0	-29.5
8. Caballo	11%	36.1	332.0	25.9
9. Lake Avalon	NA	NA	4.0	NA
10. Brantley	NA	NA	1,008.2	NA
11. Sumner	NA	NA	102.0	NA
12. Santa Rosa	NA	NA	438.3	NA
13. Costilla	1%	2.6	16.0	-0.1
14. Conchas	26%	4.1	254.2	0.2
15. Eagle Nest	0%	0.0	79.0	0.0

* thousands of acre-feet

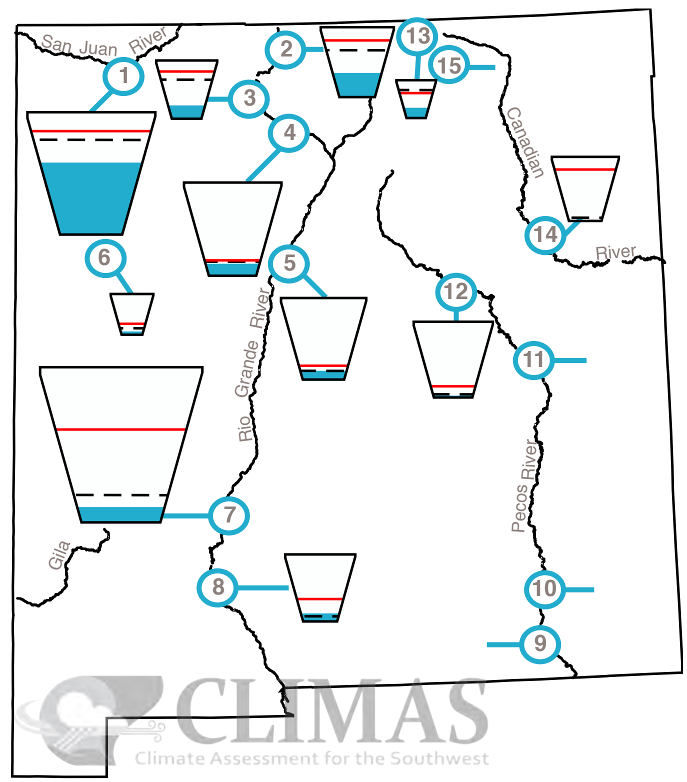


Figure 7. New Mexico reservoir volumes for the end of May as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

Southwest Fire Summary

DATA THROUGH: JUNE 20, 2013

Source: Southwest Coordination Center

Dry conditions across Arizona and New Mexico since October 1 have set the stage for another active fire season. However, only 12 fires in Arizona and six in New Mexico have burned more than 100 acres between January 1 and June 20 (*Figures 8a–c*). The total number of acres burned in each state is also below its median. In Arizona, only 42,385 acres had burned through June 20—the median number of acres burned over the 2000-2012 for the January–June period is about 130,000. About 70,000 acres had burned in New Mexico as of June 20; the median in New Mexico during the 2000¬–2012 period is about 286,000 acres. More fire and acres burned will likely occur in coming weeks before the monsoon begins in earnest. More fires and scorched acreage are expected, as the fire season peaks in June; monsoon rains help quell fires in July, August, and September.

As of June 20, four fires were burning in Arizona, the largest of which is the Fourmile fire. It has burned about 14,255 acres as of June 20, mostly in grasslands near Morenci in eastern Arizona. The largest fire in New Mexico is the Silver fire, which has charred about 30,000 acres in the Gila National Forest near Silver City. Significant fire potential is expected to remain above normal until early July in southern portions of Arizona and New Mexico and mid-July in northern regions of Arizona (see page 15).

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	523	25,301	48	17,377	571	42,678
NM	395	44,414	114	40,187	509	84,601
Total	918	69,715	162	57,564	1080	127,279

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of June 20, 2013.

Figure 8b. Arizona large fire incidents as of June 20, 2013.

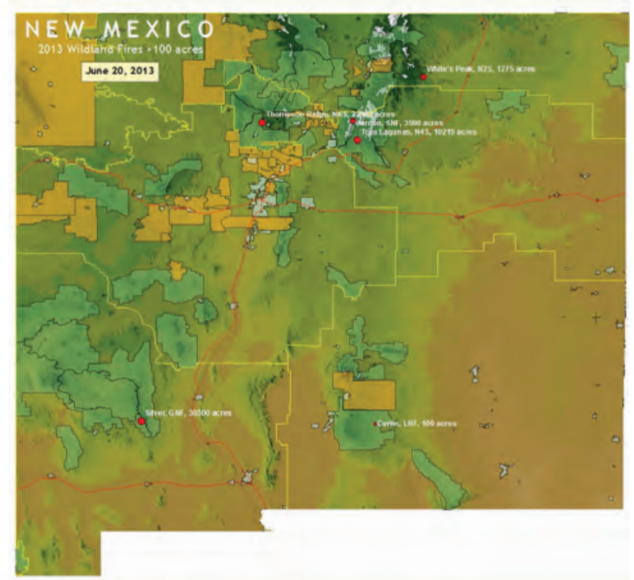


Figure 8c. New Mexico large fire incidents as of June 20, 2013.

Online Resources

Data obtained from the Southwest Coordination Center

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

http://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 top figure shows a table of year-to-date fire information for Arizona and New Mexico. Prescribed burns are not included in these numbers. The bottom two figures indicate the approximate locations of past and present "large" wildland fires in Arizona and in New Mexico. A "large" fire is defined as a blaze covering 100 acres or more in timber or 300 acres or more in grass or brush. The name of each fire is provided next to the symbol.

Online Resources

Data obtained from High Plains Regional Climate Center

http://www.hprcc.unl.edu/maps/current/

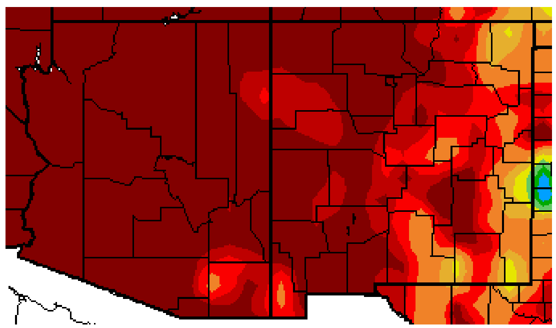
Monsoon Summary

DATA BETWEEN JUNE 15-21, 2013

Data Source: Western Regional Climate Center

The monsoon storms historically begin in the first week of July in southern Arizona and New Mexico. However, the National Weather Service (NWS) announced that June 15 through September 30 would mark the official dates of the monsoon in order to more clearly communicate when monsoon risks, such as flash floods, are most likely to occur. Since June 15, there has been some precipitation in parts of the Southwest, but little rain has fallen throughout most of the region, which is typical (Figures 9a–c). Some places in the Tucson area received about 0.5 inches of rain on June 15, and parts of eastern New Mexico received 0.25 to 1.5 inches. While this rainfall did occur within the NWS defined monsoon period, it was not technically monsoon-driven as atmospheric circulation patterns characteristic of the monsoon are not yet in place. These include a monsoon high-pressure ridge over parts of Arizona and New Mexico that allows winds to blow from the south and southeast. The classic definition of the monsoon refers to a shift in prevailing wind direction by 120 degrees, which does occur in the Southwest.

This year, there are several indications that the monsoon will begin on time or slightly early. These include forecasts for the presence of a northward moving tropical storm in the eastern Pacific Ocean and the formation of a surface heat low near the border between California and Arizona. Both scenarios would help ferry moisture from the Gulf of California into the Southwest. Current conditions this year are similar to those of last year, and this summer may evolve similarly. Last year, substantial monsoon rains first fell at the Tucson International Airport around July 4. By July 15, nearly 66 percent of the season's total rain had fallen. September 14 marked the final day of monsoon precipitation and the season tallied just under its long-term average.



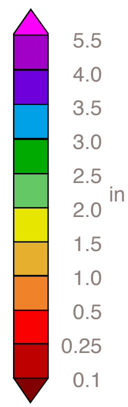
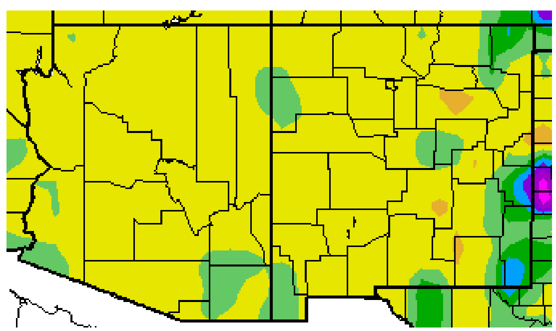


Figure 9a. Total precipitation in inches for June 15–June 21, 2013.



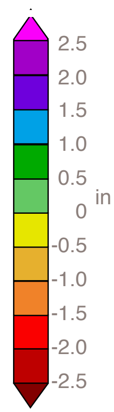
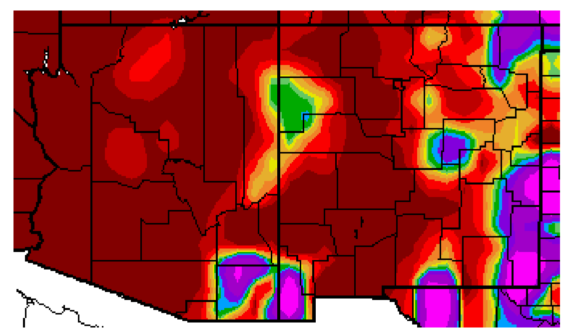


Figure 9b. Departure from average precipitation in inches for June 15–June 21, 2013.



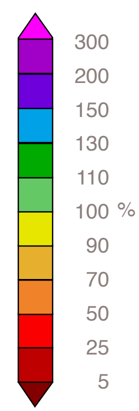


Figure 9c. Percent of average precipitation (interpolated) for June 15–June 21, 2013.

Notes

The continuous color maps (figures above) 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.

Online Resources

CPC forecasts

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

Seasonal temperature forecast downscaled to the local scale

http://www.weather.gov/climate/l3mto.php

IRI forecasts

http://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: JULY–DECEMBER 2013

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal temperature outlooks issued by the NOAA-Climate Prediction Center (CPC) in June 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 July through December (*Figures 10a–d*). The seasonal forecasts presented here are based on statistical and dynamical models and are largely consistent with decadal warming trends. The CPC also notes that initial soil moisture conditions played a role in the July–September and August–October outlooks; dry soil moisture conditions favor increased temperatures because there is reduced evaporative cooling. The amount and character of precipitation during monsoon months will also feedback on temperature. For example, evaporation and cloud cover are greater when precipitation is consistent and frequent and both help lower daytime temperatures. Precipitation forecasts call for equal chances for above-, below-, or near-average conditions in the Southwest for the monsoon (see page 13). The highest temperature probabilities in the U.S. for both July–September and August–October are across the central Rockies, Great Basin, and Southwest (*Figures 10a–b*). The September–November and October–December forecasts are predominantly based on the average conditions in the last 10 years because there is high uncertainty in the evolution of the El Niño-Southern Oscillation (ENSO; *Figures 10c–d*). ENSO usually develops in early winter and can have a substantial influence on temperature and precipitation in the Southwest.

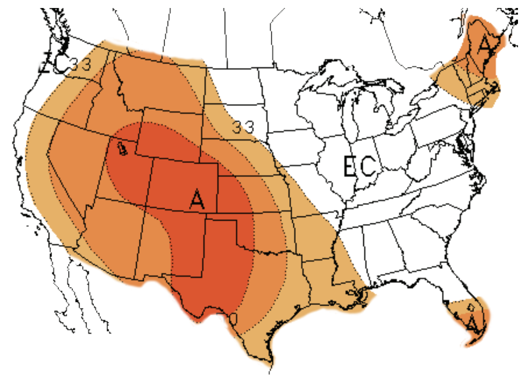


Figure 10a. Long-lead national temperature forecast for July–September 2013.

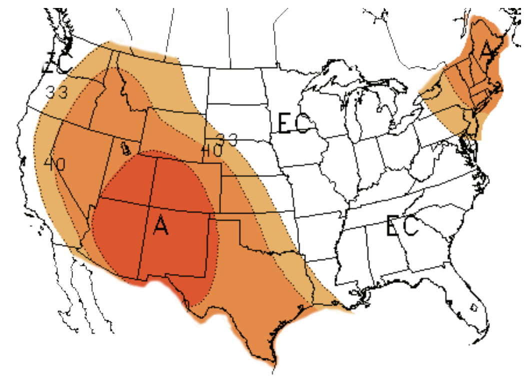
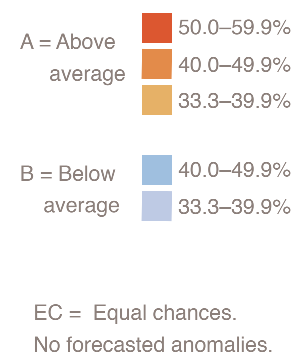


Figure 10b. Long-lead national temperature forecast for August–October 2013.



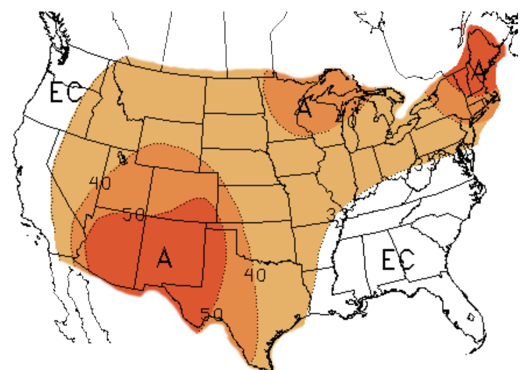


Figure 10c. Long-lead national temperature forecast for September–November 2013.

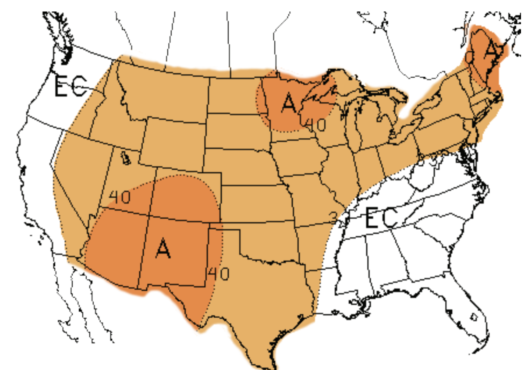


Figure 10d. Long-lead national temperature forecast for October–December 2013.

Online Resources

CPC forecasts

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

Seasonal temperature forecast downscaled to the local scale

http://www.weather.gov/climate/l3mto.php

IRI forecasts

http://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: JULY–DECEMBER 2013

Data Source: NOAA-Climate Prediction Center (CPC)

The seasonal precipitation outlooks issued by the NOAA-Climate Prediction Center (CPC) in June call for equal chances that precipitation during the July–September and August–October periods will be above, below, or near average across nearly all of New Mexico and Arizona (*Figures 11a–b*). However, decision support tools used to help guide forecasts show stronger signals this month for enhanced monsoon precipitation than in previous months. This reflects, in part, eight- to 14-day medium-range weather forecasts that indicate moisture will waft into the region and set the stage for a slightly early or on-time arrival of the monsoon. The monsoon usually begins around July 1 in southwest New Mexico and southeast Arizona.

While there is some indication monsoon rainfall will be above average, some climate models suggest the opposite, which provides forecasters with no clear signal for above- or below-average conditions. Moreover, dynamical models often are not accurate at forecasting the entire three-month monsoon. Nonetheless, there is also no indication that the monsoon will be a dud, which is good news for a region in the throes of widespread and intense drought. For the September–November and October–December periods, an equal chances forecast stems from uncertainty in the evolution of the El Niño–Southern Oscillation (ENSO; *Figures 11c–d*). ENSO usually develops in early winter and can have a substantial influence on precipitation in the Southwest.

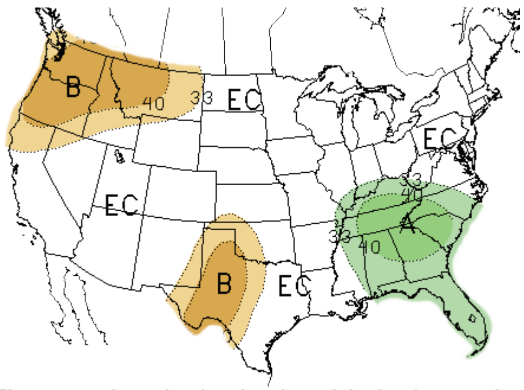


Figure 11a. Long-lead national precipitation forecast for July–September 2013.

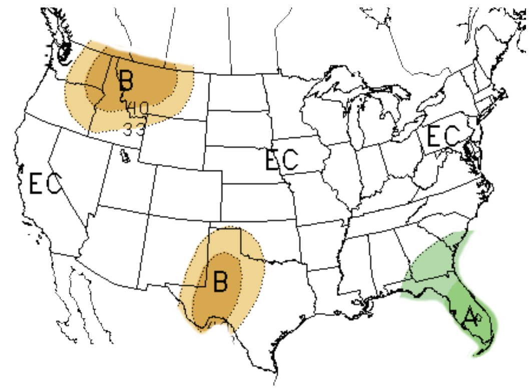


Figure 11b. Long-lead national precipitation forecast for August–October 2013.

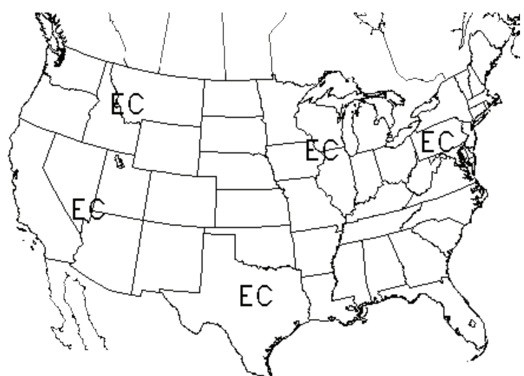


Figure 11c. Long-lead national precipitation forecast for September–November 2013.

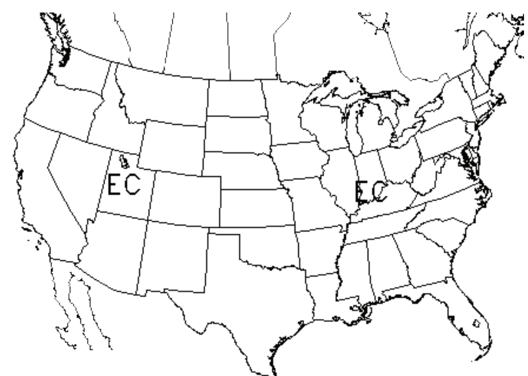


Figure 11d. Long-lead national precipitation forecast for October–December 2013.

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

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

EC = Equal chances. No forecasted anomalies.

Online Resources

More information

http://www.cpc.ncep.noaa.gov/products/expert_assessment/seasonal_drought.html

Medium- and short-range forecasts

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

Soil moisture tools

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

Seasonal Drought Outlook

DATA THROUGH SEPTEMBER 2013

Data Source: NOAA-Climate Prediction Center (CPC)

This summary is partially excerpted and edited from the June 20 Seasonal Drought Outlook technical discussion produced by the NOAA-Climate Prediction Center (CPC) and written by forecaster A. Allgood.

Dry and hot conditions persisted across the southwestern U.S. during the last 30 days, but monsoon moisture, which typically streams into the Southwest in early July, will likely bring much needed rain to the region. Consequently, the NOAA-Climate Prediction Center (CPC) states drought improvement is likely across Arizona, western New Mexico, southern Utah, and southern Nevada (*Figure 12*).

There are several indications that the onset of monsoon moisture will be both early and strong. These include the possibility of a north-moving tropical storm in the eastern Pacific Ocean, which would promote the flow of moist air from the Gulf of California into the Southwest. Additionally, the eight- to 14-day medium-range weather forecast suggests a surface low will form from solar heating near the border between California and Arizona and a high pressure system will sit across Colorado and New Mexico. These conditions would also promote the northward flow of moisture into the Southwest. However, forecasting the entire three-month monsoon is difficult. The CPC suggests that chances are equal that the monsoon will be above, below, or near average (see page 13). The CPC assigns a low to moderate confidence in this forecast, in part because the monsoon is difficult to project. Nonetheless, because the monsoon will bring at least some moisture to the region, drought improvement in some regions is likely.

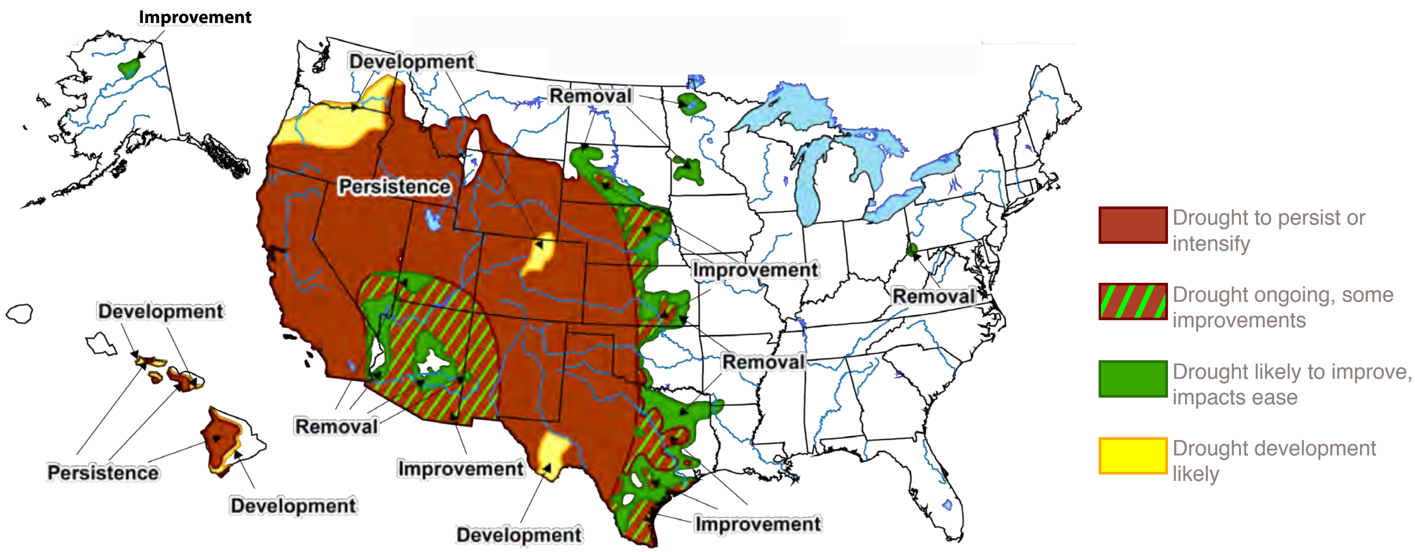


Figure 12. Seasonal drought outlook through September 2013 (released June 20).

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.

Online Resources

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

Southwest Wildland Fire Outlook
http://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 fire potential for fires greater than 100 acres.

Wildland Fire Outlook

FORECAST PERIOD: JULY 2013

Sources: National Interagency Coordination Center, Southwest Coordination Center

Above-normal significant fire potential is expected to return to normal over much of Arizona and western New Mexico in early July (*Figure 13*), but significant fire risk will remain above average through mid-July in parts of northern Arizona. Significant fire potential is also expected to be normal in August and September. Significant fire potential refers to the likelihood that a wildland fire will require additional resources from outside the area in which the fire originated. Decreasing fire risk in July relates to the onset of the monsoon, which begins, on average, in early July in southern Arizona and New Mexico and slightly later in northern regions. The monsoon helps deliver rain and humidity that dampen fire risk. However, as the monsoon approaches more dry lightning strikes occur contributing to increased fire activity in the weeks prior to vigorous monsoon activity. The peak of the fire season in the Southwest is in June.

Fuel and soil moisture conditions remain extremely dry due to above-average temperatures and below-average precipitation. These conditions are reflected in the moderate to extreme drought that covers most of the Southwest (see drought status for Arizona and New Mexico on pages 6 and 7).

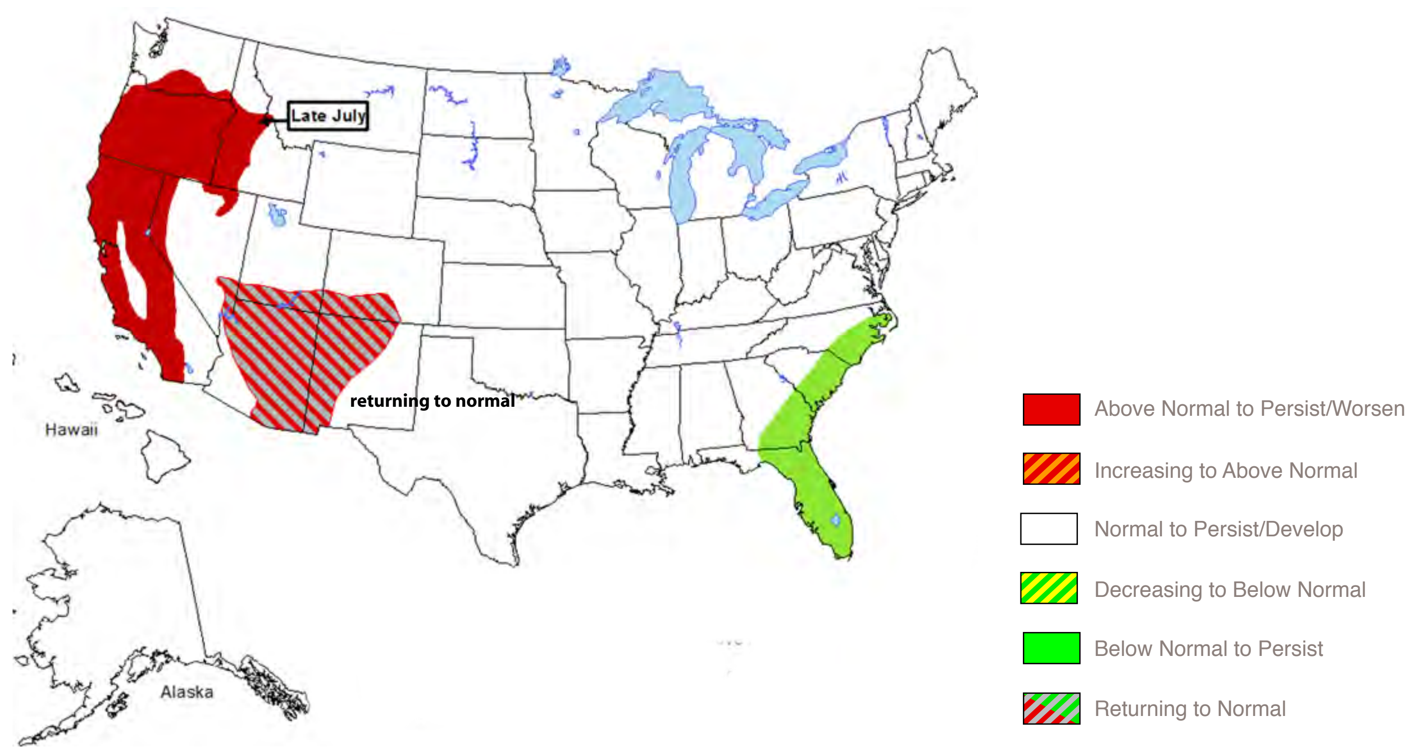


Figure 13. National wildland fire potential for fires greater than 100 acres for July 2013.

Online Resources

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

Information about El Niño and graphics similar to these figures
http://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 May 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 (SSTs) are close to average for this time of year across the equatorial Pacific Ocean, signaling that the El Niño-Southern Oscillation (ENSO) continues to be in its neutral phase. The NOAA-Climate Prediction Center (CPC) notes that a decrease in SSTs in the eastern Pacific in mid-June quickly returned to average. This cooling was not interpreted as a move towards a developing La Niña event. Wind patterns, reflected in the Southern Oscillation Index (SOI), are also largely close to average across the equatorial Pacific, further indicating that the development of a La Niña or El Niño event is not imminent *(Figure 14a)*.

Official SST outlooks issued jointly by the CPC and the International Research Institute for Climate and Society (IRI) continue to indicate that neutral conditions are likely to persist into next year (*Figure 14b)*. These chances are greater than the long-term average chances (green line in Figure 14b). Most dynamical and statistical models agree that neutral conditions are the most likely outcome over the next several months, but the IRI also notes that a few statistical models were leaning towards a weak La Niña event developing in this period.

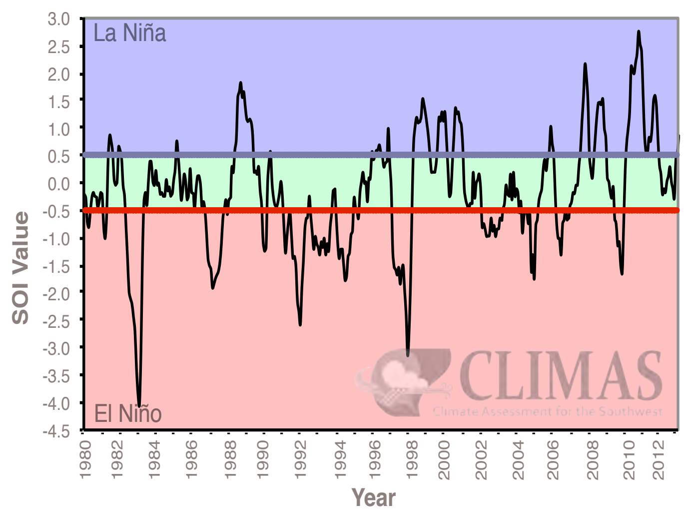


Figure 14a. The standardized values of the Southern Oscillation Index from January 1980–May 2013. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red), respectively. Values between these thresholds are relatively neutral (green).

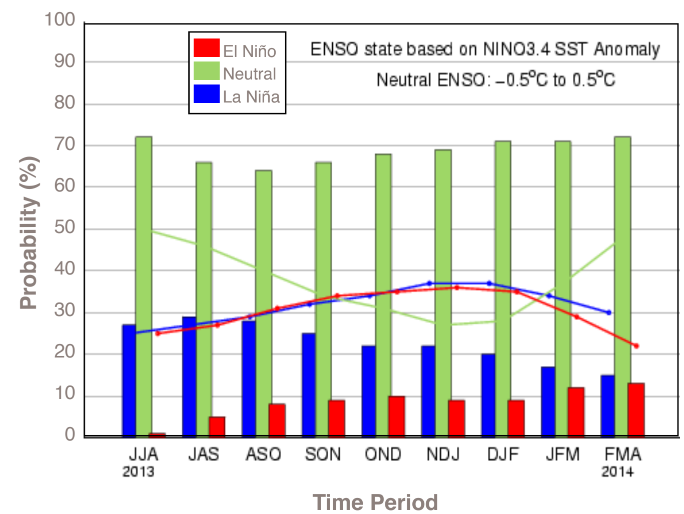


Figure 14b. IRI probabilistic ENSO forecast for the Niño 3.4 monitoring region (released June 20). Colored lines represent average historical probability of El Niño, La Niña, and neutral conditions. Consecutive letters in x-axis refer to months. For example, JJA is equal to June-July-August.