July 21, 2010

Southwest Climate Outlook

Vol. 9 Issue 7

Source: John Burfiend, Air Tactical Specialist for the U.S. Forest Service.

Photo Description: An air tanker buzzes the Rio Fire above the Santa Fe National Forest, about 30 miles west of Los Alamos, New Mexico. The fire, which began on June 1, was started by human activity and burned about 1,356 acres before it was quelled.

Would you like to have your favorite photograph featured on the cover of the *Southwest Climate Outlook*? For consideration send a photo representing Southwest climate and a detailed caption to: macaulay@email.arizona.edu

In this issue...

CLIMAS Climate Assessment for the Southwest

ARIZONA COOPERATIVE EXTENSION THE UNIVERSITY OF ARIZONA • COLLEGE OF AGRICULTURE AND LIFE SCIENCES

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July Climate Summary

Drought– Drought conditions expanded in Arizona in the last month and remained steady in New Mexico. About 58 percent of Arizona is experiencing abnormally dry conditions or worse, up from about 36 percent one month ago; about 50 percent New Mexico is abnormally dry or worse.

Temperature– The absence of moisture and thunderstorms is causing extreme daytime temperatures across the Southwest.

Precipitation– Dry conditions continue as monsoon storms have been few and far between. Most of Arizona has received 25 percent of average precipitation; northwestern New Mexico has been the driest part of the state, while southern portions have experienced above-average rainfall.

ENSO– Atmospheric and oceanic conditions are set for the development of a La Niña event during the July–August period. Forecasts indicate an approximately 80 percent chance that La Niña conditions will occur for the July–September period and persist through the remainder of 2010.

Climate Forecasts– Forecasts call for the remainder of the monsoon season and early fall to be warmer and drier than average with below-average precipitation for August–October for most of Arizona and the western half of New Mexico.

The Bottom Line– It has been a dry and warm start to the monsoon season. Most of Arizona and western New Mexico have experienced less than 50 percent of average precipitation. As a result, drought conditions have cropped up in southeastern Arizona, which typically receives the brunt of monsoon moisture in the state. Looking ahead, NOAA–CPC has downgraded its outlook for the monsoon season precipitation from equal chances to below average. This doesn't bode well for drought conditions, because the La Niña that likely will take shape in July or August also will likely decrease fall and winter precipitation. If the monsoon season fizzles like it did last year, the Southwest could experience rapidly expanding drought conditions.

2010 Drought Monitoring Report in Tucson: Education remains primary drought response

Drought conditions have improved and water use efficiency has been on the rise for Tucson Metropolitan residents in the past year. The combination of these and other indicators has prompted Tucson Water—the major Tucson metropolitan water service provider—to recommend remaining in a Stage 1 Drought Response. That means primary drought mitigation efforts will focus on increasing drought awareness and promoting water use efficiency as opposed to harsher measures, like restrictions. This recommendation, issued in a June 15 report, is based in part on decreasing per capita water use in the Tucson area. Also, water stored in aquifers from which Tucson Water draws is increasing relative to 2000, resulting in less use of mined groundwater as a percent of demand.

It's not all rosy, however. The Upper Colorado River Basin received only about 80 percent of average snowpack between October 1 and June 8, Lakes Mead and Powell are only about half full, and Tucson Water recognizes that climate change may stress supplies by accentuating natural climate variability that cause droughts and floods.

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This work is published by the Climate Assessment for the Southwest (CLIMAS) project and the University of Arizona Cooperative Extension; and is funded by CLIMAS, Institute of the Environment, and the Technology and Research Initiative Fund of the University of Arizona Water Sustainability Program through the SAHRA NSF Science and Technology Center at the University of Arizona.

Climate and fire connections: the 2010 fire season in review and beyond

By Zack Guido

Figure 1. The Paradise Fire raged near Alpine, Arizona, on June 22. The fire began from a lightning strike on June 7 and burned about 6,355 acres. Photograph is courtesy of John Burfiend, Air Tactical Specialist for the U.S. Forest Service.

Wildfires burning in the Southwest this year have grabbed headlines but haven't come close to the region's average for acres burned. Fires in the last 20 years have charred more than 410,000 acres on average in Arizona and New Mexico. As of mid-July, a date when the height of fire activity has past, only about 145,150 acres have burned. With the monsoon rains beginning to dampen the Southwest's 2010 wildfire season, CLIMAS staff scientist Zack Guido turned to Richard Naden, fire meteorologist and coordinator of the Remote Automated Weather Stations for the National Park Service, to talk climate, weather, and fire management.

In a July 7 interview, Naden, who is also part of the Southwest Coordination Center, a multi-agency fire management group that coordinates fire management in Arizona and New Mexico, shed light on several aspects of Southwest wildfire: the weather patterns that suppressed fire activity this season, the natural climate oscillations that set the stage for active or quiet fire seasons, climate change effects on future fire seasons, and the application of fire outlooks for allocating fire-fighting resources.

The following transcript is a slightly abridged version of the discussion. You can listen to the entire discussion by downloading the mp3 audio file from our Web site: http://climas.arizona.edu or browsing to the discussion on iTunes. See last month's issue for reference.

Question: How has the fire season unfolded in the Southwest this year?
Richard Naden: In the large scheme of things the season has unfolded how we expected. We have had a slow year or a below-average year. If you are looking at statistics, we are probably going to have a little more than half of the average of the acres burned for a year. Right now we have had about 108,000 acres burned... The only time we had high fire activity has been in June, which is normally our biggest fire month and this year was no exception. The Southwest had cool temperatures through May, which we were anticipating with the dissolving El Niño and the evolving La Niña, which I was anticipating back in April. …We've had a quick flip in the El Niño–Southern Oscillation pattern. We've gone from basically a moderate to strong El Niño to at least a moderate La Niña right now in a matter of two or three months. And that's driving the weather situation for us entirely. I did some statistics for other years when we have seen a similar flip—there have only been a couple of similar years. One of those years was 1998, and that year was a below-average fire season. Using that knowledge, using that analog year and recognizing trends in weather patterns, we were able to predict a down year with a peak around mid- to late June, which is indeed what occurred.

Q: Can you define the Southwest region?
RN: The Southwest for us is the western third of Texas, …a small sliver of western Oklahoma, …and all of Arizona and New Mexico.

Q: When is the fire season in the Southwest?
RN: Typically our main fire season is from around March 15 to about July 15. Some years, typically La Niña winters, we have fires as early as December and January, typically in the eastern Plains. In poor monsoon years, we could have fires burning into August.

Our main fire season was only about three weeks this year, from around late May to June 20. The last few weeks have really slowed down, especially the last two weeks because we started having moisture coming in and temperatures cooled off

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Climate and fire connections, continued

Figure 2. The Rio Fire burned about 1,356 acres in the Santa Fe National Forest about 30 miles west of Los Alamos. Human activity on June 1 started the blaze. Photograph is courtesy of John Burfiend, Air Tactical Specialist for the U.S. Forest Service.

some. In order to get big fires in the Southwest you need excessive heat with low humidity values and some source of ignition—either human-related or some lightning a few days after the heat. That's what we had around June 6 when we had a pretty epic lightning event along the Continental Divide area, the Gila National Forest region, and the White Mountain area, and that really got our fire season going this year. …That was really the event of the year. A lot of fires we had this year started with that lightning event. We had the Shultz Fire start near Flagstaff, Arizona [during this event], which was probably the most notable fire this year.

Q: How big was the Shultz Fire?
RN: 15,000 acres.

Q: How does that fit into a historical perspective of large fires?
RN: The other large fire was the South Fork fire in the Santa Fe National Forest. [That fire] was 17,000 acres... But the Shultz fire was in the news more. As far as how large those fires were [in a historical context] I would say they are below average. Some of the biggest fires we saw back in 2001, 2002, and 2003, when we hit our heyday, were several hundred thousand acres. One of the reasons we were able to corral fires so well this year was because we were the only game in town. All the other geographic areas were not doing anything in early June. We were able to grab other national resources and move them down here from the northern Rocky Mountains, Idaho, and the Pacific Northwest and when we had that advantage, which normally the Southwest does, we were able to corral the fires and prevent them from becoming epic. Sometimes when our fire season dangles further into July and goes into August, and there is more activity in the Great Basin and southern and northern California, for example, that's when the national situation becomes murkier. Some of these other geographic areas start asking for more helicopters, more air tankers, more crews, and we have to pull them out of here even when our fire season hasn't collapsed. This year we didn't have that. We had everything at our disposal. We had as much as we wanted—all the crews. There was a period

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Climate and fire connections, continued

of time in early June when all the crews were committed, but within a week and a half it slowed down incredibly and the crews became available again and they still are to this minute.

Q: How do El Niño events, like the one we had this past winter, impact the fire season?

RN: In general, El Niño is going to lead to a down fire year just because there is more moisture in the soil—unless it turns out the El Niño is more feeble, which has occurred at times. There are different flavors of El Niño. It doesn't always mean we are going to get sopped for three months straight. But in general, it means we should be tamer in the fire season once we get there.

We put a large emphasis on climate. I stare at this information all the time. I believe it's the driver of everything. If you're watching these oscillations, and by natural oscillations I am talking about the Pacific Decadal Oscillation, Atlantic Multidecadal Oscillation, El Niño–Southern Oscillation, and others, we really believe that if you look at these and relate them to the past you can foretell weather patterns and the fire patterns because of the weather patterns.

Q: How might climate change affect future fire seasons?

RN: That's a murky area. There is not really a lot of foresight and resources devoted to this. I'm not an expert on this but I have some knowledge. … I guess the present belief right now is that we might be entering a period of cooling that might possibly mask the large scale global warming signal we have been experiencing the last 30 years. We might be entering a period of global cooling just due to some switches in the natural oscillations across the globe. … Again, this is not clear cut. But I wouldn't be surprised if we go into a period of cooler temperatures for the next decade or two and then by 2030 onward to 2050 we could be really warm, perhaps dangerously warm, since we are still putting out the fossil fuels during this whole time frame and the natural oscillations are masking the underlining warming for the next several decades. …This would possibly portend some epic fire seasons by 2025 onward. I don't really know.

Q: How do climate and fire outlooks create advanced preparation?

RN: This has been an evolving thing. I've been here since 2003. A lot of this is dependent upon knowledge and expertise and experience and trust. …We had to prove our predictive capabilities, prove that we could gage fire season in advance. And we are not perfect. For example, last year the flip from La Niña to a quick El Niño in May I didn't see coming, and the switch really changed our fire season. We had a slow start in 2009. There were toads in my back yard in Albuquerque in mid- to late June, which is typically the driest and hottest month in New Mexico. It was moist and wet. This was due to the transition from La Niña to El Niño in a matter of six weeks. It changed the weather to a wet signal. This was something we were surprised about. Later in the summer the fire season kind of dragged on into August.

It really has come down to experience and getting the fire management community here and the people we associate with to trust our predictions and our forecasts. And to a certain extent we must be doing a pretty decent job or they would not believe us. I think fire management through the years, 15 to 30 years ago, was more reactionary. There wasn't much planning. A fire ignited and [fire management would] send everything you got. Now, a manager comes back and says we have these three fires burning and asks which is likely to last the longest and why. Or, for example, the person in charge of allocating the air tankers might walk back here and say, "I have four tankers here, I have two in Fort Huachuca, Arizona, one in Winslow, Arizona, and one in Albuquerque. Should I move the one in Albuquerque to Silver City or Fort Huachuca?" This is just an example of how we can use our knowledge of weather and climate to gage where we need to move resources. These helicopters and air tankers cost about $15,000 in fuel just to move them, [climate and weather information feeds] into high dollar decisions.

Temperature (through 7/14/10)

Source: High Plains Regional Climate Center

Temperatures since the water year began on October 1 have averaged between 30 and 45 degrees Fahrenheit on the Colorado Plateau in northeastern Arizona and 40 to 55 degrees F in the northern half of New Mexico (Figure 1a). The higher elevations of the Sangre de Cristo Mountains of northern New Mexico have averaged between 30 and 40 degrees F. The southwest deserts of Arizona have averaged between 55 and 70 degrees F. The southern border of New Mexico has had temperatures between 55 and 60 degrees F. These temperatures have been 0–2 degrees F cooler than average across the entire southwestern United States (Figure 1b). Only the southeastern corner of Arizona has had temperatures warmer than average. The cooler temperatures during the water year are due to the El Niño circulation that brought more frequent arctic cold fronts down to the Southwest this winter.

During the past 30 days, temperatures have been 0–4 degrees above average in central and southern Arizona and northern New Mexico (Figures 1c–d). The lower Colorado River has had temperatures ranging from 0 to 3 degrees above average, and southwestern New Mexico has had very cool conditions measuring 2–4 degrees below average. The warmest temperatures have been 4–6 degrees above average in northeastern New Mexico. The most recent warm weather is a result of the eastward location of the Bermuda high over Texas which has suppressed the monsoonal flow of moisture into Arizona.

Figure 1a. Water year '09–'10 (October 1 through July 14) average temperature.

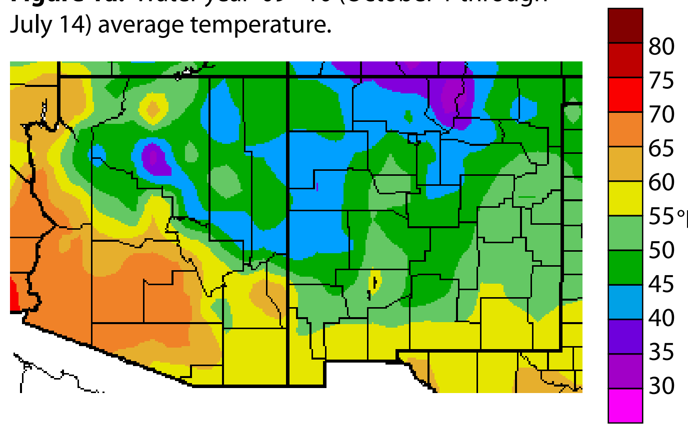


Figure 1b. Water year '09–'10 (October 1 through July 14) departure from average temperature.

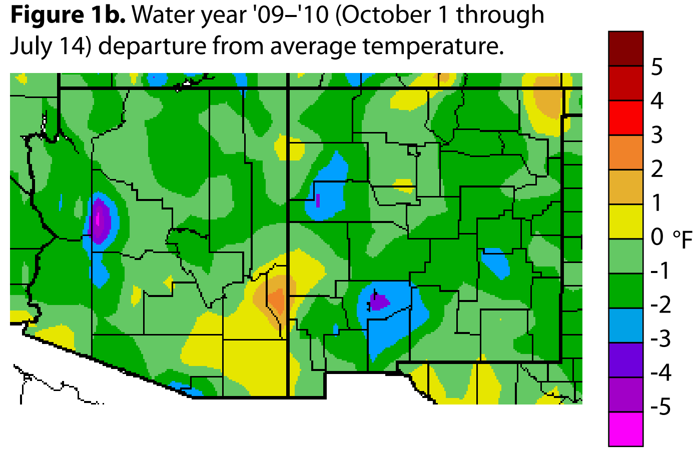


Figure 1c. Previous 30 days (June 15–July 14) departure from average temperature (interpolated).

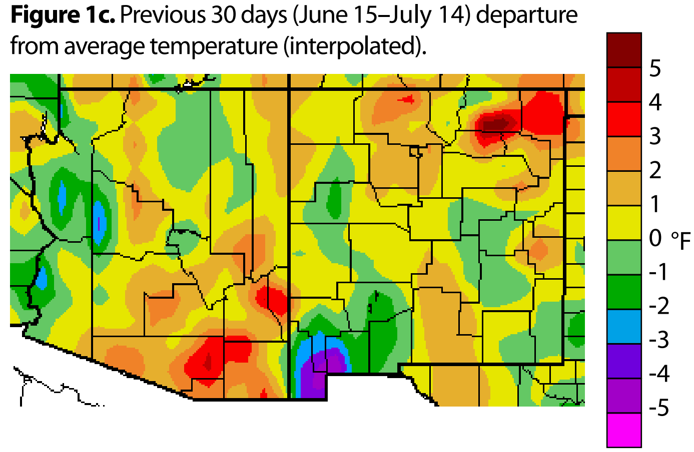
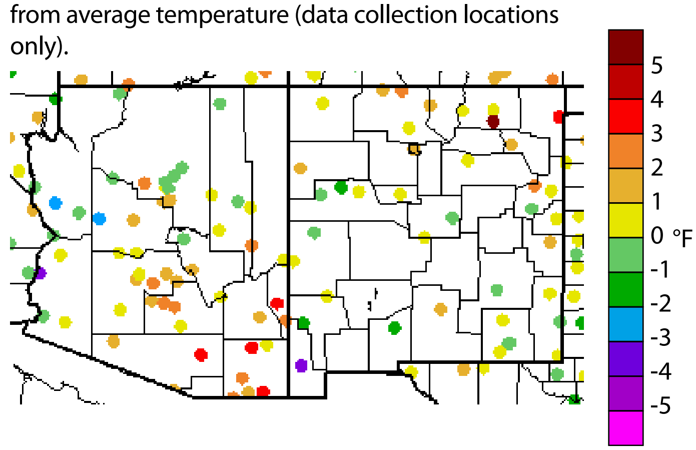


Figure 1d. Previous 30 days (June15–July 14) departure from average temperature (data collection locations only).



Notes:

The water year begins on October 1 and ends on September 30 of the following 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 1971–2000. Departure from average temperature is calculated by subtracting current data from the average. The result can be positive or negative.

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

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

On the Web:

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

For information on temperature and precipitation trends, visit:
http://www.cpc.ncep.noaa.gov/trndtext.shtml

Precipitation (through 7/14/10)

Source: High Plains Regional Climate Center

Precipitation since the water year began on October 1 has been below average in most of Arizona and in western New Mexico (Figures 2a–b). The Colorado Plateau has been the driest area in Arizona, receiving less than 50 percent of average precipitation. There have been wetter-than-average conditions in the state, including the lower Gila River and lower Colorado River. In New Mexico, the eastern portion of the state has had more than 110 percent of average precipitation, and the southeastern corner of the state has received more than 150 percent of average.

The past 30 days have brought significant precipitation to southeastern New Mexico, moderate precipitation to central and northeastern New Mexico, and very little precipitation to Arizona and northwestern New Mexico (Figures 2c–d). Most of Arizona has received less than 25 percent of average precipitation, and western Arizona is extremely dry, with less than 2 percent of average precipitation. These dry conditions are due to a winter-type atmospheric circulation in which the Bermuda high has remained over eastern Texas, allowing dry westerly flow to prevail and suppressing the moisture flow northward from Mexico into Arizona and western New Mexico. The above-average precipitation in southeastern New Mexico is due to the flow of moisture from the Gulf of Mexico, much of it originating from Hurricane Alex. If the monsoon is delayed much longer, the soil moisture and groundwater recharge gains from the wet winter will be rapidly erased.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2009, we are in the 2010 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 1971–2000. Percent of average precipitation is calculated by taking the ratio of current to average precipitation and multiplying by 100.

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

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

On the Web:

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

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

Figure 2a. Water year '09–'10 (October 1 through July 14) percent of average precipitation (interpolated).

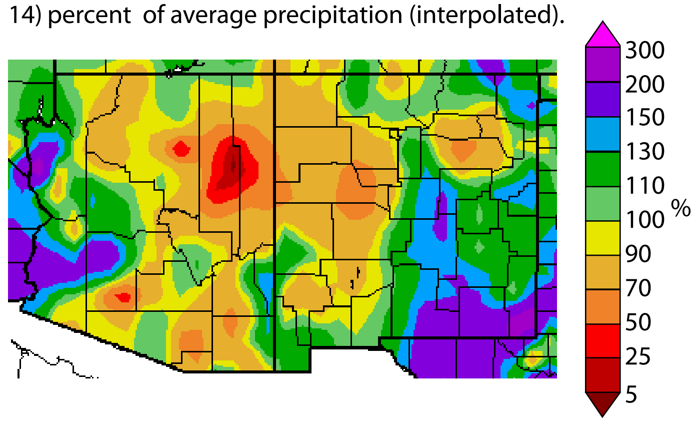


Figure 2b. Water year '09–'10 (October 1 through July 14) percent of average precipitation (data collection locations only).

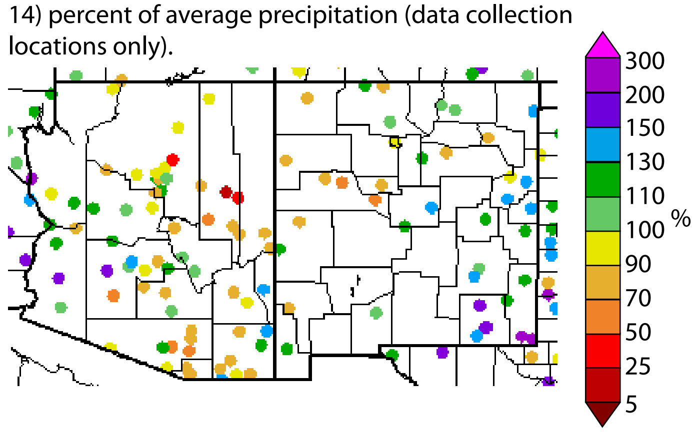


Figure 2c. Previous 30 days (June 15–July 14) percent of average precipitation (interpolated).

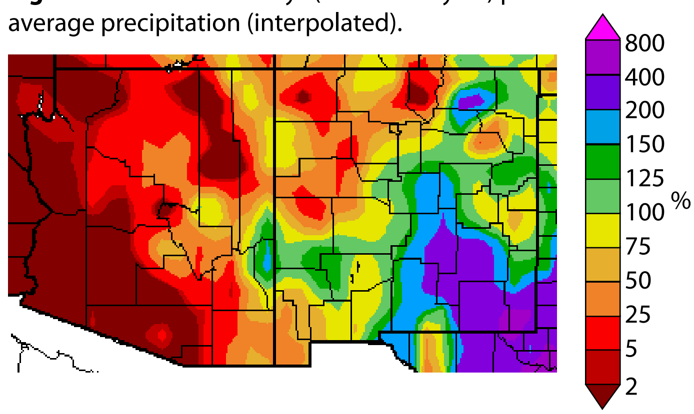
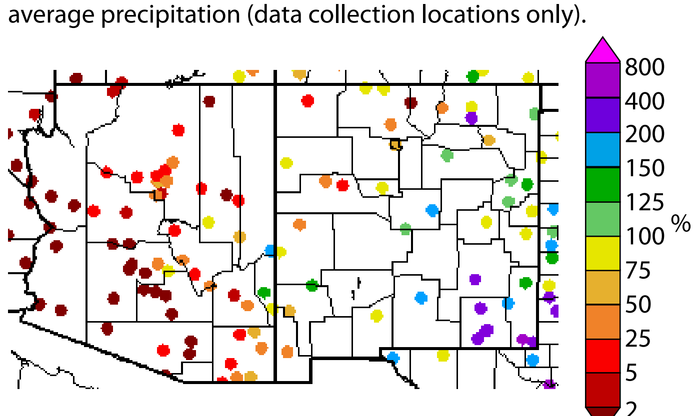


Figure 2d. Previous 30 days (June 15–July 14) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(data through 7/13/10)

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

About 29 percent of the 11 western states are abnormally dry or worse (Figure 3). At the start of the water year on October 1, about 58 percent of the area was classified with drought conditions. Nevada is experiencing the largest coverage of drought conditions, with 72 percent of the state classified as abnormally dry or worse.

In the Southwest, the monsoon season is just underway. Light to moderate showers of up to an inch fell over central and southeastern Arizona in recent weeks, with a few spotty locations receiving between 1.5 and 2.5 inches of precipitation, according to the July 13 update of the U.S. Drought Monitor. About a dozen sites in New Mexico, mostly in the southern part of the state, reported rainfall amounts in excess of 2 inches.

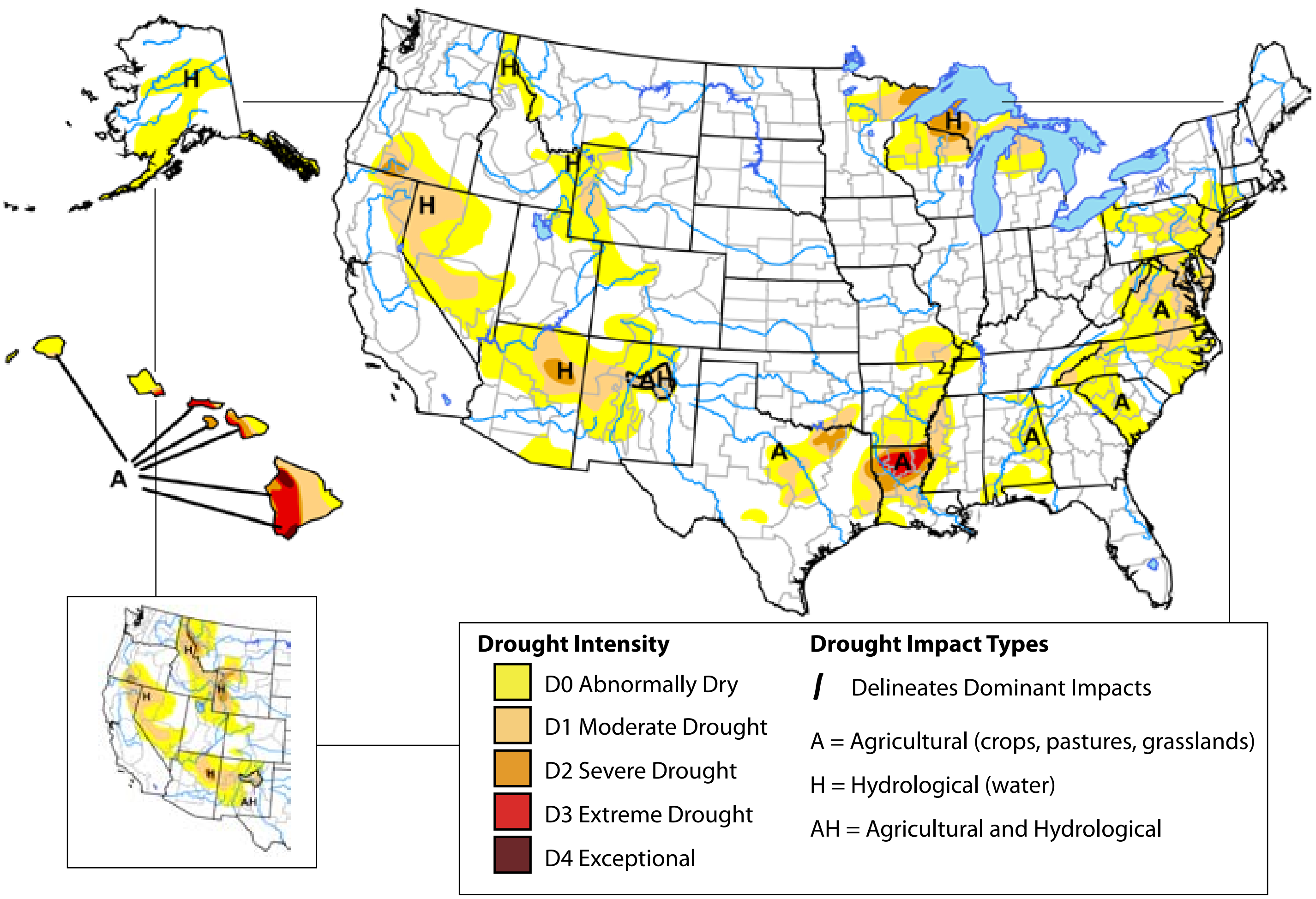
Elsewhere, warm and humid weather has been smothering the East Coast. Temperatures in the past week have ranged from 8 to 12 degrees F above average throughout the Northeast and 4 to 8 degrees F above average throughout the mid-Atlantic region, according the U.S. Drought Monitor. In the Great Lakes region, recent heavy rains contributed to drought improvements in northern Michigan.

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; the author of this monitor is Anthony Artusa, NOAA/NWS/NCEP/CPC.

Figure 3. Drought Monitor data through July 13 (full size), and June 15 (inset, lower left).



On the Web:

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor website: http://www.drought.unl.edu/dm/monitor.html

Arizona Drought Status

(data through 7/13/10)

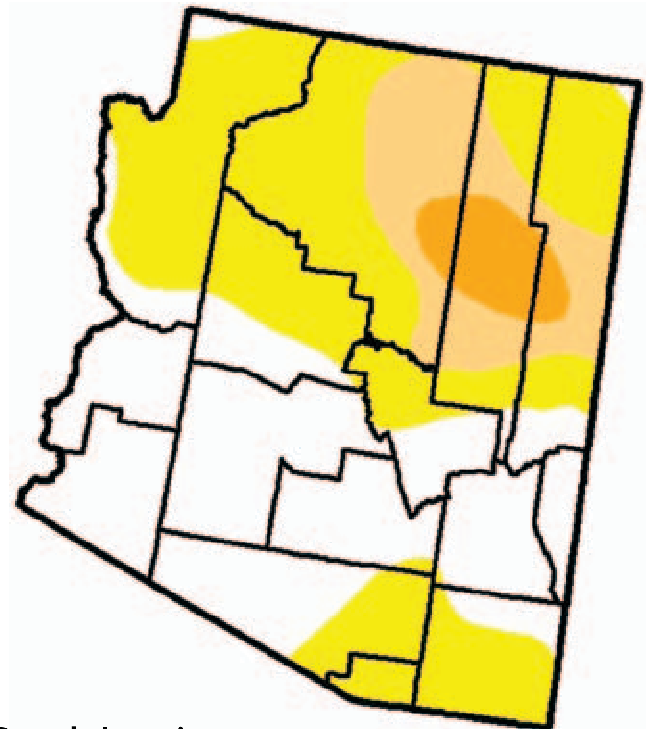
Source: U.S. Drought Monitor

The extent of drought conditions across Arizona increased in the last month, according to the July 13 update of the National Drought Monitor. About 58 percent of Arizona is experiencing abnormally dry conditions or worse, up from about 36 percent one month ago (Figures 4a–b). The majority of this area is in the northern areas and the Colorado Plateau, where a section of severe drought is also located. Southeastern Arizona is now currently experiencing abnormally dry conditions, reflecting warmer-than-average temperatures and the late start to the monsoon season. Since the monsoon season officially began on June 15, most of southeastern Arizona has received less than 50 percent of average precipitation, and many areas of the state have received less than 5 percent of average. The precipitation forecast for the remainder of the monsoon season calls for increased chances that rainfall will be below average, which may cause expansion of drought conditions in this and other regions.

Compared to the drought conditions of one year ago, Arizona has slightly less area experiencing drought conditions but has more area classified with moderate and severe drought.

Impact reports submitted through Arizona DroughtWatch indicate plant mortality and poor forage nutritional quality across parts of southern Arizona. Other impact reports show unusually low water levels in reservoirs, lakes, and ponds in northwestern Arizona. Visit www.azdroughtwatch.org for more detailed impact information and photographs.

Figure 4a. Arizona drought map based on data through July 13.



Drought Intensity

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

Figure 4b. Percent of Arizona designated with drought conditions based on data through July 13.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	41.9	58.1	16.0	4.2	0.0	0.0
Last Week (07/06/2010 map)	41.9	58.1	16.0	4.2	0.0	0.0
3 Months Ago (04/20/2010 map)	43.1	56.9	14.4	2.7	0.0	0.0
Start of Calendar Year (01/05/2010 map)	0.0	100.0	97.2	71.1	5.1	0.0
Start of Water Year (10/06/2009 map)	1.4	98.6	80.3	10.7	0.0	0.0
One Year Ago (07/14/2009 map)	45.8	54.2	0.0	0.0	0.0	0.0

Notes:

The Arizona section of the U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of several agencies.

On the Web:

For the most current drought status map, visit:
http://www.drought.unl.edu/dm/DM_state.htm?AZ,W

For monthly short-term and quarterly long-term Arizona drought status maps, visit:
http://www.azwater.gov/AzDWR/StatewidePlanning/Drought/DroughtStatus.htm

New Mexico Drought Status

(data through 7/13/10)

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

Drought conditions have held steady across New Mexico over the past 30 days, according to the July 13 update of the U.S. Drought Monitor. Abnormally dry and moderate drought conditions cover almost half the state, up from just 11 percent on the May 18 Drought Monitor map. Currently, about 17 percent of the state is experiencing moderate drought, while about 33 percent is abnormally dry (Figures 5a–b). The U.S. Drought Monitor reported last month that the increase in drought conditions between May and June was due to unusually dry conditions during those months accompanied by record high temperatures; the first two weeks of June were the third warmest on record in Albuquerque since 1892. While temperatures in the past month have been within 1 degree F of average, precipitation has been below average for the northwestern region.

The drought pattern in New Mexico reflects in large part the precipitation pattern since the water year began on October 1. The southeastern half of the state has received above-average precipitation while the northwestern corner has experienced below-average rain and snow. Compared to one year ago, the total area of New Mexico experiencing drought has decreased by about 5 percent and the amount of area classified as severely dry is also lower, by about 4 percent.

Figure 5a. New Mexico drought map based on data through July 13.

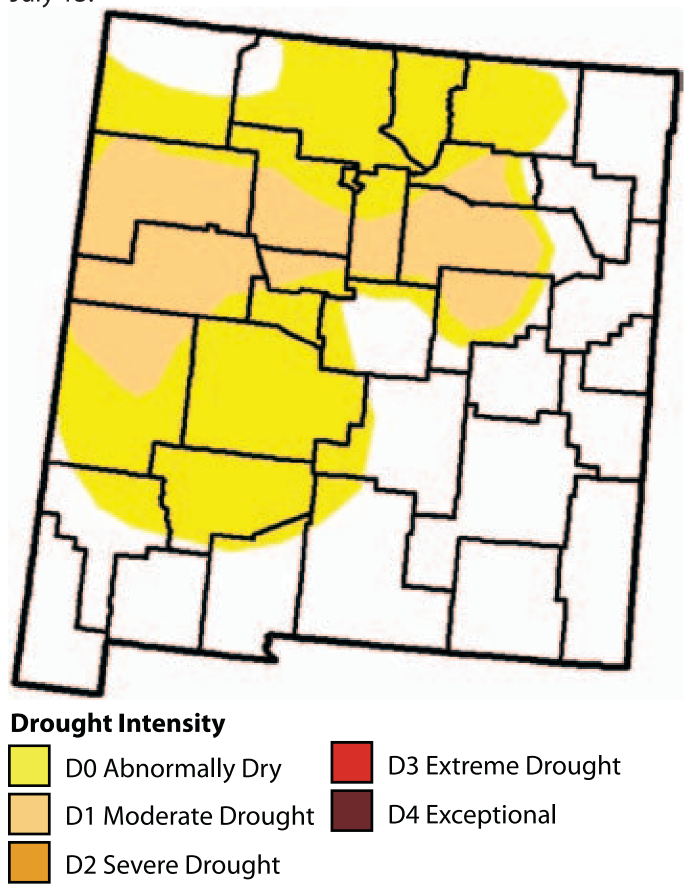


Figure 5b. Percent of New Mexico designated with drought conditions based on data through July 13.

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	50.2	49.8	17.3	0.0	0.0	0.0
Last Week (07/06/2010 map)	50.2	49.8	17.3	0.0	0.0	0.0
3 Months Ago (04/20/2010 map)	79.2	20.8	0.0	0.0	0.0	0.0
Start of Calendar Year (01/05/2010 map)	56.9	43.1	10.1	2.3	0.0	0.0
Start of Water Year (10/06/2009 map)	72.2	27.8	3.4	0.0	0.0	0.0
One Year Ago (07/14/2009 map)	56.5	43.5	20.7	3.8	0.0	0.0

Notes:

The New Mexico section of the U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. The maps are based on expert assessment of variables including (but not limited to) the Palmer Drought Severity Index, soil moisture, streamflow, precipitation, and measures of vegetation stress, as well as reports of drought impacts. It is a joint effort of several agencies.

This summary contains substantial contributions from the New Mexico Drought Working Group.

On the Web:

For the most current drought status map, visit:
http://www.drought.unl.edu/dm/DM_state.htm?NM,W

For the most current Drought Status Reports, visit:
http://www.nmdrought.state.nm.us/MonitoringWorkGroup/wk-monitoring.html

Arizona Reservoir Levels

(through 6/30/10)

Source: USDA-NRCS, National Water and Climate Center

Overall storage in the Colorado River Basin as of June 30 was 58.3 percent of capacity, according to the U.S. Bureau of Reclamation (BOR). During the last month, storage in Lake Powell increased substantially, by about 1.46 million acre-feet, while storage in Lake Mead decreased by about 0.44 million acre-feet. Combined Powell and Mead storage is currently 52.3 percent of capacity (Figure 6), which is about 0.7 million acre-feet less than a year ago. Lake Powell elevation reached a peak of about 3,639 feet above sea level on June 30, which is likely to be the peak for the 2010 water year, according to BOR. Total storage in reservoirs within Arizona's borders, excluding Lake Powell, decreased in June. However, storage in the Salt and Verde river basins is greater than last year. The predicted April through July inflow to Lake Powell is 72 percent of average.

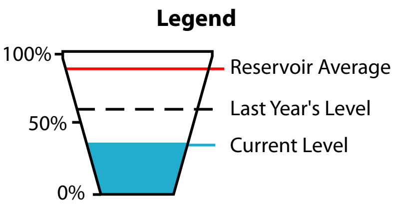
Notes:

The map gives a representation of current storage levels 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 level (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 level (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels 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 Resource Conservation Service (NRCS). For additional information, contact Dino DeSimone, Dino.DeSimone@az.usda.gov.

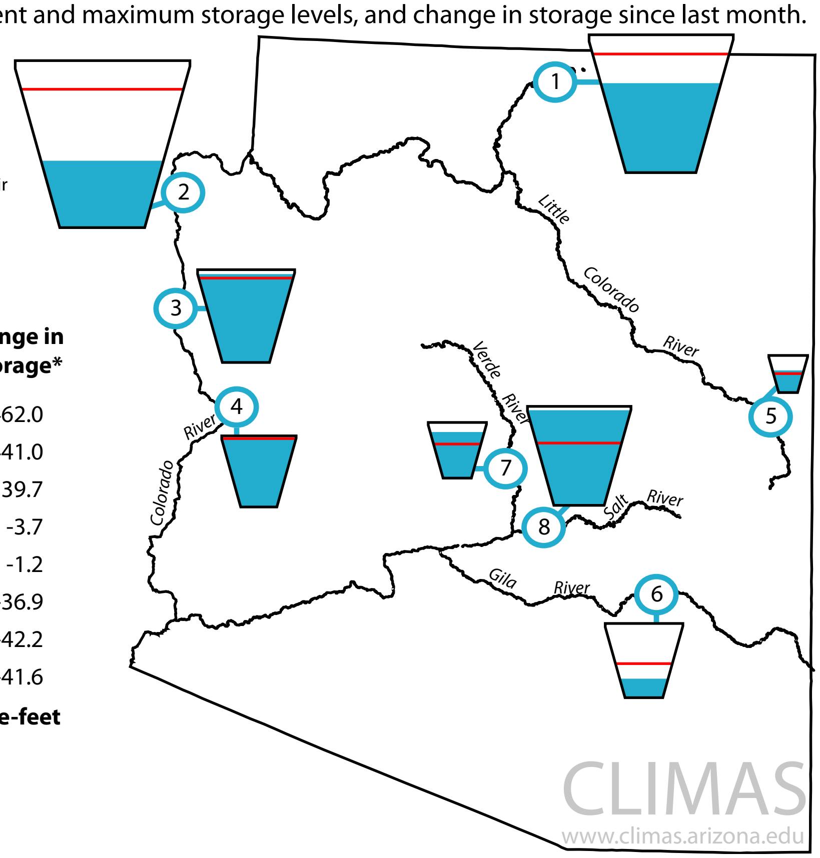
Figure 6. Arizona reservoir levels for June as a percent of capacity. The map depicts the average level and last year's storage for each reservoir. The table also lists current and maximum storage levels, and change in storage since last month.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Lake Powell	65%	15,864.0	24,322.0	1462.0
2. Lake Mead	40%	10,546.0	26,159.0	-441.0
3. Lake Mohave	95%	1,719.3	1,810.0	39.7
4. Lake Havasu	96%	592.4	619.0	-3.7
5. Lyman Reservoir	60%	17.9	30.0	-1.2
6. San Carlos	26%	228.9	875.0	-36.9
7. Verde River System	83%	238.8	287.4	-42.2
8. Salt River System	96%	1,954.5	2,025.8	-41.6

*** thousands of acre-feet**

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



On the Web:

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

New Mexico Reservoir Levels

(through 6/30/10)

Source: USDA-NRCS, National Water and Climate Center

The total reservoir storage in New Mexico decreased by about 37,100 acre-feet in June. While storage in large northern New Mexico reservoirs like Navajo and Heron increased, storage declined in other large reservoirs such as Abiquiu, El Vado, and Elephant Butte (Figure 7). Projected April through July inflow to Navajo Reservoir is only 83 percent of average runoff for the Upper San Juan River Basin. As a result, there will not be spring peak releases from this reservoir, according to the Bureau of Reclamation. Storage in Elephant Butte Reservoir is 5 percent lower, or approximately 104,000 acre-feet less, than it was one year ago.

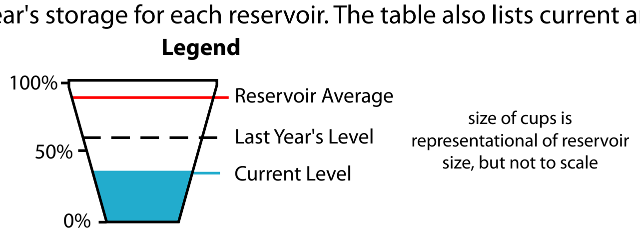
Notes:

The map gives a representation of current storage levels 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 level (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 level (dotted line) and the 1971–2000 reservoir average (red line).

The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels 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.

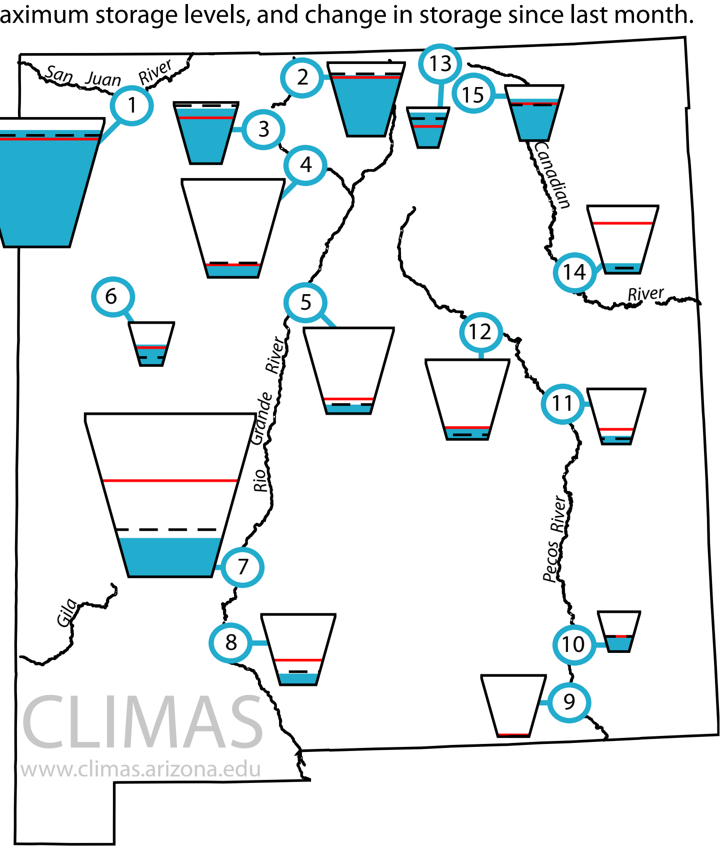
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). For additional information, contact Wayne Sleep, wayne.sleep@nm.usda.gov.

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



Reservoir Name	Capacity Level	Current Storage*	Max Storage*	Change in Storage*
1. Navajo	91%	1,544.0	1,696.0	38.3
2. Heron	83%	332.2	400.0	25.0
3. El Vado	90%	171.7	190.3	-3.0
4. Abiquiu	13%	156.5	1,192.8	-13.4
5. Cochiti	11%	52.7	491.0	1.0
6. Bluewater	49%	18.9	38.5	3.7
7. Elephant Butte	24%	530.4	2,195.0	-69.7
8. Caballo	16%	52.9	332.0	-5.4
9. Brantley	2%	15.8	1,008.2	-7.4
10. Lake Avalon	35%	1.4	4.0	0.1
11. Sumner	15%	15.1	102.0	-2.1
12. Santa Rosa	14%	60.0	438.3	-1.1
13. Costilla	88%	14.1	16.0	0.0
14. Conchas	15%	37.5	254.2	-2.0
15. Eagle Nest	76%	60.0	79.0	-1.1

*** thousands of acre-feet**



On the Web:

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

Southwest Fire Summary
(updated 7/15/10)

Source: Southwest Coordination Center

Fire activity increased during the last 30 days, as expected for this time of year. Dry, warm, and windy conditions across the Southwest contributed to increases in the number of acres burned. The peak fire season is likely winding down, as the onset of the monsoon typically suppresses fire activity.

The total number of acres burned in Arizona and New Mexico as of July 9 is about one-third of average, totaling 137,790 (Figure 8a). The total number of fires—29—is also below average. The below-average fire season was in part caused by the wet winter, which increased soil moisture and delayed the drying of fuels. The onset of the monsoon season typically ends the peak fire season.

This year lightning caused about 29 percent of all fires in the Southwest, which includes Arizona, New Mexico, and West Texas. This is substantially lower than the average of 47 percent. In Arizona, lightning-caused fires are even less, representing only 14 percent of the total ignitions. In New Mexico, lightning strikes have started about 33 percent of the wildfires.

The Shultz fire has been the most prominent fire to date charring about 15,000 acres in the Kaibab National Forest near Flagstaff, Arizona, between June 20 and 30 (Figure 8b). Another large fire was the South Fork fire in New Mexico in which more than 17,000 acres burned (Figure 8c).

Figure 8a. Year-to-date wildland fire information for Arizona and New Mexico as of July 9, 2010.

State	Human Caused Fires	Human caused acres	Lightning caused fires	Lightning caused acres	Total Fires	Total Acres
AZ	684	25,355	113	22,495	797	47,850
NM	454	33,563	221	56,377	675	89,940
Total	1,138	58,918	334	78,872	1,472	137,790

Figure 8b. Arizona large fire incidents as of July 15, 2010.

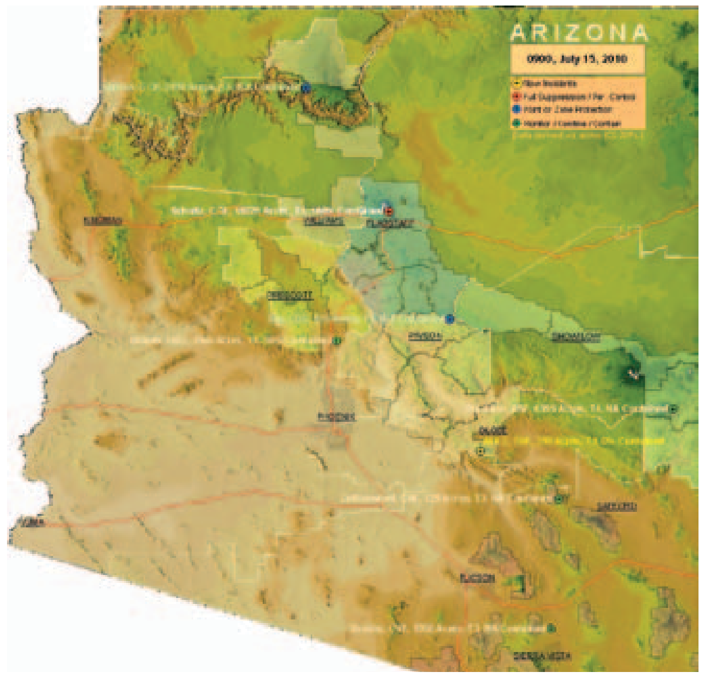
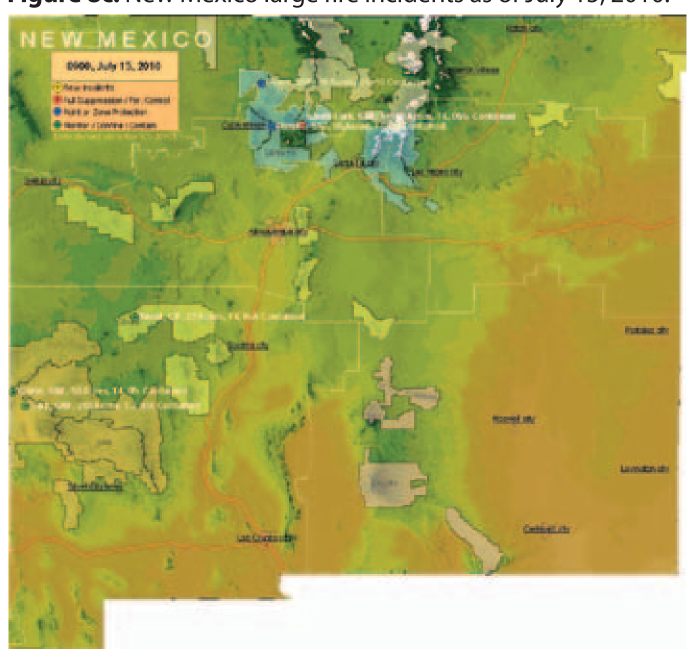


Figure 8c. New Mexico large fire incidents as of July 15, 2010.



Notes:
The fires discussed here have been reported by federal, state, or tribal agencies during 2010. 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 and prescribed burns 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.

On the Web:
These data are obtained from the Southwest Coordination Center website:
http://gacc.nifc.gov/swcc/predictive/intelligence/daily/ytd_all_wf_by_state.pdf

http://gacc.nifc.gov/swcc/predictive/intelligence/maps/wf/swa_fire_combined.htm

Monsoon Summary
(through 7/14/2009)

Source: Western Regional Climate Center

The start of the monsoon season officially began in Arizona on June 15, the date the National Weather Service (NWS) adopted in 2008. New Mexico, however, does not have an official date for the summer rainy season.

The monsoon arrived a little later than average and so far has been weaker than usual, according to the National Weather Service Tucson office. Although moisture has been available for thunderstorms, winds have been weak and disorganized, and warm temperatures in the upper atmosphere have kept the atmosphere more stable than usual for July. As a result, the Southwest has been dry and warm during the last 30 days (Figures 9a–c). Most areas have experienced up to 1.5 inches less than average, and much of Arizona has not had any rain (Figure 9b). Even the southeastern corner of the state, which typically experiences the first monsoon rainstorms, has had less than 75 percent of average (Figure 9c).

Last month the NOAA–Climate Prediction Center (CPC) forecasted equal chances for above-, below-, or near-average precipitation for the summer monsoon. This month the CPC forecasts below-average precipitation for the August–October period for most of Arizona and the western half of New Mexico. There is still a chance that the developing La Niña event will eventually increase the strength of the monsoon during August and early September (see page 19). However, if the weak start to the monsoon persists, it will be increasingly difficult to make up for the rainfall deficits currently accruing.

Figure 9a. Total precipitation in inches (June 15–July 14, 2010).

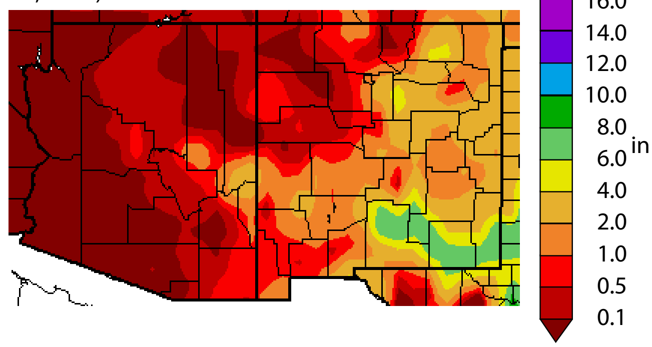


Figure 9b. Departure from average precipitation in inches (June 15–July 14, 2010).

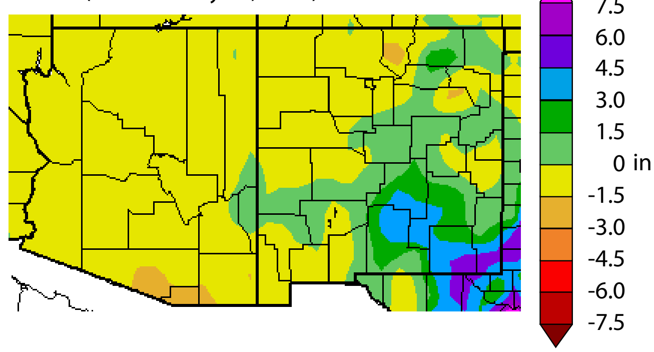
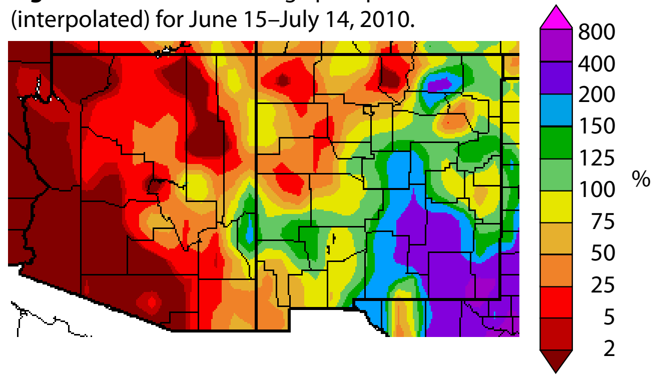


Figure 9c. Percent of average precipitation (interpolated) for June 15–July 14, 2010.



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.

On the Web:

These data are obtained from the National Climatic Data Center: http://www.hprcc.unl.edu/maps/current/

Temperature Outlook

(August 2010–January 2011)

Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (CPC) long-lead temperature outlooks show greater than a 50 percent probability that temperatures will be above-average in all of Arizona and western New Mexico for the remainder of the monsoon season and into the early fall (Figure 10a). The CPC also indicates that temperatures have greater than a 50 percent chance of being above average for most of the Southwest into early 2011 (Figures 10b–10d). Both the expectation of La Niña conditions and decadal warming trends contribute to the enhanced probability of above-average temperatures in the West.

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 3-category forecast. As a starting point, the 1971–2000 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC temperature outlook, areas with light brown shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average temperature. A shade darker brown indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average temperature, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 10a. Long-lead national temperature forecast for August–October 2010.

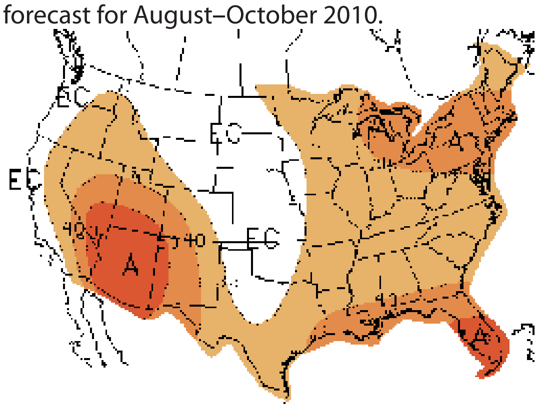
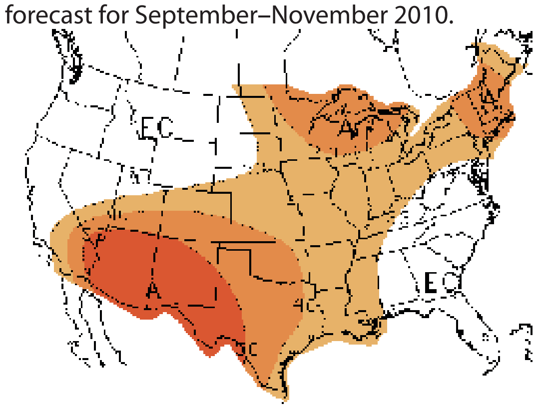


Figure 10b. Long-lead national temperature forecast for September–November 2010.



A= Above

- 50.0–59.9%
- 40.0–49.9%
- 33.3–39.9%

B=Below

- 40.0–49.9%
- 33.3–39.9%

Figure 10c. Long-lead national temperature forecast for October–December 2010.

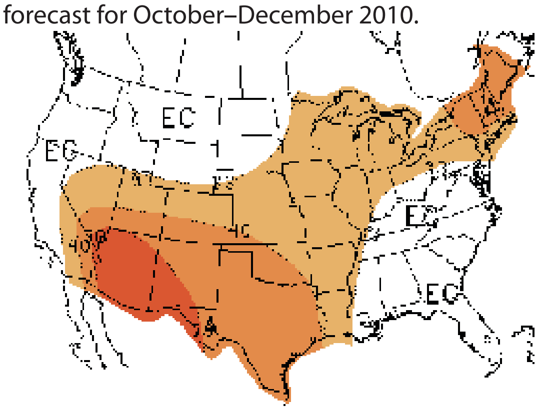
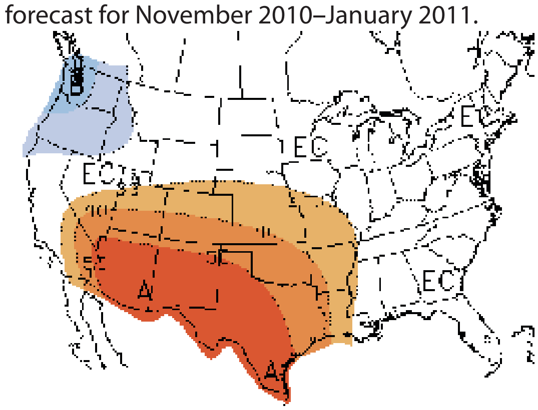


Figure 10d. Long-lead national temperature forecast for November 2010–January 2011.



EC= Equal chances. No forecasted anomalies.

On the Web:

For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php

For seasonal temperature forecast downscaled to the local scale, visit: http://www.weather.gov/climate/l3mto.php

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

Precipitation Outlook
(August 2010–January 2011)

Source: NOAA-Climate Prediction Center (CPC)

The NOAA–Climate Prediction Center (CPC) long-lead precipitation outlooks suggest drier-than-average conditions for the remainder of the monsoon season and early fall for all of Arizona and western New Mexico (Figure 11a). With the expectation that a La Niña event will develop during July–August, outlooks also favor drier-than-average conditions in the Southwest through the fall and winter (Figures 11b–11d). The forecast for increased chances of below-average precipitation in the North American Monsoon region, including Arizona, is primarily being driven by forecast models and comparisons of previous years in which La Niña developed in a similar way to current conditions. The outlooks for dry conditions in the southern tier of the U.S. in fall 2010 and into early 2011 also reflect expected La Niña impacts.

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 1971–2000 climate record is divided into 3 categories, each with a 33.3 percent chance of occurring (i.e., equal chances, EC). The forecast indicates the likelihood of one of the extremes—above-average (A) or below-average (B)—with a corresponding adjustment to the other extreme category; the "average" category is preserved at 33.3 likelihood, unless the forecast is very strong.

Thus, using the NOAA-CPC precipitation outlook, areas with light green shading display a 33.3–39.9 percent chance of above-average, a 33.3 percent chance of average, and a 26.7–33.3 percent chance of below-average precipitation. A shade darker green indicates a 40.0–50.0 percent chance of above-average, a 33.3 percent chance of average, and a 16.7–26.6 percent chance of below-average precipitation, and so on.

Equal Chances (EC) indicates areas where no forecast skill has been demonstrated or there is no clear climate signal; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 11a. Long-lead national precipitation forecast for August–October 2010.

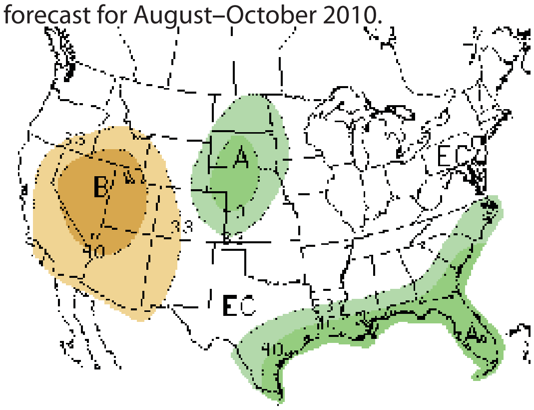


Figure 11b. Long-lead national precipitation forecast for September–November 2010.

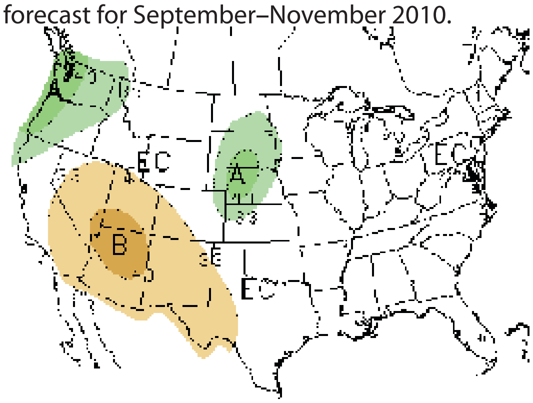


Figure 11c. Long-lead national precipitation forecast for October–December 2010.

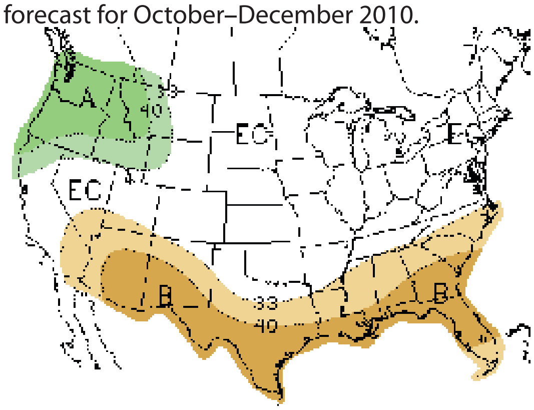
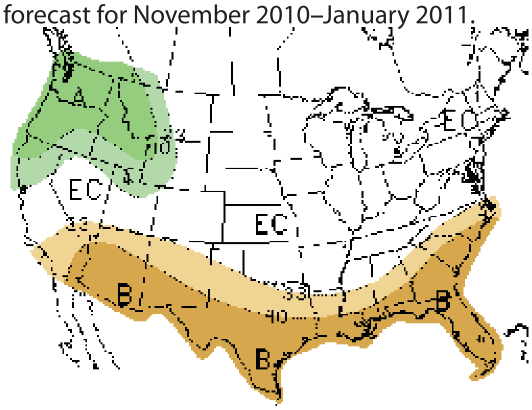


Figure 11d. Long-lead national precipitation forecast for November 2010–January 2011.



B= Below: 33.3–39.9%; 40.0–49.9%

A=Above: 40.0–49.9%; 33.3–39.9%

EC= Equal chances. No forecasted anomalies.

On the Web:

For more information on CPC forecasts, visit:
http://www.cpc.ncep.noaa.gov/products/predictions//multi_season/13_seasonal_outlooks/color/churchill.php
(note that this website has many graphics and July load slowly on your computer)

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

Seasonal Drought Outlook

(through October)

Source: NOAA-Climate Prediction Center (CPC)

This summary is excerpted and edited from the July 15 Seasonal Drought Outlook technical discussion produced by the NOAA–Climate Prediction Center and written by forecaster B. Pugh.

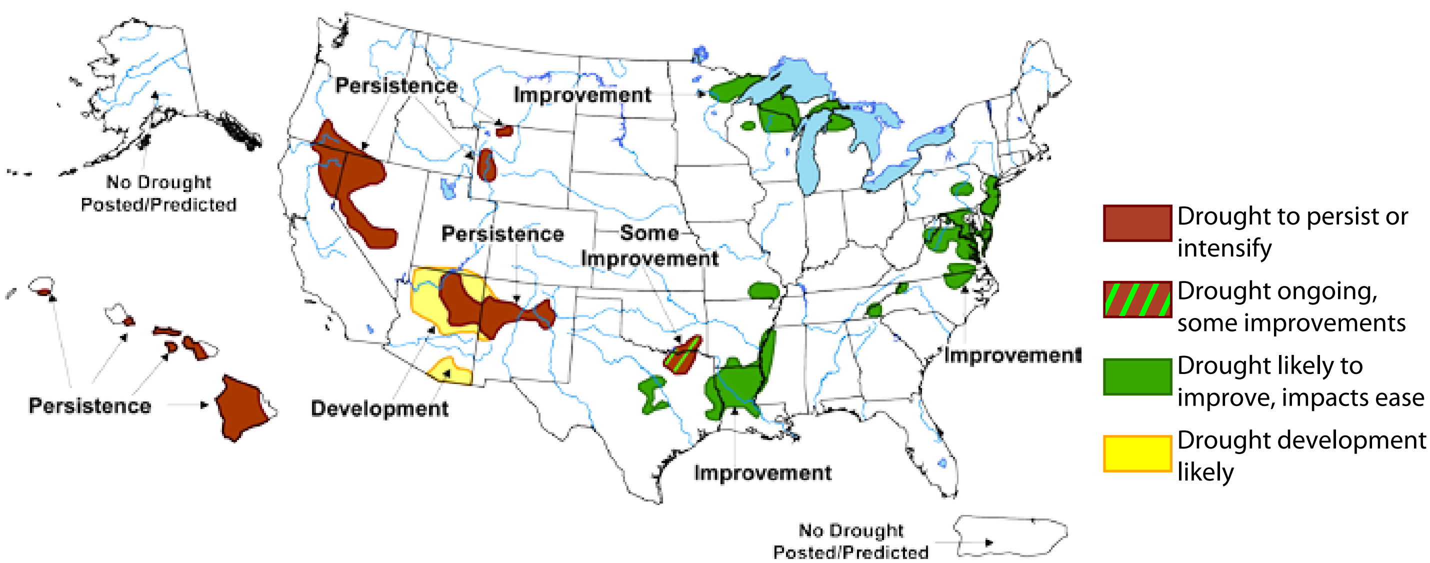
In the Southwest, very little rain has fallen over the moderate to severe drought areas of Arizona and New Mexico. The summer monsoon has started weakly through mid-July. The monsoon typically peaks during August. The seasonal precipitation outlooks issued by the NOAA–Climate Prediction Center for August and August–October indicate a tilt in the odds for below-average precipitation, which suggests drought persistence or development through much of the region (Figure 12). If the monsoon remains erratic during the next few weeks, drought development may be expanded. Confidence in this forecast for the Southwest is high.

Elsewhere, much-needed rainfall has occurred in parts of the eastern U.S. drought areas since July 9. Although improvement is forecast for the that region, small areas of drought could linger. Since the beginning of June, major drought improvement has occurred across the upper Mississippi Valley and Great Lakes region, with improvement likely to continue. Historically the next few months are dry in western Wyoming, northeast California, Nevada, and the leeward sides of the Hawaiian Islands.

Notes:

The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators, including the official precipitation outlooks, various medium- and short-range forecasts , models such as the 6-10 day and 8-14 day forecasts, soil moisture tools, and climatology.

Figure 12. Seasonal drought outlook through October (released July 15).



On the Web:

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

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

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

Wildland Fire Outlook
(August–October 2010)

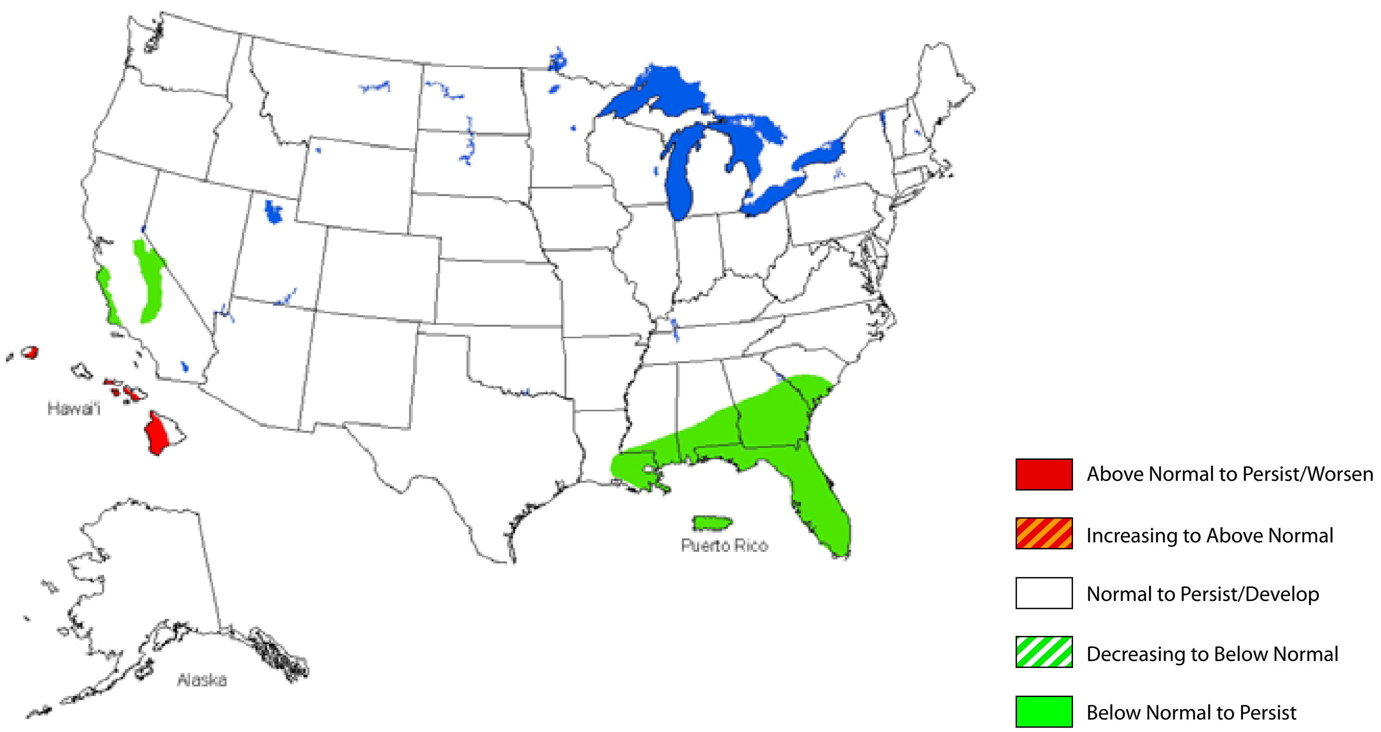
Sources: National Interagency Coordination Center, Southwest Coordination Center

Above-normal fire potential is forecast for portions of central and western Arizona for the remainder of July or until substantial monsoon moisture reaches the region (not shown). The rest of the Southwest will continue to be at normal levels of significant fire potential. Significant fire potential means that it is likely that the suppression of fire will require fire fighting resources from outside the Southwest Coordination Center (SWCC) geographic area. Fire activity usually decreases quite rapidly across the Southwest during this time of year as the North American Monsoon marches northward. Monsoon precipitation as of July 13 has been primarily concentrated in eastern and southern New Mexico. The SWCC cautions that the abundant and widespread dry fine fuels in southern and western Arizona will add to the risk of fire if ignitions are accompanied by erratic winds.

Notes:

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

Figure 13. National wildland fire potential for fires greater than 100 acres (valid August–October 2010).



On the Web:

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

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

El Niño Status and Forecast

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

The El Niño event that officially began in May 2009 has ended. The recent April–June period marked the first three consecutive months that sea surface temperatures (SSTs) in the Niño 3.4 region in the central Pacific Ocean were below the 0.5 degrees Celsius El Niño threshold. SSTs measured 0.3 degrees C for this period, indicative of ENSO-neutral conditions. The NOAA–Climate Prediction Center (CPC) continues to issue a La Niña Watch as SSTs continue to decrease; for an official La Niña event, SST anomalies in the Niño 3.4 region must be equal to or below -0.5 for three consecutive months. For June, the SST anomaly in the Niño 3.4 region was 0.43 degrees C; between July 6 and 12, SSTs were even cooler, at -0.8 degrees C. ENSO events are often solidified in the month of July and conditions that develop then often remain until the early months of the following year. According to the CPC, atmospheric and oceanic conditions are set for the development of a La Niña event during the July–August period. Forecasters have confidence that La Niña will take hold because cool ocean temperatures persist from the surface to substantial depths in the central and eastern Pacific Ocean and current near-surface wind anomalies will likely cause this cool water to surface during the coming months.

Notes:

The first figure shows the standardized three month running average values of the Southern Oscillation Index (SOI) from July 1980 through December 2009. 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, the coolest 25 percent of Niño 3.4 SSTs; and neutral conditions where SSTs fall within the remaining 50 percent of observations. The IRI probabilistic ENSO forecast is a subjective assessment of current model forecasts of Niño 3.4 SSTs that are made monthly. The forecast takes into account the indications of the individual forecast models (including expert knowledge of model skill), an average of the models, and other factors.

On the Web:

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

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

The atmosphere is also responding to the developing La Niña event. Trade winds in the western Pacific Ocean are stronger than average, according to the International Research Institute for Climate and Society (IRI). These indicators, together with the Southern Oscillation Index (SOI), which has been positive since April, are consistent with the developing stages of a La Niña event (Figure 14a).

Forecasts state that there is an approximately 80 percent chance that La Niña conditions will occur for the July–September period and persist through the remainder of 2010 (Figure 14b).

Figure 14a. The standardized values of the Southern Oscillation Index from January 1980–May 2010. 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).

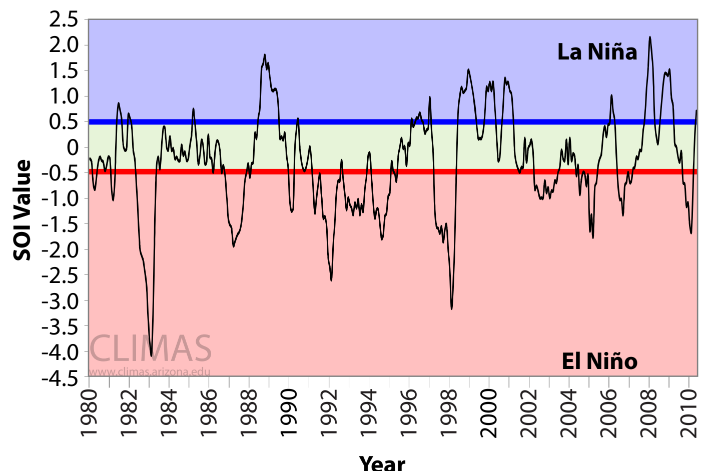
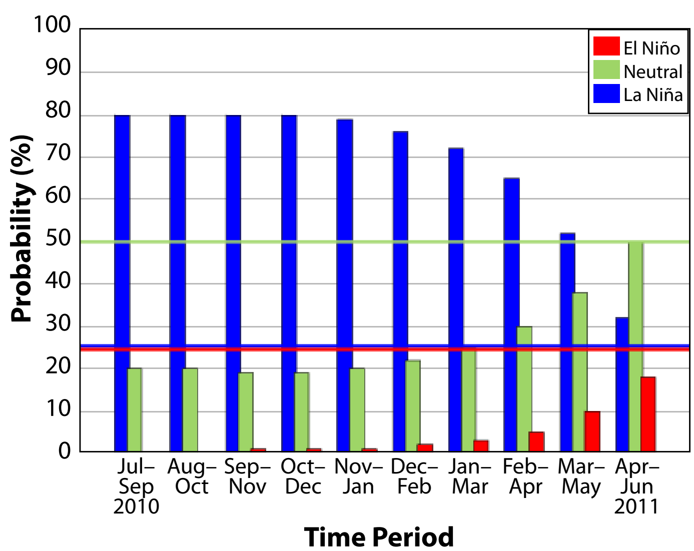


Figure 14b. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released July 15). Colored lines represent average historical probability of El Niño, La Niña, and neutral.



Temperature Verification
(August 2010–January 2011)

Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook.

Comparisons of observed temperatures for August–October to forecasts issued in July for the same period suggest that in southern and western Arizona forecasts have been more accurate than an equal chances forecast, while forecasts have been less accurate than equal chances in all of New Mexico (Figure 15a). Forecast skill—a measure of the accuracy of the forecast—is highest in the southern and western regions of Arizona. Skill for the two-month lead time forecasts for the September–November period in southern and western Arizona is less than for the one-month lead time but still exhibits positive values (Figure 15b). The three- and four-month lead time forecasts historically have been more accurate than equal chances in the southern regions of the Southwest, suggesting that forecasts for these periods are more likely to occur (Figures 15c–d). While bluish hues denote more accurate forecasts, caution is advised to users of the seasonal forecasts for regions with reddish colors.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the warmest, coolest, or normal temperatures for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine.

The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories.

The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 15a. RPSS for August–October 2010.

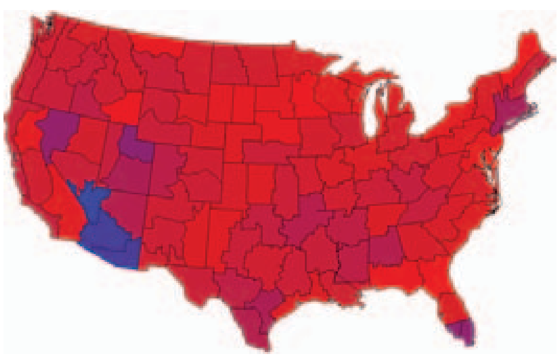


Figure 15b. RPSS for September–November 2010.

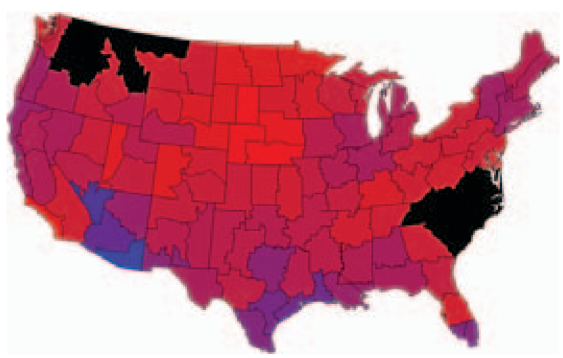


Figure 15c. RPSS for October–December 2010.

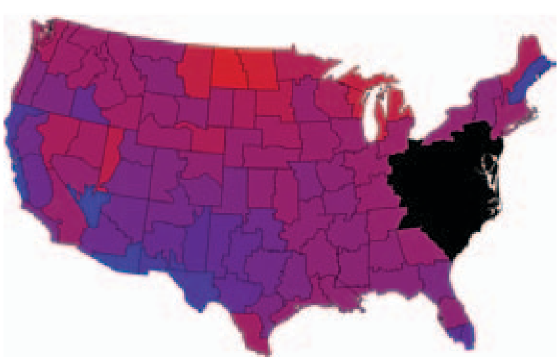
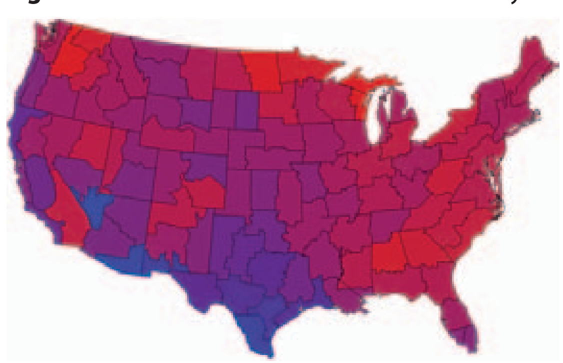
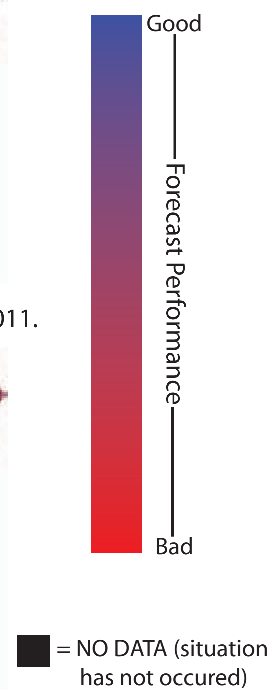


Figure 15d. RPSS for November 2010–January 2011.





On the Web:

For more information on the Forecast Evaluation Tool, visit
http://fet.hwr.arizona.edu/ForecastEvaluationTool/

For a CLIMAS publication that explains how to use the Forecast Evaluation Tool, visit
http://www.climas.arizona.edu/forecasts/articles/FET_Nov2005.pdf

Precipitation Verification
(August 2010–January 2011)

Source: Forecast Evaluation Tool

For a thorough description of the interpretation of these maps, see the feature article, "Evaluating forecasts with the RPSS," in the April 2009 issue of the Southwest Climate Outlook.

Comparisons of observed precipitation for August–October to forecasts issued in July for the same period suggest that forecasts have been slightly more accurate than forecasting equal chances (i.e., 33 percent chance that rain will be above-, below-, or near-average) in only southeast Arizona. This largely reflects the area of Arizona most influenced by the monsoon (Figure 16a). Outside of southeast Arizona, forecast skill—a measure of the accuracy of the forecast—does not improve upon an equal chances forecast. For the September–November period, forecasts have been most accurate in southern Arizona, while forecasts have been less accurate than equal chances in northern Arizona (Figure 16b). As the year progresses into the early winter, forecast skill is either less accurate than equal chances or only a slight improvement upon an equal chances forecast in most of New Mexico and northern Arizona (Figures 16c–d). While bluish hues suggest that NOAA–CPC historical forecasts have been more accurate than equal chances, caution is advised to users of the seasonal forecasts for regions with reddish colors.

Notes:

These maps evaluate the historical performance of the one- to four-month long-lead forecasts made by NOAA's Climate Prediction Center (CPC). The maps convey the historical accuracy of the CPC forecasts in relation to the reference forecast, which assigns a 33 percent chance to the three CPC categories, "above," "below," and "neutral." These categories indicate whether conditions are predicted to be similar to the wettest, driest, or normal precipitation for 1971 to 2000. The maps are generated from the Forecast Evaluation Tool, which was developed by The University of Arizona in partnership with NOAA, NASA, NSF, and the University of California-Irvine.

The maps display the Ranked Probability Skill Score (RPSS). The more the forecasts and actual weather match, the bluer the color. A bluish or reddish RPSS indicates the forecast is more accurate or less accurate, respectively, than assigning a 33 percent chance to each of the three CPC categories.

The RPSS is calculated by comparing all the forecasts made since December 1994 for particular seasons and specified lead times to the actual weather of the season.

Figure 16a. RPSS for August–October 2010.

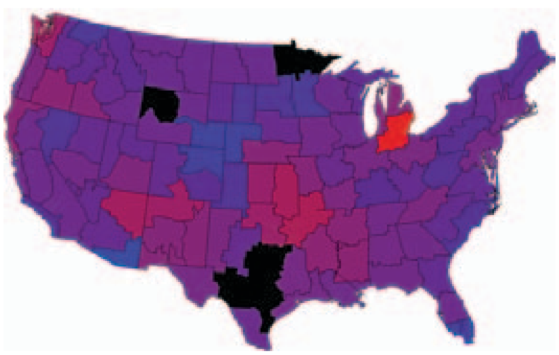


Figure 16b. RPSS for September–November 2010.

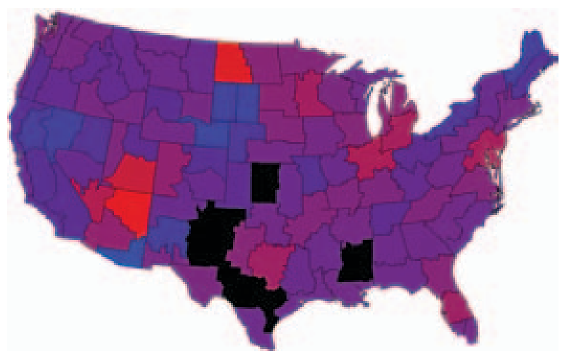


Figure 16c. RPSS for October–December 2010.

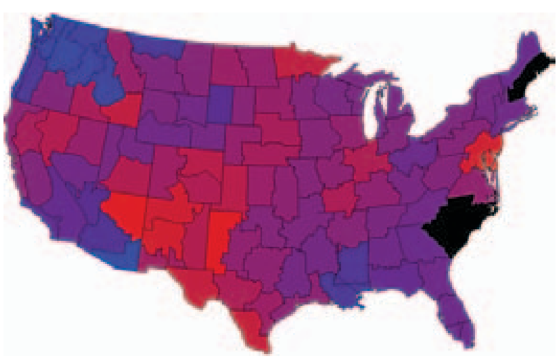
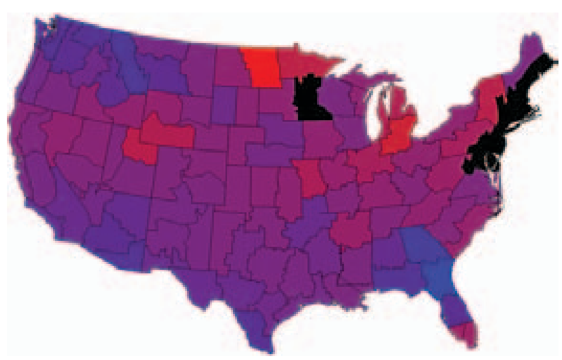
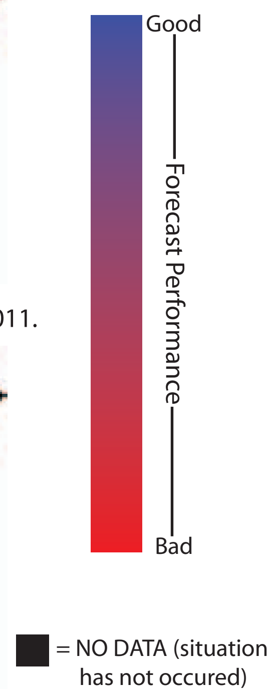


Figure 16d. RPSS for November 2010–January 2011.





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