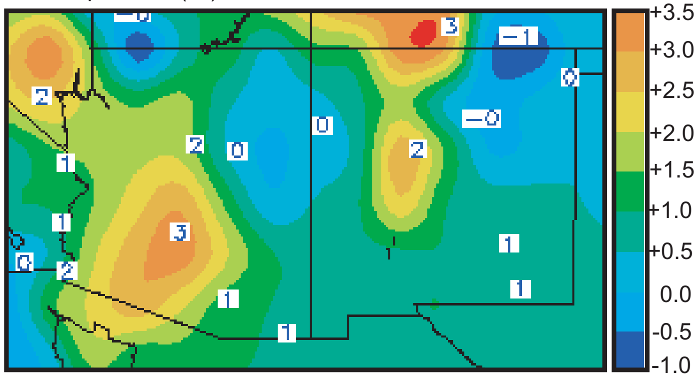
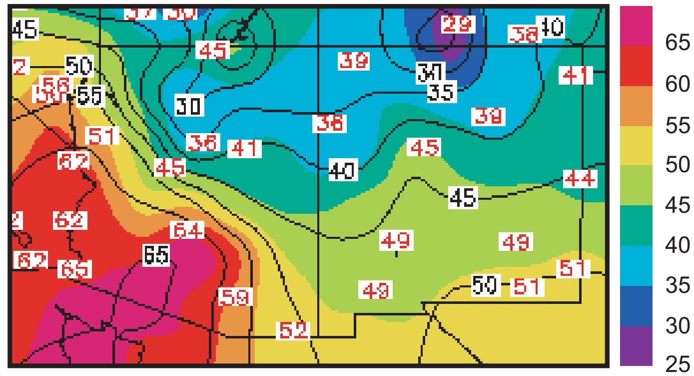
1. Recent Conditions: Temperature (up to 03/22/03) Source: Western Regional Climate Center

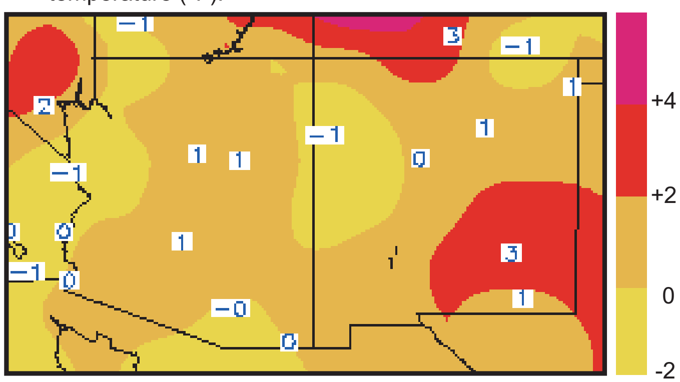
1a. Water year '02-'03 (through 03/22) departure from average temperature (°F).



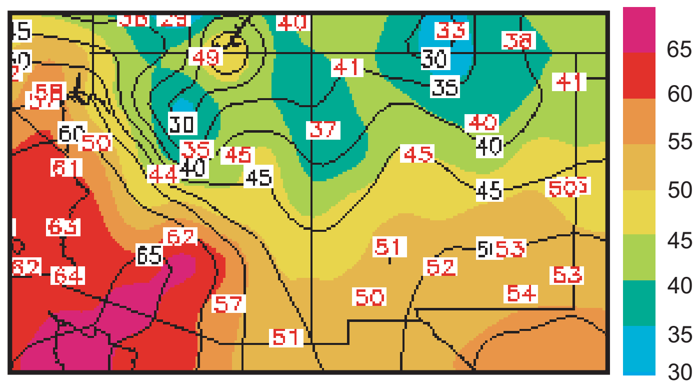
1b. Water year '02-'03 (through 03/22) average temperature (°F).



1c. Previous 28 days (02/23 - 03/22) departure from average temperature (°F).



1d. Previous 28 days (02/23 - 03/22) average temperature (°F).



Highlights: Storms passing through our region in mid-and-late-February and mid-March interrupted the above-average temperatures that have characterized the water year for much of our region (Figure 1a). Much of the above-average temperatures can be attributed to increased minimum temperatures in central Arizona and central and southeastern New Mexico. The previous 28 days temperatures in Arizona and New Mexico have been close to average (Figure 1c), with the exception of southeastern New Mexico. This is a large change from February, when both Arizona and New Mexico were several degrees warmer than average. During the previous 28 days, minimum temperatures over the region were above average, probably due to long-term upward temperature trends and increased cloud cover during storm episodes.

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

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

Notes:

The Water Year begins on October 1 and ends on September 30 of the following year. As of October 1, we are in the 2003 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 arithmetic mean of annual data from 1971-2000.

The data are in degrees Fahrenheit (°F).

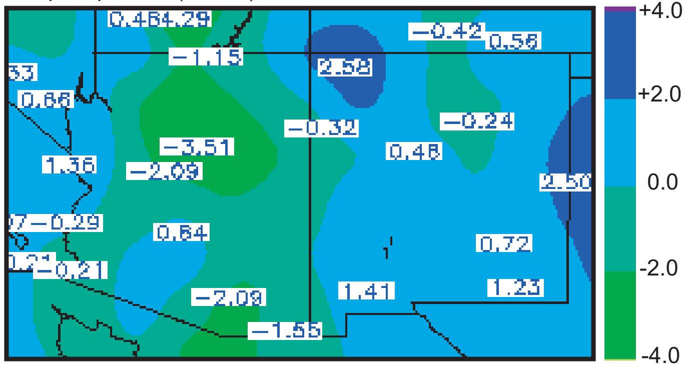
Departure from average temperature is calculated by subtracting current data from the average and can be positive or negative.

These maps are derived by taking measurements at meteorological stations (at airports) and estimating a continuous map surface based on the values of the measurements and a mathematical algorithm. This process of estimation is also called spatial interpolation.

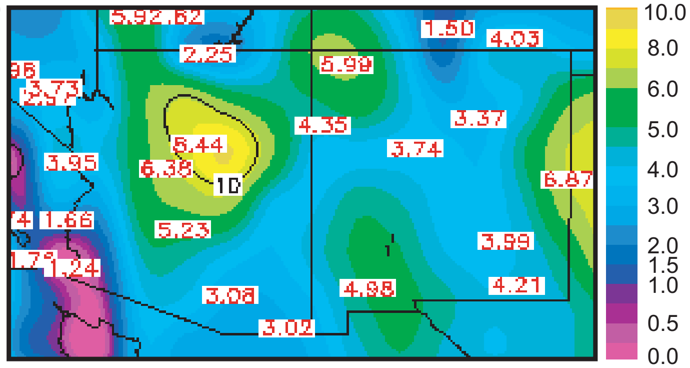
The red and blue numbers shown on the maps represent individual stations. The contour lines and black numbers show average temperatures.

2. Recent Conditions: Precipitation (up to 03/22/03) Source: Western Regional Climate Center

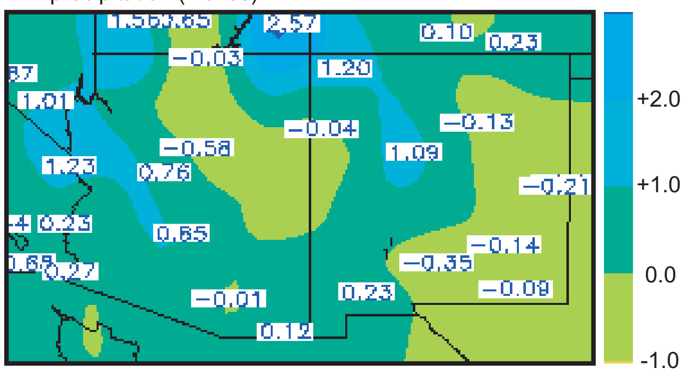
2a. Water year '02-'03 (through 03/22) departure from average precipitation (inches).



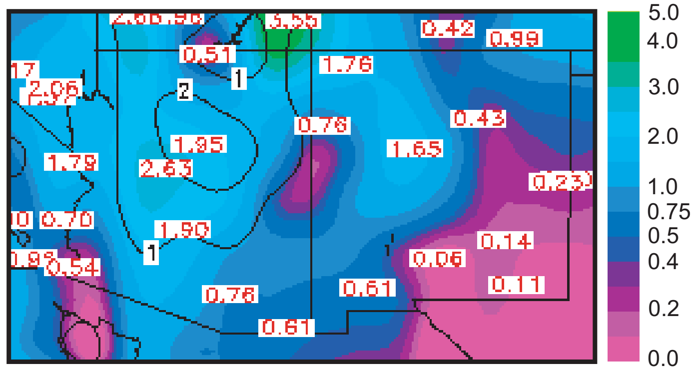
2b. Water year '02-'03 (through 03/22) total precipitation (inches).



2c. Previous 28 days (02/23 - 03/22) departure from average precipitation (inches).



2d. Previous 28 days (02/23 - 03/22) total precipitation (inches).



Highlights: Most of New Mexico and parts of western and central Arizona have received above-average precipitation since October 1, 2002 (Figure 2a). Water-year precipitation for northern and southern Arizona, however, has been below average. During the past 28 days much of our region has received above-average precipitation (Figure 2c), which is especially notable in western/central Arizona and western/southern New Mexico. High-elevation locations in Arizona and New Mexico received some snow during mid-February through mid-March (see page 8).

In Arizona, reports of spring wildflower blooms across low elevation areas in the Sonoran Desert demonstrate, in part, the effect of this late winter precipitation.

For these and other precipitation maps, visit: http://www.wrcc.dri.edu/recent_climate.html

For National Climatic Data Center monthly and weekly precipitation and drought reports for Arizona, New Mexico and the Southwest region, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/2002/perspectives.html

Notes:

The Water Year begins on October 1 and ends on September 30 of the following year. As of October 1, we are in the 2003 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.

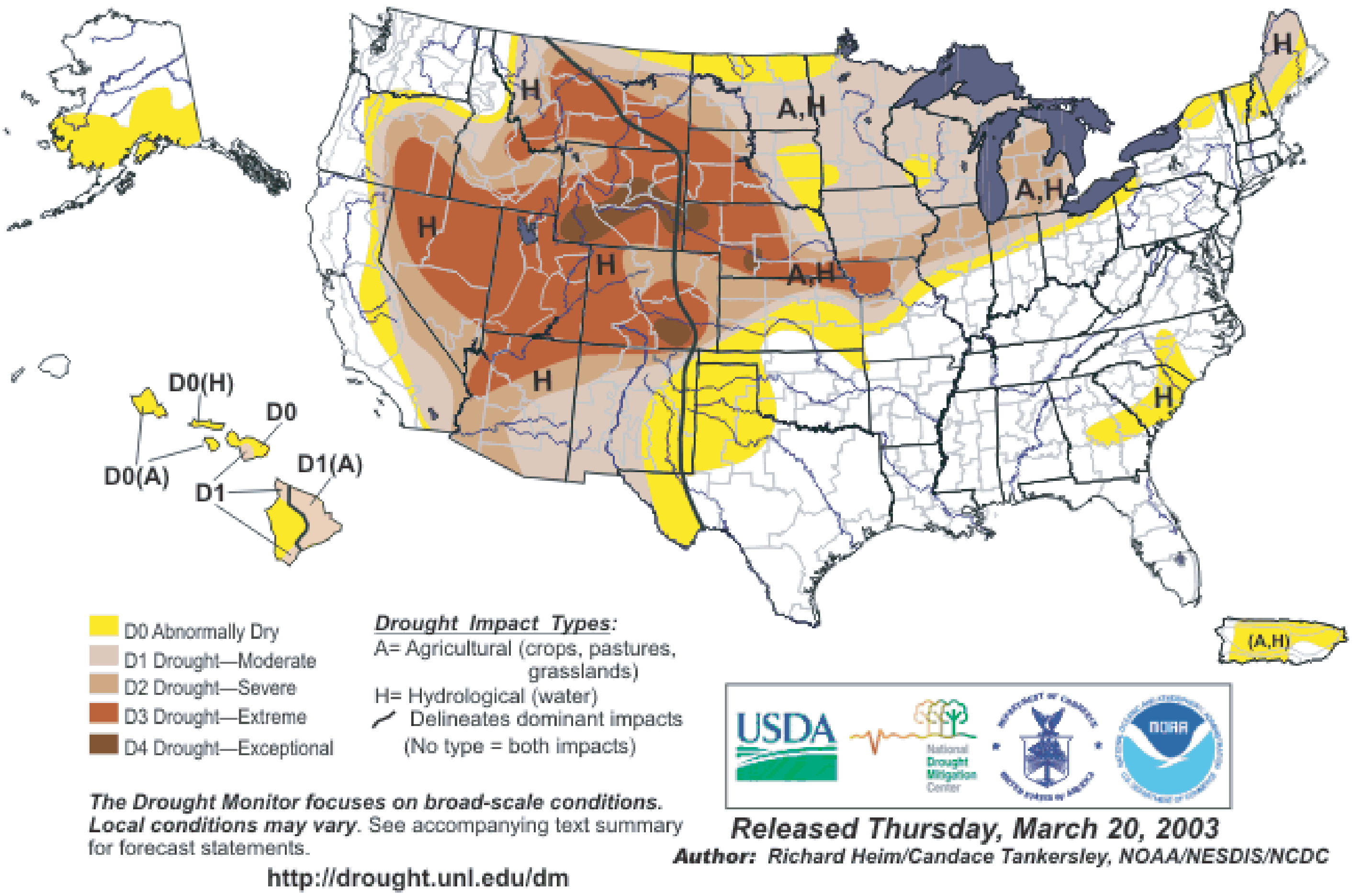
The data are in inches of precipitation. **Note: The scales for Figures 2b & 2d are non-linear.**

Departure from average precipitation is calculated by subtracting current data from the average and can be positive or negative.

These maps are derived by taking measurements at meteorological stations (at airports) and estimating a continuous map surface based on the values of the measurements and a mathematical algorithm. This process of estimation is also called spatial interpolation.

The red and blue numbers shown on the maps represent individual stations. The contour lines and black numbers show average precipitation.

3. U.S. Drought Monitor (updated 03/18/03) ♦ Source: USDA, NDMC, NOAA



Notes:

The U.S. Drought Monitor is released weekly (every Thursday) and represents data collected through the previous Tuesday. This monitor was released on 03/20 and is based on data collected through 03/18 (as indicated in the title).

The best way to monitor drought trends is to pay a weekly visit to the U.S. Drought Monitor website (see left and below).

The U.S. Drought Monitor maps are based on expert assessment of variables including (but not limited to) PDSI, soil moisture, stream flow, precipitation, and measures of vegetation stress, as well as reports of drought impacts.

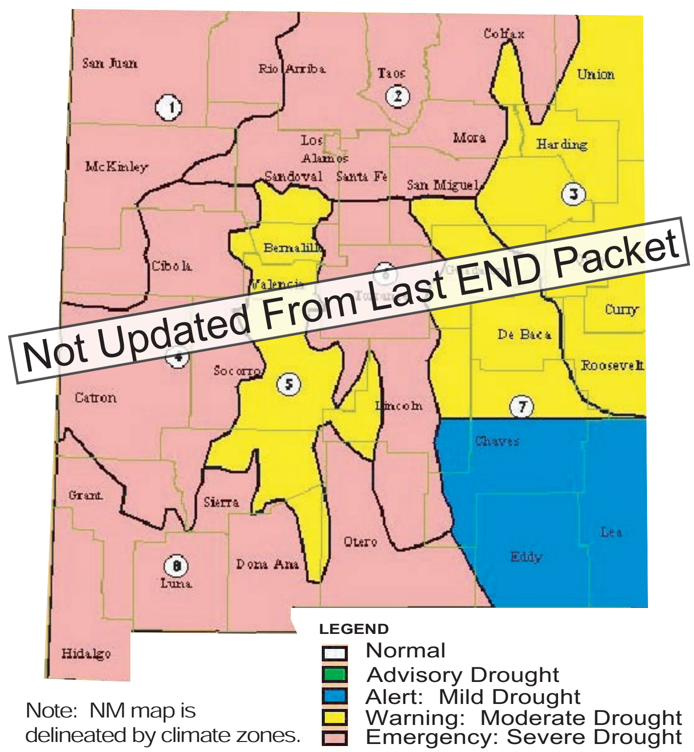
Highlights: Although extreme to exceptional drought continues over parts of the West, during the past month drought conditions eased somewhat for Arizona and remained virtually unchanged in New Mexico. Areas of moderate drought status in Arizona and New Mexico are due to deficient groundwater levels. Short-term drought eased, especially in western Arizona, with winter season coolness and recent rain and snowfall. Winter precipitation in February and March at many mountain locations in both states was above average, leading to an improvement in both short-term drought and snowpack conditions (see page 8). However, despite mid-March precipitation many times greater than the weekly long-term average in some places, precipitation amounts have not been enough to overcome several years of deficits. Hence, hydrological drought is still a concern of resource managers in Arizona and New Mexico. In addition, severe to exceptional drought conditions persist in Mexico, south of the Arizona and New Mexico borders (see page 18).

Animations of the current and past weekly drought monitor maps can be viewed at: http://www.drought.unl.edu/dm/monitor.html

4. Drought: Recent Drought Status for New Mexico (updated 02/20/03) ♦ Source: New Mexico NRCS

New Mexico Drought Map

Drought Status as of February 20, 2003



Source: NM Natural Resources Conservation Service (2003)

Notes: The New Mexico drought status map, provided by the New Mexico Natural Resource Conservation Service, indicates current drought status. As of March 25, 2003, the New Mexico Drought Planning Team has not updated the map. They have retained the September 2002 drought status map, due chiefly to concerns about how to accurately and adequately represent drought impacts and recovery that range across multiple time scales on a single map. Water supply, streamflow, agriculture, and rangelands respond to drought and precipitation on different time scales. No changes will be made in the New Mexico drought status map until at least April.

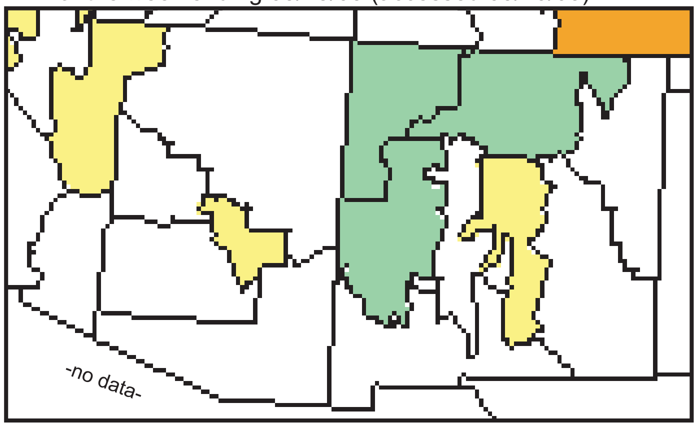
Drought indices, such as PDSI and SPI, indicate short-term drought relief, especially in northern New Mexico. However, streamflow forecasts and reservoir levels give cause for concern about long-term (hydrological) drought. Snowpack is below average at many sites across New Mexico, especially in southwestern New Mexico; above-average levels are located chiefly in northeastern New Mexico. Rangeland recovery from drought is of particular concern in southwestern New Mexico.

On January 13, 2003 the Arizona Department of Emergency Management (ADEM) released a drought situation report. The report does not contain a detailed map for Arizona. On March 21, 2003 Arizona governor, Janet Napolitano, ordered the creation of the state's first comprehensive drought management plan.

The New Mexico map (http://www.nm.nrcs.usda.gov/drought/drought.htm), currently is produced monthly, but when near-normal conditions exist, it is updated quarterly. Contact Matt Parks at ADEM at (602) 392-7510 for more information on Arizona regional drought declarations and situation reports.

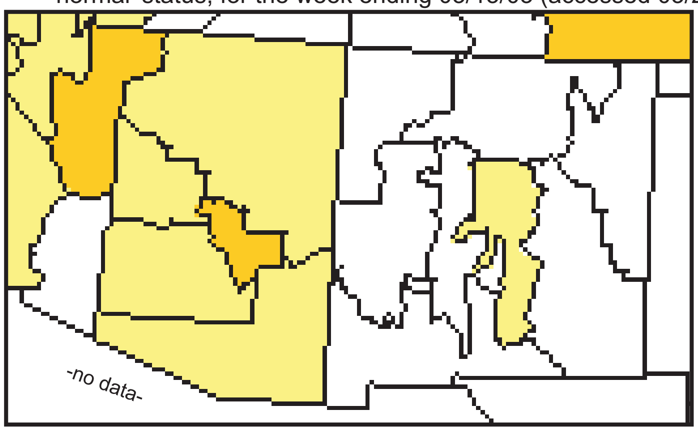
5. PDSI Measures of Recent Conditions (up to 03/15/03) ♦ Source: NOAA Climate Prediction Center

5a. Current weekly Palmer Drought Severity Index (PDSI), for the week ending 03/15/03 (accessed 03/20/03).



- -4.0 to -4.9 (extreme drought)
- -3.0 to -3.9 (severe drought)
- -2.0 to -2.9 (moderate drought)
- -1.9 to +1.9 (near normal)
- +2.0 to +2.9 (unusual moist spell)
- +3.0 to +3.9 (very moist spell)

5b. Precipitation needed to bring current weekly PDSI assessment to 'normal' status, for the week ending 03/15/03 (accessed 03/20).



- Zero inches
- Trace to 3 inches
- 3 to 6 inches
- 6 to 9 inches
- 9 to 12 inches
- 12 to 15 inches
- Over 15 inches

Notes:
The PDSI (Palmer Drought Severity Index) attempts to measure the duration and intensity of long-term conditions that underlie drought.

'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

Arizona and New Mexico are divided into *climate divisions.* Climate data are aggregated and averaged for each division within each state. Note that climate division calculations stop at state boundaries.

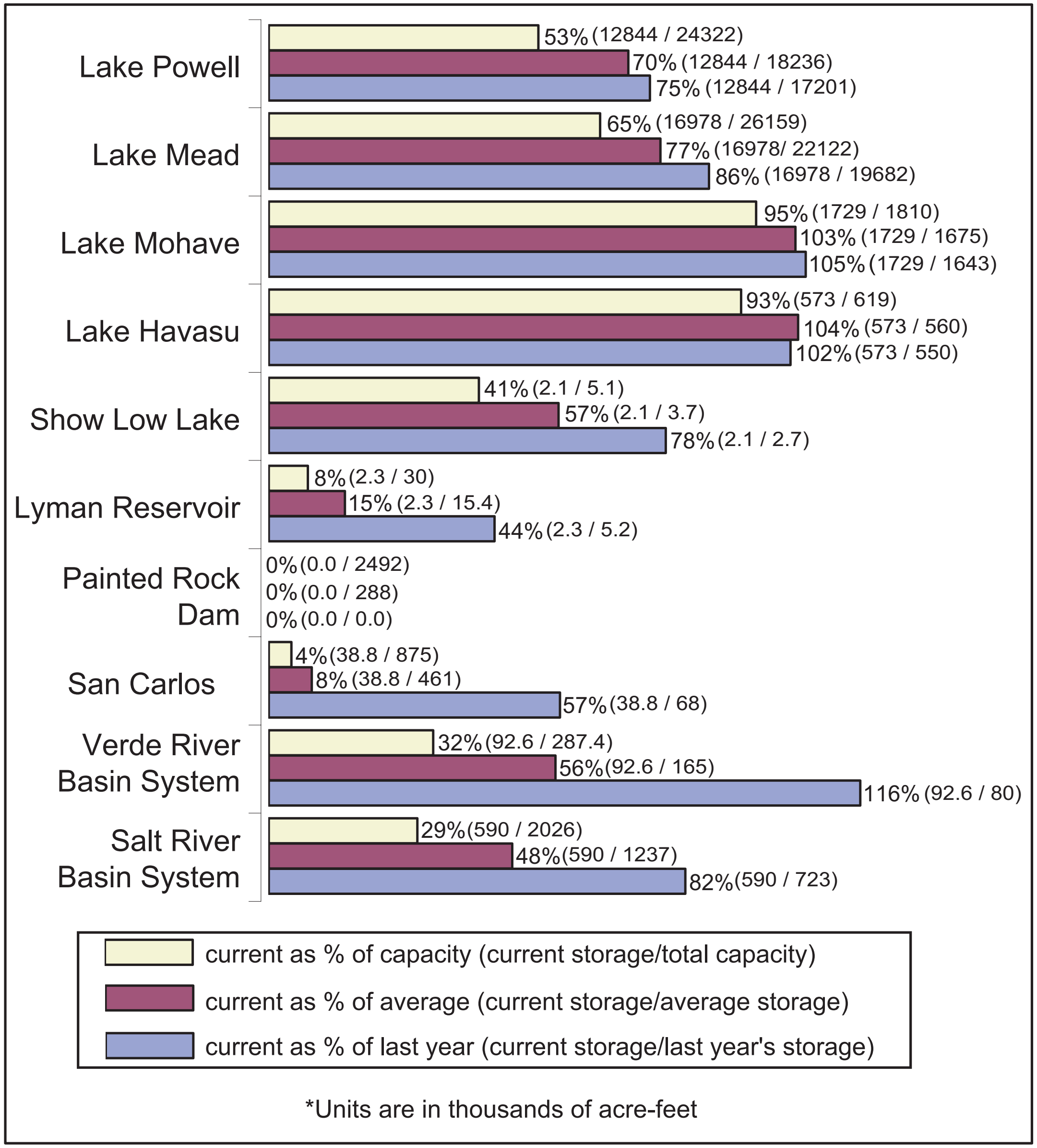
These maps are issued weekly by the NOAA CPC.

Highlights: Winter precipitation has improved short-term drought conditions for almost all of Arizona (*near normal* to *moderate drought*; Figure 5a), compared to February's report. New Mexico PDSI values have pretty much held steady since December 2002, with slightly dry conditions in central New Mexico. Recent storms have led to *unusually moist* conditions in northwestern New Mexico (Figure 5a). Figure 5b shows that in New Mexico amelioration of meteorological drought has continued and in Arizona almost all climate divisions require less precipitation to relieve drought than they did one month ago. However, substantial precipitation and cool temperatures are necessary to relieve long-term hydrologic drought.

For a more technical description of PDSI, visit: http://www.cpc.noaa.gov/products/analysis_monitoring/cdus/palmer_drought/ppdanote.html

For information on drought termination and amelioration, visit: http://lwf.ncdc.noaa.gov/oa/climate/research/drought/background.html

6. Arizona Reservoir Levels (through the end of February 2003) ♦ Source: USDA NRCS



Notes: Reservoir reports are updated monthly and are provided by the National Water and Climate Center (NWCC) of the U.S. Department of Agriculture's Natural Resource Conservation Service (NRCS). Portions of the information provided in this figure can be accessed at the NRCS website:
http://www.wcc.nrcs.usda.gov/water/reservoir/resv_rpt.html

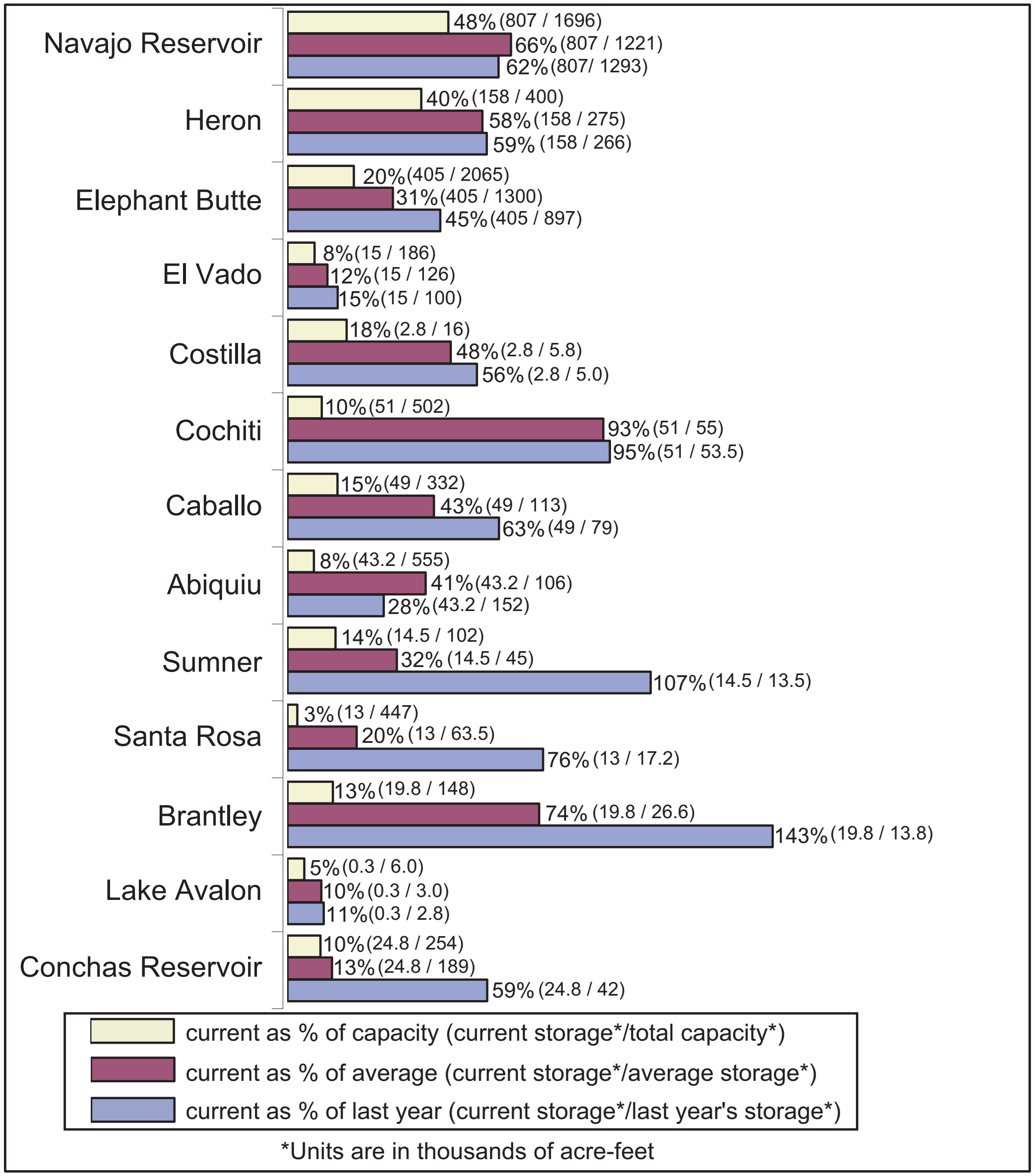
As of 03/18/03, Arizona's report had been updated through the end of February.

For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, NRCS, USDA, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov)

Highlights: Levels in most Arizona reservoirs have mostly held steady or increased slightly since last month and continue to be below average and lower than last year at this time. Reservoir levels in the Verde River Basin have improved by about 10 percent in terms of total capacity since February 2003, due to winter storms that passed through the region in mid and late February. However, federal laws protecting the endangered willow flycatcher have necessitated water transfers along the Verde River, from Horseshoe Lake, which was virtually empty at the beginning of February (currently at about 50% capacity), to Bartlett Lake (*Arizona Republic*, March 21, 2003).

Reservoirs on the lower Colorado River, such as Lake Mohave and Lake Havasu, are near or slightly above average, but Lake Powell is still at its lowest levels since 1973, when the lake was still filling behind Glen Canyon Dam.

7. New Mexico Reservoir Levels (through the end of February 2003) ♦ Source: USDA NRCS



Notes: Reservoir reports are updated monthly and are provided by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resource Conservation Service. Reports can be accessed at their website (http://www.wcc.nrcs.usda.gov/water/reservoir/resv_rpt.html).

As of 03/18/03, New Mexico's report has been updated through the end of February.

For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (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)

Highlights: During the past month, New Mexico reservoir levels have mostly held steady or slightly increased their levels; however most reservoirs are still reporting levels far below average. A few reservoirs in the Rio Grande Basin are higher than last year at this time (i.e., Sumner and Brantley). Lake Avalon is up to 5% of capacity, which is an improvement over its empty state in February.

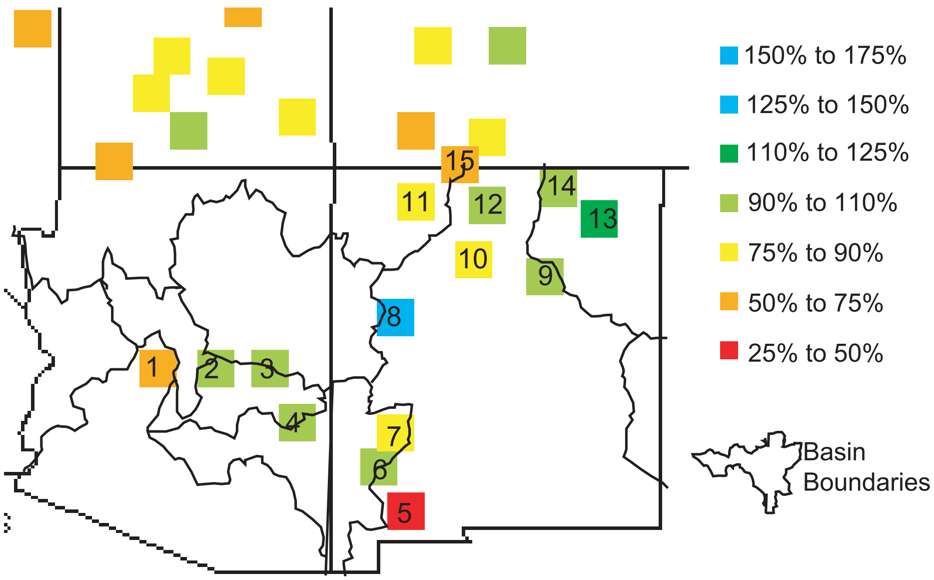
A March 14, 2003 report in the *Santa Fe New Mexican* outlined possible legislative responses that would improve New Mexico's ability to respond to the continued drought. Responses included a measure that would ease restrictions on irrigation districts leasing their water rights to meet municipal demands and a bill that would authorize creation of a statewide water plan.

Albuquerque Mayor Martin Chavez has proposed a plan to bring Colorado River water to Albuquerque, in order to ease damage due to overpumping of the city's groundwater aquifer (*Albuquerque Journal,* February 25, 2003).

In order to help ease drought-related water impacts, Governor Bill Richardson signed into law a bill that allows New Mexico residents to use gray water for irrigation (*Albuquerque Journal*, March 11, 2003).

8. Snowpack in the Southwestern United States (updated 03/20/03) Source: USDA NRCS, WRCC

8. Basin average snow water content (SWC) for available monitoring sites as of 03/20/03 (% of average).



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

Highlights: As of March 20, 2003, snow water content (SWC) is close to or slightly below the 1971-2000 average for the majority of river basins in Arizona and New Mexico. However, SWC varies greatly across the region (Figure 8); the Verde River Basin in Arizona and the Mimbres River Basin in New Mexico are *far below average* for this time of year, whereas the Zuni/Bluewater River Basin and northeastern New Mexico river basins are well above average. Upper Colorado River Basin SWC totals continue to be below average at SNOTEL sites in western Wyoming, Utah, and western Colorado. Recent winter storms have, however, eased concerns about spring runoff conditions in some basins. They also have been a boon to Arizona and New Mexico's winter sports economy. According to a report in the *Arizona Republic* (March 4, 2003), the Arizona Snowbowl (outside of Flagstaff) estimates that the economic impact of winter snow is about $20 million in an average season. Poor snowfall has characterized four of the past seven years.

For color maps of SNOTEL basin SWC, visit: http://www.wrcc.dri.edu/snotelanom/basinswe.html
For a numeric version of the SWC map, visit: http://www.wrcc.dri.edu/snotelanom/basinswen.html
For a list of river basin SWC and precipitation, visit http://www.wrcc.dri.edu/snotelanom/snotelbasin

Notes:

The data shown on this page are from snowpack telemetry (SNOTEL) stations grouped according to river basin. These remote stations sample snow, temperature, precipitation, and other parameters at individual sites.

Snow water content (SWC) and snow water equivalent (SWE) are different terms for the *same* parameter.

The SWC in Figure 8 refers to the snow water content found at selected SNOTEL sites in or near each basin compared to the *average* value for those sites on this day. *Average* refers to the arithmetic mean of annual data from 1971-2000. SWC is the amount of water currently in snow. It depends on the density and consistency of the snow. Wet, heavy snow will produce greater SWC than light, powdery snow.

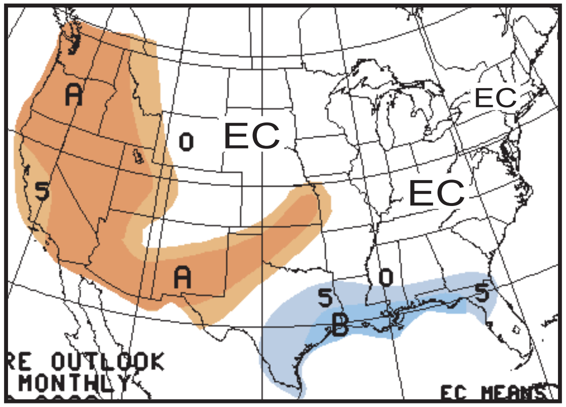
Each box on the map represents a river basin for which SWC data from individual SNOTEL sites have been averaged. Arizona and New Mexico river basins for which SNOTEL SWC estimates are available are numbered in Figure 8. The colors of the boxes correspond to the % of average SWC in the river basins.

The dark lines within state boundaries delineate large river basins in the Southwest.

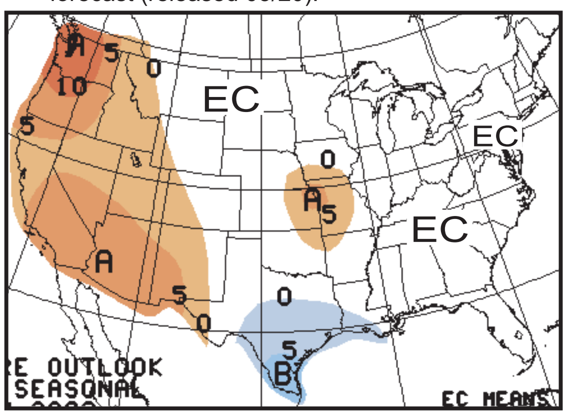
These data are provisional and subject to revision. They have not been processed for quality assurance. However, they provide the best available land-based estimates during the snow measurement season.

9. Temperature: Monthly and 3-Month Outlooks ♦ Source: NOAA Climate Prediction Center

9a. April 2003 U.S. temperature forecast (released 03/20).



9b. April - June 2003 U.S. temperature forecast (released 03/20).



Percent Likelihood of Above/ Below Average Temperatures*

20% - 30%		
10% - 20%	A = Above	
5% - 10%		
0% - 5%		
0% - 5%		
5% - 10%	B = Below	
10% - 20%		

*EC indicates no forecasted anomalies due to lack of model skill.

Notes:

The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average temperature.

Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average temperature.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

These forecasts are based on a combination of factors, including the results of statistical models, moderate El Niño conditions, and long-term trends.

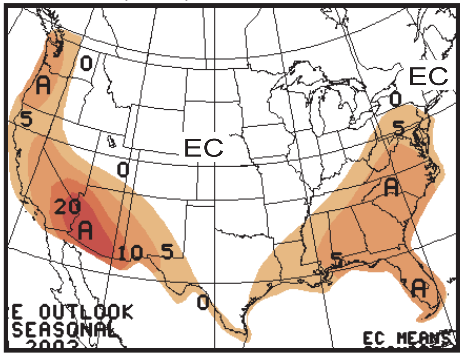
Highlights: The CPC temperature outlook for April (Figure 9a) and for the next three months (April-June; Figure 9b) indicates slightly increased probabilities (33% to 43% likelihood) of above-average temperatures for much of the Southwest. The International Research Institute (IRI) for Climate Prediction also indicates a only slight shift in the chances of above-average temperatures in the Southwest for April–June (40% likelihood of above-average temperatures). The CPC predictions are based chiefly on historical El Niño temperature patterns reinforced by long-term temperature trends. As the current El Niño weakens, the forecast moves closer to the long-term trend. NOAA CPC climate outlooks are released on the Thursday, between the 15th and 21st of each month.

For more information, visit: http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please 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/

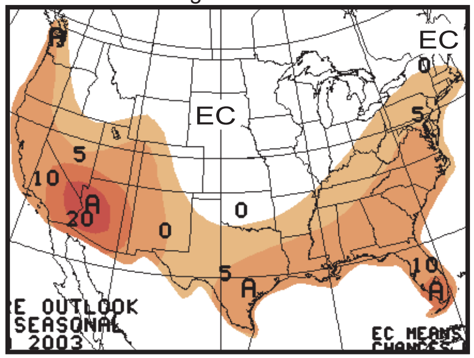
10. Temperature: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead temperature forecasts (released 03/20/03).

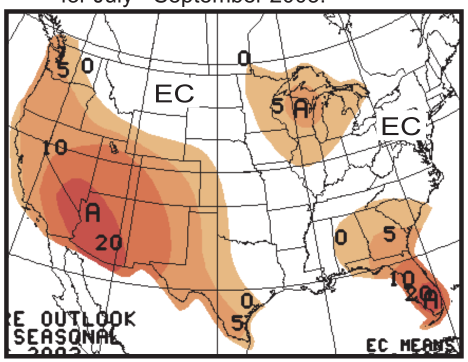
10a. Long-lead national temperature forecast for May - July 2003.



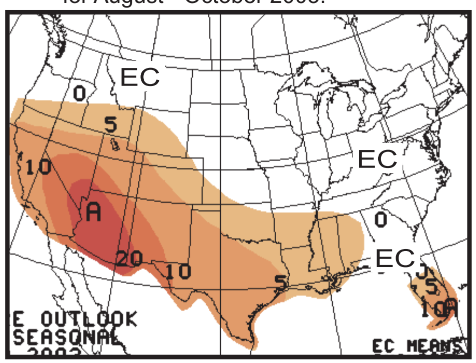
10b. Long-lead national temperature forecast for June - August 2003.



10c. Long-lead national temperature forecast for July - September 2003.



10d. Long-lead national temperature forecast for August - October 2003.



Percent Likelihood of Above/ Below Average Temperatures*

20% - 30%	A = Above
10% - 20%	
5% - 10%	
0% - 5%	
0% - 5%	B = Below
5% - 10%	
10% - 20%	

*EC indicates no forecasted anomalies due to lack of model skill.

Highlights: The CPC temperature outlooks for May-October 2003 show increased probabilities of above-average temperatures for most of the Southwest in the spring (Figures 10a-d), with maximum forecast confidence centered over the Arizona-California border. There is a fairly high probability of above-average temperatures across Arizona during the forecast period, with the likelihood of above-average temperatures reaching 53 to 63%. These forecasts are based chiefly on long-term trends toward above-average temperatures. Forecast evaluation research by CLIMAS investigator Holly Hartmann shows high forecast skill across western Arizona and central New Mexico for CPC summer temperature forecasts made during March. Forecasts for increased chances of above-average temperatures show skill throughout our region. Fears of another dry, hot summer, combined with tree deaths due to beetle infestations, led Arizona's Governor Napolitano to convene a forest health summit in mid-March and for Arizona to host its inaugural Arizona Wildfire Academy to train firefighters (*Arizona Republic*, March 9, 2003).

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

Notes:
The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average temperature.

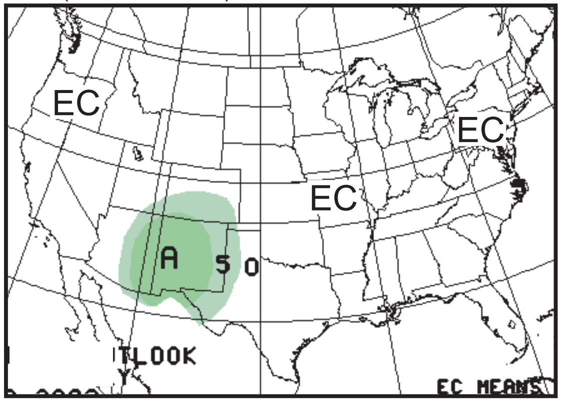
Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average temperature.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

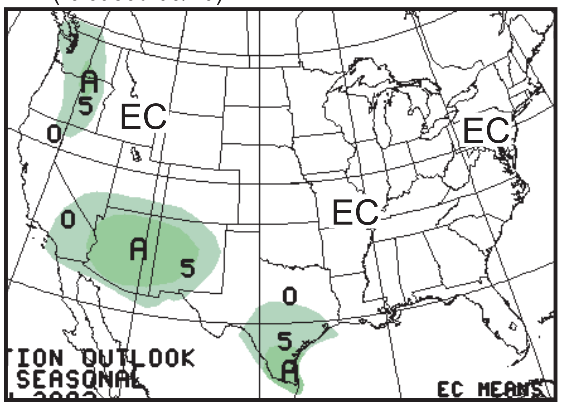
Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

11. Precipitation: Monthly and 3-Month Outlooks ♦ Source: NOAA Climate Prediction Center

11a. April 2003 U.S. precipitation forecast (released 03/20).



11b. April - June 2003 U.S. precipitation forecast (released 03/20).



Percent Likelihood of Above or Below Average Precipitation*

10% - 20%
5% - 10% A = Above
0% - 5%

0% - 5% B = Below
5% - 10%

*EC indicates no forecasted anomalies due to lack of model skill.

Notes:

The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average precipitation.

Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

These forecasts are based on a combination of factors, including the results of statistical models, moderate El Niño conditions, and long-term trends.

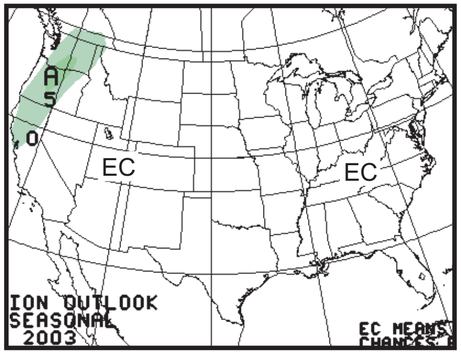
Highlights: The official NOAA-CPC precipitation outlook for April shows slightly increased chances (33-43% likelihood) of above-average precipitation centered over eastern Arizona and western New Mexico. The forecast shows greater chances of above-average precipitation across the Southwest for April–June (Figure 11b), with the greatest forecast confidence (38 to 43% chance of above-average precipitation) centered over Arizona and western New Mexico. A key factor contributing to the CPC forecast is an analysis of the historical effect of weakening El Niño events on spring precipitation in the Southwest. Forecast skill is higher for 3-month seasons than for individual months. The April–June precipitation forecast from the International Research Institute (IRI) for Climate Prediction (not pictured) shows a 40% chance of above-average precipitation across Arizona and notes that the forecast period includes the Southwest's historically dry foresummer.

For more information about NOAA-CPC seasonal outlooks, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please note that this website has many graphics and may load slowly on your computer.
For more information about IRI experimental seasonal forecasts, visit: http://iri.columbia.edu/climate/forecast/net_asmt/

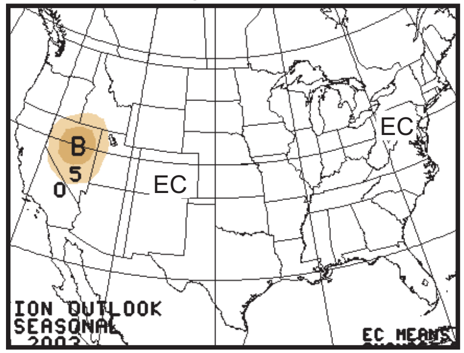
12. Precipitation: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead precipitation forcasts (released 03/20/03).

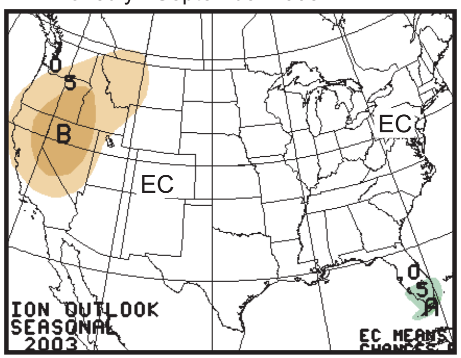
12a. Long-lead U.S. precipitation forecast for May - July 2003.



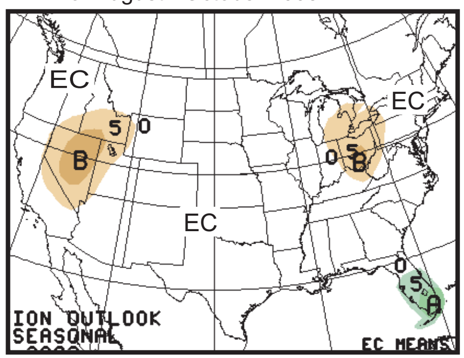
12b. Long-lead U.S. precipitation forecast for June - August 2003.



12c. Long-lead U.S. precipitation forecast for July - September 2003.



12d. Long-lead U.S. precipitation forecast for August - October 2003.



Percent Likelihood of Above or Below Average Precipitation*

5% - 10%
0% - 5%
A = Above

0% - 5%
5% - 10%
B = Below

*EC indicates no forecasted anomalies due to lack of model skill.

Notes:
The NOAA CPC (National Oceanic and Atmospheric Administration Climate Prediction Center) outlooks predict the "excess" 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.

In a situation where there is no forecast skill, one might look at *average* conditions in order to get an idea of what might happen. Using past climate as a guide to average conditions and dividing the past record into 3 categories, there is a 33.3% chance of above-average, a 33.3% chance of average, and a 33.3% chance of below-average precipitation.

Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above-average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

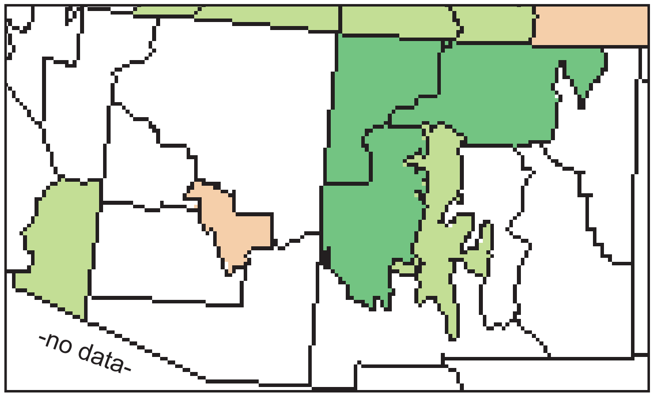
The term *average* refers to the 1971-2000 average. This practice is standard in the field of climatology.

Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

Highlights: The expected weakening of El Niño and its impacts on the Southwest are reflected by decreased probabilities of above-average precipitation for spring (Figures 12a-b), compared to previous outlooks. The large-scale atmospheric circulation patterns for the spring are expected to reflect very weak El Niño conditions. For the summer months (Figures 12c-d), CPC forecasters have withheld judgment (*EC*) for almost all of the United States. Forecasting summer precipitation is exceedingly difficult and is a topic at the cutting edge of climatological inquiry. Arizona State Climatologist Andrew Ellis has developed a monsoon precipitation forecast model, and he will begin to issue summer precipitation forecasts this spring. For more information, visit: http://geography.asu.edu/azclimate/.
NOAA CPC climate outlooks are released on Thursday, between the 15th and 21st of each month.
For more information, visit:
http://www.cpc.ncep.noaa.gov/products/predictions/multi_season/13_seasonal_outlooks/color/churchill.html
Please note that this website has many graphics and may load slowly on your computer.
For more information about IRI experimental forecasts, visit: http://iri.columbia.edu/climate/forecast/net_asmt/

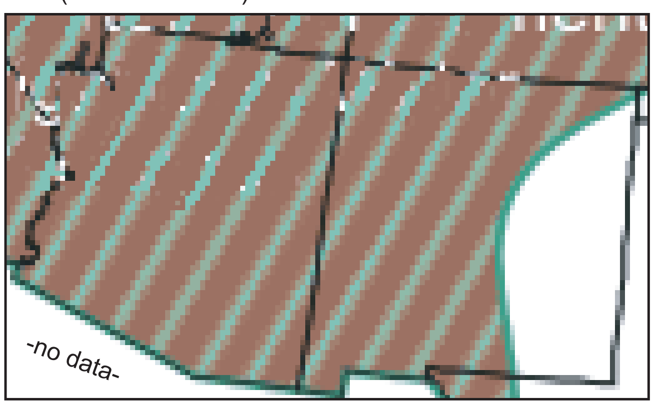
13. Drought: PDSI Forecast and U.S. Seasonal Outlook ♦ Source: NOAA Climate Prediction Center

13a. Short-term Palmer Drought Severity Index (PDSI) forecast through 03/22/03 (accessed 03/20).



- -4.0 or less (extreme drought)
- -3.0 to -3.9 (severe drought)
- -2.0 to -2.9 (moderate drought)
- -1.9 to +1.9 (near normal)
- +2.0 to +2.9 (unusual moist spell)
- +3.0 to +3.9 (very moist spell)

13b. Seasonal drought outlook through June 2003 (accessed 03/20).



- drought ongoing, some improvement
- Drought likely to improve, impacts ease

Notes:
The PDSI (Palmer Drought Severity Index) attempts to measure the duration and intensity of the climatological drought.

'Normal' on the PDSI scale is defined as amounts of moisture that reflect long-term climate expectations.

The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators including outputs of short- and long-term forecast models.

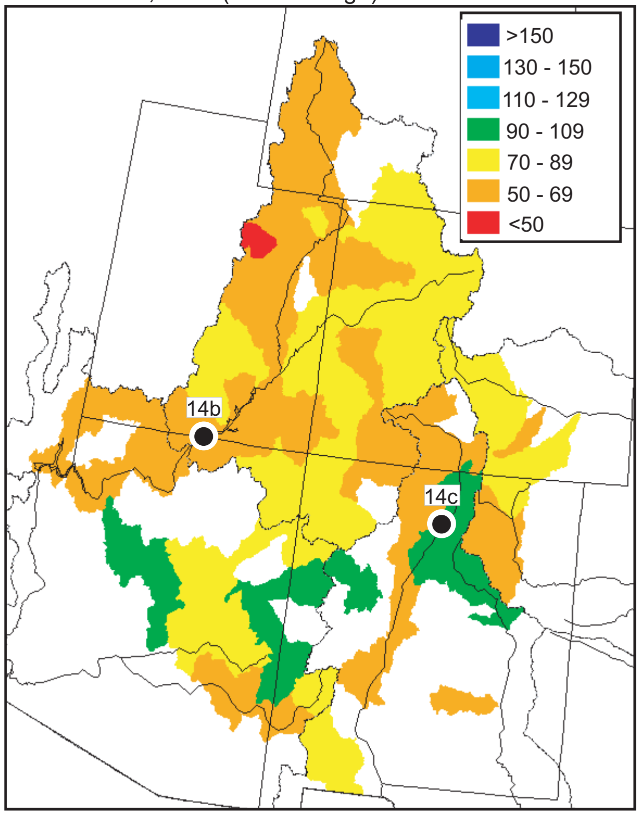
Highlights: The short-term Palmer Drought Severity Index (PDSI) forecast (Figure 13a) has improved for northwestern New Mexico and central/western Arizona, compared to February's forecast. The forecast remains unchanged for the remaining climate divisions in Arizona and New Mexico. The Climate Prediction Center (CPC) has forecast El Niño conditions to dissipate in the coming months; consequently, the likelihood of El Niño-related precipitation will decrease (see pages 11 and 12). The seasonal drought outlook (Figure 13b) suggests ongoing drought throughout most of Arizona and New Mexico. Improvements to water supplies in the Southwest will be limited due to the duration and severity of the drought and diminishing prospects for snowfall after March or April; hence, the forecast for limited improvement.

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

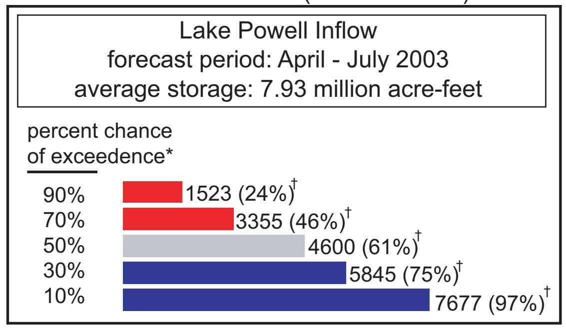
14. Streamflow Forecast for Spring and Summer

Source: USDA NRCS National Water and Climate Center

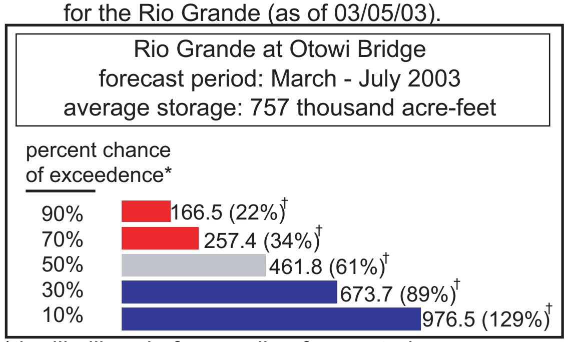
14a. NRCS spring and summer streamflow forecast as of March 1, 2003 (% of average).



14b. NRCS percent exceedence forecast chart for Lake Powell inflow (as of 03/06/03).



14c. NRCS percent exceedence forecast chart for the Rio Grande (as of 03/05/03).



*the likelihood of exceeding forecasted streamflow volume.

†associated forecasted streamflow volume (thousands of acre-feet) and percent of average volume.

Highlights: March 1, 2003, streamflow forecasts for Arizona and New Mexico river basins indicate that average to below-average streamflow is most likely this spring and summer for many gauged basins in both states. Figure 14a shows that the streamflow forecast for large basins in the Upper Colorado River Basin states (WY, UT, CO) is for below average streamflow. Streamflow forecasts for Arizona and New Mexico basins have improved since February. Recent snowfall has improved spring and summer streamflow forecasts in several Arizona and New Mexico basins, changing forecasts from below average last month to average this month. The best estimate of streamflow volume at Lake Powell given current conditions and based on past outcome of similar situations is that inflow will be 61% of average, up slightly from last month. However, there is a 50% likelihood that this forecasted flow will be exceeded.

For state river basin streamflow probability charts, visit: http://www.wcc.nrcs.usda.gov/water/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

Notes:

The forecast information provided in Figures 14a-c is updated monthly and is provided by the National Resources Conservation Service (NRCS). Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and diversions.

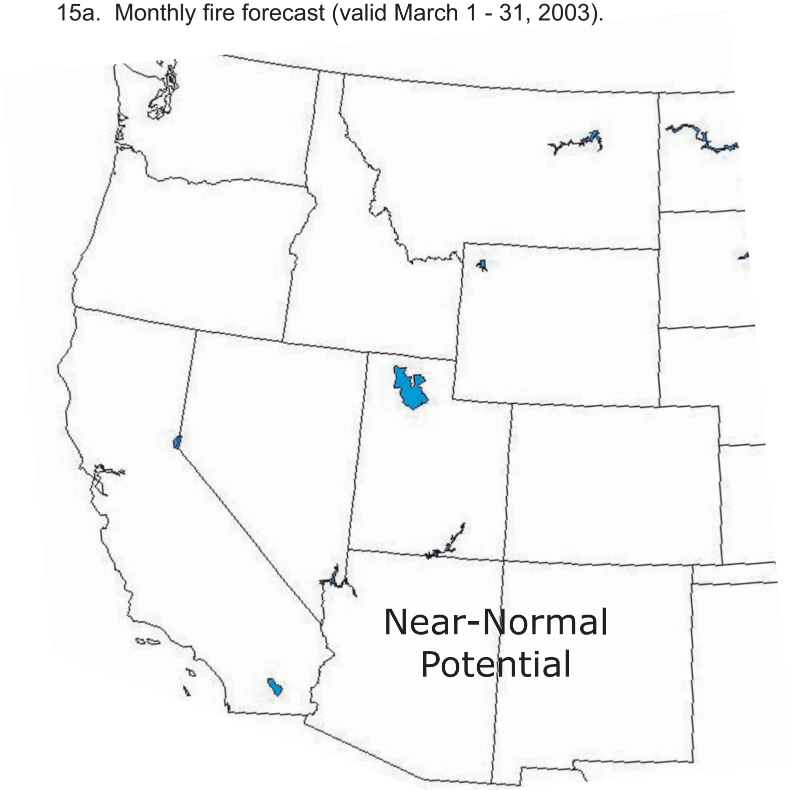
Each month, five streamflow volume forecasts are made by the NRCS for several river basins in the United States. These five forecasts correspond to standard *exceedence* percentages, which can be used as approximations for varying 'risk' thresholds when planning for short-term future water availability.

90%, 70%, 50%, 30%, and 10% exceedence percentage streamflow volumes are provided by the NRCS. Each exceedence percentage level corresponds to the following statement: "There is an (X) percent chance that the streamflow volume will ***exceed*** the forecast volume value for that exceedence percentage." Conversely, the forecast also implies that there is a (100-X) percent chance the volume will be ***less than*** this forecasted volume. In Figure 14c for example, there is a 30% chance that at Otowi Bridge the average streamflow during the forecast period (March through July) will exceed 673.7 acre-feet of water (89% of average), with a 70% chance that it will not exceed that volume. Note that for an individual location, as the exceedance percentage declines, forecasted streamflow volume increases.

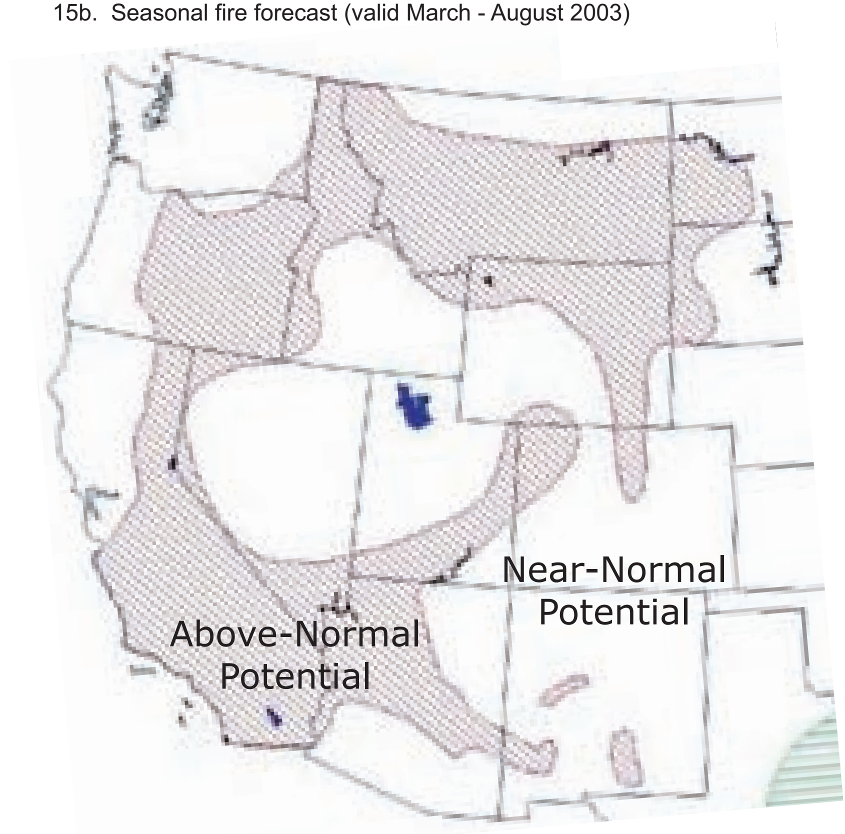
In addition to monthly graphical forecasts for individual points along rivers (Figures 14b and 14c), the NRCS provides a forecast map (Figure 14a) of basin-wide streamflow volume averages based on the forecasted 50% exceedence percentage threshold.

15. National Wildland Fire Outlook (Monthly & Seasonal) Source: National Interagency Fire Center

15a. Monthly fire forecast (valid March 1 - 31, 2003).



15b. Seasonal fire forecast (valid March - August 2003)

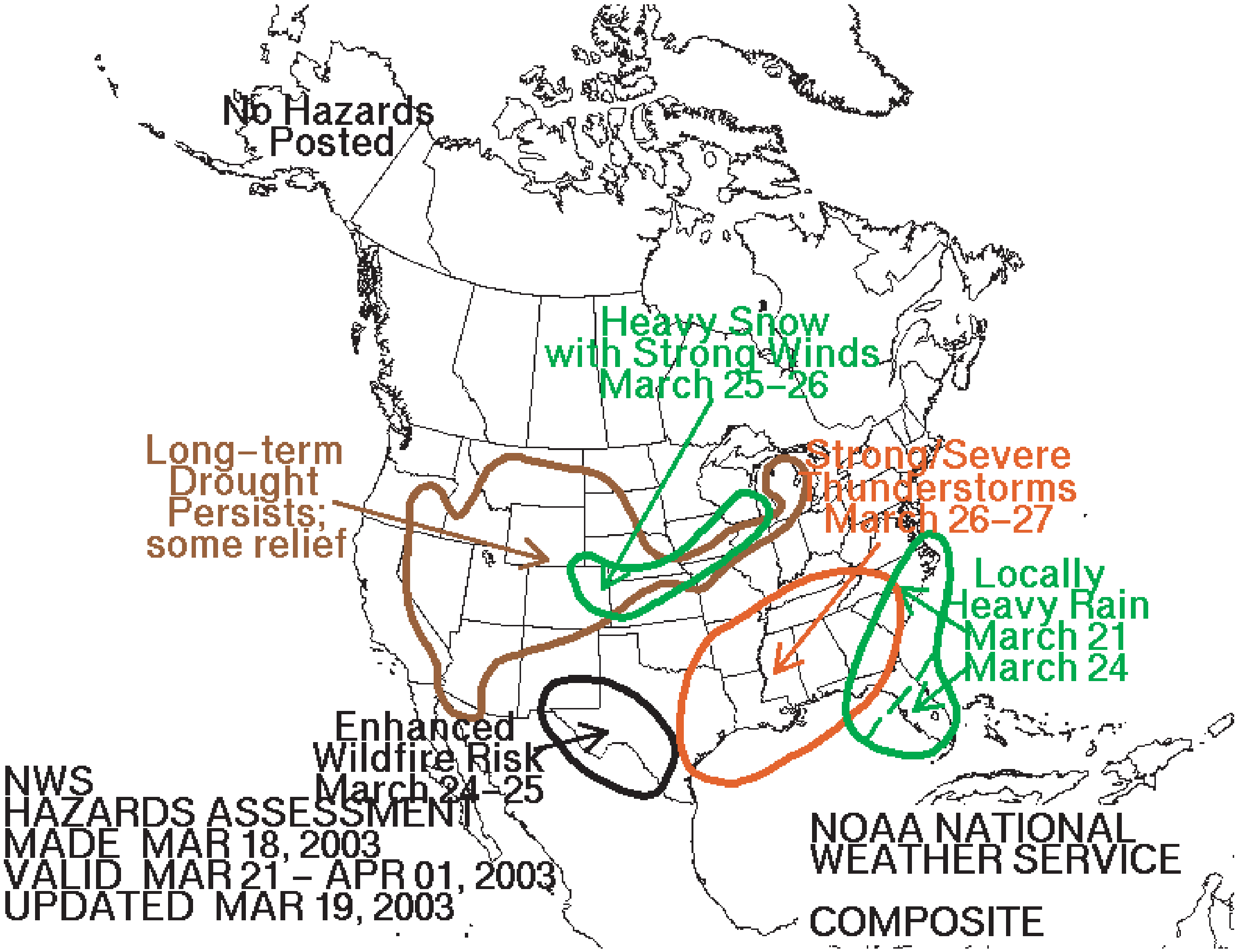


Notes: The National Interagency Coordination Center (NICC) at the National Interagency Fire Center (NIFC) produces monthly and seasonal wildland fire outlooks (Figures 15a and 15b, respectively). These forecasts consider climate forecasts and surface-fuels conditions to assess fire potential. They are subjective assessments, based on synthesis of regional fire danger outlooks. The seasonal forecast is produced once prior to the fire season, in this case March 7, 2003.

Highlights: The Wildland Fire Outlook for March 2003 indicates near-normal fire potential for all of the western United States (Figure 15a). The seasonal fire forecast (Figure 15b) indicates that the fire danger across some areas of the Southwest is expected to be above average during an overall normal length fire season. This is due to continuing long-term drought, a better than even chance for above normal temperatures, low amounts of winter snowpack at the mid-elevations, and widespread vegetative dieback due to insect and disease damage. For the Southwest, during March through August, the potential for large fires (fires greater than 100 acres) will be near to below normal through April and then increase sharply to above normal in May and June and continue through the start of the monsoon season.

For more detailed discussions, visit the National Wildland Fire Outlook web page: http://www.nifc.gov/news/nicc.html
and the Southwest Area Wildland Fire Operations web page: http://www.fs.fed.us/r3/fire/ (click on Predictive Services > Outlooks Products)

16. U.S. Hazards Assessment Forecast (valid March 21 – April 1, 2003) Source: NOAA CPC



Notes:

The hazards assessment incorporates outputs of National Weather Service medium- (3-5 day), extended- (6-10 day) and long-range (monthly and seasonal) forecasts and hydrological analyses and forecasts.

Influences such as complex topography may warrant modified local interpretations of hazards assessments.

Please consult local National Weather Service offices for short-range forecasts and region-specific information.

Individual maps of each type of hazard are available at the following websites:

Temperature and wind:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/t_threats.gif

Precipitation:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/p_threats.gif

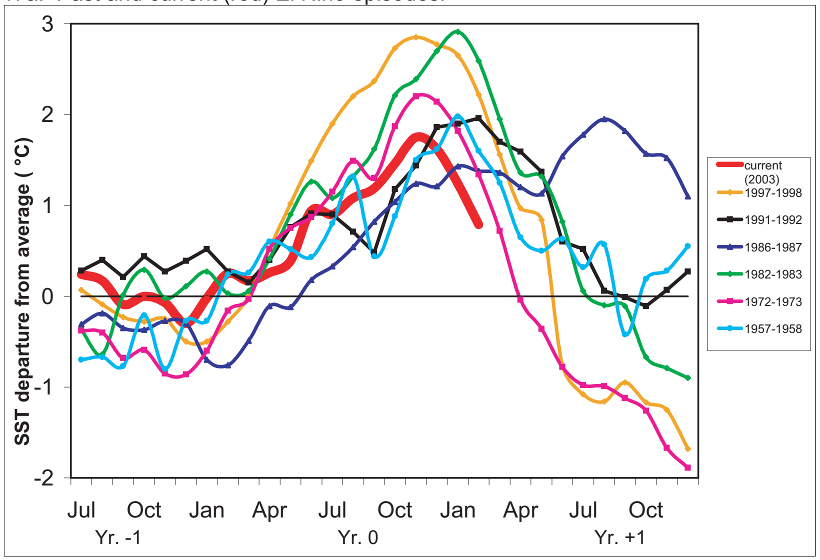
Soil and/or Fire:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/s_threats.gif

Highlights: The U.S. Hazards Assessment indicates long-term, persistent drought for much of Arizona and for northwestern New Mexico. Southeastern New Mexico and western Texas face enhanced wildfire risk during the upcoming month.

For more information, visit: http://www.cpc.ncep.noaa.gov/products/predictions/threats

17. Tropical Pacific SST and El Niño Forecasts ♦ Sources: NOAA CPC, IRI

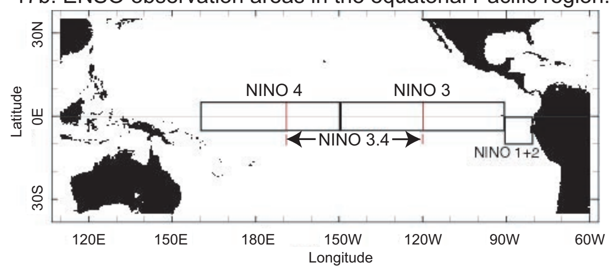
17a. Past and current (red) El Niño episodes.



Notes: The graph (Figure 17a) shows sea-surface temperature (SST) departures from the long-term average for the Niño 3.4 region (Figure 17b). This is a sensitive indicator of ENSO conditions.

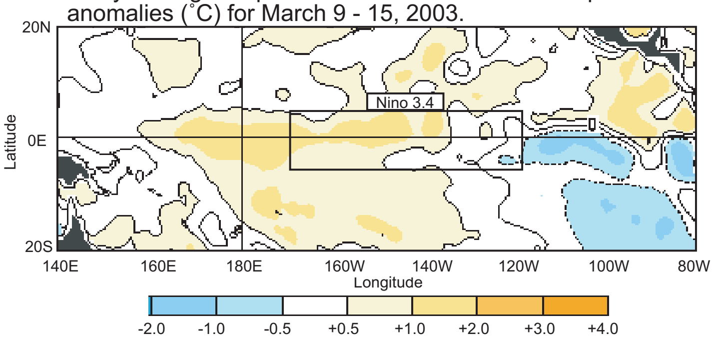
Each line on the graph represents SST departures for previous El Niño events, beginning with the year before the event began (Yr. –1), continuing through the event year (Yr. 0), and into the decay of the event during the subsequent year (Yr. +1).

17b. ENSO observation areas in the equatorial Pacific region.

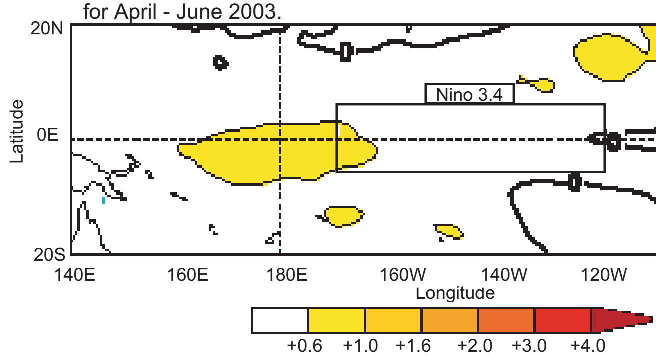


This year's SST departures are plotted as a red line (Figure 17a). The magnitude of the SST departure, its timing during the seasonal cycle, and its exact location in the equatorial Pacific Ocean are some of the factors that determine the degree of impacts experienced in the Southwest.

17c. 7-day averaged equatorial Pacific sea surface temperature anomalies (˚C) for March 9 - 15, 2003.



17d. Forecasted equatorial Pacific sea surface temparture anomalies (˚C) for April - June 2003.

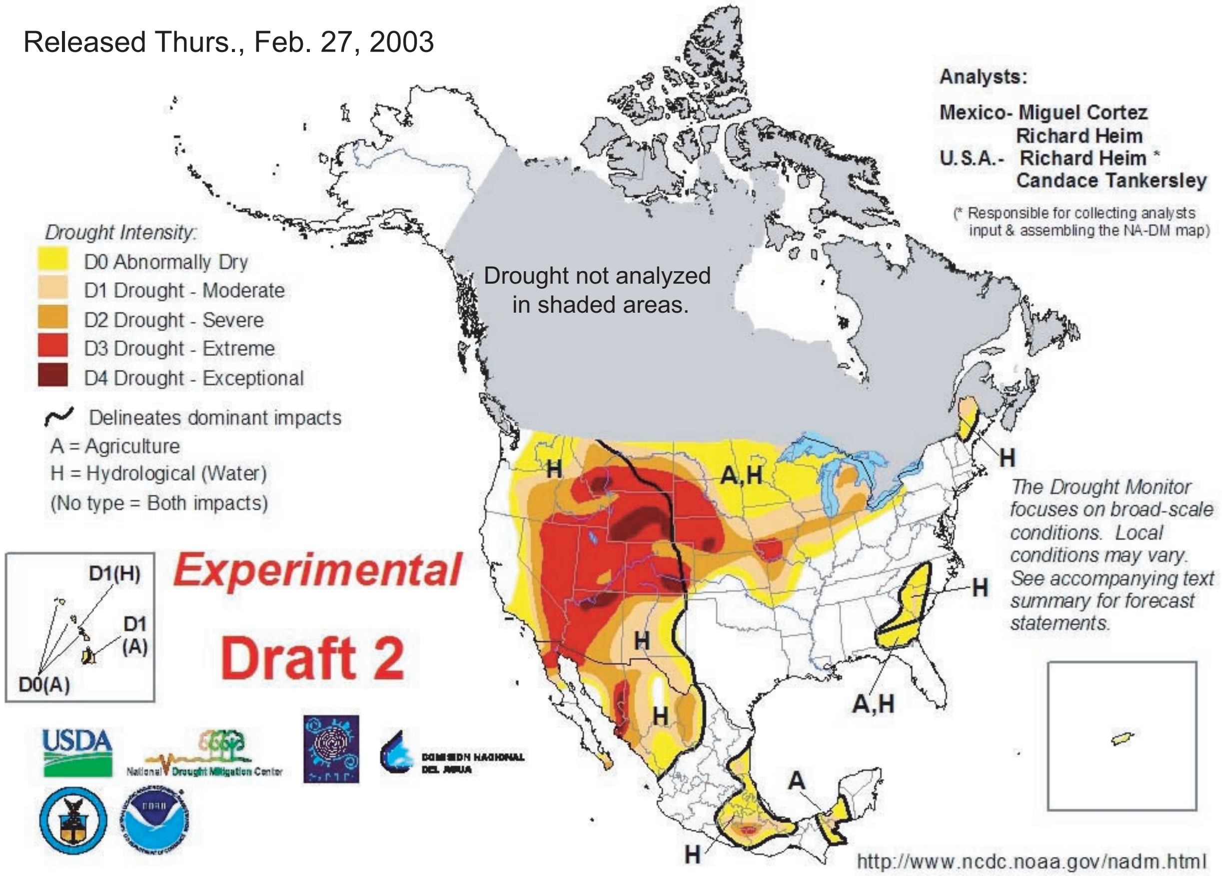


Highlights: El Niño conditions weakened in February, as sea surface temperature anomalies (SSTAs) decreased throughout the eastern and central equatorial Pacific Ocean (Figure 17a). SSTAs are still positive (Figure 17c), however, and El Niño conditions, such as enhanced precipitation and cloudiness, are still evident. The NOAA Climate Prediction Center (CPC) forecast for April–October 2003 is for near-neutral conditions in the equatorial Pacific. However, the current suite of El Niño forecasts vary greatly. Some show El Niño rebounding during the fall months, whereas other forecasts show La Niña conditions developing during the last half of 2003. CPC says that "recent cooling of the upper ocean in the eastern equatorial Pacific supports the possibility of the development of La Niña later this year." The International Research Institute for Climate Prediction (IRI) says this El Niño episode is "likely in its last one to two months before weakening to neutral levels." The IRI El Niño forecast gives a 50% probability of neutral conditions developing by summer, along with 25% probabilities of both El Niño and La Niña – thus indicating high forecast uncertainty.

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 the graphics found on this page, visit: http://iri.columbia.edu/climate/ENSO/

18. Experimental North American Drought Monitor Source: USDA, NDMC, NOAA, SMN, CNA



Notes: The North American Drought Monitor is an experimental product that will be available monthly in the future. It is a joint product created by U.S. and Mexican agencies. This North American Drought Monitor was created in February and is based on data collected in January of 2003.

The Mexican meteorological agency (Servicio Meteorlógico Nacional or SMN) and the Mexican water commission (Comisión Nacional de Aqua or CNA) provided data for Mexcio; various U.S. agencies provided data for the United States. Discussions are ongoing with Canada about their participation in this effort.

The North American Drought Monitor maps are based on expert assessment of variables including (but not limited to) PDSI, soil moisture, stream flow, precipitation, and measures of vegetation stress, as well as reports of drought impacts.

Highlights: The North American Drought Monitor is a cooperative effort between drought experts in Mexico and the United States to monitor drought across the continent on an ongoing basis. The program was initiated at a three-day workshop in late April 2002 and is part of a larger effort to improve the monitoring of climate extremes on the continent. The North American Drought Monitor is based on the highly successful U.S. Drought Monitor and, as such, is being developed to provide an ongoing comprehensive and integrated assessment of drought throughout North America.

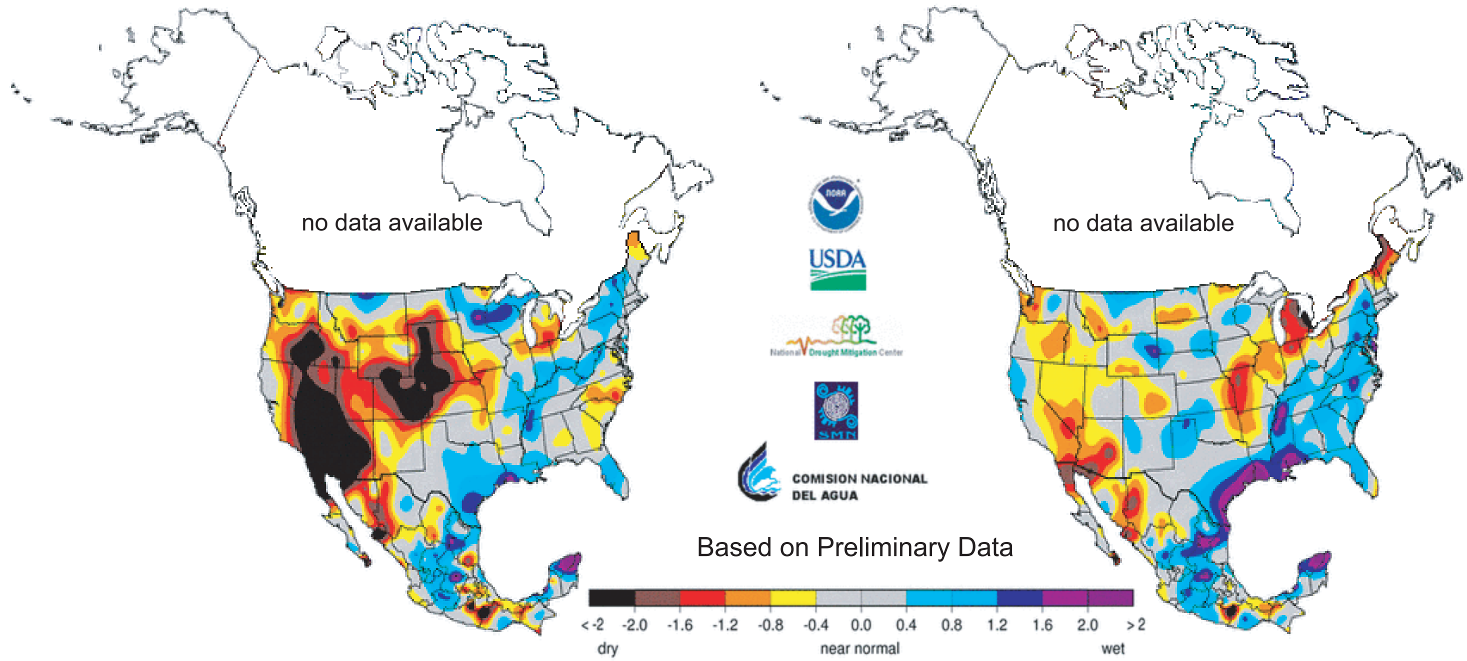
For the Southwest, this experimental map puts our ongoing drought into perspective by including drought conditions south of the border. Northwestern Mexico experienced abnormally dry to exceptional drought conditions in January, but the geographical extent of exceptional and extreme drought conditions was not as great as it was in western Arizona due, in part, to anomalously high rainfall levels in January and February in the Mexican states of Baja California, Baja California del Sur, and Sonora.

This Experimental Map will be available in the near future at http://www.ncdc.noaa.gov/nadm.html

19. Experimental North American SPI Source: USDA, NDMC, NOAA, SMN, CNA

19a. 12-month Standard Precipitation Index, Feb. 2002 – Jan. 2003.

19b. 6-month Standard Precipitation Index, Aug. 2002 – Jan. 2003.



Notes: The North American Standardized Precipitation Index (SPI) maps are experimental products that will be available monthly in the future. They are the result of a joint effort of U.S. and Mexican agencies. Additional information about the SPI can be found in the October, November, and December 2002 END Insight focus pages (http://www.ispe.arizona.edu/climas/forecast/archive.html).

The Mexican meteorological agency (Servicio Meteorlógico Nacional or SMN) and the Mexican water commission (Comisión Nacional de Aqua or CNA) provided data for Mexico; various U.S. agencies provided data for the United States. The Mexican agencies usually use the Palmer Drought Severity Index (PDSI) as a standard by which to assess drought conditions; the North American PDSI maps have yet to be completed.

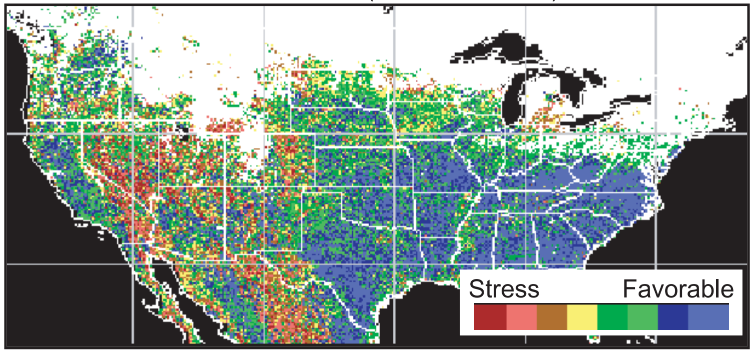
Highlights: The North American Standardized Precipitation Index maps are produced as part of a cooperative effort between drought experts in Mexico and the United States to monitor drought across the continent on an ongoing basis. The program was initiated at a three-day workshop in late April 2002 and is part of a larger effort to improve the monitoring of climate extremes on the continent.

For the Southwest, these experimental maps put our ongoing drought into perspective by including drought conditions south of the border. The northwestern Mexico states of Sonora, Sinaloa, Baja California, and western Chihuahua have been plagued by drought conditions that rival those in the western United States. The persistence of this drought is especially evident in states with a winter precipitation maximum, such as Baja California.

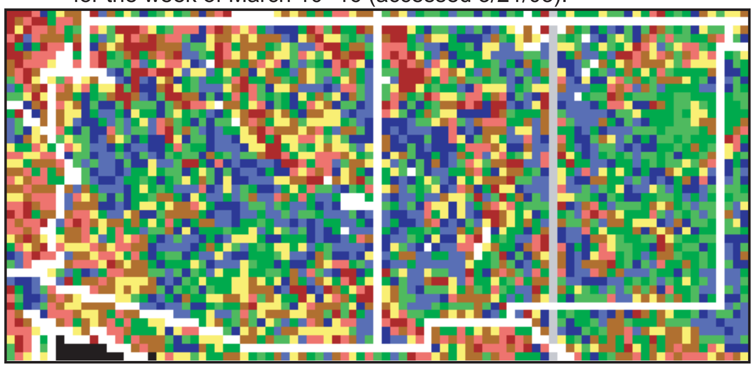
These Experimental Maps will be available in the near future at http://www.ncdc.noaa.gov/oa/climate/monitoring/drought/nadm/spi.html
For more information about SPI, visit the Western Regional Climate Center at: http://www.wrcc.dri.edu/spi/spi.html and the NCDC at http://www.ncdc.gov/oa/climate/research/prelim/drought/spi.html.

20. Remotely Sensed Drought Assessment Products ♦ Source: NOAA NESDIS Vegetation Monitoring

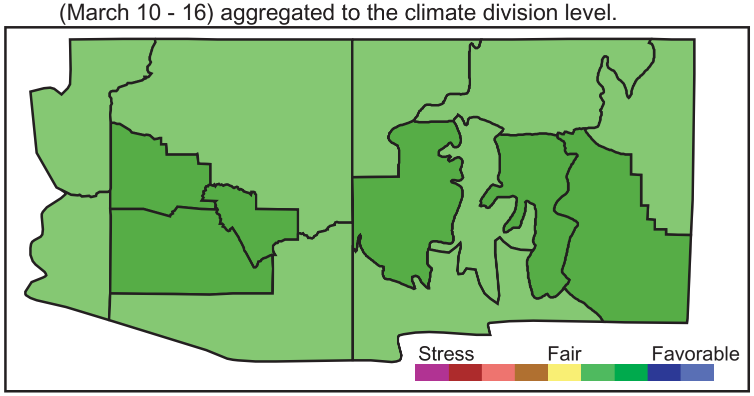
20a. Vegetation health (VT-index) assessment for North America for the week of March 10 - 16 (accessed 3/21/03).



20b. Vegetation health (VT-index) assessment for Arizona and New Mexico for the week of March 10 -16 (accessed 3/21/03).



20c. Vegetation health (VT-index) assessment for Arizona and New Mexico (March 10 - 16) aggregated to the climate division level.



Notes: The NOAA National and Environmental Satellite, Data and Information Service (NESDIS) provides a range of meteorological and oceanographic satellite products to agencies and people worldwide. The Surface and Atmosphere Team of the Climate Research and Applications Division of NESDIS produces several land-based products including vegetation health assessments (Figures 20a, b, and c).

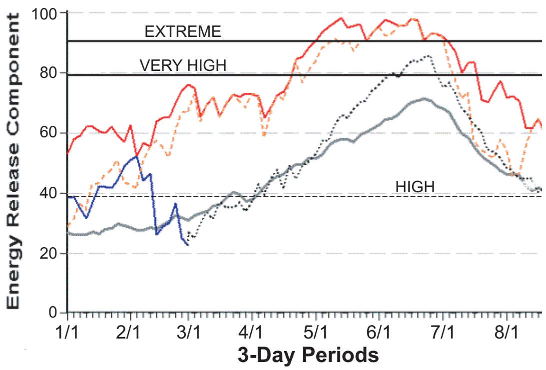
Images are produced weekly and are derived from the least cloudy, remotely sensed (i.e., satellite) image obtained during the week. The images are color-coded maps of vegetation condition (health) estimated by the Vegetation and Temperature Condition Index (VT). The VT is a numerical index that ranges from extremely poor (0; red) to excellent (100; blue). The VT reflects, indirectly, a combination of chlorophyll (photosynthetic plant material) and moisture content in the vegetation, as well as thermal conditions at the surface.

Highlights: NESDIS produces VT-index products for virtually all areas in the world. The images are provided online by NESDIS at the continental scale (e.g., Figure 20a; http://orbit-net.nesdis.noaa.gov/crad/sat/surf/vci/index.html). They are best used for regional and larger-scale analyses. Figure 20b provides a close up of Figure 20a centered on Arizona and New Mexico. An individual VT-index value is estimated for each grid cell, which measures 16 km (approximately 10 miles) on a side. NESDIS also aggregates the VT-index to the climate division level; thus, VT products can be compared with other NOAA climate products currently provided at the climate division level (e.g., Palmer Drought Severity Index). A handy online feature (at the NESDIS website) that can help to put these VT images in perspective for decision making is a comparison with VT conditions one year ago.

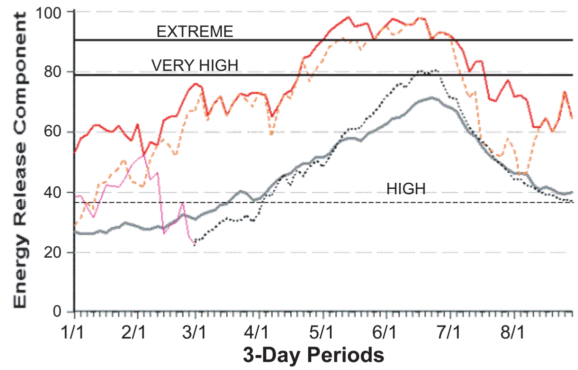
For more information on the vegetation health products, the VT- index, or technical aspects of the methodology employed, visit: http://orbit-net.nesdis.noaa.gov/crad/sat/surf/vci/background.html. Also, see Kogan, F.N. 1997. Global drought watch from space. *Bulletin of the American Meteorological Society*, 78:621-636 for a detailed description of the products presented here.

21. Preliminary 2003 Fire Season Outlook ♦ Source: Southwest Coordination Center

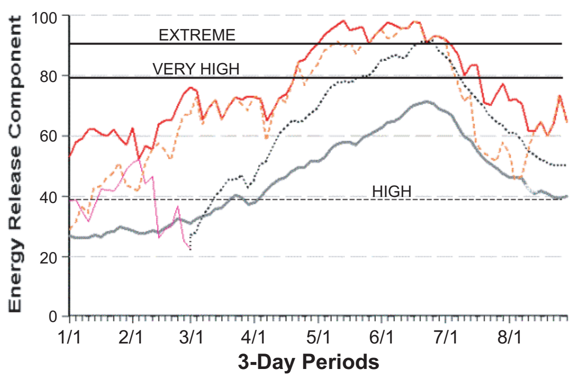
21a. Southwest Area ERC most likely scenario (3-day periods).



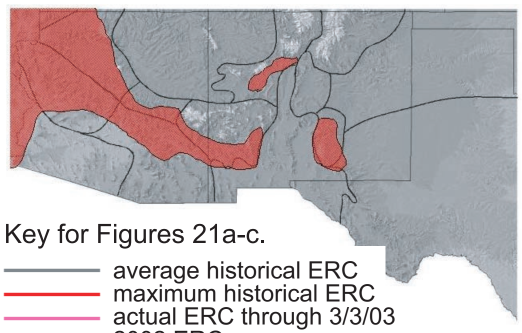
21b. Southwest Area ERC best case scenario (3-day periods).



21c. Southwest Area ERC worst case scenario (3-day periods).



21d. Southwest areas of concern, shown in red, for the 2003 fire season.



Key for Figures 21a-c.

- average historical ERC
- maximum historical ERC
- actual ERC through 3/3/03
- 2002 ERC
- projected ERC for 2003

Notes: This outlook was produced by fire and weather specialists at the Southwest Coordination Center, in conjunction with the National Seasonal Assessment Workshop. The complete outlook is available online at **http://www.fs.fed.us/r3/fire/** and is based on a synthesis of current weather, climate and fuels conditions, along with seasonal climate and fuels outlooks and other expert assessments.

The fire danger scenarios are expressed in terms of the energy release component (ERC), which is defined as the potential available energy per square foot in the flaming zone of a fire (expressed in BTU/sq. ft.). The day-to-day variations of the ERC are caused by changes in short- and long-term fuel moisture content of a selected fuel type (e.g., forest vs. grassland).

Fuel Model G, which is used here, is for dense conifer stands where there is a heavy accumulation of litter and downed woody material. Such stands are typically overmature and also may be suffering damage from insects, disease, or natural events that create a heavy buildup of dead material on the forest floor.

Highlights: Figures 21a-c show the most likely (60% chance), best (15% chance), and worst (25% chance) case scenarios for 2003 fire danger. The ERC values in the graphs are calculated for 3-day non-overlapping periods between January 1 and September 1. Based on the most likely scenario, fire danger across some parts of the Southwest Area is expected to be above average during a fire season of average duration. Factors contributing to above-average fire danger for 2003 include: persistent effects of long-term drought, forecasts for a high probability of above-average temperatures (see page 10), low winter snowpack at mid-elevations, and widespread tree and shrub mortality. Fire danger is expected to peak between late May and early July. Fire danger is expected to be somewhat higher throughout Arizona and in selected subregions of New Mexico experiencing continued drought conditions. Figure 21d shows areas of special concern, primarily due to vegetation mortality or stress and fine fuel build-up in low elevation areas (e.g., western Arizona).