Issued: March 22, 2005

CLIMAS
Southwest Climate Outlook

March Climate Summary

Hydrological Drought – Hydrological drought continued to ease in the Southwest.

- Most of southwestern Arizona and southern New Mexico are now considered free of drought impacts.
- Arizona statewide reservoir storage is above average, while New Mexico statewide average storage is just over half of its average capacity.

Precipitation – Wetter-than-average conditions continue in much of the Southwest. Snowpack remains above average in many regional river basins despite slight decreases in some areas.

Temperature – Water year temperatures are above average. The past 30 days have generally been warmer than average.

Climate Forecasts – The long-lead temperature forecasts call for increased chances of warmer-than-average conditions in Arizona and far western New Mexico through September. Increased chances of above-average precipitation are predicted through June in New Mexico and western Arizona.

El Niño – Models predict that the current weak El Niño will persist through mid to late summer before neutral conditions began to dominate the tropical Pacific Ocean.

The Bottom Line – Continued improvement is expected in drought conditions through June in the Southwest.

The climate products in this packet are available on the web:
http://www.ispe.arizona.edu/climas/forecasts/swoutlook.html

Desert In Bloom

Early forecasts for this year's crop of wildflowers looked good with some reports that it could be one of the best seasons on record (*Tucson Citizen*, February 15). So far, dazzling displays of flowers colored the lowland desert of areas such as Death Valley, California, the Pinacate Natural Reserve in Sonora, Mexico, and the Kofa National Wildlife Refuge in Arizona. Invasive grasses may be winning out over annual flowers in some spots, but peak blooms could continue through late April in other areas. Wildflower lovers can check for updates at:

http://www.desertusa.com/wildflo/wildupdates.html

http://www.desertmuseum.org/programs/flw_blooming.html

In early March, fields of golden poppies were in bloom along Highway 86 near Kitt Peak. Photo by Shoshana Mayden.

In this issue:

The Southwest Climate Outlook is jointly published each month by the Climate Assessment for the Southwest project and the University of Arizona Cooperative Extension.

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Will the drought continue?

Rains bring relief to Southwest, but experts caution the wet spell may be short-lived

By Melanie Lenart

A series of fortunate events has pulled drought-busting precipitation into the Southwest since about fall. Still, climatologists warned this doesn't mean the region has moved out of the danger zone for long-term drought.

Tropical rainfall, short-term pressure systems that favored the Southwest, and El Niño conditions conspired to make the six-month September through February period the second wettest in Arizona and third-wettest in New Mexico in the 111-year instrumental record, as indicated by a National Climatic Data Center (NCDC) online comparison.

Meanwhile, New Mexico set a record high for November through February precipitation, while the same period was the third wettest for Arizona, NCDC records show (Figure 1).

The September through February period was also record-breaking when considering the Four Corner states together, NCDC reports show. This bodes well for spring snowmelt into rivers that supply residents and farmers in the Southwest, including the Colorado River.

"We're definitely in recovery mode. We had to kick over that first domino," said Mark Svoboda, a climatologist with the National Drought Mitigation Center. "Mother Nature has a way of giving things back a lot quicker than she takes it away."

A really wet October saturated western soils roughly everywhere south of Oregon, Idaho, and Wyoming, Svoboda said. With soils sated, additional moisture could flow into streams and reservoirs.

Short-term surplus

The boon of precipitation is greening the Southwest and bringing forth a colorful cast of wildflowers. Waterways are also responding to the bounty, with many reservoirs filling surprisingly fast from streams sometimes bursting at their banks. Floods included a late December overflow of Oak Creek in Sedona, Arizona.

"It's really wet out there, that's for sure," agreed Tom Pagano, water supply forecaster at the National Water and Climate Center in Oregon. As of mid-March, all three main reservoirs in Phoenix were rebounding dramatically from years of overdrafts.

"The Verde system, for all intents and purposes, is completely full right now. Lake Pleasant on the Agua Fria is 99 percent full. And the Salt system has gone where the Salt has never gone before," Pagano said, alluding to a recent expansion that allows the Salt system to trap more water than it could previously.

Even the San Carlos Reservoir in Gila County is nearly half full, after hovering at about 4 percent capacity for much of the past year.

"We've been in disbelief," Pagano said. But he and others cautioned against hailing the end of the drought. "It sounds really paradoxical, but I think a lot of people are concerned that this is really just a blip in a long-term drought situation."

"Yes, we see the drought improving," agreed Charlie Liles, the meteorologist in charge of the National Weather Service's Albuquerque office. "The surface looks great because of the recent wet weather and the snowpack. But I have to believe that the groundwater has been short-changed over the past 48 months. We can't say that the drought is gone."

Unfortunately, it seems unlikely that many of the conditions that led to the recent stellar improvement will re-align next year.

A spell of relief

The improvement arguably began when a tropical storm—the remnants of Hurricane Javier—drizzled days of rain on the Southwest as it cut a northeasterly diagonal across Arizona. Most of the Southwest received at least some moisture during the storm's three-day sojourn that started September 19, with a regional high of 5.2 inches of precipitation falling on Promontory, Arizona.

The drizzle served as a gentle way to soak parched soils without pummeling them into an erosive state. But rainfall events linked to hurricanes only affect Arizona every 4.5 years on average, according to calculations by Erik Pytlak of the National Weather Service's Tucson office.

On the heels of the tropical storm came a series of frontal events. Since about October, the Southwest has been receiving a good share of the storms that normally would keep clouds over the Pacific Northwest, especially Oregon and Washington.

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Drought, continued

"It's going to look like an El Niño year when you look at the overall pattern of dryness in the Northwest and wetness in the Southwest," Svoboda said. "But looks can be deceiving."

In fact, the "smoking gun" from late December through January can be traced to short-term atmospheric pressure systems, mainly a Madden Julian Oscillation (MJO), said Ed O'Lenic, chief of the operations branch for NOAA's Climate Prediction Center.

"The MJO lives and dies on the time scale of about a month. And an El Niño lasts a year or more. They are two very different kinds of things," O'Lenic explained. "Both of them can have impacts on the weather where we live."

The MJO is a relatively new discovery, and references to it are easier to find on the internet than in climatology textbooks. "Pineapple express" events that carry moisture over from Hawaii often are succumbing to MJO pressure.

This particular Madden-Julian Oscillation dissipated by the end of January. MJO activity tends to be stronger during neutral or weak El Niño years, as a Climate Prediction Center website reports. The ongoing El Niño is considered weak.

Still, it apparently had enough punch to make February the wettest for New Mexico and the second-wettest for Arizona in the instrumental record, according to the NCDC online comparison.

"The February rains appear to have been related to kind of a late bloom of El Niño," O'Lenic said. "We pretty much waited all winter for this to happen."

And now the bad news. The El Niño bloom may already be fading. Forecasts predict a 65 percent chance of neutral conditions pervailing over El Niño for the March to May period. At any rate, El Niño impacts in the Southwest tend to center around winter precipitation.

The long and short of it

Regardless of which way the winds blow, the drought that established over more than a decade won't disappear overnight. Nor will its impacts.

"It takes a while to dig yourself into a hole. And it takes a while to get yourself out of it," as Pagano put it. At the moment, Arizona's Lake Powell is still "bottoming out," filled to only about 35 percent of capacity with roughly one year's supply stored. Pagano anticipated that it, too, still would be half empty by the end of July. Or half full—this would be a gain of about 4 million acre-feet after distributing its portion of the Lower Basin's annual share of the Colorado River flow. Still it could take decades to fill entirely.

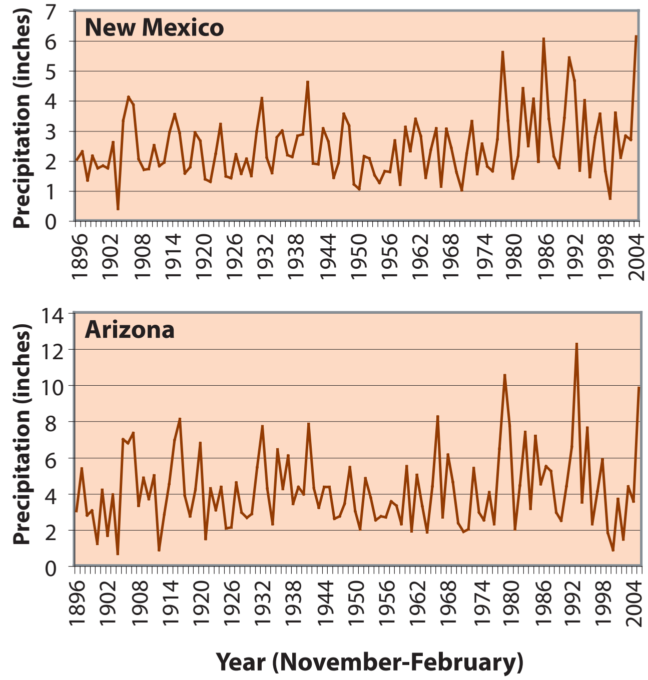

Figure 1. Precipitation from November 2004 through February 2005 was the highest on record for New Mexico (top figure) and the third-wettest on record for Arizona (bottom figure) compared to previous November-February periods. The data also seem to show a visual increase in variability, or extreme events, since about the mid-1970s. Source: Western Regional Climate Center.

Liles used a budget analogy to make a similar point, noting New Mexico had a 25-inch precipitation deficit accrued over five years when the current water year began on October 1. The state has garnered about 5 inches of precipitation toward that negative balance.

"Now we're trying to put some money back in the bank, but the account's pretty low," he added. For instance, Elephant Butte Reservoir had dropped to only 9 percent of its average storage by the end of last summer. Now it's approaching 30 percent of average, but it's a long way from its 2 million acre-feet capacity. Groundwater, too, continues to be "short-changed," he noted.

Liles and others worry that reservoirs and aquifers could falter for decades, if long-term ocean patterns are aligning to maintain a multidecadal western drought. While the MJO might affect regional climate for a month and El Niño fluctuations might hold sway for a year or so, other patterns appear to keep the Southwest in overall drought mode for decades despite these short-term swings.

In particular, the Pacific Decadal Oscillation (PDO) and the Atlantic Multidecadal Oscillation (AMO) are suspected of having holding patterns that can last some 20 years or so based on observations in the instrumental record and inferences in the longer-term record reconstructed from natural archives such as tree rings. These oscillations appear to be associated with western drought.

Julio Betancourt of the U.S. Geological Survey in Tucson is among the research-

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Drought, continued

ers arguing that these decades-long fluctuations contributed to the southwestern drought that spanned from about the 1940s through the 1970s (Figure 2). Betancourt indicated he fears drought could continue to haunt the Southwest for decades to come.

"I haven't seen any evidence indicating that what we've seen lately will persist," he said of the recent wet spell.

Liles agreed, noting that an El Niño-inspired wet period spanning about 1956 through early 1958 helped alleviate the drought impacts, but didn't really end the drought.

"People thought drought was over. Looking back, you could see that drought actually lasted until about the 1980s," Liles said (see Figure 2). "I think that Julio and I are pretty similar on our concerns that we were headed into a long-term drought. I think right now it's going to take a couple of years to really know."

Another wild card

There's an even longer term potential influence on modern drought regimes in the Southwest: global warming. The input of additional greenhouse gases into the atmosphere is expected to yield a temperature increase on the scale of about 1 degree Fahrenheit per decade in the Southwest through this century and beyond, as last month's *Southwest Climate Outlook* article explained.

That warming trend appears to have started in earnest in the mid-1970s, in the U.S. Southwest as well as the rest of the world. Although it remains unclear exactly how the warming will affect southwestern hydrologic regimes, consensus is emerging on several fronts. Climbing temperatures will certainly increase evaporation rates and will likely continue to shorten winters, resulting in an earlier seasonal snowmelt.

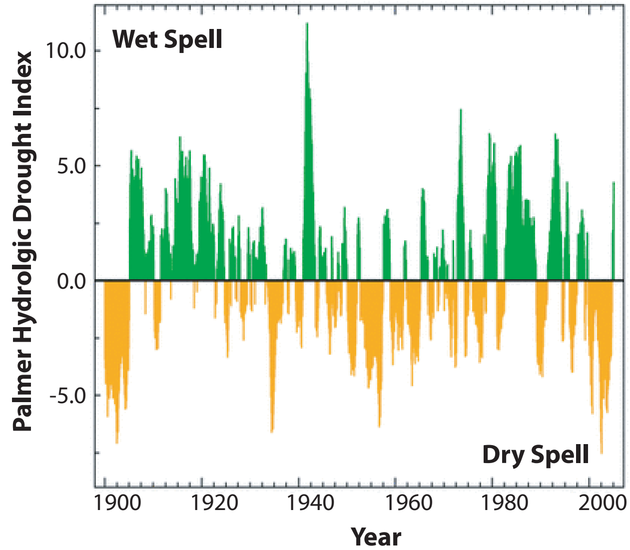


Figure 2. The Palmer Hydrological Drought Index above indicates that drought is a common occurrence in the Southwest, which for this analysis includes the Four Corner states of Arizona, New Mexico, Utah, and Colorado. Hydrologic drought tends to be more entrenched than other types of droughts, as it takes reservoirs and aquifers longer to rebound.
Source: National Climatic Data Center.

Warmer temperatures may also yield more extreme precipitation events, such as droughts and floods. Interestingly, the instrumental records for November-February precipitation in Arizona and New Mexico (Figure 1) seem to show an increase in extreme events—i.e., greater variability around the norm—since about the mid-1970s. This is a moment in time that many climatologists identify as launching a critical jump in global temperatures.

Since then, temperatures have continued an upward trend in the Southwest. Some of the concern over water supplies stems from these rising temperatures. For instance, warm temperatures during March of last year—which soared to record highs for Arizona and placed second for New Mexico in the instrumental record—consumed much of the existing southwestern snowpack without leaving moisture behind.

Beyond global warming and the other short and long-term influences on climate, extreme precipitation events are part and parcel of life in the semi-arid desert.

If drought is seen as including any year when precipitation falls below 75 percent of the average, the Southwest is in drought about 43 percent of the time, as New Mexico State University Professor Jerry Holechek and colleagues note in their 1998 textbook "Range Management." By comparison, the Pacific Northwest is in drought only 13 percent of the time, given this approach.

So odds are that relatively wet periods like the current one won't last long in the Southwest.

"You're still living in the desert. Average annual precipitation is a foot a year," Pagano reminded, referring to Tucson. "That hasn't changed."

Melanie Lenart is a postdoctoral research associate with the Climate Assessment for the Southwest (CLIMAS).

Resources on the Web

- To compare moisture status for different states using the NCDC online tool, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/prelim/drought/state-reg-moisture-status.html
- To compare moisture status for different time frames using the Western Regional Climate Center online tool: http://www.wrcc.dri.edu/cgi-bin/divplot1_form.pl?0204
- For more details on the Madden-Julian Oscillation: http://www.cpc.ncep.noaa.gov/products/intraseasonal/intraseasonal_faq.html
- For more on how the PDO influences Southwest climate, see: http://www.ispe.arizona.edu/climas/learn/pdo/index.html http://www.srh.noaa.gov/abq/research/feature.htm

Temperature (through 3/16/05)

Sources: Western Regional Climate Center, High Plains Regional Climate Center

Water year departures are mostly above average across the Southwest (Figure 1a). The warmest anomalies (3–4 degrees Fahrenheit) are in northeastern Arizona and north-central New Mexico. Average temperatures since October 1, 2004 have ranged from the lower to mid 30's in north-central New Mexico to the mid-60's in southwestern Arizona (Figure 1b). From mid-February to mid-March average temperatures were generally warmer than average (Figures 1c–d). North-central Arizona had the highest positive temperature departures (4–6 degrees F).

According to the National Climatic Data Center and the Albuquerque National Weather Service (NWS), the 2004–2005 winter has been the 8th warmest since records have been kept (*Santa Fe New Mexican*, March 9). In Tucson, Arizona, February average temperatures were nearly 1 degree F above average, and the winter has been the 13th warmest on record through the end of February (Tucson NWS). A recent study reports that winters have been warmer over the past 50 years, resulting in less mountain snowpack in the West (*Santa Fe New Mexican*, February 21). According to the research, the decreasing snowpack is consistent with global warming, and the trend may persist if temperatures continue to warm.

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.

Figures 1c and 1d are experimental products from the High Plains Regional Climate Center.

On the Web:

For these and other temperature maps, visit:
http://www.wrcc.dri.edu/recent_climate.html and
http://www.hprcc.unl.edu/products/current.html

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

Figure 1a. Water year '04–'05 (through March 15, 2005) departure from average temperature.

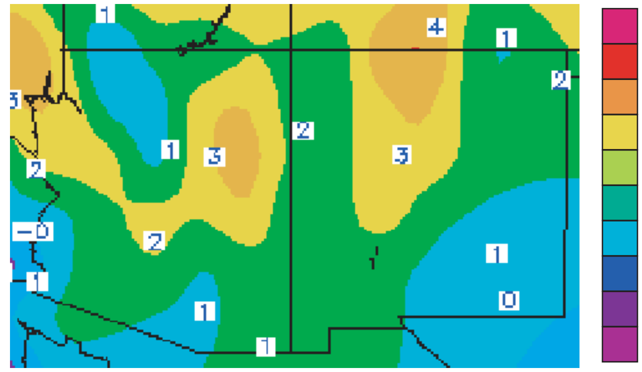


Figure 1b. Water year '04–'05 (through March 15, 2005) average temperature.

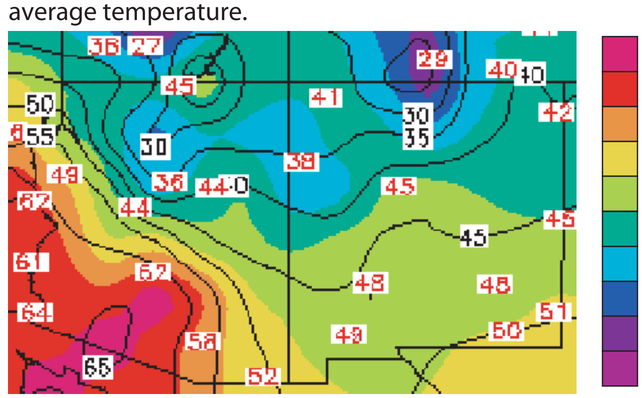


Figure 1c. Previous 30 days (February 15–March 16, 2005) departure from average temperature (interpolated).

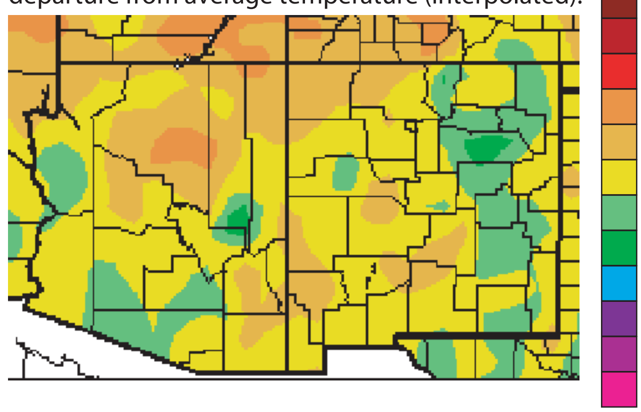
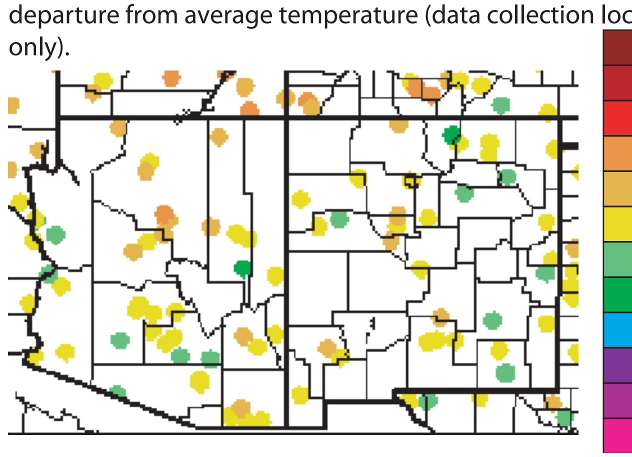


Figure 1d. Previous 30 days (February 15–March 16, 2005) departure from average temperature (data collection locations only).



Precipitation (through 3/16/05)

Source: High Plains Regional Climate Center

Precipitation has been much above average for nearly the entire Southwest since October 1, 2004 (Figures 2a–b). Portions of western Arizona and southeastern New Mexico are in excess of 300 percent of average for the water year. Only small portions of southeastern Arizona and north-central New Mexico have deficits during the period. Precipitation from February 15–March 16 was near to above average for most of the region (Figures 2c–d). The same areas that have experienced drier-than-average conditions for the water year also had below-average precipitation over the past 30 days.

The anomalously high precipitation amounts have been a boon to regional reservoirs. For example, the capacity of Roosevelt Reservoir near Phoenix increased from 31 percent in late December to 87 percent in mid-March (*East Valley Tribune*, March 16). The Tucson National Weather Service reports that February was the 23rd wettest on record, and this winter season is the first with above-average rainfall since 1997–1998. According to the National Climatic Data Center, New Mexico statewide average precipitation is the highest since records began in 1896 (*Santa Fe New Mexican*, March 9).

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2004 we are in the 2005 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/products/current.html

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 '04–'05 through March 16, 2005 percent of average precipitation (interpolated).

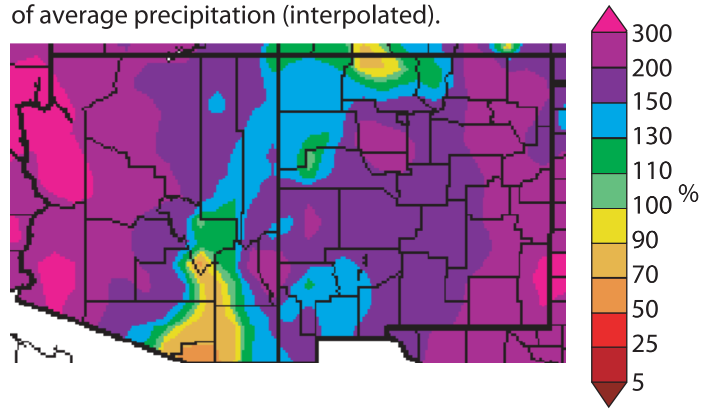


Figure 2b. Water year '04–'05 through March 16, 2005 percent of average precipitation (data collection locations only).

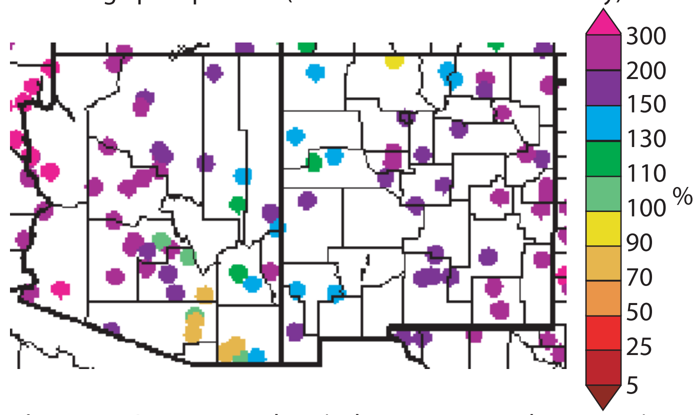


Figure 2c. Previous 30 days (February 15–March 16, 2005) percent of average precipitation (interpolated).

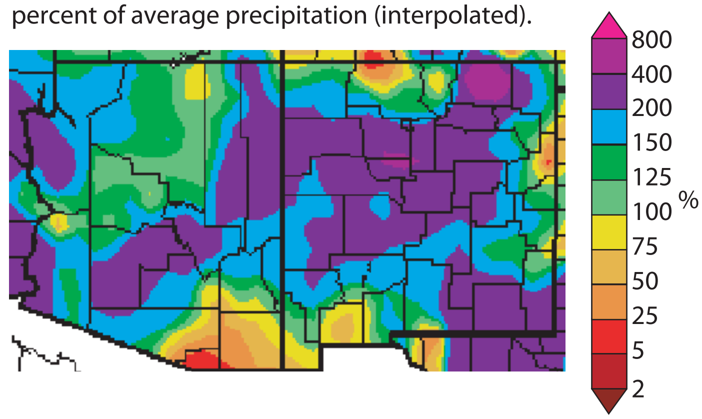
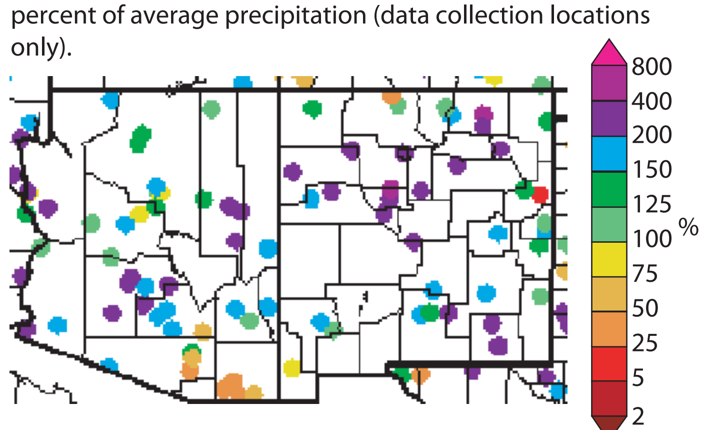


Figure 2d. Previous 30 days (February 15–March 16, 2005) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 3/17/05)

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

Another month of above-average precipitation eased drought impacts across the Southwest. While portions of northeastern Arizona and northwestern New Mexico are in severe drought, they have improved from the extreme conditions observed in February (Figure 3). Both southwestern Arizona and southern New Mexico are almost free of drought impacts. According to the NOAA-Climate Prediction Center, conditions have gotten better for nearly the entire Southwest since October 1, 2004.

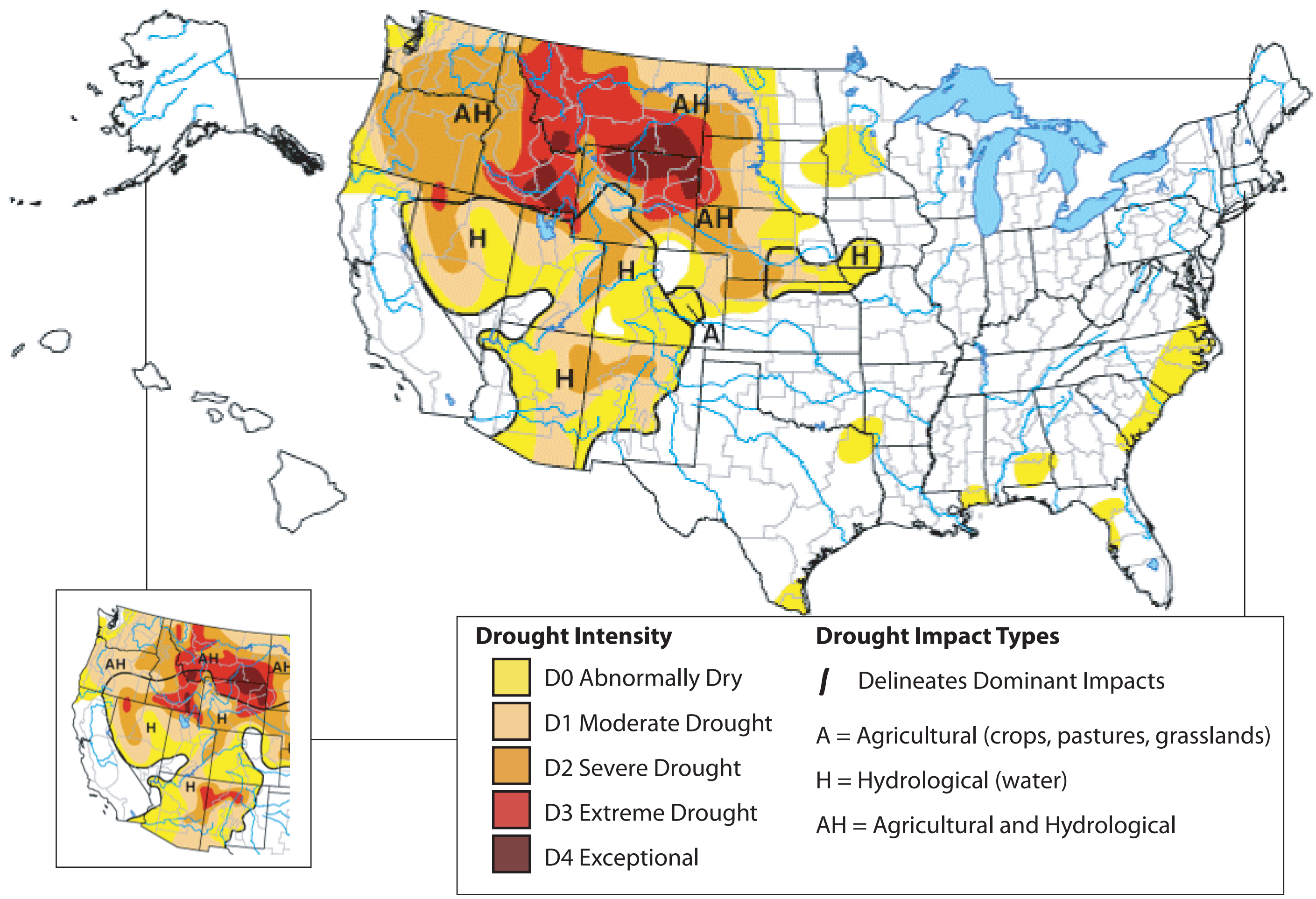
However, the northern Rocky Mountains and northwestern Great Plains are in extreme to exceptional drought. Much of Oregon and Washington are now in severe drought. Conditions have deteriorated enough in Washington that Governor Christine Gregoire has declared a statewide drought emergency (*U.S. Water News*, March 2005). The conditions across the West are due to the more southerly track of the jet stream throughout the winter, which pushed storm systems into southern California and the Southwest. Further improvement can be expected in the Southwest and parts of the northern Great Plains, but drought will likely persist in the northern Rockies and northern Great Basin (see Figure 10).

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 the several agencies; the author of this monitor is Michael Hayes, NDMC.

Figure 3. Drought Monitor released March 17, 2005 (full size) and February 17, 2005 (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

New Mexico Drought Status
(through 2/18/05)

Source: New Mexico Natural Resources Conservation Service

Short-term drought conditions continue to improve in New Mexico. Eastern, southern, and some northwestern portions of the state are classified as normal, meaning that precipitation is near or above average. Nearly half the remaining area is under advisory conditions. Emergency status remains near Los Alamos and Santa Fe. Short-term improvement occurred as a result of the above-average precipitation over the past 30 days across the state (see Figure 2). Long-term conditions are normal or above average in the Pecos, San Juan, San Francisco, Upper Gila, and Mimbres river basins, while other areas are not faring as well (Figure 4b). The Canadian, Bluewater, and Zuni river basins are in emergency status. Despite the excessive precipitation that has fallen during the water year, longer term deficits (12 months or more) persist.

The Alamogordo News (March 3) reported that the city placed in the top 25 percent of localities that submitted applications for the 2005 Innovations in American Government Award, in recognition of the city's water conservation program. Several agencies are working with elementary school students near Socorro to educate them about groundwater through field trips to New Mexico Tech and area refuges (*El Defensor Chieftain*, March 16). In Santa Fe County, officials want to enforce county-imposed water restrictions on private wells (*Santa Fe New Mexican*, March 11). Several options for implementing the restrictions are being considered.

Notes:

The New Mexico drought status maps are produced monthly by the New Mexico Drought Monitoring Workgroup. When near-normal conditions exist, they are updated quarterly. The maps are based on expert assessment of variables including, but not limited to, precipitation, drought indices, reservoir levels, and streamflow.

Figure 4a shows short-term or *meteorological* drought conditions. Meteorological drought is defined usually on the basis of the degree of dryness (in comparison to some "normal" or average amount) over a relatively short duration (e.g., months). Figure 4b refers to long-term drought, sometimes known as *hydrological* drought. Hydrological drought is associated with the effects of relatively long periods of precipitation shortfalls (e.g., many months to years) on water supplies (i.e., streamflow, reservoir, and lake levels, groundwater). This map is organized by river basins—the white regions are areas where no major river system is found.

On the Web:

For the most current New Mexico drought status map, visit:
http://www.nm.nrcs.usda.gov/snow/drought/drought.html

Information on Arizona drought can be found at:
http://www.water.az.gov/gdtf/

Figure 4a. Short-term drought map based on meteorological conditions as of February 14, 2005.

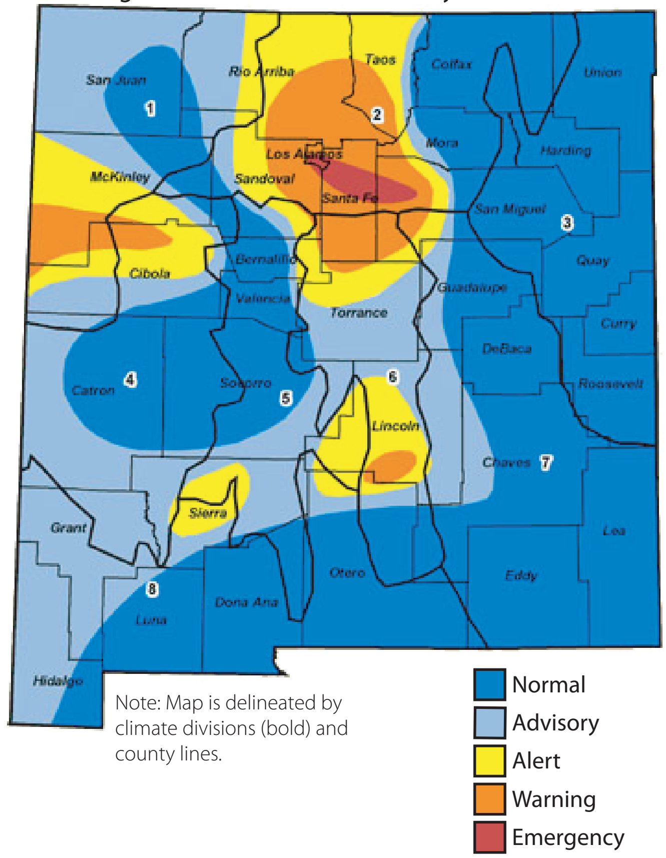
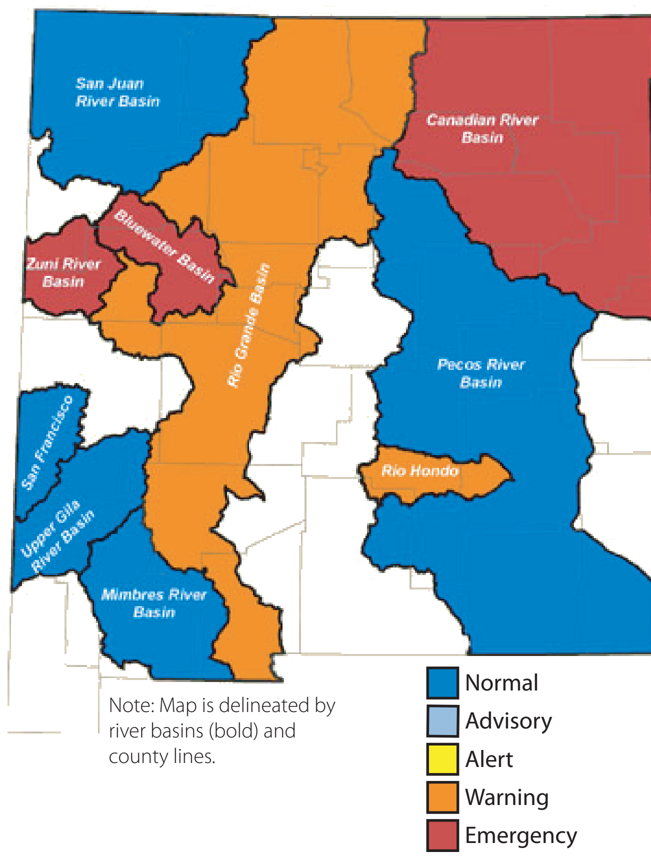


Figure 4b. Long-term drought map based on hydrological conditions as of February 18, 2005.



Arizona Reservoir Levels
(through 2/28/05)

Source: National Water and Climate Center

According to the Natural Resources Conservation Service, statewide storage is 75 percent of capacity and about 10 percent above average. Storage is now 85 percent or higher at 5 of the 9 reservoirs/river systems in the state (Figure 5). Show Low Lake has the highest capacity level (122 percent). The greatest increase occurred at San Carlos Reservoir (35 percent). The Verde and Salt River systems also experienced double-digit increases since January. Lake Powell was the only reservoir with a storage decrease (1 percent), and is also the only Arizona reservoir that is below last year's storage. San Carlos Reservoir, now at 381,500 acre-feet, has not been above 381,000 acre-feet since May 20, 1996 (*Gallup Independent*, March 16).

With the approval of the Arizona Water Settlement Act earlier this year, the Gila River Indian Community hopes to double their current tilled acreage in the next year (*Tri-Valley Dispatch*, March 1). Robert Stone of Gila River Farms says that the community can put an additional 146,000 acres of land to agricultural use. Yuma water officials recently assured residents that the city's water supply is secure (*Yuma Sun*, March 2). Due to high priority water rights, Yuma County will be the last to receive cutbacks. Tucson and Marana continue to argue over 1,500 acre-feet of Central Arizona Project water that the Flowing Wells Irrigation District agreed to transfer to Marana in 2003 (*Northwest Explorer*, March 9). Officials from both cities met with Arizona Department of Water Resources representatives and believe that the meeting will eventually lead to a resolution of the dispute.

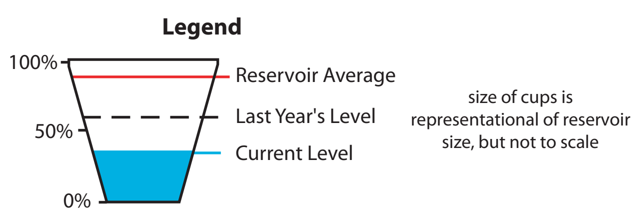
Notes:

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 (red line) and the 1971–2000 reservoir average (dotted 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.

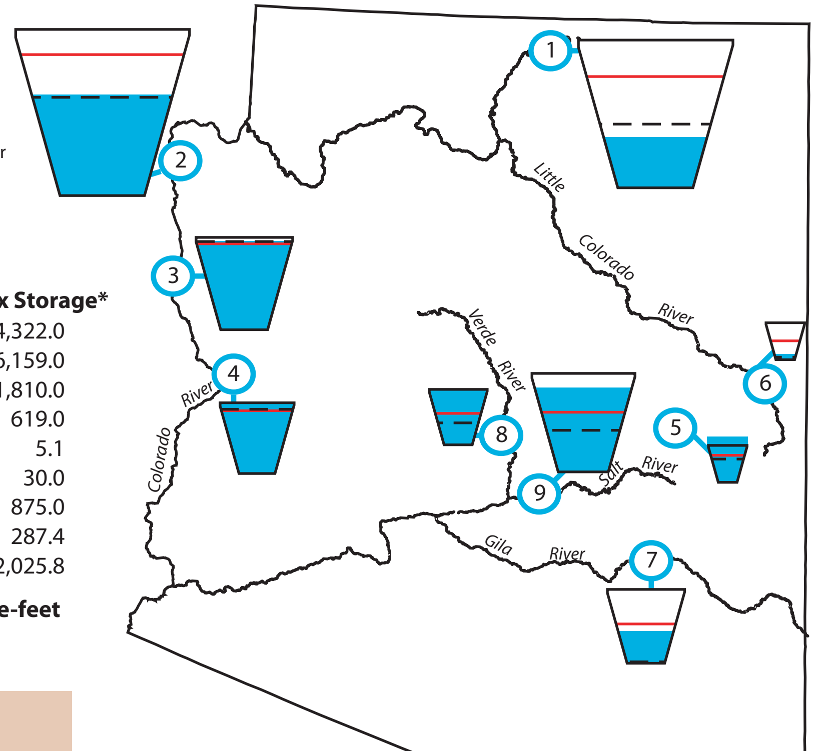
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, Natural Resource Conservation Service, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov).

Figure 5. Arizona reservoir levels for February 2005 as a percent of capacity, the map also depicts the average level and last year's storage for each reservoir, while the table also lists current and maximum storage levels.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*
1. Lake Powell	34%	8,265.0	24,322.0
2. Lake Mead	60%	15,739.0	26,159.0
3. Lake Mohave	95%	1,722.9	1,810.0
4. Lake Havasu	99%	613.4	619.0
5. Show Low Lake	122%	6.2	5.1
6. Lyman Reservoir	16%	4.9	30.0
7. San Carlos	44%	381.5	875.0
8. Verde River System	99%	284.5	287.4
9. Salt River System	85%	1,724.8	2,025.8

*** thousands of acre-feet**



On the Web:

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

New Mexico Reservoir Levels
(through 2/28/05)

Source: National Water and Climate Center

Reservoirs in New Mexico remain well-below capacity; only Navajo Lake and Lake Avalon are greater than 30 percent of maximum storage (Figure 6). Of the remaining 11 reservoirs, capacities at 5 of them remain below 20 percent. The positive news is that nearly every lake in the state had increases in storage since January. While most reservoirs rose by less than 5 percent, Lake Avalon increased 35 percent in the past month. The statewide reservoir average is approximately 30 percent of capacity, just over half the average capacity (Natural Resources Conservation Service, March 1). Despite this low average, nearly every lake is higher than last year, except for Cochiti, Costilla, and El Vado reservoirs.

The Elephant Butte Irrigation District announced that farmers in their area will be given an additional 0.75 acre-feet of Rio Grande water for each acre of land that they farm (KOBTV, March 10). This allotment may increase, depending on spring snowmelt. Water fees and taxes have been a topic of discussion in many New Mexico localities. Española city manager Jim Romero proposed a water rate increase for both commercial and residential customers (*Santa Fe New Mexican*, February 26). The increase would nearly double the money currently paid to water utilities. Santa Fe residents are voting on a water rate increase. The money would contribute to the city's portion of the bill to upgrade the water system (*Santa Fe New Mexican*, March 6). A large percentage of the fees would contribute to the money owed by the city for the Buckman Direct Diversion, a plan to divert approximately 5,600 acre-feet of Rio Grande water to Santa Fe.

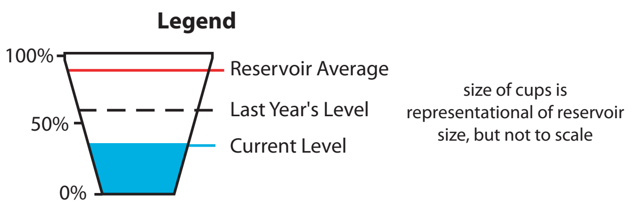
Notes:

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 (red line) and the 1971–2000 reservoir average (dotted 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.

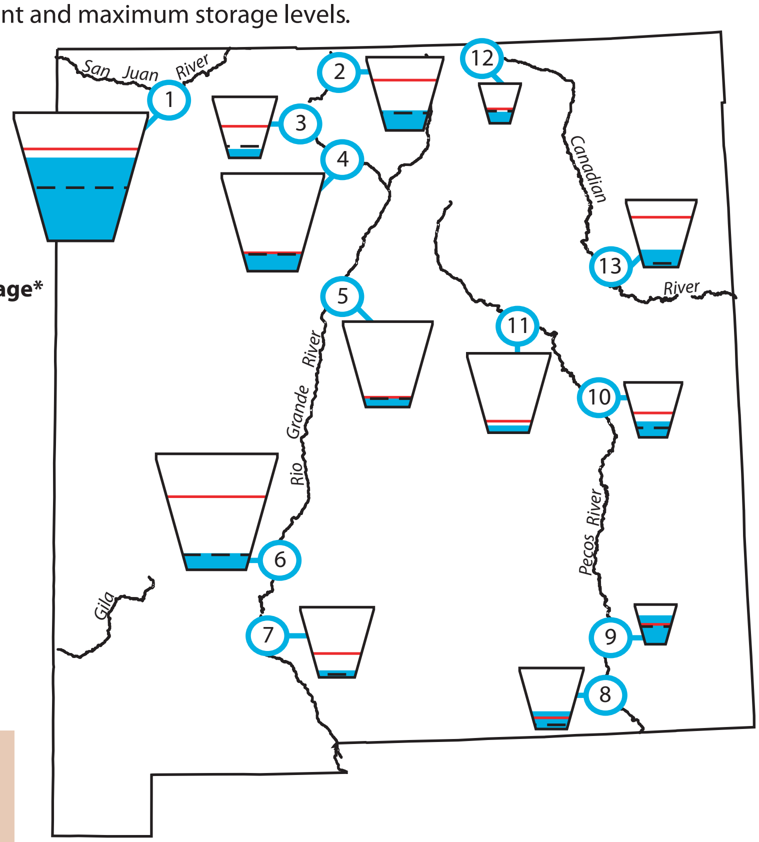
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. For additional information, contact Tom Pagano at the National Water Climate Center (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Dan Murray, NRCS, USDA, 6200 Jefferson NE, Albuquerque, NM 87109; 505-761-4436; Dan.Murray@nm.usda.gov).

Figure 6. New Mexico reservoir levels for February 2005 as a percent of capacity, the map also depicts the average level and last year's storage for each reservoir, while the table also lists current and maximum storage levels.



Reservoir Name	Capacity Level	Current Storage*	Max Storage*
1. Navajo	65%	1,101.9	1,696.0
2. Heron	27%	107.6	400.0
3. El Vado	15%	27.9	186.3
4. Abiquiu	20%	112.3	554.5
5. Cochiti	10%	49.6	502.3
6. Elephant Butte	14%	295.0	2,065.0
7. Caballo	10%	33.2	331.5
8. Brantley	29%	42.1	147.5
9. Lake Avalon	73%	4.4	6.0
10. Sumner	29%	30.0	102.0
11. Santa Rosa	9%	39.3	447.0
12. Costilla	29%	4.6	16.0
13. Conchas	26%	67.0	254.0

*** 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

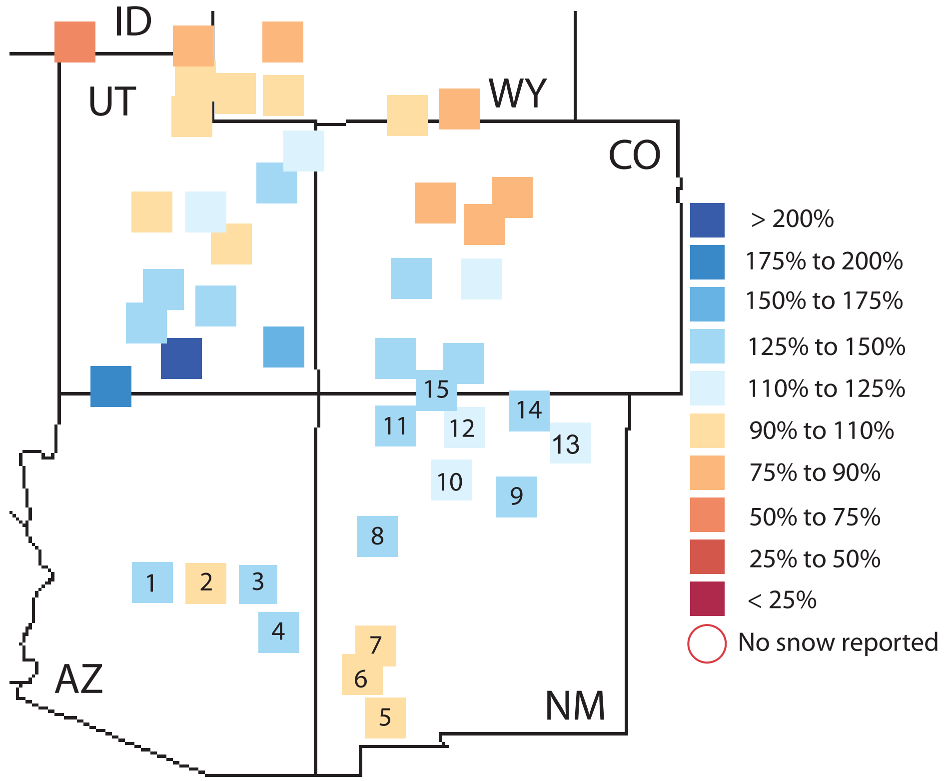
Southwest Snowpack
(updated 3/17/05)

Source: National Water and Climate Center

Snow water content (SWC) remains near to above average across Arizona and New Mexico (Figure 7). SWC in the Central Mogollon Rim in Arizona and the Mimbres and San Francisco river basins in New Mexico decreased slightly since mid-February. The rest of the Colorado River Basin is split between above average SWC in much of Utah and Colorado and near- to below-average SWC in the northern sections of the basin.

Nora Rasure, the Coconino National Forest Supervisor, recently approved the use of reclaimed Flagstaff water for snowmaking at Arizona Snowbowl (*U.S. Water News*, March 2005, and AZCentral.com, March 8). While the ski area has above-average snowpack this year, the measure will help business in the future. American Indian tribes, who consider the area sacred, and environmental groups oppose the decision. In a report issued in early March, the Natural Resources Conservation Service said that statewide snowpack in Arizona was over two times higher than early March 2004 (*Gallup Independent*, March 16). Although percent of departure has decreased in the last few weeks, due in part to warmer-than-average temperatures, snowpack remains above average. In New Mexico, ski areas will stay open later than usual due to the above-average snowpack. The *Santa Fe New Mexican* (March 9) reports that Ski Santa Fe will remain open until April 10, Taos Ski Valley will keep runs open through April 11 and decrease prices for lift passes during the last week, and Ski Apache will close on April 3.

Figure 7. Average snow water content (SWC) in percent of average for available monitoring sites as of March 17, 2005.



Arizona Basins
1 Verde River Basin
2 Central Mogollon Rim
3 Little Colorado - Southern Headwaters
4 Salt River Basin

New Mexico Basins
5 Mimbres River Basin
6 San Francisco River Basin
7 Gila River Basin
8 Zuni/Bluewater River Basin
9 Pecos River
10 Jemez River Basin
11 San Miguel, Dolores, Animas, and San Juan River Basins
12 Rio Chama River Basin
13 Cimarron River Basin
14 Sangre de Cristo Mountain Range Basin
15 San Juan River Headwaters

On the Web:

For a table of snowpack data, visit:
http://www.wcc.nrcs.usda.gov/snow/update.html

For a numeric version of the map, visit:
http://www.wrcc.dri.edu/snotelanom/basinswen.html

For a list of river basin snow water content and precipitation, visit: http://www.wrcc.dri.edu/snotelanom/snotelbasin

Notes:

Snowpack telemetry (SNOTEL) sites are automated stations that measure snowpack depth, temperature, precipitation, soil moisture content, and soil saturation. A parameter called snow water content (SWC) is calculated from this information. SWC refers to the depth of water that would result by melting the snowpack at the SNOTEL site and is important in estimating runoff and streamflow. It depends mainly on the density of the snow. Given two snow samples of the same depth, heavy, wet snow will yield a greater SWC than light, powdery snow.

Figure 7 shows the SWC for selected river basins in Arizona and New Mexico, based on SNOTEL sites in or near the basins, compared to the 1971–2000 average values. Data for Utah, Colorado, and parts of Wyoming and Utah are also shown, since these states contribute to runoff and streamflow in the Colorado River basin. The number of SNOTEL sites varies by basin. Basins with more than one site are represented as an average of the sites. Individual sites do not always report data due to lack of snow or instrument error.

Temperature Outlook
(April–September 2005)
Source: NOAA Climate Prediction Center

The NOAA-Climate Prediction Center (CPC) long-lead temperature forecasts show the Southwest, particularly Arizona, to have the highest probabilities of above-average temperatures through September (Figures 8a–d). Except for May–July (Figure 8b), the West Coast also has increased chances of warmer-than-average conditions during the period. While the models predict increased chances of below-average temperatures in New Mexico and Texas from April–June (Figure 8a), the northern Great Plains are most consistently in this category (Figures 8a–c). Given the anticipated continual weakening of the already weak El Niño, the NOAA-CPC expects little influence from the tropical Pacific after the spring in the United States. These forecasts are based mainly on output from dynamical and statistics models, with the highest model agreement during April–June (Figure 8a) and June–August (Figure 8c).

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 the reliability (i.e., 'skill') of the forecast is poor; 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 8a. Long-lead national temperature forecast for April–June 2005.

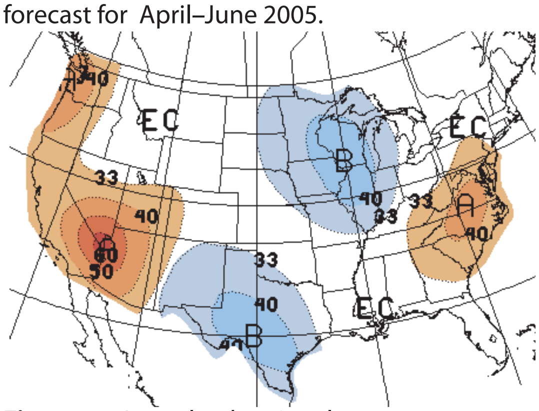


Figure 8b. Long-lead national temperature forecast for May–July 2005.

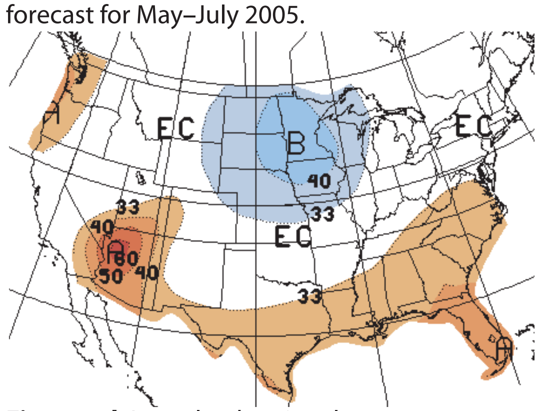


Figure 8c. Long-lead national temperature forecast for June–August 2005.

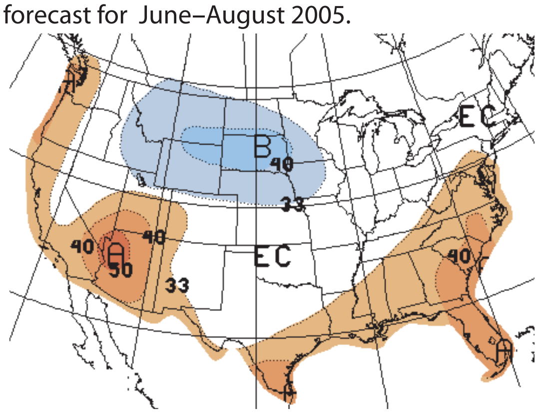
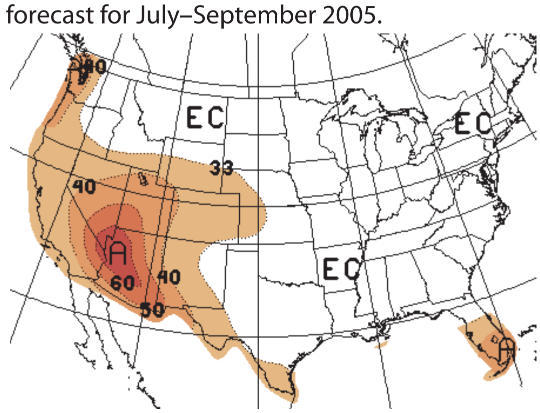


Figure 8d. Long-lead national temperature forecast for July–September 2005.



A= Above
- 60.0–69.9%
- 50.0–59.9%
- 40.0–49.9%
- 33.3–39.9%

B= Below
- 33.3–39.9%
- 40.0–49.9%

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.html
(note that this website has many graphics and may load slowly on your computer)

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

Precipitation Outlook

(April–September 2005)

Source: NOAA Climate Prediction Center

Long-lead forecasts call for increased chances of above-average precipitation in eastern Arizona, New Mexico, and much of Texas, as well as the Midwest, from April–June (Figure 9a). Thereafter, the Southwest has no forecasted anomalies through September (Figures 9b–d). The increased chances of wetter-than-average conditions shift westward from the Midwest to the northern Great Plains and northern Rocky Mountains through June–August (Figure 9c). The CPC expects only minor influence of the weak El Niño through May; predicted deterioration of El Niño means that any related precipitation patterns will wane further. The forecasts are based on dynamical and statistical model output, with much consensus among the models for April–June (Figure 9a). Wet anomalies in the Southeast in July–September (Figure 9d) result from a long-term trend toward enhanced tropical activity.

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 the reliability (i.e., 'skill') of the forecast is poor; areas labeled EC suggest an equal likelihood of above-average, average, and below-average conditions, as a "default option" when forecast skill is poor.

Figure 9a. Long-lead national precipitation forecast for April–June 2005.

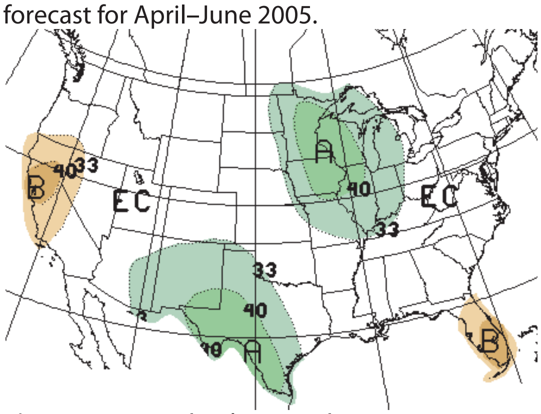
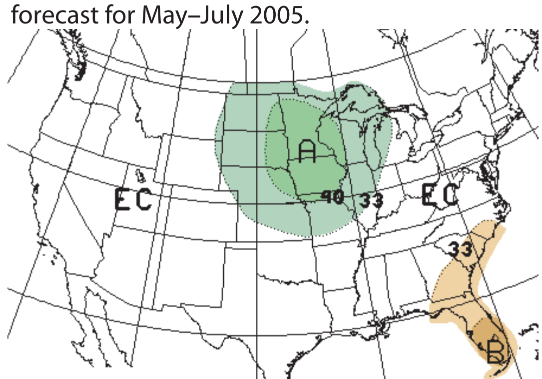


Figure 9b. Long-lead national precipitation forecast for May–July 2005.



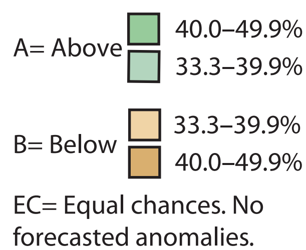


Figure 9c. Long-lead national precipitation forecast for June–August 2005.

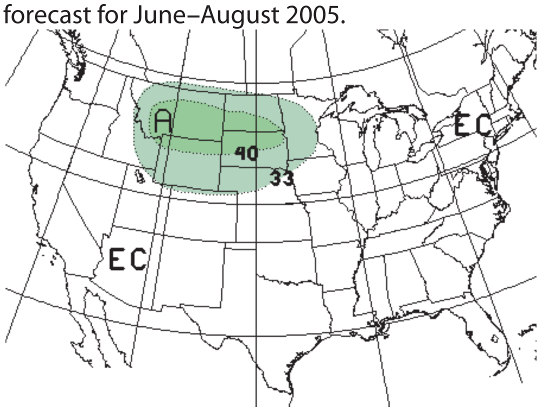
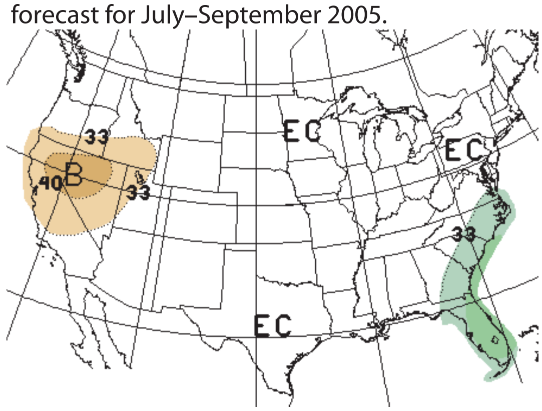


Figure 9d. Long-lead national precipitation forecast for July–September 2005.



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.html
(note that this website has many graphics and may load slowly on your computer)

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

Seasonal Drought Outlook
(through June 2005)
Sources: NOAA Climate Prediction Center

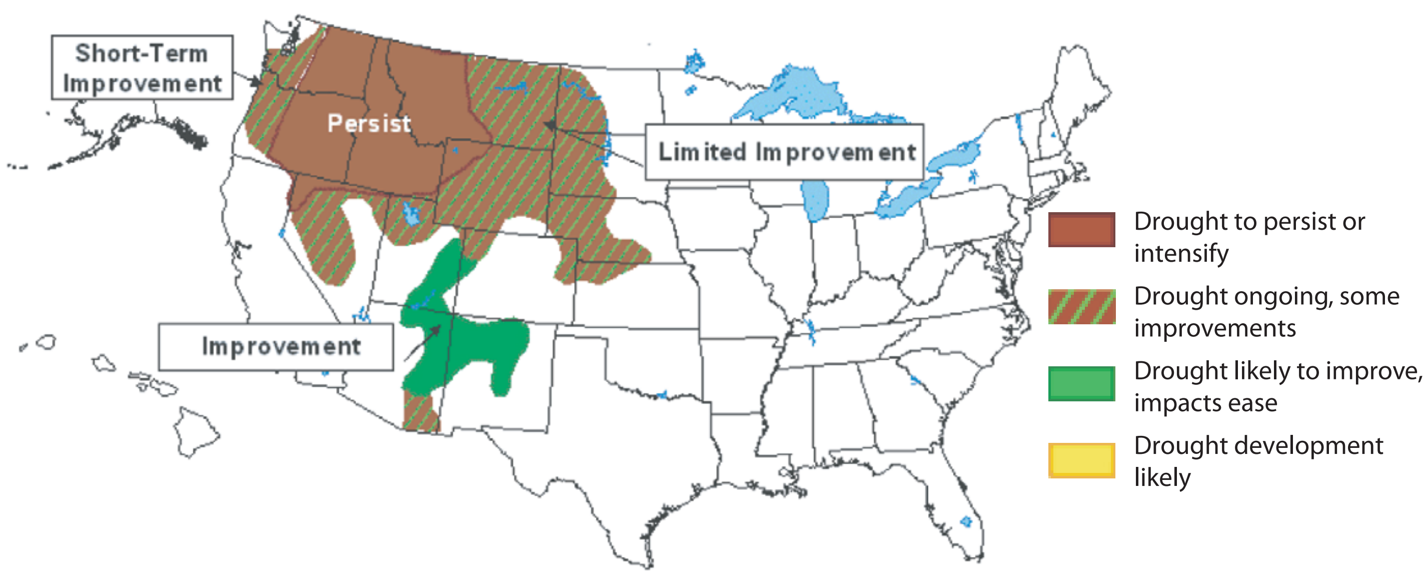
The NOAA-CPC seasonal drought outlook through June 2005 predicts continued improvement in the portions of the Southwest still affected by drought (Figure 10). While drought impacts are forecasted to ease in southeastern Arizona, less improvement is expected than for other parts of the state. Elsewhere in the West, limited drought improvement is predicted in the northwestern Great Plains, the central Rocky Mountains, the Great Basin, and along the Northwest Coast. Drought should persist in the northern Rockies. The forecasted improvement in Arizona and New Mexico is based on factors such as the long-lead precipitation forecasts, which indicates increased chances of above average precipitation (see Figure 9) and snow water content (Figure 7) in the region.

Changes in drought impacts are indicative of the winter precipitation pattern in the western United States over the past six months. According to the National Drought Mitigation Center, the Southwest drought has already improved since the beginning of the 2005 water year, while the drought outlook for the Northwest has deteriorated. According to *U.S. Water News* (March 2005) Conditions in Washington have worsened so much that the governor has declared a statewide drought emergency.

The Southern Nevada Water Authority hopes to make the area's current water restrictions and conservation measurements a permanent fixture (*Las Vegas Review-Journal*, March 7). Officials complimented the residents for their recent conservation, but they recognize that they must continue the conservation efforts to help the region in the future. The agency must get approval from its board and other member agencies before the measures can be made permanent.

Notes:
The delineated areas in the Seasonal Drought Outlook (Figure 10) are defined subjectively and are based on expert assessment of numerous indicators, including outputs of short- and long-term forecasting models.

Figure 10. Seasonal drought outlook through June 2005 (release date March 17, 2005).



On the Web:
For more information, visit:
http://www.drought.noaa.gov/

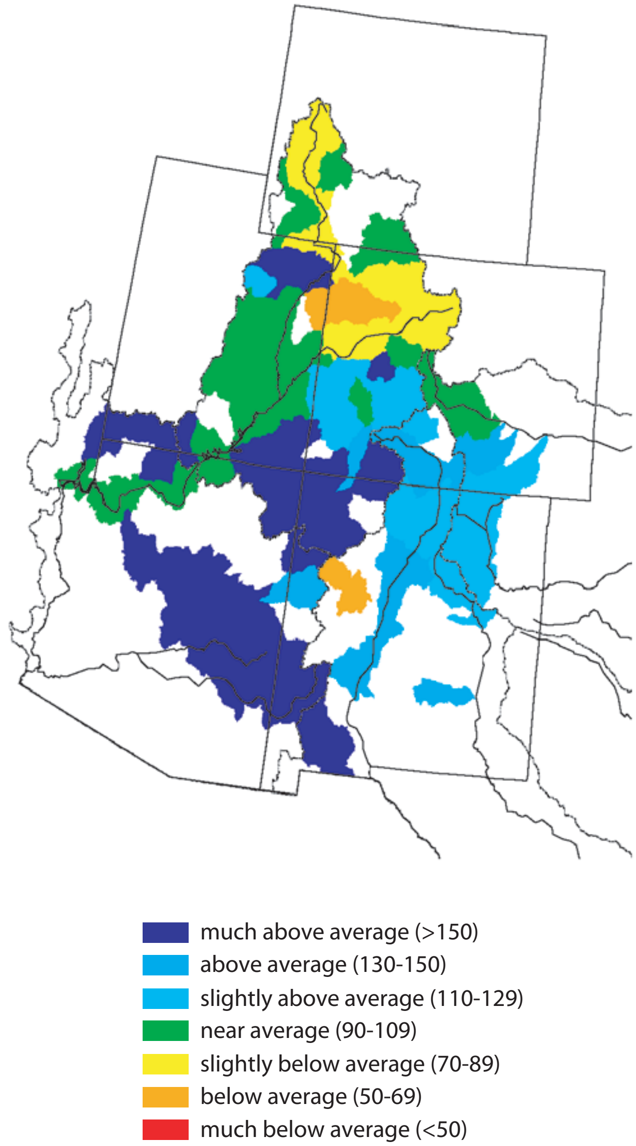
Streamflow Forecast
(for spring and summer)

Source: National Water and Climate Center

The spring and summer forecast from the Natural Resources Conservation Service (NRCS) indicates near-average to much-above-average streamflow throughout nearly the entire Southwest and Colorado River Basin (Figure 11). Models predict that several basins will have much-above-average flow. The NRCS expects slightly-below-average to below-average streamflow in sections of northwestern New Mexico and the northern Colorado River Basin. Despite the above-average precipitation that has fallen recently in New Mexico and a slight decrease in drought intensity, part of northwestern New Mexico is in severe drought (see Figure 3). Severe drought also persists in the northern Colorado River Basin. Recent warm temperatures throughout the region have led to early snowmelt. If long-term forecasts for increased chances of warmer-than-average conditions through spring and summer (see Figure 8) verify, then less snowfall and more rapid melting of the current snowpack are both possible.

Recent high streamflows have resulted in some headaches in the region. The large amount of vegetation in the Gila River bed caused the water to spread out farther than usual (*Yuma Sun*, March 1). Area farmers are concerned that another heavy rainfall could cause flooding, which may damage their crops. The flooding during mid-February in the Upper Gila River Valley led to an exceedance of the yearly water allotment for the Safford and Duncan valley areas (*Eastern Arizona Courier*, February 27). Based on the Gila Decree of 1935, when this situation occurs diversions must be halted until the actual consumptive use drops below a 120,000 acre-foot threshold. The result is that farmers will have to pump water for irrigation, which is more expensive than diversion. Elsewhere, several agencies and volunteers will meet on March 24 to clean up debris that was carried into San Carlos Reservoir after recent heavy rains (*Arizona Silver Belt*, March 8).

Figure 11. Spring and summer streamflow forecast as of March 1, 2005 (percent of average).



Notes:
The forecast information provided in Figure 11 is updated monthly by the National Water and Climate Center, part of the U.S. Department of Agriculture's Natural Resources Conservation Service. Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions. The USDA-NRCS only produces streamflow forecasts for Arizona between January and April, and for New Mexico between January and May.

The NWCC provides a range of forecasts expressed in terms of percent of average streamflow for various statistical exceedance levels. The streamflow forecast presented here is for the 50 percent exceedance level, and is referred to as the most probable streamflow. This means there is at least a 50 percent chance that streamflow will occur at the percent of average shown in Figure 11.

On the Web:
For state river basin streamflow probability charts, visit:
http://www.wcc.nrcs.usda.gov/cgibin/strm_cht.pl

For information on interpreting streamflow forecasts, visit:
http://www.wcc.nrcs.usda.gov/factpub/intrpret.html

For western U.S. water supply outlooks, visit:
http://www.wcc.nrcs.usda.gov/water/quantity/westwide.html

Wildland Fire Outlook

Sources: National Interagency Coordination Center, Southwest Coordination Center

The National Interagency Coordination Center (NICC) outlook for March shows below-average potential for large fires (greater than 100 acres) across the southern tier of the United States and along the East Coast (Figure 12a). Portions of the Northwest are forecasted to have above-average potential. These patterns are based on a combination of the recent and forecasted temperature and precipitation and current fuel conditions. Temperatures have been generally near average across the Southwest for the past 30 days and for the current water year. Warmer-than-average-temperatures are expected throughout March, according to the NOAA-CPC forecasts (not shown). Recent precipitation is much above average in Arizona and New Mexico, even when considering the values over the past 6 months. As a result, large dead fuels are wet or covered with snow (NICC). The March forecast from the NOAA-CPC predicts increased chances of above-average precipitation over Arizona and western New Mexico (not shown). This trend continues for the April–June period (see Figure 9).

Looking at the entire fire season, the NICC forecasts a below-average potential for fire activity in the Southwest, especially in forested areas. In addition, the wet winter should also result in delaying the wildland fire season.

Figure 12a. National wildland fire potential for fires greater than 100 acres (valid March 1–31, 2005).

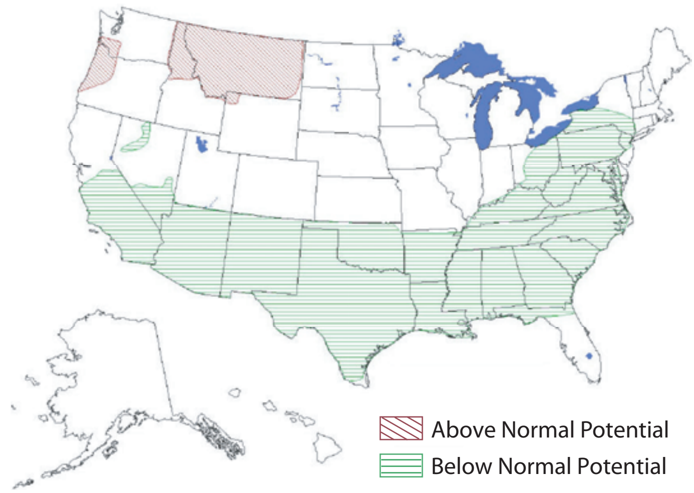


Figure 12b. Current fine fuel condition and live fuel moisture status in the Southwest.

Current Fine Fuels						
Grass Stage	Green		Cured	x		
New Growth	Sparse		Normal	x	Above Normal	

Live Fuel Moisture	Percent of Average
Ponderosa Pine	
Douglas Fir	
Piñon	
Juniper	
Sagebrush	
1000-hour dead fuel moisture	
Average 1000-hour fuel moisture for this time of year	

Table Not Updated
see text for more information

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces monthly wildland fire outlooks. The forecasts (Figure 12a) consider climate forecasts and surface-fuels conditions in order to assess fire potential for fires greater than 100 acres. They are subjective assessments, based on synthesis of regional fire danger outlooks.

The Southwest Area Wildland Fire Operations produces monthly fuel conditions and outlooks. Fuels are any live or dead vegetation that are capable of burning during a fire. Fuels are assigned rates for the length of time necessary to dry. Small, thin vegetation, such as grasses and weeds, are 1-hour and 10-hour fuels , while 1000-hour fuels are large-diameter trees. The top portion of Figure 12b indicates the current condition and amount of growth of fine (small) fuels. The lower section of the figure shows the moisture level of various live fuels as percent of average conditions.

On the Web:

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

Southwest Area Wildland Fire Operations (SWCC) web page:
http://www.fs.fed.us/r3/fire/

El Niño Status and Forecast

Sources: NOAA Climate Prediction Center, International Research Institute for Climate Prediction

The Southern Oscillation Index (SOI) continues to indicate a weak El Niño in progress (Figure 13b). After a slight increase in January, the SOI decreased in February. Sea surface temperatures (SSTs) also remain slightly warmer than average in the central tropical Pacific Ocean (not shown). The probabilistic forecast from the International Research Institute for Climate Prediction (IRI) for the El Niño 3.4 monitoring region indicates that neutral conditions have the highest probability of occurrence through February 2006 despite percentages decreasing to the historical average (Figure 13a). The models predict that the chances for El Niño will increase but will remain slightly lower than the likelihood of neutral conditions. Probabilities for La Niña remain low for the entire forecast period. In accordance with the IRI forecast, the NOAA-CPC believes that the weak El Niño will continue to wane in the coming months with a transition to neutral conditions across the tropical Pacific. This forecast is based on recent trends in SSTs and the output of the majority of the statistical and dynamic models (IRI ENSO Update, March 17, and CPC ENSO Diagnostic Discussion, March 3). Furthermore, the IRI and CPC expect very slight lingering effects of the El Niño to continue through April and May, with no influence thereafter. As a result, the ENSO models play a very small role the CPC long-term forecasts (CPC Prognostic Discussion for Long-lead Seasonal Outlooks, March 17).

Notes:

Figure 13a shows the International Research Institute for Climate Prediction (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.

Figure 13b shows the standardized three month running average values of the Southern Oscillation Index (SOI) from January 1980 through January 2005. 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.

Figure 13a. IRI probabilistic ENSO forecast for El Niño 3.4 monitoring region (released March 17, 2005). Colored lines represent average historical probability of El Niño, La Niña, and neutral.

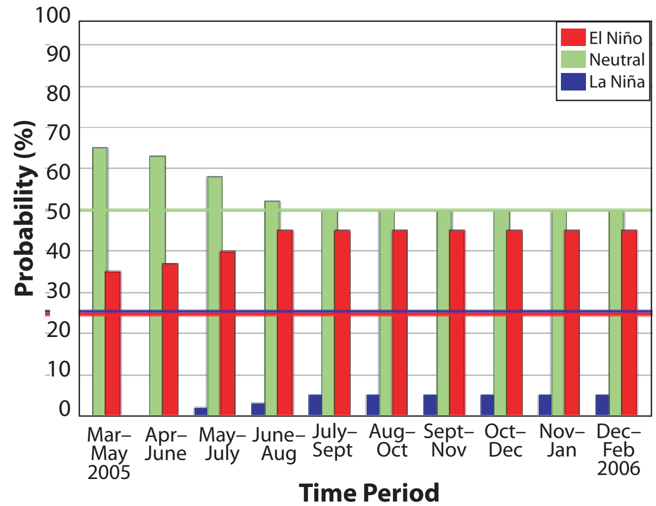
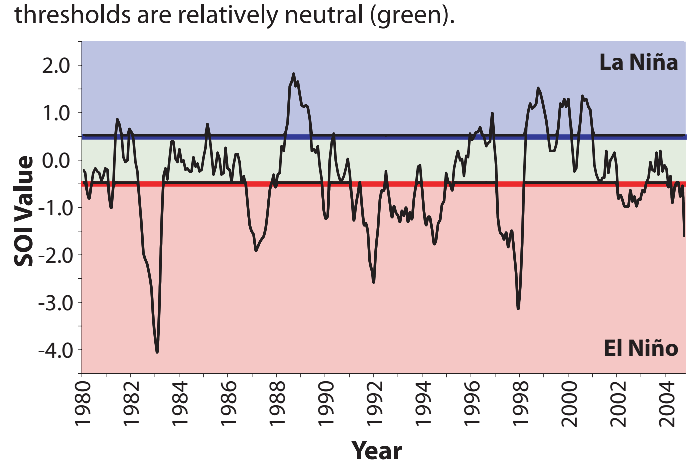


Figure 13b. The standardized values of the Southern Oscillation Index from January 1980–February 2005. La Niña/El Niño occurs when values are greater than 0.5 (blue) or less than -0.5 (red) respectively. Values between these thresholds are relatively neutral (green).



On the Web:

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

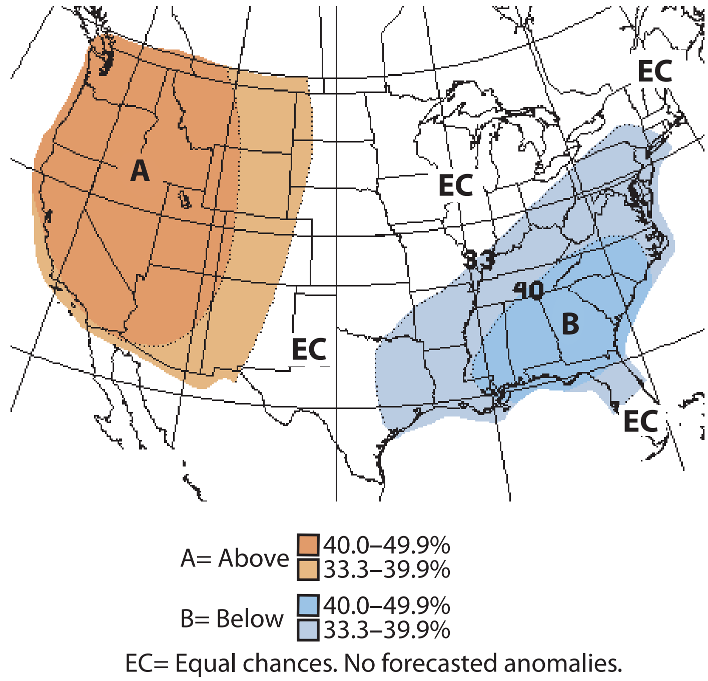
For more information about El Niño and to access graphics similar to the figures on this page, visit:
http://iri.columbia.edu/climate/ENSO/

Temperature Verification
(December 2004–February 2005)

Source: NOAA Climate Prediction Center

The NOAA-Climate Prediction Center long-lead temperature forecast for December 2004–February 2005 predicted increased chances of warmer-than-average conditions in the western United States and increased chances of cooler-than-average conditions across the much of the East (Figure 14a). Observed temperatures were near to much above average for almost the entire country during the period (Figure 14b). The warmest anomalies occurred in the central Rocky Mountains and contributed to increased snowmelt. In general the forecast verified in the West, but it was less successful in the eastern United States. The weak El Niño conditions in the tropical Pacific Ocean are part of the reason for the difficulty the models have in forecasting. During a moderate to strong El Niño, the northern United States is typically warmer than average, and the southern United States is cooler than average.

Figure 14a. Long-lead U.S. temperature forecast for December 2004–February 2005 (issued November 2004).



Notes:

Figure 14a shows the NOAA Climate Prediction Center (CPC) temperature outlook for the months December 2004–February 2005. This forecast was made in November 2004.

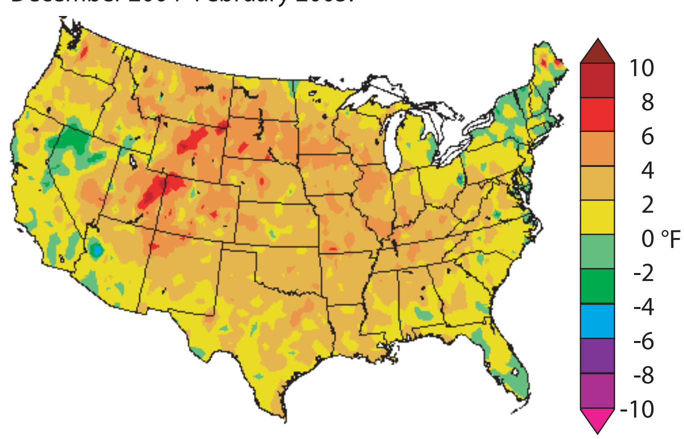
The December 2004–February 2005 NOAA CPC outlook predicts the likelihood (chance) of above-average, average, and below-average temperature, but not the magnitude of such variation. The numbers on the maps do not refer to degrees of temperature. Care should be exercised when comparing the forecast (probability) map with the observed temperature maps described below.

Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3 percent chance of above-average, a 33.3 percent chance of average, and a 33.3 percent chance of below-average temperature. Thus, using the NOAA CPC likelihood forecast, in areas with light brown shading there is 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. Equal Chances (EC) indicates areas where reliability (i.e., the skill) of the forecast is poor and no prediction is offered.

Figure 14b shows the observed departure of temperature (°F) from the average for December 2004–February 2005.

In all of the figures on this page, the term average refers to the 1971–2000 average. This practice is standard in the field of climatology.

Figure 14b. Average temperature departure (in degrees F) for December 2004–February 2005.



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.html

Precipitation Verification
(December 2004–February 2005)

Source: NOAA Climate Prediction Center

The long-lead precipitation forecast for December 2004–February 2005 from the NOAA-CPC indicated increased chances of wetter-than-average conditions in the south-central United States, including far eastern Arizona and most of New Mexico (Figure 15a). The models predicted increased chances of below-average precipitation in the Pacific Northwest and in the Ohio River Valley and southern Great Lakes region. The Southwest and from Kansas through the Ohio River Valley into Pennsylvania and New York received above-average precipitation during the period (Figure 15b). Much of the remainder of the United States was drier than average. The dry conditions over the past three months have led to increased drought concerns from the Northwest to the northern Great Plains. The forecast performed well in New Mexico, far western Texas, and the Pacific Northwest, but it did poorly in the Ohio River Valley.

Figure 15a. Long-lead U.S. precipitation forecast for December 2004–February 2005 (issued November 2004).

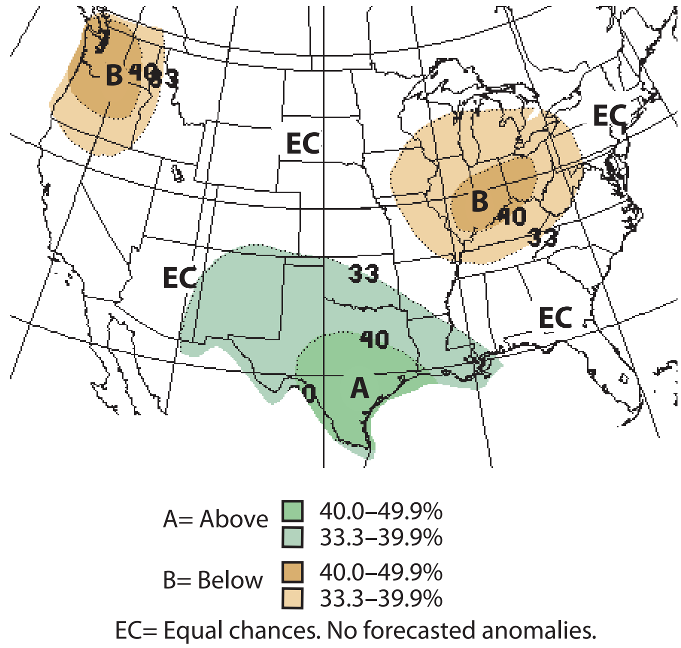
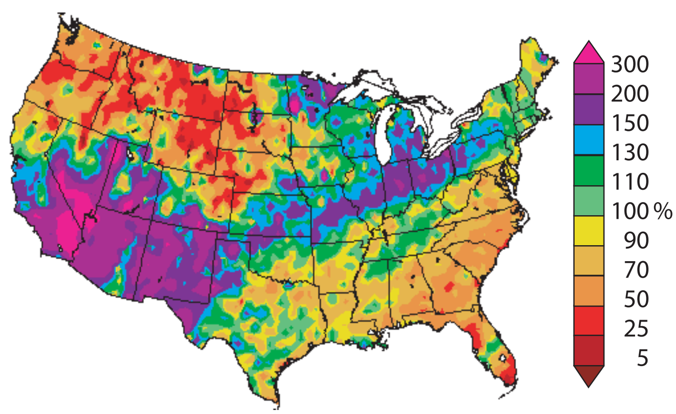


Figure 15b. Percent of average precipitation observed from December 2004–February 2005.



Notes:

Figure 15a shows the NOAA Climate Prediction Center (CPC) precipitation outlook for the months December 2004–February 2005. This forecast was made in November 2004.

The December 2004–February 2005 NOAA CPC outlook predicts 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. Care should be exercised when comparing the forecast (probability) map with the observed precipitation maps described below.

Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3 percent chance of above-average, a 33.3 percent chance of average, and a 33.3 percent chance of below-average precipitation. Thus, using the NOAA CPC likelihood forecast, in areas with light brown shading there is 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. Equal Chances (EC) indicates areas where reliability (i.e., the skill) of the forecast is poor and no prediction is offered.

Figure 15b shows the observed percent of average precipitation observed December 2004–February 2005.

In all of the figures on this page, the term average refers to the 1971–2000 average. This practice is standard in the field of climatology.

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.html