Issued: June 22, 2004

CLIMAS
Southwest Climate Outlook

June 2004 Climate Summary

Hydrological Drought – Hydrological drought continues in the Southwest.

- Arizona and New Mexico reservoirs are still at well below-average levels.
- Surface and groundwater levels are being affected by the ongoing drought: there have been increasing reports of towns in rural Arizona and New Mexico adopting water restrictions and conservation measures.
- Current storage in Lake Powell and Lake Mead is well below average and is expected to decline through the summer months.

Precipitation – Mid-May through mid-June has been drier than average across Arizona and New Mexico. This is important in eastern New Mexico, where June precipitation accounts for more than 10 percent of the annual precipitation total.

Temperature – Temperatures have been above average across most of the Southwest during the past month, consistent with long-term trends for the region.

Climate Forecasts – Seasonal forecasts indicate considerably increased probabilities of above-average temperatures across Arizona and most of New Mexico through the summer months.

El Niño – Conditions in the tropical Pacific Ocean remain neutral. Forecasts do not indicate a strong likelihood for the development of either El Niño (wet Southwest winter) or La Niña (dry Southwest winter).

The Bottom Line – Hydrological drought is expected to persist in most of the Southwest for the foreseeable future.

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

Monsoon Watch

A few rain drops fell in Tucson on June 21 and there is a slight chance of thunderstorms forecasted this week. But according to an article in the *Arizona Daily Star* (June 22, 2004) the moisture is coming from northern Mexico and does not herald the start of the monsoon. In Tucson, the monsoon officially begins on the third consecutive day that the dew point is at least 54 degrees.

	Tucson	Phoenix
Average Onset Date	July 3	July 7
Earliest Onset Date	June 17, 2000	June 16, 1925
Latest Onset Date	July 25, 1987	July 25, 1987
Average Precipitation	6.06 in.	2.65 in.
Most Precipitation	13.84 in., 1964	9.38 in., 1984
Least Precipitation	1.59 in., 1924	0.35 in., 1924

The July Southwest Climate Outlook packet will feature research and products on the North American monsoon.

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The Southwest Climate Outlook is published monthly by the Climate Assessment for the Southwest Project at the University of Arizona. This work is funded, in part, by the U.S. Bureau of Reclamation and the Technology Research Initiative Fund of the University of Arizona Water Sustainability Program.

THE UNIVERSITY OF ARIZONA®

Arizona to release drought plan for public comment

BY JOE GELT

The Governor's Drought Task Force, established about a year ago to develop a management plan for drought-stressed Arizona, will be releasing its plan for public comment in July.

Timing is important to the success of the plan, knowing what to do and when. The drought plan will set various trigger points to indicate when certain actions are to be taken as drought develops, from its early beginnings to a full-scale emergency. Because drought affects multiple sectors in the same location differently, triggers will be in response to the vulnerability of each sector and region rather than to statewide drought stages.

"The focus of the plan is primarily on developing an adequate monitoring system so that we can give people enough up-front notice to enable them to adapt land management practices and personal habits … to the conditions we are in at the time," explained Governor's Drought Task Force Coordinator Sandy Fabritz of the Arizona Department of Water Resources (ADWR).

Governor Janet Napolitano established the task force by executive order on March 20, 2003, and gave the ADWR lead responsibility.

Fabritz emphasized that drought is not a sudden, unexpected event and that the triggers will enable the state to prepare for a drought.

"We can see it coming," she said. When triggers are hit, sufficient information will be available and local involvement organized to be able to identify impacts and those likely to be affected by them. Appropriate responses can then be implemented.

Droughts are best managed to the extent they are understood, with a lack of information and a limited understanding creating the cracks that the best-laid plans fall through. To avoid this pitfall the task force is relying heavily on science. Obtaining and applying the latest scientific information, particularly climate data, is key to the plan.

"We are trying to incorporate scientific information into the drought plan in new ways, particularly as it relates to the ability to predict drought conditions in the future," said Kathy Jacobs, a University of Arizona faculty member who initiated the drought plan in 2003 while working for ADWR.

"The task force is clearly taking advantage of research that has been going on nationally and internationally," Jacobs continued. "What we are doing is tying ongoing research to the specific drought plan in Arizona."

The task force also considered the experiences of other states, with drought plans from Montana, Georgia and New Mexico proving especially useful, she said. As of December 2003, 37 states had implemented drought plans (Figure A).

The plan's emphasis on science is boosted by recent scientific developments. For example, scientists now better understand the workings of global atmospheric circulation and its effect on local climate. Other scientific advances include the monitoring of ocean temperatures to predict future climate conditions. Of further scientific significance, important work is being done by researchers and alumni of the University of Arizona's Laboratory of Tree-Ring Research in identifying long-term climate conditions.

Nor have the social sciences been overlooked in developing the state drought plan. Researchers including anthropologists and geographers from the UA Climate Assessment for the Southwest (CLIMAS) project have studied sources of vulnerability in the municipal, ranching and agricultural sectors. They also have looked at the effectiveness of various strategies for communicating drought-related information.

"Historically," Jacobs said, "the social science contributions to drought plans

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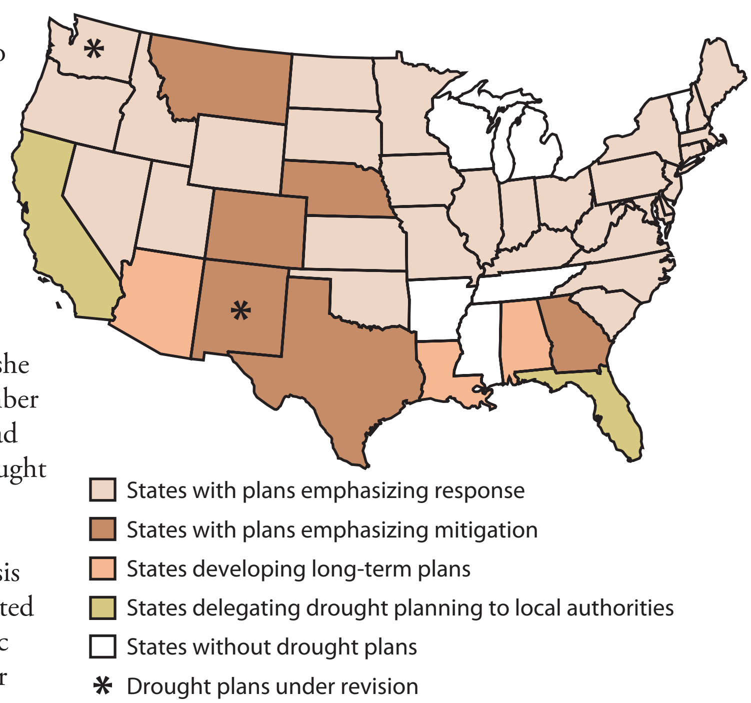

Figure A. During the widespread U.S. drought of 1976–77, no state had a formal drought plan, and in 1982, only three states had plans. But as of December 2003, 37 states had drought plans. Arizona was one of four states in the process of developing a plan at the end of 2003 (including Hawaii, not shown on the map). Only seven states did not have formal drought plans (including Alaska, not shown on map). Source: National Drought Mitigation Center, 2003.

Drought Plan, continued

have gotten short shrift. We are doing our best to incorporate that kind of information into the Arizona plan."

For example, the Arizona drought planning process seeks to respond to the questions: What conditions create vulnerability to drought and what potential adaptive responses can be taken to cope with the effects of drought? This is a different approach than many other states have taken.

The task force realizes that whatever drought plan is devised must be sufficiently flexible to take advantage of the new and more extensive climate information becoming available. Rather than defining a specific drought management plan, therefore, the task force worked to develop a sustainable planning process.

"The process is intended to be ongoing, and we hope to improve the way we do this over time. This is commonly called adaptive management," Jacobs stated.

Jacobs said that, historically, drought plans often stressed reaction or after-the-fact emergency responses, whereas Arizona's plan encourages sectors and regions to be more adapted to drought.

"In other words, we figure out what sectors are vulnerable and how they have been affected by drought in the past," she said. "And then we work out how we can prevent those kinds of impacts in the future."

Arizona's drought plan is breaking new ground. In the past, state drought planning focused on identifying water supplies for the major metropolitan areas, then reacting to emergency situations in outlying areas by trucking in water. The proposed plan adopts a broader perspective, with conditions in rural as well as urban areas now considered.

Also the plan includes an evaluation of the dependability of urban area supplies in the face of severe sustained drought, such as during times when the Salt and Colorado Rivers have reduced flow.

"Our water supplies may not be as secure as we believe they are, so drought planning is essential," Jacobs said.

The proposed plan's organizational structure includes a monitoring committee, which Jacobs calls "the heart of the ongoing exercise."

The committee's task is to be forever vigilant and on the outlook for any signs portending drought, explained Gregg Garfin, CLIMAS project manager and co-chair of the committee along with Tony Haffer, meteorologist in charge of the National Weather Service Office in Phoenix.

CLIMAS, affiliated with the University of Arizona's Institute for the Study of Planet Earth, produces the Southwest Climate Outlook packet that contains this newsletter story. The packet includes information and interpretations on precipitation, temperature, reservoir levels, and national drought status, among other features. It is distributed to members of the drought task force and about 1,200 other southwestern decision makers and residents.

The climate information packet production helps meet one of the monitoring committee's four main goals by conveying information to the government and the general public. In addition, the Arizona Department of Water Resources will be responsible for conveying information to the state's residents via a website dedicated to drought.

The other goals of the committee are:

1) Developing the databases needed to monitor drought in a timely fashion;

2) Creating a system for assessing the severity of drought in different parts of the state at a finer scale than currently available; and

3) Designing a set of "drought triggers" that can be tested by comparing them to historic drought impacts.

"This is very experimental," Garfin said of the plan to design drought triggers. The monitoring committee is adapting a Georgia model that uses a sophisticated statistical approach to combine various types of monitoring data to assess drought stage.

"It's a model that was developed for a southeastern state, so we have some retooling to do. For instance, winter snowpack is not the same issue for them that it is here in the Southwest," Garfin said with a smile. "In Georgia, they're using indicators you can measure continuously. Here, snow is only measured maybe five or six months of the year, but it sets the stage for how a lot of things will play out for the other half of the year."

The influence of snowpack varies by location throughout the state as well, which is another reason Arizona triggers need to include qualitative measures of subjective observations to support a set of quantitative formulas related to climate conditions.

Ideally, the monitoring committee will develop a set of quantitative formulas that can alert members to a potential problem. With input from local experts and other interested parties, the team can then examine qualitative information, such as ranching conservation district reports and wildlife assessments, to determine whether the warning holds up to scrutiny.

Monitoring committee members plan to test the system initially by "hindcasting" drought stages for historic periods at a regional scale, and then checking if resource managers who were around

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Drought Plan, continued

during that time did indeed observe impacts commensurate with those drought stages. They'll also check whether the hindcasted drought stages gave adequate warning of impending drought impacts.

Working with local people is also one of the keys to bringing the information down to a finer scale. The committee is starting at the climate division level, but eventually plans to be able to map drought severity at the county and, later, community level. At the same time, the team is consulting with the developers of a National Integrated Drought Information System so that the various scales will fit into the larger picture.

Whether signs of drought are present or not, the committee will meet monthly to review and evaluate present weather and climate conditions and anticipate future developments.

Membership in the monitoring committee consists of experts in their fields, ensuring that the most recent scientific information will be available for review. Along with ADWR and CLIMAS, officials from the National Weather Service, U.S. Geological Survey, the U.S. Department of Agriculture-Natural Resources Conservation Service, the Salt River Project, Arizona State University, and the Arizona Department of Emergency Management also participate.

"These are all people who are very involved either in data collection or weather and climate prediction," Jacobs noted.

Members are not only the "top in their field," but many also belong to the flood warning committee as well, Garfin pointed out. This will help to provide continuity to the climatic and hydrological monitoring "regardless of the hazard at hand," he added.

According to the draft plan, the monitoring committee is to notify the governor at the first signs of drought and

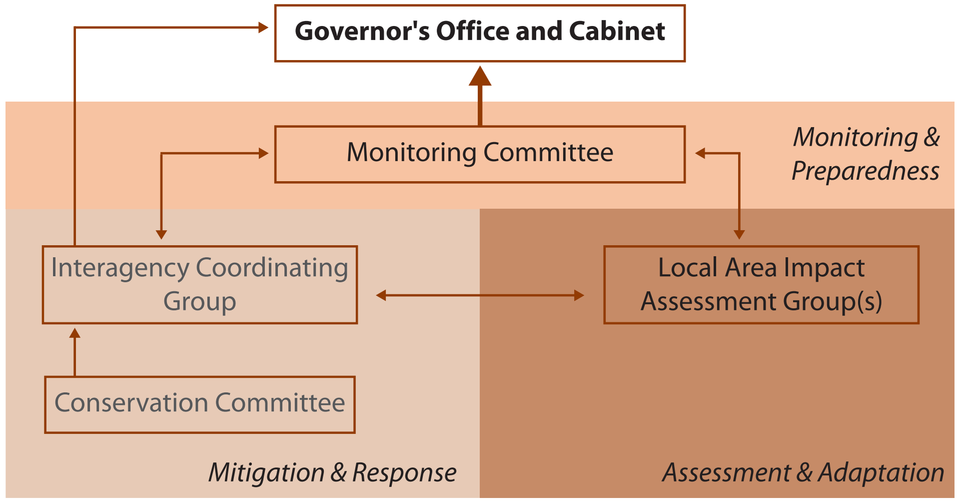


Figure B. The Governor's Drought Task Force proposed the above structure to strengthen Arizona's efforts to prepare for drought in the future. A monitoring committee, required to meet monthly from November to April, would be charged with alerting the governor's office to drought conditions. An interagency coordinating group would assess, implement, and develop response options—making recommendations to the governor for resources necessary to provide assistance and implement the plan. Under specified drought conditions, the governor would initiate groups to assess the impacts to local areas.

recommend the declaration of a drought warning or emergency when conditions warrant.

The early drought warning will call into action two other groups created by the drought plan, one consisting of local officials and interested citizens from around the state and another group made up of state and federal agency heads (Figure B). They will meet more regularly as drought conditions build, sharing information and coordinating activities in response to local and statewide conditions.

Conservation has a role in the drought management plan, although a separate and distinct effort is underway to develop a statewide water conservation plan.

"We are trying to make a distinction between long-term conservation practices and short-term drought response options," Fabritz said. "These are two completely different things, although sometimes they overlap."

"We are trying to get information out about the technology of water conservation," she added. "Hopefully communities can then adopt conservation measures to reduce their drought vulnerability."

Public input has been invited as the plan was developed, and will continue to be sought. To sign up for an electronic mailing list to receive information about task force activities and a link to the monthly Southwest Climate Outlook, follow the instructions at this address: http://www.ispe.arizona.edu/climas/subscribe.html.

The ADWR also maintains a website to enable people to access materials related to the plan: http://www.water.az.gov/gdtf/. The website will list upcoming public workshops on the drought plan, once the draft plan is released for public comment later this summer. The task force expects to have a final version of the drought plan in the fall.

Joe Gelt is an editor for the Water Resources Research Center at the University of Arizona. Melanie Lenart contributed to the adaptation of this article from its original publication in the April/May issue of Arizona Water Resources.

Temperature (through 6/16/04)

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

The departure from average temperature for the water year has not changed dramatically in the past month. Warmer than average conditions continue throughout our region, with the highest water-year temperature departures in the low deserts of central and southwestern Arizona and in extreme northeastern New Mexico (Figures 1a and 1b). Much of Arizona and New Mexico had above-average temperatures since mid-May, with scattered locations as high as 4 to 6 degrees Fahrenheit warmer (Figures 1c and 1d). Some areas in west central, east central, and south central Arizona and west central New Mexico were below average, the most notable of which was extreme southwestern Yavapai County in northwestern Arizona, where temperatures were as much as 4 to 6 degrees Fahrenheit cooler. According to the Tucson National Weather Service office, Arizona experienced the tenth warmest May on record (since 1894), over 3 degrees Fahrenheit above average. In addition, the entire spring was the third warmest, and the calendar year has been the fifteenth warmest through the end of May. The Albuquerque National Weather Service office had a similar story, reporting that Albuquerque experienced the ninth warmest May since 1931, although still slightly cooler than May 2000 and 2001.

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 blue numbers in Figure 1a, the red and black numbers in Figure 1b, and 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.

Figure 1a. Water year '03–'04 (through June 16, 2004) departure from average temperature.

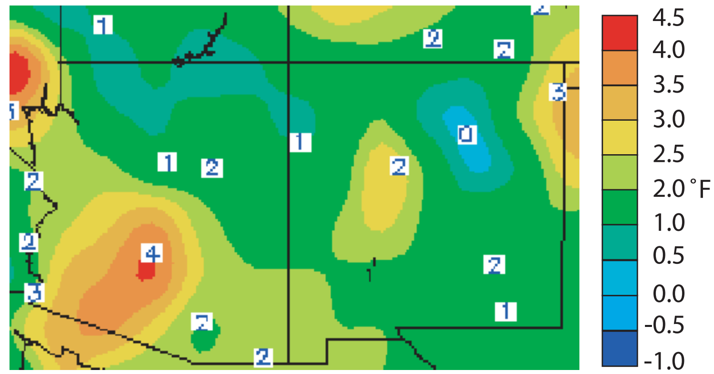


Figure 1b. Water year '03–'04 (through June 16, 2004) average temperature.

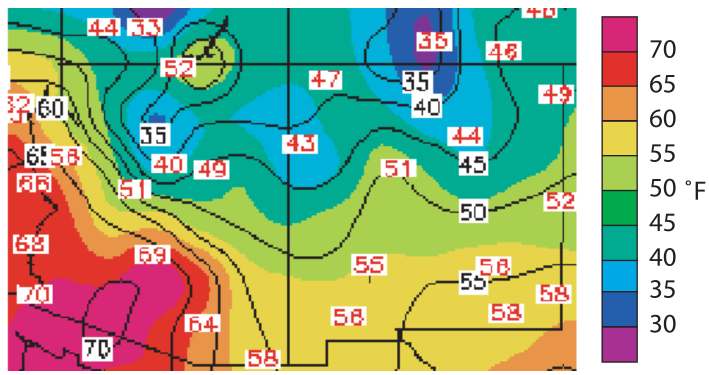


Figure 1c. Previous 30 days (May 18–June 16, 2004) departure from average temperature (interpolated).

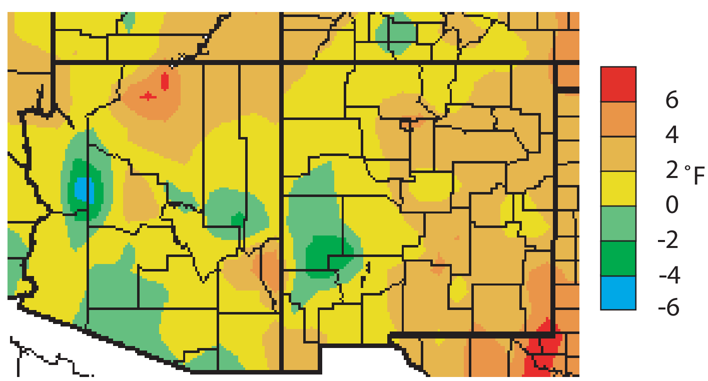
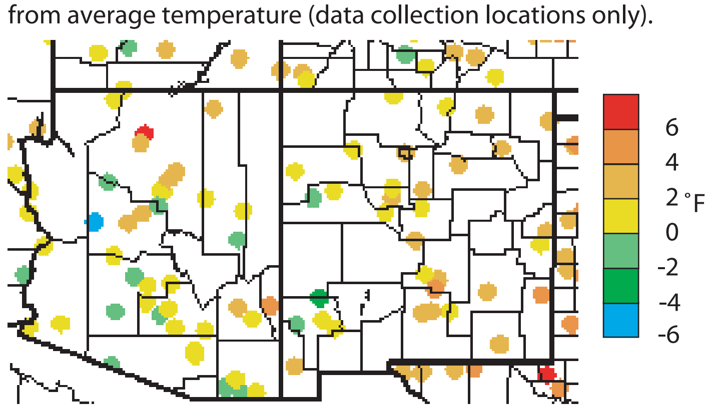


Figure 1d. Previous 30 days (May 18–June 16, 2004) departure from average temperature (data collection locations only).



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

Precipitation (through 6/16/04)

Source: High Plains Regional Climate Center

Precipitation since October 1, 2003 remains below average for most of Arizona with much of the northern half of the state and along the middle portion of the Colorado River receiving only 50–70 percent of the water year averages (Figures 2a and 2b). Some areas along the eastern two-thirds of the International Border and in Graham and Greenlee counties have gotten up to 150–200 percent of average water year precipitation. The situation in New Mexico appears somewhat better. More areas have experienced above-average precipitation in the past nine months, especially in the southeastern and central parts of the state. The stretch from mid-May through mid-June was another dry period for Arizona and New Mexico. Much of Arizona and northern New Mexico had less than 5 percent of the 1971–2000 average precipitation. Northern Hidalgo County in southwestern New Mexico was the most notable exception to the drier than average month. According to the National Weather Service in Albuquerque, New Mexico, the Lordsburg area received nearly half an inch of rain in May, which led to the above-average total precipitation for the last 30 days (Figures 2c and 2d). The eastern plains of New Mexico received rain on May 20, including strong to severe thunderstorms, but it was not adequate to significantly affect the percent of average precipitation.

Notes:

The water year begins on October 1 and ends on September 30 of the following year. As of October 1, 2003 we are in the 2004 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 '03–'04 through June 16, 2004 percent of average precipitation (interpolated).

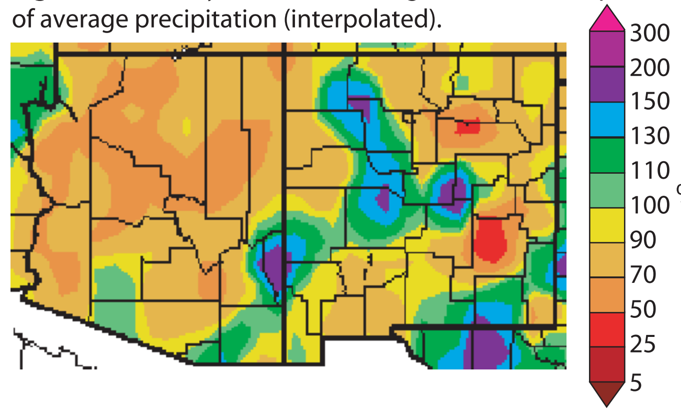


Figure 2b. Water year '03–'04 through June 16, 2004 percent of average precipitation (data collection locations only).

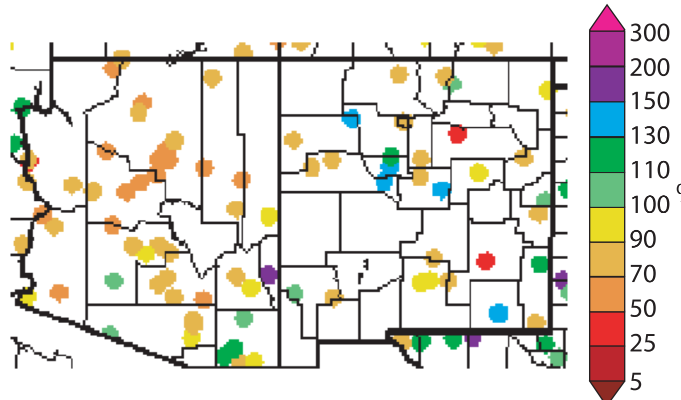


Figure 2c. Previous 30 days (May 18–June 16, 2004) percent of average precipitation (interpolated).

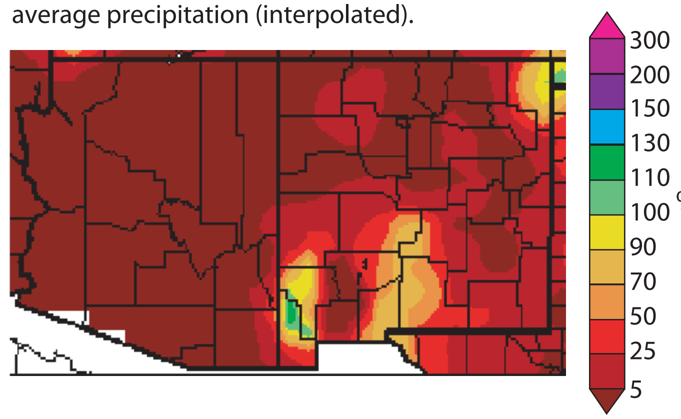
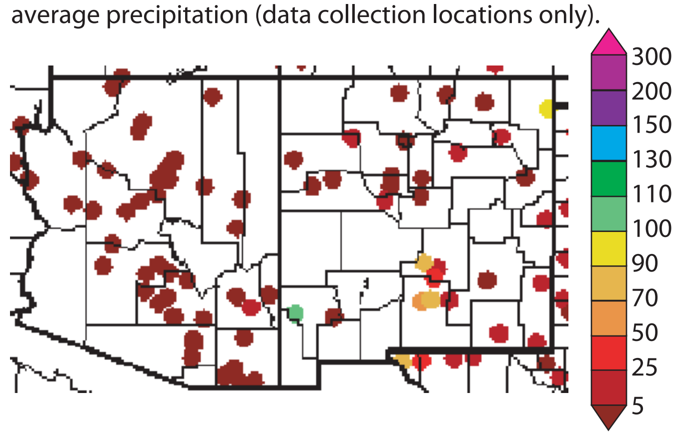


Figure 2d. Previous 30 days (May 18–June 16, 2004) percent of average precipitation (data collection locations only).



U.S. Drought Monitor

(released 6/17/04)

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

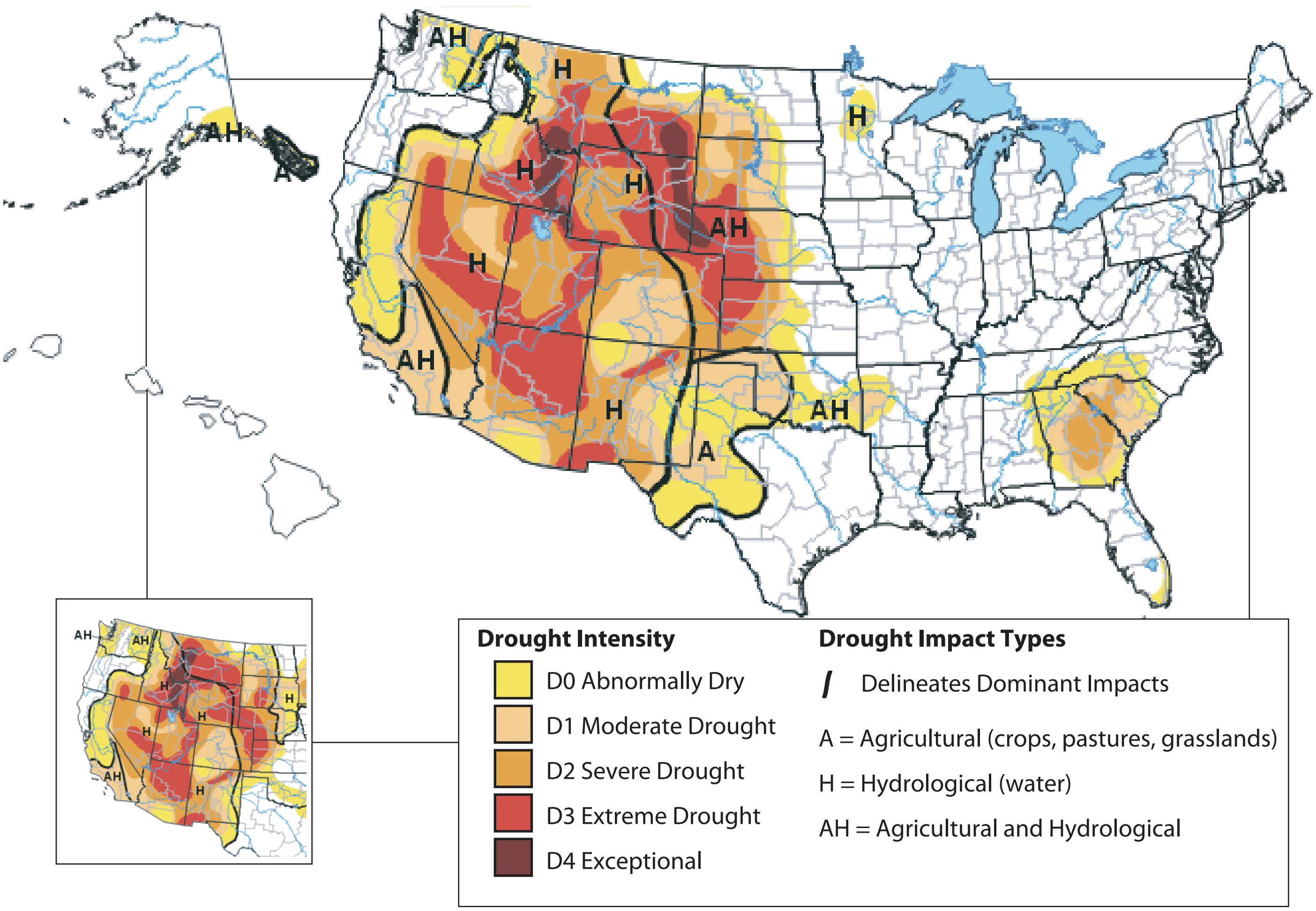
Although the general drought pattern in the United States remains similar to the past two months, the intensity of drought has varied. Conditions have improved in portions of western Washington and the northeastern Great Plains, while Georgia and South Carolina have been raised to D2 "Severe Drought" intensity. The continued dry weather across much of the West has worsened drought status in many areas. In the Southwest, the only noticeable change since last month is in eastern New Mexico and west Texas, where the drought intensity has been extended. Despite the minor variations, the conditions of range and pasture land classified as "poor to very poor" has increased in Arizona and New Mexico. In Arizona 46 percent of range and pasture land is in this category, up 3 percent from last month, while New Mexico now stands at 62 percent, up 15 percent since May. According to the National Drought Mitigation Center, both states are experiencing conditions that are worse than average for this time of year. Reservoir levels and streamflow reflect the dry conditions across the western United States, as both are low and decreasing. This trend is predicted to continue. Media outlets across the region are reporting increasing water conservation efforts and fire restrictions due to the current drought status.

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 Brad Rippey from the U.S. Department of Agriculture.

Figure 3. Drought Monitor released June 17, 2004 (full size) and May 20, 2004 (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 6/16/04)

Source: New Mexico Natural Resources Conservation Service

A very dry period from mid-May to mid-June in New Mexico (see Figure 2c) has resulted in a dramatic change in drought status for many areas. Virtually the entire state is now classified in either the warning or emergency category (Figure 4a). Some eastern counties are the exception, although they have been raised to alert status this month despite recent rainfall. According to the *Clovis News Journal* (June 18, 2004), Clovis has only received 0.22 inches of rain as of June 18, well behind pace to meet the June average of 2.63 inches. The city is in the first stage of a water conservation ordinance, which calls for voluntary water conservation by residents. Clovis officials are planning to have several new wells online in the coming month. Elsewhere, the U.S. Drought Monitor reports that Albuquerque is now in the fifth longest dry spell (approximately ten weeks) since 1931.

Copious spring precipitation has lessened hydrological drought severity in the Upper Rio Grande and Pecos River Basins (Figure 4b) from warning to alert status. Nevertheless, many New Mexico localities are still suffering hydrological drought effects and are implementing water use restrictions. The Otis Water Users Cooperative recently began shutting down the water system between 10 p.m. and 4 a.m. each day due to water supply issues (KRQE-TV, Albuquerque, June 15, 2004). Similar to the plans in Clovis, Gerald Fugate, general manager of the Otis cooperative intends to have a new well ready for use by the end of the month.

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 June 16, 2004.

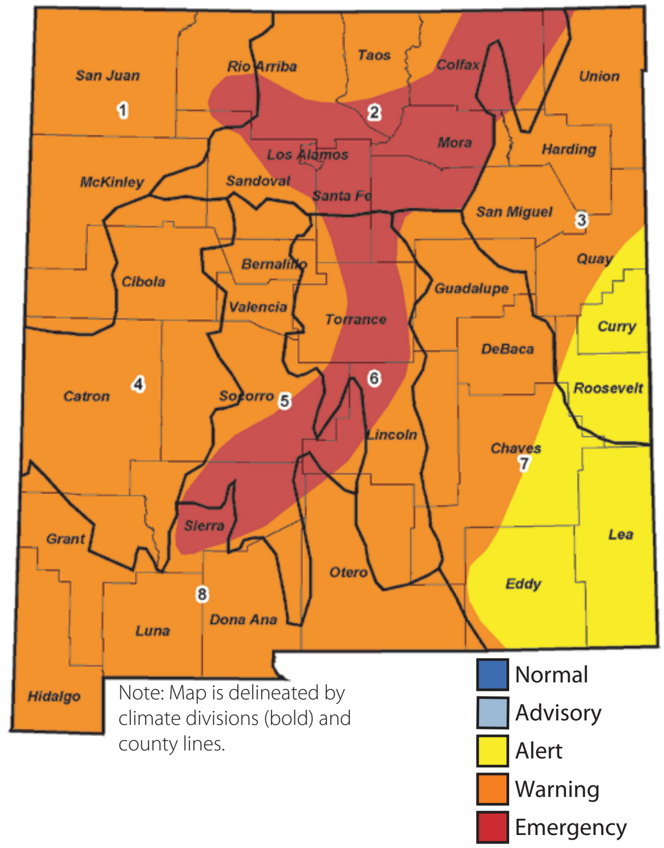
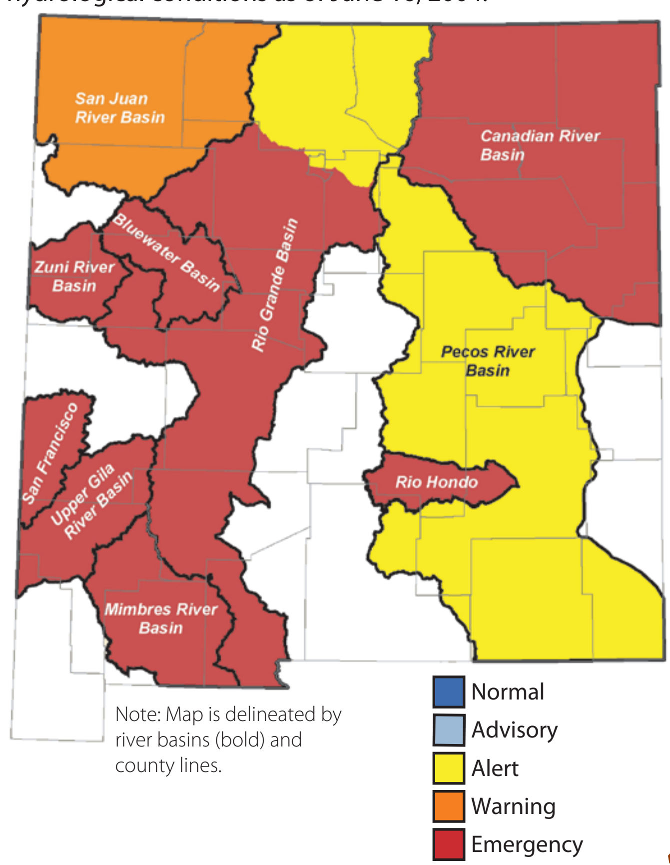


Figure 4b. Long-term drought map based on hydrological conditions as of June 16, 2004.



Arizona Reservoir Levels

(through 5/31/04)

Source: National Water and Climate Center

Arizona reservoirs once again showed little variation in the past month. Most locations registered gains or losses of only a few percent of capacity. The largest change occurred at Show Low Lake, which experienced a 6 percent drop. Compared to last year at this time, the levels of many reservoirs are lower, some significantly. Show Low Lake is also atop the list in this category, down 25 percent since the end of May 2003.

The conditions of Lake Powell and Lake Mead remain in the news, with media outlets across the West helping to keep the public aware of this issue. KLAS-TV in Las Vegas (May 28, 2004) reports that the situation at both lakes is very similar, due to their loss of water and their importance in supplying water to large metro areas. While Lake Powell had a minimal gain in storage, it continues to be well below capacity. Lake Mead is at its lowest level since 1968, and the shoreline has decreased from approximately 700 miles when near capacity in 1998 to about 500 miles in early June, according to the *San Francisco Chronicle* (June 7, 2004). The *Tucson Citizen* (June 8, 2004) adds that the difference in shoreline from 1998 to the present location represents a drop in depth of 80 feet. Compared to last year, the lake was 13 feet lower as of the end of May (*Los Angeles Times,* May 29, 2004).

The low water level in these two reservoirs is leading to concerns in Yuma due to the low flow in the Colorado River. The *Yuma Sun* (June 6, 2004) reports that W. Bennet Raley, the chief water official in the Bush administration, supports the possible restart of the Yuma Desalting Plant. The plant would produce treated water to help the United States meet a contract of supplying 1.5 million acre-feet of low-salt water per year to Mexico.

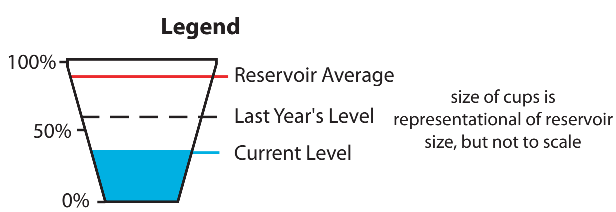
Notes:

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).

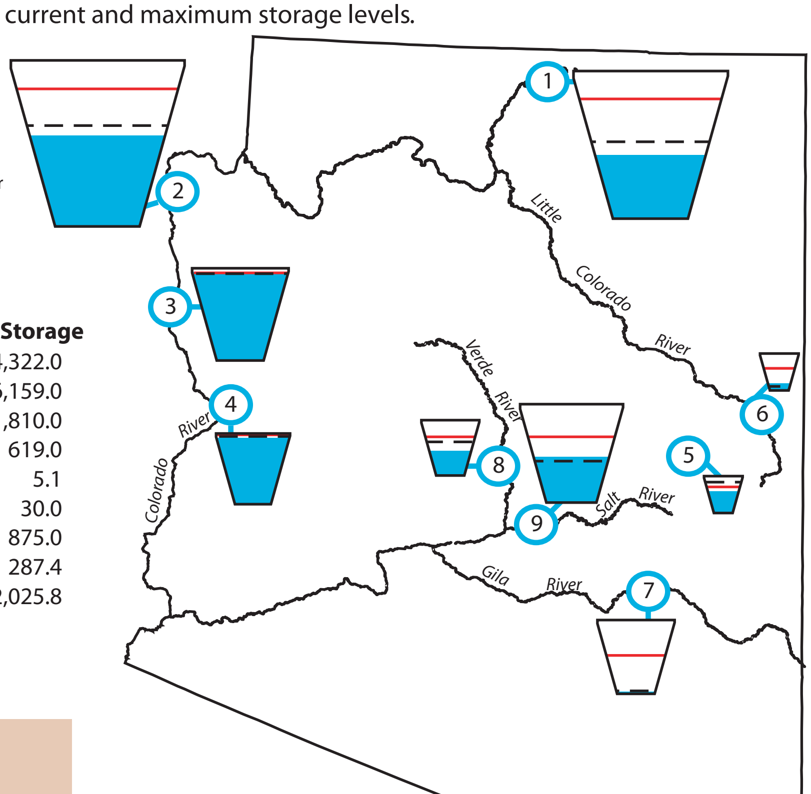
The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir.

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 May 2004 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	43%	10,566.0	24,322.0
2. Lake Mead	55%	14,324.0	26,159.0
3. Lake Mohave	96%	1,728.7	1,810.0
4. Lake Havasu	94%	582.8	619.0
5. Show Low Lake	59%	3.0	5.1
6. Lyman Reservoir	20%	5.9	30.0
7. San Carlos	3%	22.6	875.0
8. Verde River System	45%	128.0	287.4
9. Salt River System	47%	959.2	2,025.8



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 5/31/04)

Source: National Water and Climate Center

With a few exceptions, reservoirs across much of New Mexico registered gains in storage for all of 2004 to this point. May proved to be no different, with levels again increasing due in part to two storms that passed through the state at the end of April. These storms brought high-mountain snow (over a foot in some areas) to the north-central portions of the state, while lower elevations received rain. The above-average temperatures that followed in May helped to melt the snow quickly in the mountains. The remainder of the month saw drier than average conditions, despite showers and thunderstorms in the eastern portions of the state in early and mid-May.

All reservoir levels remain well below capacity, except for those at Navajo, El Vado, and Costilla, where levels are around 60 percent of maximum storage. Despite the low levels, most reservoirs are higher than at this time last year. According to Dan Williams of New Mexico State Parks, levels are expected to decrease beginning in mid-July, as more water is drawn from the reservoirs for agriculture (*Santa Fe New Mexican,* June 9, 2004). Towns discussing or implementing conservation plans include Mesilla, Otis, and Reserve. According to the *Las Cruces Sun-News* (June 8 and 10, 2004), Mesilla is practicing water conservation efforts, as some residents near town are experiencing either intermittent or no water supply from their wells. Reserve and surrounding areas are performing analyses of the regional water resources and developing plans to help alleviate future supply issues (*Silver City Daily Press,* June 9, 2004). The *Carlsbad Current-Argus* (June 9, 2004) reports that water supplies in the Otis Water Cooperative are dangerously low due to the current drought and excessive water use. Officials continue to ask residents to conserve water.

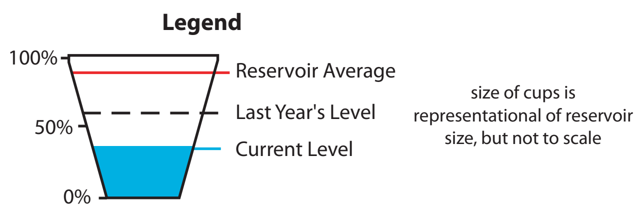
Notes:

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).

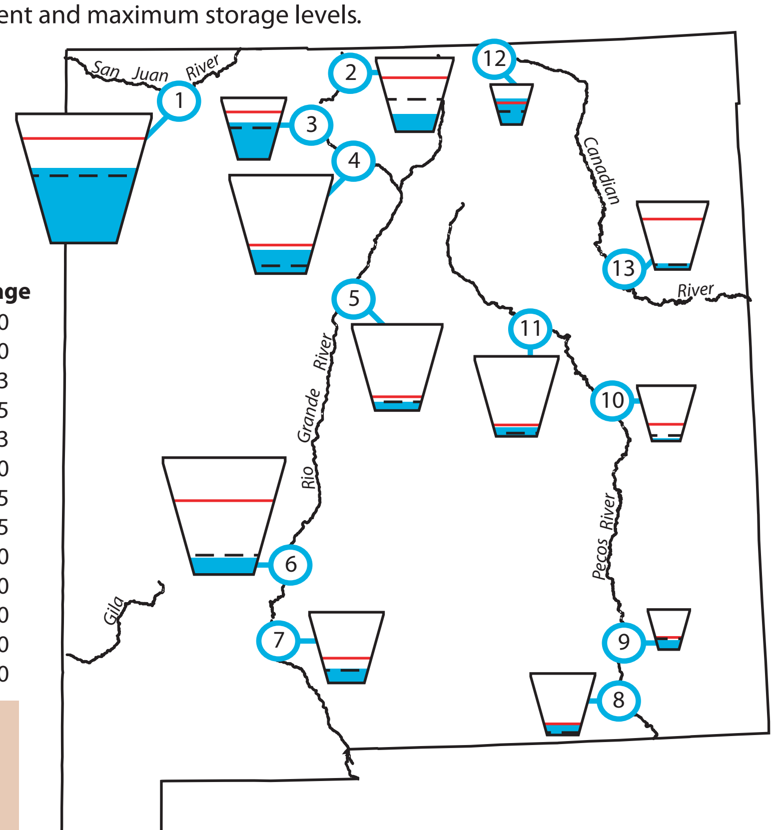
The table details more exactly the current capacity level (listed as a percent of maximum storage). Current and maximum storage levels are given in thousands of acre-feet for each reservoir.

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 May 2004 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	58%	984.4	1,696.0
2. Heron	24%	97.2	400.0
3. El Vado	60%	111.0	186.3
4. Abiquiu	24%	135.1	554.5
5. Cochiti	10%	51.2	502.3
6. Elephant Butte	15%	315.7	2,065.0
7. Caballo	20%	66.9	331.5
8. Brantley	17%	25.4	147.5
9. Lake Avalon	23%	1.4	6.0
10. Sumner	5%	5.4	102.0
11. Santa Rosa	11%	47.0	447.0
12. Costilla	65%	10.4	16.0
13. Conchas	9%	23.7	254.0



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

Temperature Outlook
(July–December 2004)
Source: NOAA Climate Prediction Center

According to the NOAA-CPC temperature outlooks, the Southwest has increased chances of above-average temperatures for the July through September (Figure 7a) and August through October (Figure 7b) time frames, based on long-term trends supported by statistical forecasts. The forecasts for September through November (Figure 7c) and October through December (Figure 7d) do not show as strong of an increased probability for above-average temperatures, with northwestern Arizona and all but southwestern New Mexico being classified as equal chances. The International Research Institute (IRI) for Climate Prediction temperature forecasts (not shown) are very similar for the first two periods before diverging slightly. The products from IRI indicate higher probabilities for above-average temperatures for September through November and a slightly larger area of Arizona covered for October through December.

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 7a. Long-lead national temperature forecast for July–September 2004.

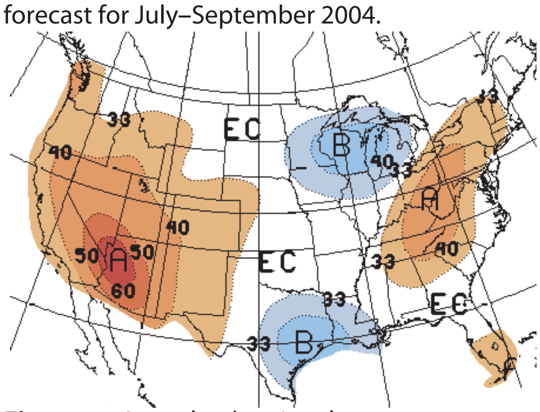


Figure 7b. Long-lead national temperature forecast for August–October 2004.

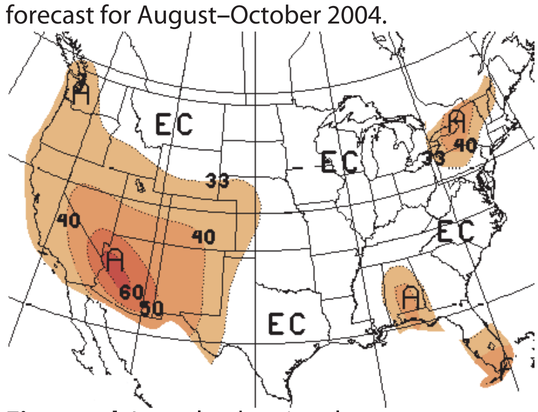


Figure 7c. Long-lead national temperature forecast for September–November 2004.

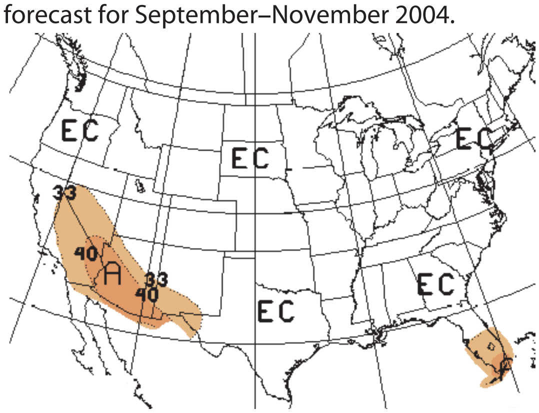
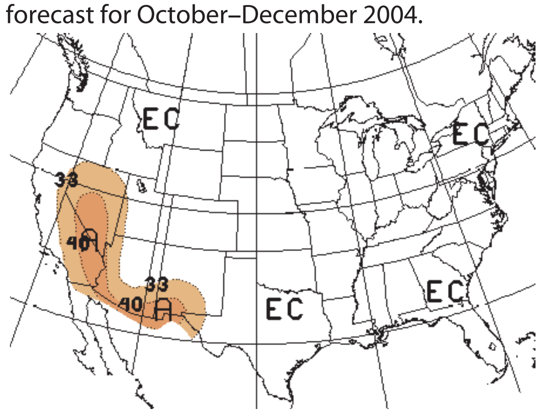


Figure 7d. Long-lead national temperature forecast for October–December 2004.



A= Above
- >60.0%
- 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

(July–December 2004)

Source: NOAA Climate Prediction Center

The NOAA-CPC precipitation outlook withholds judgment for Arizona and New Mexico from July through December. A similar pattern is forecasted by the International Research Institute for Climate Prediction for this period (not shown). Given the difficulty in forecasting precipitation even a week in advance in the Southwest during the summer, especially location of the precipitation, the "equal chances" prediction for the region is not surprising. Ongoing and future research at the University of Arizona, other universities, and government agencies, as well as between these groups, will attempt to improve the reliability and accuracy of these long-range forecasts. The increased chances for below-normal precipitation in the Pacific Northwest and in the northern Great Basin are based on statistical forecasts.

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 8a. Long-lead national precipitation forecast for July–September 2004.

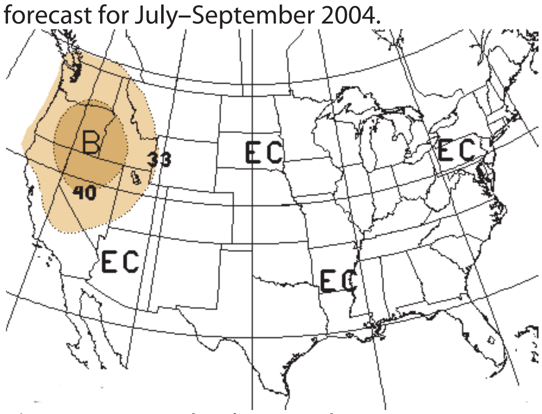


Figure 8b. Long-lead national precipitation forecast for August–October 2004.

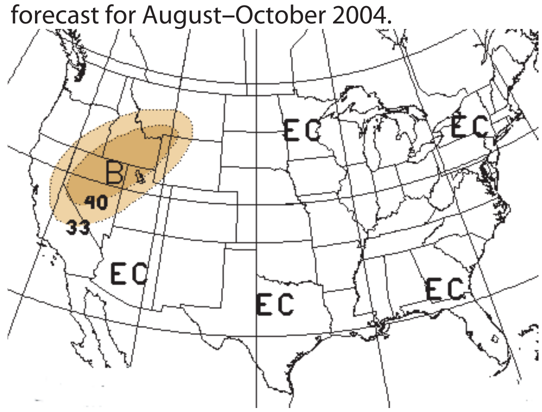


Figure 8c. Long-lead national precipitation forecast for September–November 2004.

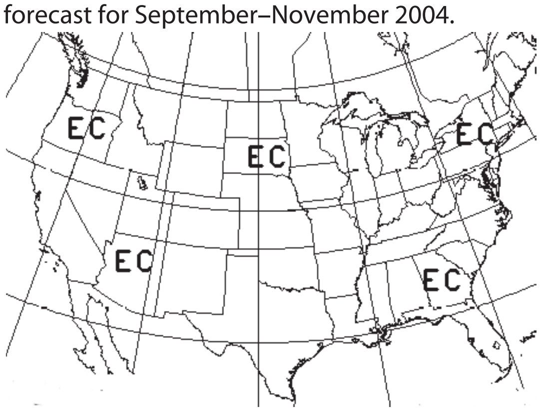
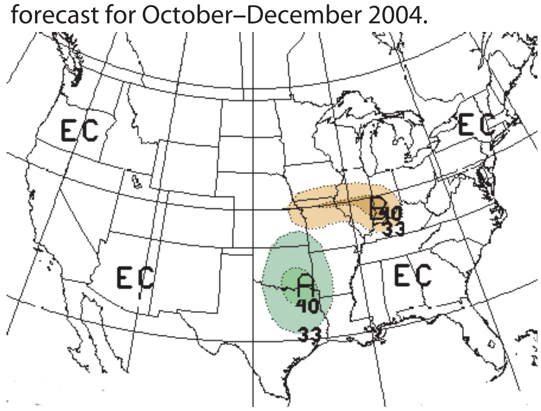
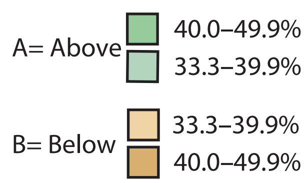


Figure 8d. Long-lead national precipitation forecast for October–December 2004.





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/

Seasonal Drought Outlook
(through September 2004)

Sources: NOAA Climate Prediction Center

The seasonal drought outlook (Figure 9) predicts that drought conditions in northern and western Arizona and northwestern New Mexico will continue through September. Possible improvement is in store for southern Arizona and much of New Mexico. Drought outlook authors anticipate that the best chance for improvement will be during the monsoon, although forecasts do not indicate increased chances of either above-average or below-average precipitation through September (Figure 8a).

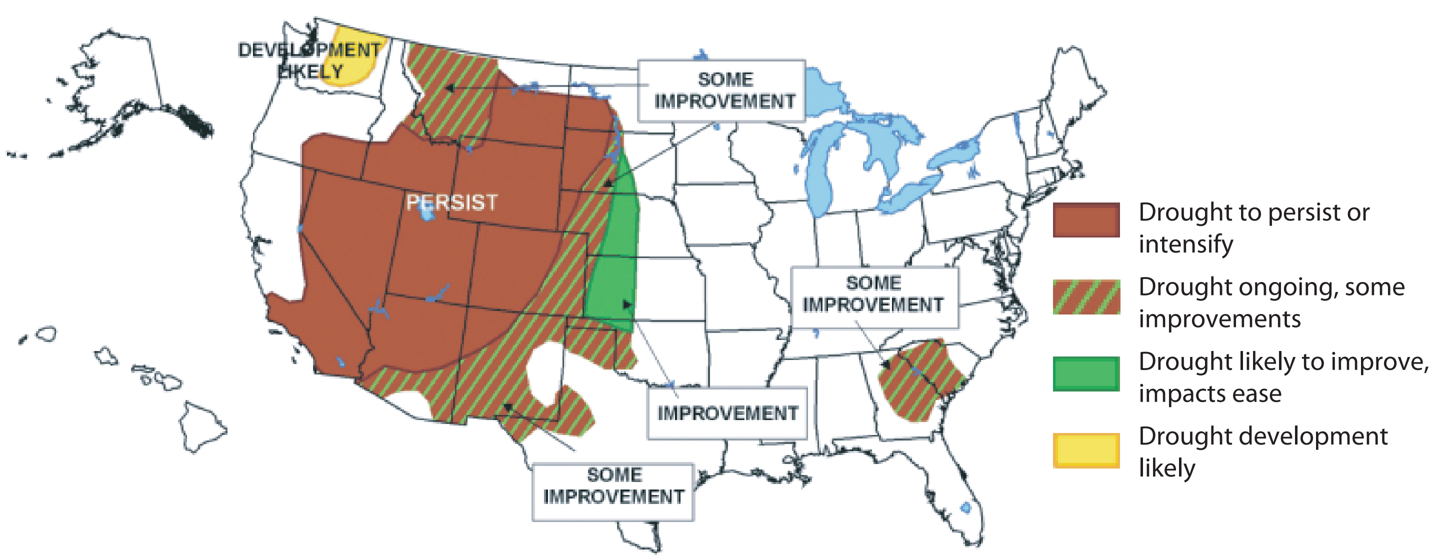
The monsoon lasts from early July through mid-September on average and can supply more than half the annual rainfall for the southern portions of the Southwest. Even with the increased summer precipitation, relief will be chiefly short-term. Relief from the long-term drought conditions may not occur until the next snow season at the earliest. Precipitation that falls during the monsoon tends to be very localized and intense. Much of the water runs off the land and into river channels or arroyos instead of infiltrating the ground, and summer precipitation is subject to very high evaporation rates.

In addition to effects on water supply, drought also impacts "interstate water compacts"—that is, arrangements between adjacent states regarding streams that flow in both states. The *Albuquerque Tribune* (June 16, 2004) reports that this could be a concern between New Mexico and Texas. Given the current drought conditions and predictions that drought will continue, New Mexico may have difficulty reaching the water delivery requirements to Texas on the Rio Grande. Kevin Bean, a volunteer with the Middle Rio Grande Water Assembly, says that this could lead to a "priority call." In a priority call situation, obligations to the interstate water compact have higher priority than water uses of in-state junior water-right holders, such as some irrigators. Stay tuned for more information as this situation develops in the coming months.

Notes:

The delineated areas in the Seasonal Drought Outlook (Figure 9) are defined subjectively and are based on expert assessment of numerous indicators, including outputs of short- and long-term forecasting models.

Figure 9. Seasonal drought outlook through September 2004 (release date June 17, 2004).



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

Wildland Fire Outlook

Sources: National Interagency Coordination Center, Southwest Coordination Center

The area of above-normal fire potential in the Southwest has increased substantially over the past month as a result of below-average precipitation and above-average temperatures in the region. The national map now includes all of Arizona, much of New Mexico and Utah, and portions of Colorado in this category (Figure 10a). Increased precipitation in some other areas of the West and around the Great Lakes has decreased fire potential. Figure 10b shows a close-up view of the Southwest. Virtually all of Arizona, western and northern New Mexico, and the mountains of central New Mexico have been placed in the above-normal, i.e. critical fire danger, category. According to the National Interagency Coordination Center, Arizona, New Mexico, and west Texas have reported that total fires and total acres burned are approximately half of the historical average through the end of May. Arizona and western New Mexico are also under preparedness level 3, which means that an increase in large fires is expected and additional firefighting resources are being ordered. Many federal and tribal lands are therefore under strict fire restrictions.

Large fires within the past month include the Three Forks Fire in the Apache-Sitgreaves National Forest in Arizona and three in New Mexico—the Peppin Fire in the Capitan Mountains, the Lookout Fire in the Gallinas Mountains, and the Sedgwick Fire in Cibola National Forest.

Notes:

The National Interagency Coordination Center at the National Interagency Fire Center produces monthly (Figure 10a) wildland fire outlooks. These forecasts consider climate forecasts and surface-fuels conditions in order to assess potential for fires greater than 100 acres, i.e., fires that will demand significant firefighting resources. They are subjective assessments, based on synthesis of regional fire danger outlooks. The Southwest Coordination Center (SWCC) produces more detailed daily and weekly (not pictured), as well as monthly (Figure 10b) subjective assessments of fire potential for Arizona, New Mexico, and west Texas. SWCC monthly fire outlooks, which include fuel condition and fire statistics, as well as a substantial written summary to accompany Figure 10b, are released by the 30th of each month at the website listed below.

Figure 10a. National wildland fire potential for fires greater than 100 acres (valid June 1–30, 2004).

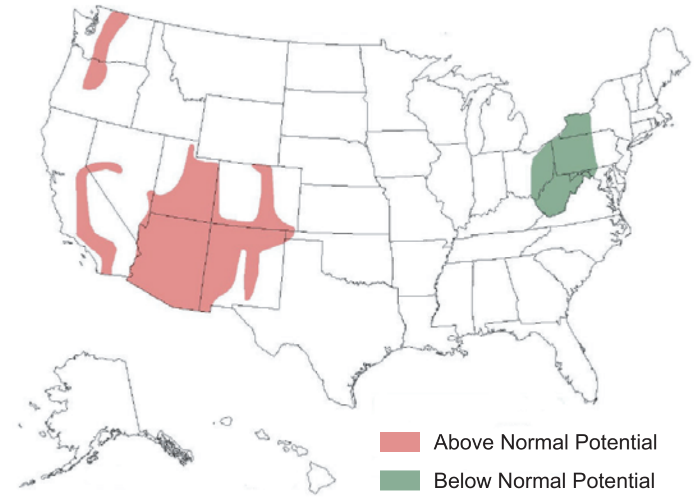
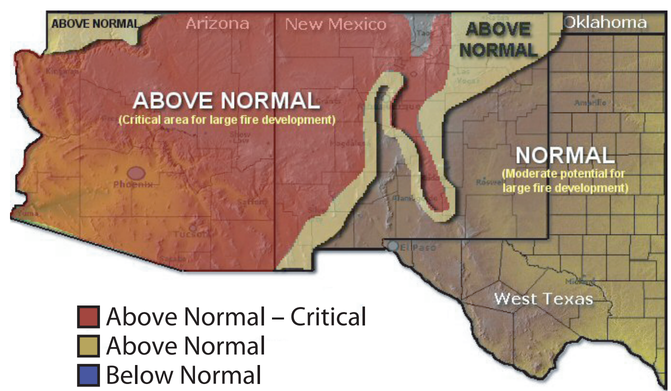


Figure 10b. Southwest potential for fires greater than 100 acres (valid June 1–30, 2004).



On the Web:

For more detailed discussions, visit:

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

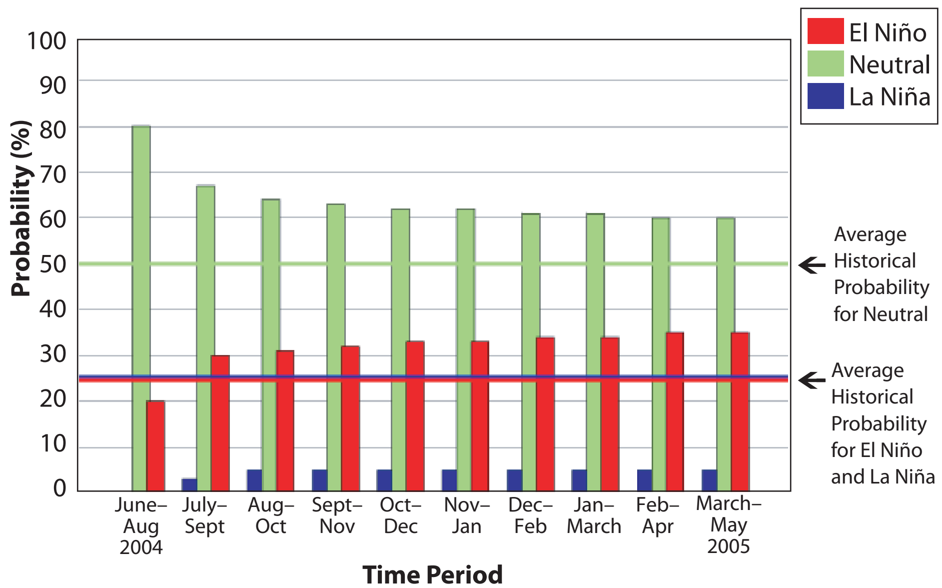
Southwest Area Wildland Fire Operations
http://www.fs.fed.us/r3/fire/swapredictive/swaoutlooks/monthly/swa_monthly.htm

El Niño Status and Forecast

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

Overall conditions in the El Niño-sensitive regions of the equatorial and tropical Pacific Ocean remain near neutral. According to the IRI, the latest observations and forecasts indicate it is likely that near-neutral, but slightly warmer than average, conditions will prevail through the rest of 2004. For the rest of the year, the likelihood of the development of El Niño (usually wet Southwest winters) is greater than the climatological likelihood, but it is still well below 50 percent. The probability of the development of La Niña conditions (reliably dry Southwest winters) is less than average. According to the NOAA Climate Prediction Center (CPC), it is likely that neutral conditions will continue for the next three months (through August 2004). The CPC cautions that there is considerable uncertainty about what will happen after August 2004. The Southwest is frequently drier than average during winters with neutral conditions in the Pacific Ocean.

Figure 11. IRI probalistic ENSO forecast for El Niño 3.4 monitoring region (released June 17, 2004).



Notes:

Figure 11 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, neutral, La Niña. El Niño conditions are defined as the warmest 25 percent of Niño 3.4 sea-surface temperatures (SSTs) during the three month period in question; La Niña conditions are the coolest 25 percent of Niño 3.4 SSTs, and neutral conditions are SSTs that 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. Only models that produce a new ENSO forecast every month are included in the assessment. The forecast takes into account the indications of the individual forecast models (including expert knowledge of model skill and how that skill varies seasonally), an average of the models, and additional factors such as the very latest observations.

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 figure above, visit: http://iri.columbia.edu/climate/ENSO/

Temperature Verification
(March–May 2004)

Source: NOAA Climate Prediction Center

Temperatures over much of the continental United States were warmer than average from March through May (Figure 12b). The NOAA-CPC forecast for this period made no prediction for the swath of warmer than average temperatures observed from the Pacific Northwest into the southern Great Plains and over much of the eastern half of the country. The prediction for increased chances of below-average temperatures in the northern Great Plains (Figure 12a) were somewhat displaced, as slightly cooler temperatures actually extended into the western Great Lakes region. Below-average temperatures occurred along much of the Rio Grande valley in Texas, while the forecast called for increased chances of warmer temperatures. Predictions for increased chances of above-average temperatures across the West and Southwest were well captured.

Figure 12a. Long-lead U.S. temperature forecast for March–May 2004 (issued February 2004).

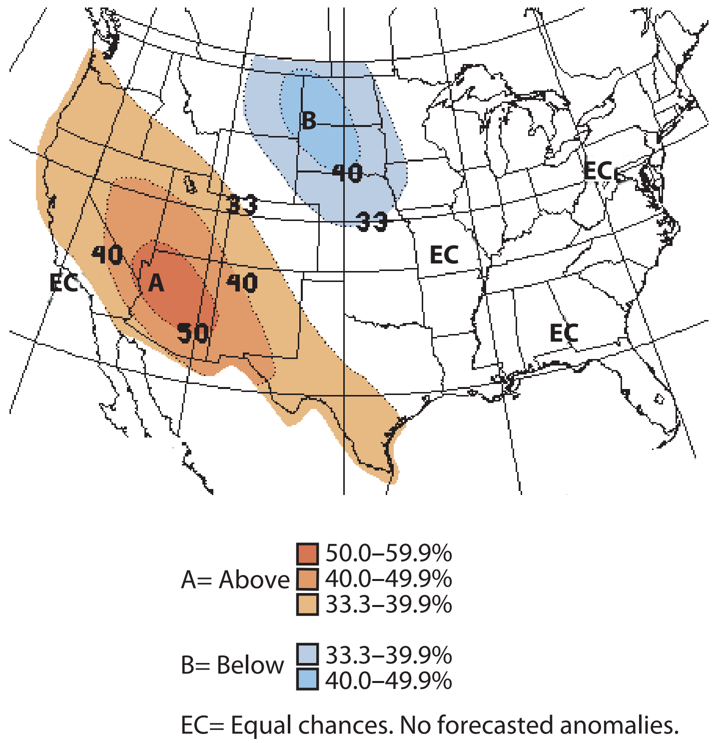
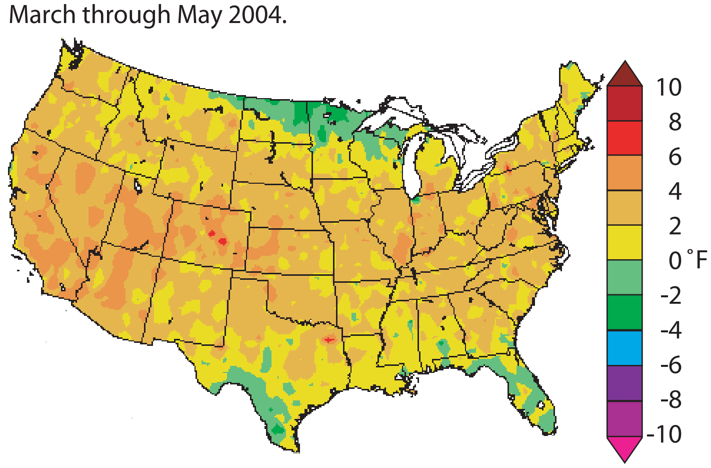


Figure 12b. Average temperature departure (in degrees F) for March through May 2004.



Notes:

Figure 12a shows the NOAA Climate Prediction Center (CPC) temperature outlook for the months March–May 2004. This forecast was made in February 2004.

The March–May 2004 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 12b shows the observed departure of temperature (°F) from the average for March–May 2004.

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

Precipitation Verification
(March–May 2004)

Source: NOAA Climate Prediction Center

The Great Lakes region and Ohio River valley exhibited above-average precipitation over the past three months, while the dry conditions worsened along the central California coast. Other areas experiencing below-average precipitation were the northern half of Arizona and much of northern and extreme southwestern New Mexico. The NOAA-CPC precipitation forecasts for March through May (Figure 13a) for increased chances of below-average precipitation were generally well placed over central California and much of Florida, although more of the southeastern United States was very dry. Predictions of above-average precipitation around the Great Lakes, Ohio River valley, and from the California-Arizona border to the central Texas Gulf Coast were not made. Likewise, the below-average precipitation in northern Arizona and portions of New Mexico were not indicated.

Figure 13a. Long-lead U.S. precipitation forecast for March–May 2004 (issued February 2004).

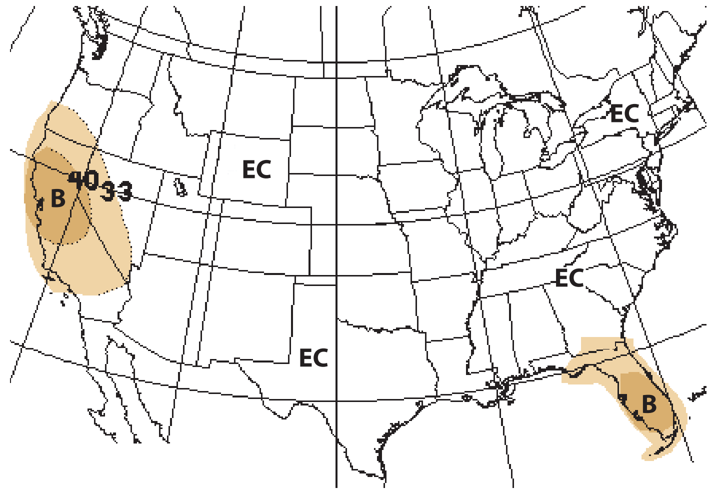
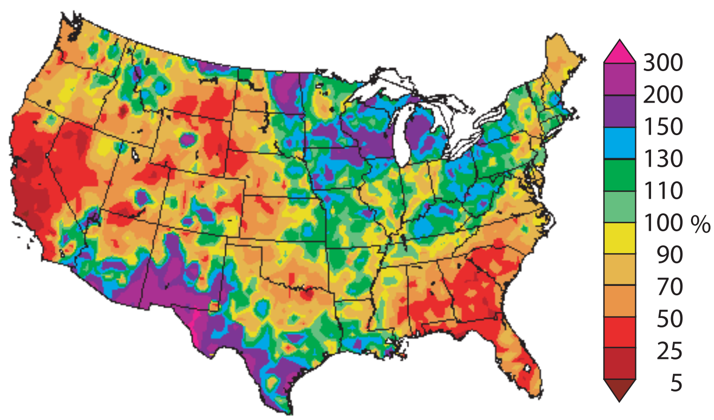


Figure 13b. Percent of average precipitation observed from March to May 2004.



Notes:

Figure 13a shows the NOAA Climate Prediction Center (CPC) precipitation outlook for the months March–May 2004. This forecast was made in February 2004.

The March–May 2004 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 13b shows the observed percent of average precipitation observed March–May 2004.

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

Arizona Drought Data Website

Source: National Weather Service, Phoenix

The National Weather Service's Arizona Drought Data site was designed to help decision makers monitor drought at individual locations. The main page includes a summary table ("ALL DATA") with total, percent of normal, and departure from normal precipitation for 83 Arizona stations (Figure 14a). Links at the top of the page lead to tables of observed and normal precipitation for the specified year (Figure 14b). Selecting a station name from the summary table produces a bar graph comparing yearly precipitation to normal for that location (Figure 14c).

The figures below highlight the types of information the site provides for an individual location—McNary, in north-central Arizona's Mogollon Rim. While McNary has the highest normal precipitation (28.46 in.) in Arizona, the station has not received a single year of above-normal precipitation during the past 8 years (Figure 14c). Delving deeper into the website reveals that since 1996 only 5 of the 83 Arizona stations have recorded above-normal total precipitation. Since 1996, Flagstaff Airport, which normally receives 22.91 in./yr. has accumulated a 53.45 in. precipitation deficit—the highest in the state. In only one year between 1996–2003, (i.e., 1998) did a majority of the stations (69 percent) receive above-normal annual precipitation.

Notes:

The website presents data for 83 stations in Arizona that have provided uninterrupted reliable data since 12/31/95. Stations used in this product are either National Weather Service (NWS) Cooperative Observer sites or NWS/Federal Aviation Authority first order stations. All climate data on these web pages should be considered "unofficial" and experimental.

All data values are presented in inches. Annual values represent calendar year (January–December) precipitation totals. "Normal" refers to the 1971–2000 average, as provided by the National Climatic Data Center. Precipitation values are usually updated on the 15th of the month. For example, total precipitation through May would be updated by June 15.

The term "departure" refers to the value in question minus normal. For example, "total departure since 12/31/95" refers to the total precipitation since that date minus the expected normal precipitation since that date. Data on the website are color coded, with above-normal values in blue, below-normal values in red, and current year data in green.

The website has a help screen (accessed via the main page) with a glossary of terms used. These terms can also be accessed by clicking on the column headings in the tables.

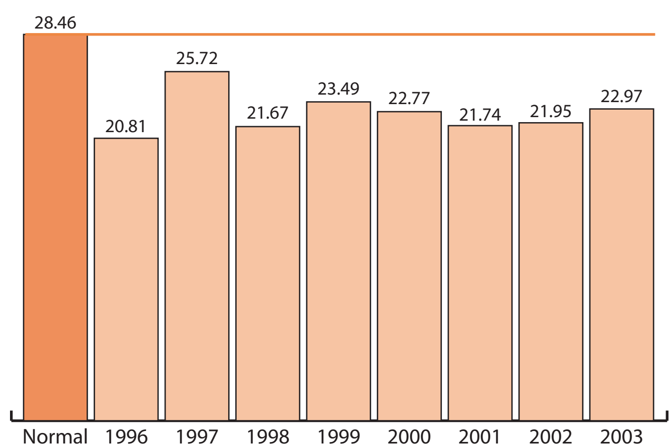
Figure 14a. Drought conditions for a sample of stations. Precipitation totals and departures are expressed in inches.

Station	Climate Division	Precipitation since 12/31/95	Percent Normal Precipitation since 12/31/95	Total Departure Since 12/31/95	Percent Normal Precipitation since 12/31/98	Total Departure Since 12/31/98
Flagstaff Airport	2	139.28	72%	-53.45	67%	-40.36
McNary 2N	2	188.36	79%	-49.84	79%	-32.66
Monument Valley	2	39.10	116%	5.29	99%	-0.15
Phoenix Airport	6	54.42	78%	-14.98	78%	-9.67
Tucson Airport	7	85.92	85%	-14.64	80%	-12.81

Figure 14b. 2004 observed monthly, normal, and year-to-date (YTD) precipitation (inches) for a sample of Arizona stations.

	Station	Jan	Feb	Mar	Apr	May	YTD
Normals	Flagstaff Airport	2.18	2.56	2.62	1.29	0.80	9.45
Observed		0.76	1.06	0.74	1.81	0.00	4.37
Normals	McNary 2N	2.79	2.47	3.07	1.32	0.87	10.52
Observed		1.45	2.02	1.90	1.87	0.00	7.24
Normals	Monument Valley	0.20	0.07	0.17	0.27	0.38	1.09
Observed		0.50	0.20	trace	0.25	0.00	0.95
Normals	Phoenix Airport	0.83	0.77	1.07	0.25	0.16	3.08
Observed		0.82	1.02	1.28	0.90	0.00	4.02
Normals	Tucson Airport	0.99	0.88	0.81	0.28	0.24	3.20
Observed		0.79	0.45	1.13	1.05	0.00	3.42

Figure 14c. Annual precipitation (inches) for McNary, Arizona, 1996–2003. "Normal" refers to 1971-2000 average precipitation.



On the Web:

The NWS Arizona Drought Data page can be found at: http://www.wrh.noaa.gov/cgi-bin/Phoenix/DroughtPage.pl?data=ALLDATA