Institute for the
Study of Planet Earth

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April 24, 2003

Dear Participant,

As temperatures across the Southwest begin to heat up, the news on the drought front is both good and bad. On the one hand, short-term drought conditions have eased across much of the Southwest, and conditions are considerably less dry than this time last year. On the other hand, even the plentiful late-season snow that has fallen across some areas of the Southwest did not bring snowpack levels up to average; fire danger is increasing along with the temperatures; and rangeland conditions over much of the region have not yet improved. As we enter the historically dry early summer period, it may seem a long wait to find out if the summer monsoons will bring bountiful rains.

This month's newsletter focuses on the controversial issue of wildfires in the Southwest, and explores the intersection of climatic conditions and forest management practices in creating the big fires of the past several years. Two focus pages continue the wildfire theme. The first discusses an experimental statistical wildfire forecast for the Western U.S. We would be particularly glad to receive your comments about the usability of this page. The second focus page presents a map of areas of New Mexico and Arizona that have experienced widespread pine tree mortality, which is due primarily to insect infestations, but has been exacerbated by drought.

It's difficult to believe that the "end of END" is in sight. We will produce two more packets, for May and June, using the current system we've established – but we are also thinking about how to answer the key question, "What's next?" We are planning a wrap-up workshop (tentatively scheduled for July 8 - save the date!) that will bring project participants together with the creators of some of the products you've become familiar with, and are also putting together an exit interview that will help us to find out to improve future research projects of this type. We'll keep you informed as the planning progresses.

For now, as always, we welcome your feedback on the features we've included in this month's packet and about the project in general. We will be conducting another round of telephone interviews, and will contact you by e-mail regarding this within the next week or so. Thanks to all those who have taken the time to participate in last month's interviews, and also to those who have returned their surveys. We would greatly appreciate receiving this month's survey by May 12, 2003.

Best regards,

Rebecca Carter
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rhcarter@u.arizona.edu

Evaluation – Monthly Information Packet

For: April 2003 Packet Number: 10

Please complete the following questionnaire about the information packet contents.

1. Does the information provided in this packet (check one):

    ___ confirm your assessment of current climate conditions

    ___ contradict your assessment of current climate conditions

    ___ both confirm and contradict your assessment of current climate conditions

2. Was there information missing from this packet that you would like to receive? (please specify)

3. Did you share or discuss any of the information provided with your co-workers?

    (please specify their position)

____ Top management ____ Field operations ____ Public relations/Education

____ Middle management ____ Research/Analysis

____ Other (please specify)____

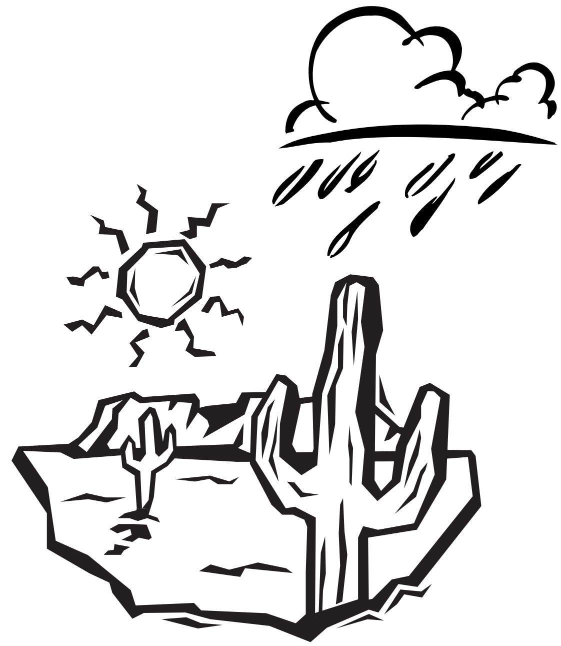
4. Did any of the information we provided have an influence on your organization?

    ____Yes ____No

    If Yes, please specify the information used and how you used it.

5. Do you have any additional comments about the packet or particular information products within it?

END InSight



CLIMAS El Niño-Drought Initiative

Information Packet #10
April 2003

Climate Assessment for the Southwest
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Section A

BACKGROUND

News from the CLIMAS El Niño-Drought Initiative

END InSight

April 2003

THE UNIVERSITY OF ARIZONA®

Climate, forest management stoke Western wildfires

The fires of 2002, including the Rodeo-Chediski with its dramatic evacuations and widespread damage to communities, riveted the nation's attention on wildfire. These and other devastating wildfires in recent years have been widely attributed to severe drought conditions, but other factors, such as sequences of wet and dry climatic conditions, fire suppression, logging, overgrazing, the actions of environmentalists, and an ongoing bark beetle infestation have also been blamed for playing significant roles.

But drought is nothing new in the western United States, and forest management policies, environmental movements, and bark beetle infestations have come and gone. How did these factors combine to cause the Rodeo-Chediski fire, the largest in Arizona history? Are there ways to prevent this from happening again? This article will attempt to provide some answers to these questions.

The scope of the problem
How bad was the 2002 fire season? It depends on where you were. In Arizona, the 629,876 acres that burned were far above the 1992–2002 average of 163,407 acres, due largely to the Rodeo-Chediski fire. New Mexico's fire season was more moderate, with 119,291 acres burned, compared to a ten-year average of 226,670 acres (1). The United States as a whole came close to setting a new record for acres burned, but did not surpass the 7,383,493 acres burned in 2000 (2).

The fires of 2002 were the most expensive on record, costing federal agencies nearly $1.7 billion to fight (3). The Rodeo-Chediski cost at least $17 million to combat. It is estimated that this one fire will cost insurance companies $102 million, making it Arizona's second-costliest disaster. The 468,638-acre fire destroyed 426 structures, including more than 250 homes (4).

One reason forest fires in recent years caused more damage and were more expensive to fight and recover from is that more people are building houses closer to forested areas (the "wildland urban interface"). Many of these homeowners prefer to leave trees and brush near their homes for aesthetic reasons; however, doing so makes the homes much more vulnerable to fire.

More people are also coming in contact with wooded areas as they pursue recreational interests. It is estimated that humans caused 95 percent of all fire starts in Arizona last year (5). A signal fire lit by a lost hiker started the Chediski fire, which soon joined with the Rodeo. Sparks caused by blown car tires, carelessly discarded cigarettes, and other human-related causes can also start fires. Some researchers point out that the abundant roads necessary for logging rarely act as effective firebreaks, but do allow greater numbers of people to access wooded areas where fires may be inadvertently started (6).

The outlook for future fires, even without continued drought, is bleak. The U.S. Forest Service, researchers, and environmental groups agree that the country's Western forests are not in good shape. By some estimates, about 190 million acres of federal forests in the lower 48 states are at high fire risk (7). Some 11,376 communities appeared on the 2001 Federal Register list of communities at high risk for wildfire; many of them are located in Arizona and New Mexico.

Drought as the "tipping point"
Drought did indeed play an important role in turning the forests into tinderboxes, but it was not just the drought of 2002; the preceding three or four dry years led to long-term moisture deficits that contributed to the explosive fire season. This extended dry period was preceded by the 1997–98 El Niño, which brought increased winter rains to the Southwest. The moisture produced plentiful grass and shrubs that later dried out and provided further fuel for the fires.

Arizona precipitation from June 2001 to May 2002, on the other hand, was the lowest recorded since 1895 (8). Moisture levels in trees play an important role in determining what fire activity will be like. By early summer of last year, the wood in some forests was drier than the kiln-dried lumber sold in home improvement stores.

By examining the fire scars in tree-ring data from widespread regions across the West, researchers know that past fires often coincided with drought years (9). But drought alone cannot account for the large fires that have

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Wildfire, continued

plagued the West in recent years. Over the past century, forests in the western United States have changed dramatically. In the ponderosa pine forests of Arizona and New Mexico, what were once vast areas of widely spaced, fire- and drought-tolerant trees with thick swaths of grass between them have become dense stands of smaller trees. Many ponderosa pine forests (the primary type burned in the Rodeo-Chediski fire) are estimated to be 15 times more dense than they were a century ago. As the Bush administration's Healthy Forests Initiative notes, "Where 25 to 35 trees once grew on each acre of forest, now more than 500 trees are crowded together in unhealthy conditions." (7)

Three main factors can account for these changes in the structure of Western forests: the suppression of low-intensity fires, which historically have provided a means of thinning out dense stands of smaller trees; the selective logging of larger trees, which are more fire resistant; and livestock grazing (10). Such changes make forests more fire-sensitive and susceptible to disease, and are linked to greater tree mortality, an increased buildup of fuels, more intense fires, and more widespread insect infestations. Competition from thicker stands of small trees can make it more difficult for larger trees to withstand drought. Each of these factors played a role in the big fires of 2002.

Fire suppression policies

At the heart of the problem is a century-long Forest Service policy of suppressing forest fires as soon as possible after they start, in an effort to prevent them from spreading and possibly threatening homes and communities on the edge of forested areas. Communities may also suffer health impacts and tourism losses from smoke generated from nearby fires that are allowed to burn. Even prescribed or intentional burning is risky, because in addition to the smoke issues, such fires can get out of control, as was the case with the highly destructive May 2000 Cerro Grande fire in Los Alamos.

Researchers have argued for decades that despite such risks, fire is an important element in forest ecology and necessary to maintaining forest health. Prior to European settlement, tree densities in Western forests remained low due to grasses out-competing tree seedlings and frequent thinning by low-intensity surface fires that were carried by the abundant grasses (10). According to tree-ring records, many trees are well adapted to withstand these periodic, low-intensity fires that swept through the Southwest every four to five years before European settlement (9). Ponderosa pines in particular develop thick, heat-resistant bark as they mature and are generally able to withstand low-intensity fires once their trunk diameter reaches 5 centimeters. More intense "stand replacing" fires that might also kill larger trees are believed to have occurred much less frequently and were often linked with drought conditions (11).

Fire suppression efforts were enacted on a widespread scale in the 1950s and have proven quite effective in reducing the amount of acreage burned. For example, records from the 1930s—before such policies were enacted—show that during that decade a total of over 39 million acres burned; but in the 1970s, after fire suppression policies were fully implemented, only about a tenth as many acres burned (3).

Since the beneficial effects of fires have been curtailed, small trees are no longer thinned out. As a result, fuel loads in central Arizona are said to have increased by a factor of 9 over the last 100 years (10) and similarly in New Mexico. This leads to fires that grow more quickly and burn with greater intensity.

Logging

If overly dense stands of trees are a major component of the forest management problem, it might seem that logging would be a good way to reduce fuel loads. However, this has proven not to be the case. Logging operations tend to target only the more lucrative, but fire-resistant larger trees because there is very little commercial market for the smaller trees that actually need to be thinned (12). As a report by several environmental groups in the aftermath of the Rodeo-Chediski fire points out, the portion of the Apache-Sitgreaves National Forest that burned in that fire has been one of the most heavily logged forests over the past 50 years. Very few old growth trees or unlogged areas remain. The same report notes that dense stands of young trees actually increased between 1972 and 1997, when the forest was heavily logged (13).

Beyond removing fire-resistant large trees, logging has other effects that increase wildfire risk. Harvesting timber affects the forest structure and local microclimate in ways that can dry out the forest and leave it more susceptible to sparks (13). Logging the larger trees also opens up spaces in the forest canopy that encourage the growth of more small trees, particularly if the grasses that would ordinarily deter small trees from taking hold have been over-grazed. Dense stands of smaller trees can also act as "ladders," by which fire can climb from the forest floor into the tops of larger trees. Crown fires, as the resultant blazes are known, are among the most difficult types of fires to control and can engulf large areas in flames very quickly.

Grazing

Livestock grazing has dramatically changed vegetation in the Southwest. Livestock currently graze 91 percent of all federal lands in the 11 Western states (10). Within forested areas, grazing can play an important role in increasing wildfire susceptibility. Overgrazing is said to have stripped the grasses that once provided the fuel for more frequent, but less destructive, fires, while small trees that would have been killed in such fires have been allowed to grow into thick stands that provide concentrated fuel for intense fires. Livestock have also been

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Wildfire, continued

blamed for disturbing forest ecosystems by compacting soils, which reduces water infiltration rates and increases soil erosion (10). Several Forest Service grazing allotments burned during the Rodeo-Chediski fire.

Bark Beetles

An ongoing bark beetle infestation continues to contribute to a higher than average likelihood of devastating fires and is also a result of forest management practices. The higher density of smaller trees allows insect infestations to spread more easily, since meadows and other open areas do not separate trees as they once did.

Drought has also played a role in the bark beetle infestation and in increasing the likelihood of major fires. Ponderosa pines have deep taproots that allow them to survive most droughts; and they can also fight beetle infestations by pushing the invaders out with their sap. However, the drought has left the trees too dry to produce the sap required to fight the beetles. Spraying pesticides over large areas to stop beetle infestation is an option forest managers are exploring, but is prohibitively expensive and may have other unwanted ecosystem impacts (14).

Thinning or Logging?

While the ecological factors outlined in the previous section might seem fairly straightforward, a storm of political controversy has surrounded major wildfires in the West. Environmentalists have been blamed for delaying fuels reduction projects through excessive litigation, while politicians have been accused of neglecting forest health in the interest of increased profits from logging.

In many cases, the issue comes down to disputes over what constitutes true thinning for fire management purposes and what may be efforts to expedite the logging of large trees. President Bush's Healthy Forests Initiative is concerned with the ability of the Forest Service to manage forests in a timely fashion. The Initiative cites procedural delays, overly complex and restrictive regulations, and the appeals process for preventing needed thinning projects from taking place. The Initiative proposes that delays in forest management projects can be avoided by streamlining the process for gaining approval for such projects and reducing the ability of environmental groups to block them. Environmental groups, on the other hand, are concerned with the fairness of Forest Service management practices. They say that they are being unjustly blamed for what is actually poor management on the part of the Forest Service. (13)

For an objective determination of whether legal actions by environmental groups to stop fuel reduction projects are indeed excessive, the U.S. General Accounting Office in 2001 conducted a review of the appeals and litigation brought against the Forest Service. The report showed that of the 1,671 hazardous fuel reduction projects undertaken during that year, only 20 had been appealed and none had been litigated. Of those 20, only 12 involved environmental groups; recreation groups, private industry interests, and individuals were also involved. The one suit filed in Arizona by environmental groups was in the Coconino National Forest and resulted in the project being withdrawn and replaced with smaller projects (15). The Bush administration ordered its own review of appeals and litigation, and

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The Future of Fire Forecasting

Although preventing all wildfires is not possible, being better prepared for them is becoming easier thanks to the increasing sophistication of fire climate forecasts. Knowing exactly where conditions are most ripe for fires allows federal and state agencies to target their resources on those areas, so they can respond quickly, before fires expand and become more difficult to stop. CLIMAS, the program that END InSight is a part of, has taken an active role in bringing forest managers together with forecasters to develop more accurate and useful fire probability forecasts. One of our goals is to create more effective decision-support tools, to improve resource allocation decisions, and maintain better safety for firefighters and the public.

The first annual National Seasonal Assessment Workshop, which took place in Mesa, Arizona February 25–28, 2003, brought together climatologists, fuels experts, and fire behavior analysts to produce seasonal fire outlooks. The outlooks do not expect the 2003 fire season to be as severe as the 2002 season, although an above average season is expected for much of the West, including large sections of Arizona and smaller areas of New Mexico.

Forecasts for the coming fire season in the Southwest indicate that it will start in early to mid-May, which is about average over the long term. In contrast, last year's fire season started early, in March, with the Oversight fire in the Huachuca Mountains. However, forecasters predict once this year's fire season starts, it will quickly become severe.

While winter and early spring rains have helped trees to recapture some of their moisture this year, getting back to normal moisture levels would take months of steady precipitation—and this is quite unlikely to occur. The increasing bark beetle infestation is expected to make matters worse, regardless of weather conditions, since the amount of dead wood available to burn will increase. However, the worst fire-related results from the bark beetle infestation may not be visible immediately, but rather in three to five years, when the dead trees begin to fall. The fallen timber could lead to ground fires that burn hotter and are very difficult to extinguish.

Wildfire, continued

reports that between January 2001 and July 2002, 48 percent of all Forest Service mechanical thinning projects were appealed. The Arizona environmental groups claim that the two reports sought to compare very different types of factors, and thus are not comparable (13). It is also worth noting that the Rodeo-Chediski fire burned primarily on the White Mountain Apache reservation, where the actions of environmental groups would have no influence (6)

How can the problem be solved?
There is widespread agreement that improving forest health and protecting communities from wildfires are key priorities. Restoring forests to conditions closer to their natural conditions is one step being pursued. Allowing fires to burn in areas that do not threaten urban areas is one option; mechanically thinning forests in areas where burning is not safe is another. More emphasis is also being placed on working with communities to take action to safeguard houses, such as using fire-resistant building materials and keeping brush-free perimeters around structures. Better forecasting of fire conditions will also allow fire managers to better target suppression efforts toward areas where the fire danger is highest (see sidebar, page 3) and their restoration efforts toward areas where prescribed burns and thinning can be done safely.

As fire historian Stephen Pyne of Arizona State University notes, "There are three strategies for dealing with the fire-prone West: convert the land to something less combustible, do the burning ourselves, or rely on suppression. The United States needs to use all three options—and in innovative mixes" (16). Projects by CLIMAS, other agencies, and researchers in the Southwest seek innovative ways to bring together fire managers, communities, and scientists to find the common ground that will allow for timely, effective and scientifically sound forest management.

–Rebecca Carter, CLIMAS

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About END InSight

END InSight is a year-long project to provide stakeholders in the Southwest with information about current drought and El Niño conditions. As part of the Climate Assessment for the Southwest (CLIMAS) project at the University of Arizona, END InSight is gathering feedback from stakeholders to improve the creation and use of climate information.

The *END InSight Newsletter* is published monthly and includes background and topical climate information. The newsletter is produced with support from the National Oceanic and Atmospheric Administration (NOAA).

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Executive Summary, April 2003

- ***Long-term (hydrological) drought*** will continue to be a major concern for the Southwest during the upcoming months. For all of Arizona and New Mexico, ***reservoir levels remain below average.***
    - ***Snowpack is below average*** for this time of year at ***most stations*** in the Southwest (with the exception of northeastern New Mexico).
    - ***Below-average streamflow*** is forecasted for the ***Colorado River*** at Lake Powell.
    - The New Mexico Drought Monitor Committee has declared ***emergency status for the Rio Grande and the Pecos Rivers.***
    - Below-average streamflow is forecasted for the ***Upper Gila River Basin***. Water users who depend on Upper Gila stream diversions for irrigation are ***expected to experience shortages later this season***.

- ***Fire danger*** is expected to be above normal across ***southeastern Arizona and southern New Mexico***, especially on mid-level slopes and grasslands. Dry weather characteristic of the pre-monsoon period will increase fire danger across our region.

- Long-term drought will have ***lingering soil moisture effects on agriculture over a large portion of New Mexico.*** At present, 50 percent of New Mexico winter wheat is in poor or very poor condition. Fifty-two percent of New Mexico range and pasture land is considered to be in poor to very poor condition.

- Seasonal temperature forecasts indicate ***high confidence in increased probabilities of above-average temperature across Arizona and New Mexico*** during the summer months.

- El Niño conditions continued to weaken. ***This El Niño is virtually over.***
    - There is considerable uncertainty in El Niño forecasts for the rest of 2003. Neutral Pacific Ocean conditions are likely this summer; however, La Niña conditions might develop this winter.

- **Bottom line:** Although short-term drought conditions have ameliorated conditions for most of the Southwest, ***this drought is not over.*** Water supply, streamflow, and soil moisture will continue to be of concern for the foreseeable future.

The climate products from the END InSight packet are also available on the web:

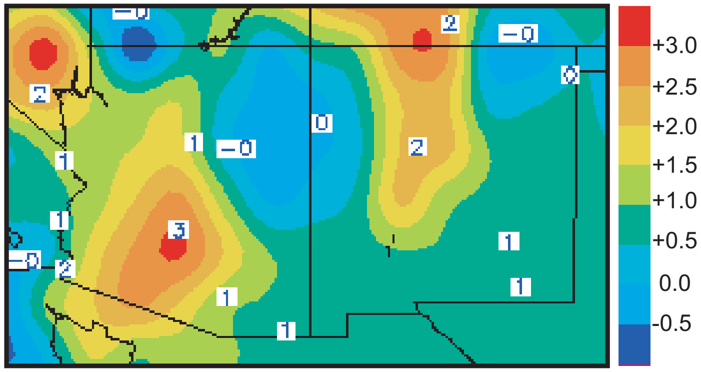
END InSight homepage: http://www.ispe.arizona.edu/climas/end/packets.html (pdf version)
CLIMAS Southwest Outlook: http://www.ispe.arizona.edu/climas/forecasts/swoutlook.html

Section B

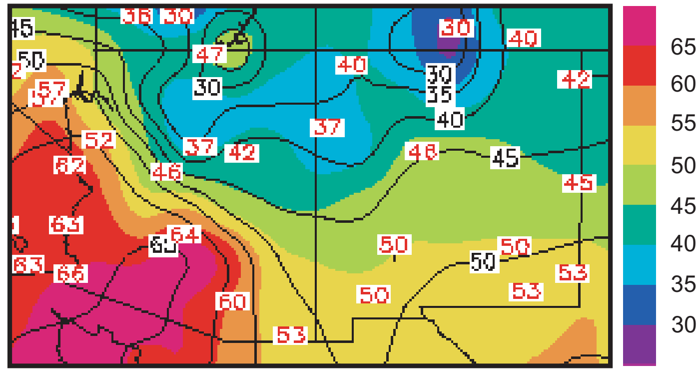
RECENT CONDITIONS

1. Recent Conditions: Temperature (up to 04/16/03) Source: Western Regional Climate Center

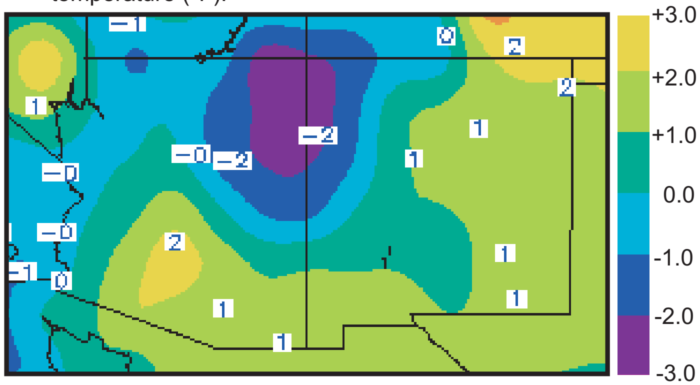
1a. Water year '02-'03 (through 4/19) departure from average temperature (°F).



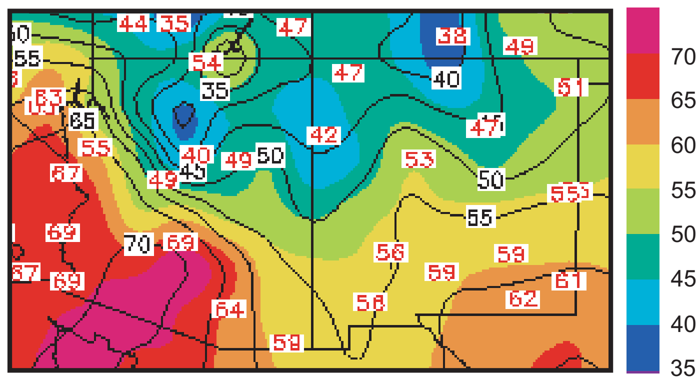
1b. Water year '02-'03 (through 4/19) average temperature (°F).



1c. Previous 28 days (3/23 - 4/19) departure from average temperature (°F).



1d. Previous 28 days (3/23 - 4/19) average temperature (°F).



Highlights: Despite cool storms passing through our region during late-March and mid-April, above-average temperatures have characterized much of our region since October 2002 (Figure 1a). In particular, during the previous 28 days, minimum temperatures have been higher than the 1971-2000 average across southern Arizona and central New Mexico. Similar monthly increases in minimum temperature have accounted for much of the average temperature departure from normal during the water year. An episode of higher-than-average temperatures across the Great Basin resulted in substantial snowmelt, with implications for streamflow in northern Arizona (see page 8). Temperatures are forecasted to be anomalously warm during the spring and summer (see pages 9-10).

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.

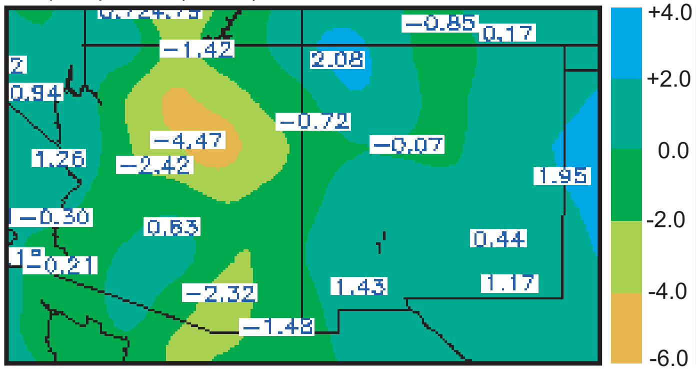
The data are in degrees Fahrenheit (°F).

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

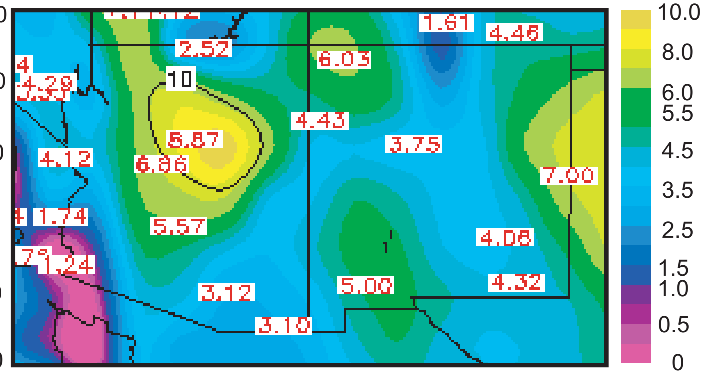
These maps are derived by taking measurements at meteorological stations (at airports) and estimating a continuous map surface based on the values of the measurements and a mathematical algorithm. This process of estimation also is called spatial interpolation.

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

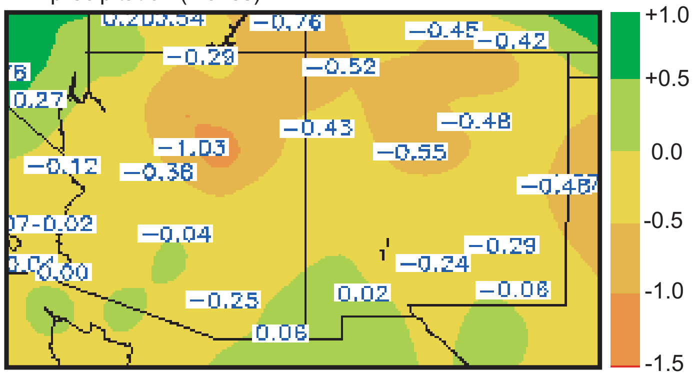
2a. Water year '02-'03 (through 4/19) departure from average precipitation (inches).



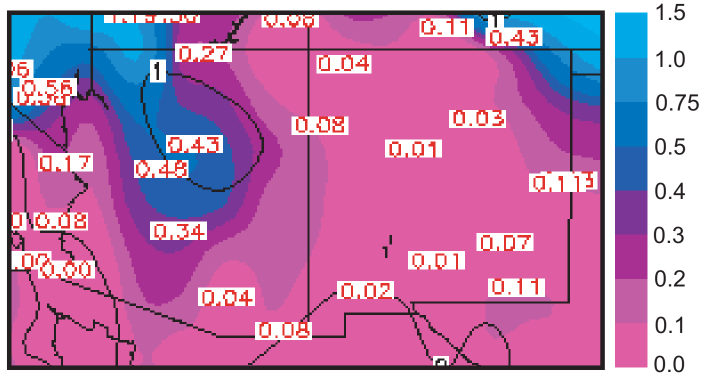
2b. Water year '02-'03 (through 4/19) total precipitation (inches).



2c. Previous 28 days (3/23 - 4/19) departure from average precipitation (inches).



2d. Previous 28 days (3/23 - 4/19) total precipitation (inches).



Highlights: Most of New Mexico and parts of western and central Arizona have received near-average to above-average precipitation since October 1, 2002 (Figure 2a). Water-year precipitation for northern and southern Arizona, however, has been below average by one to several inches. During the past 28 days much of our region has received precipitation; however, it has been below average for this time of year (Figure 2c), especially in north-central Arizona. Moreover, the region has been affected by the recent passage of a front which brought dry winds and little 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.

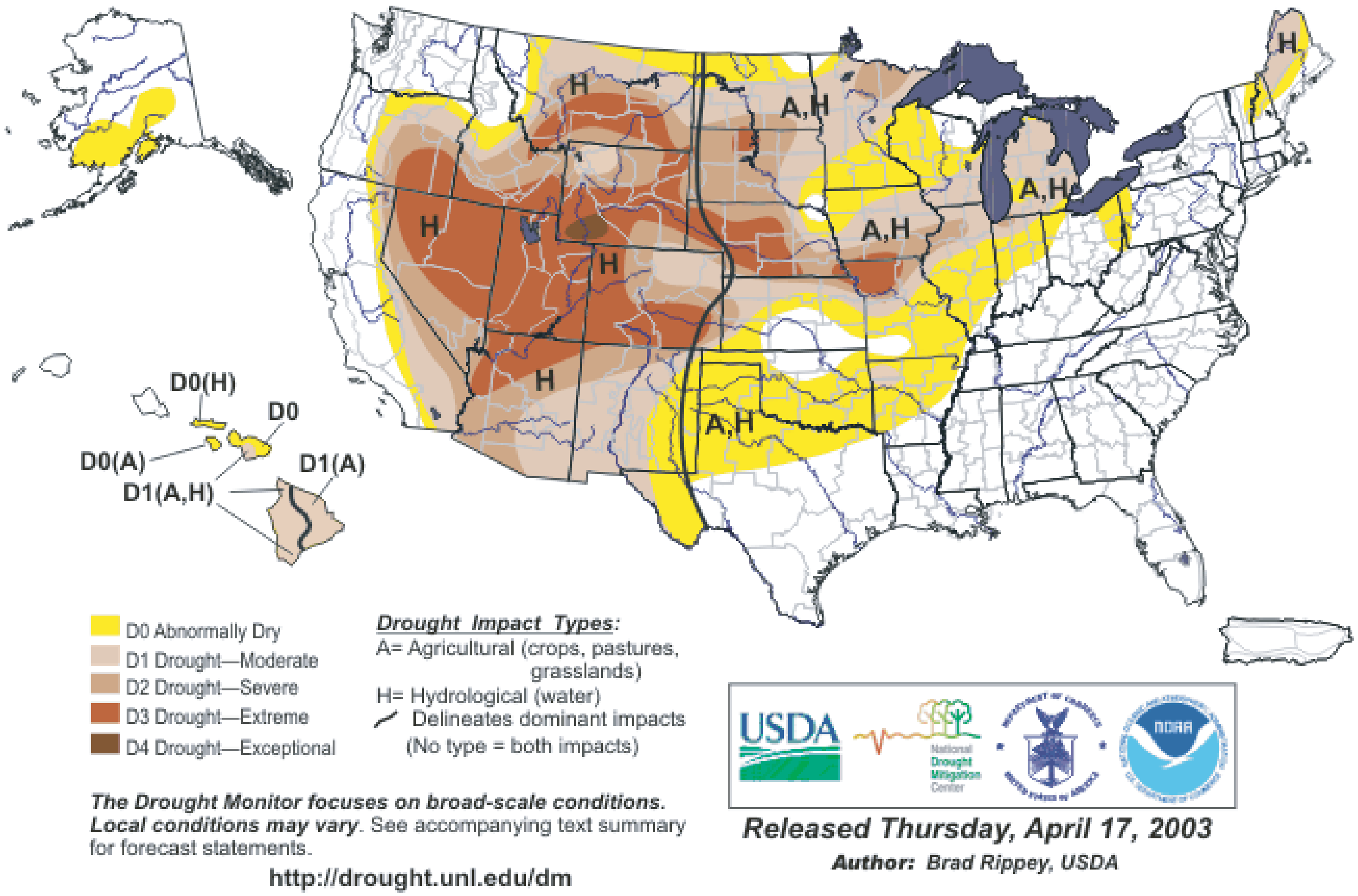
The data are in inches of precipitation. **Note: The scales for Figures 2b & 2d are non-linear.**

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 also is 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 04/15/03) 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 04/17 and is based on data collected through 04/15 (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.

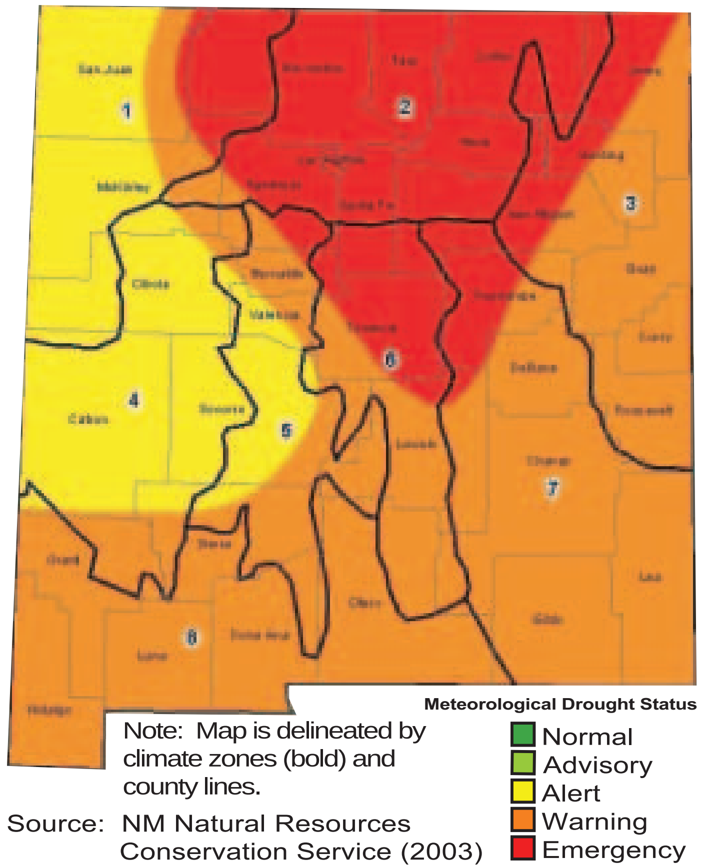
Highlights: Compared to one month ago, drought conditions have remained virtually unchanged for Arizona and New Mexico. Nevertheless, diminishing snowpack in Arizona and western New Mexico (see page 8) have fueled concerns about continued and protracted hydrological drought. In addition, severe to exceptional drought conditions persist in Mexico, south of the Arizona and New Mexico borders. Short-term drought effects on agriculture and ranching also are of concern as Arizona and New Mexico head into the dry pre-monsoon season. Southeastern Arizona has been plagued by spotty precipitation, which has resulted in uneven impacts on ranchers in the region (University of Arizona Cooperative Extension, personal communication). The USDA National Agricultural Statistics Service reports 52% of New Mexico range and pasture conditions as very poor-to-poor and New Mexico winter wheat as 50% very poor-poor. A recent windy cold front passing through New Mexico resulted in freeze damage that affected fruit trees and hay crops, as well as wind damage to alfalfa and pasture.

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 04/14/03) Source: New Mexico NRCS

New Mexico Drought Map

Drought Status as of April 14, 2003

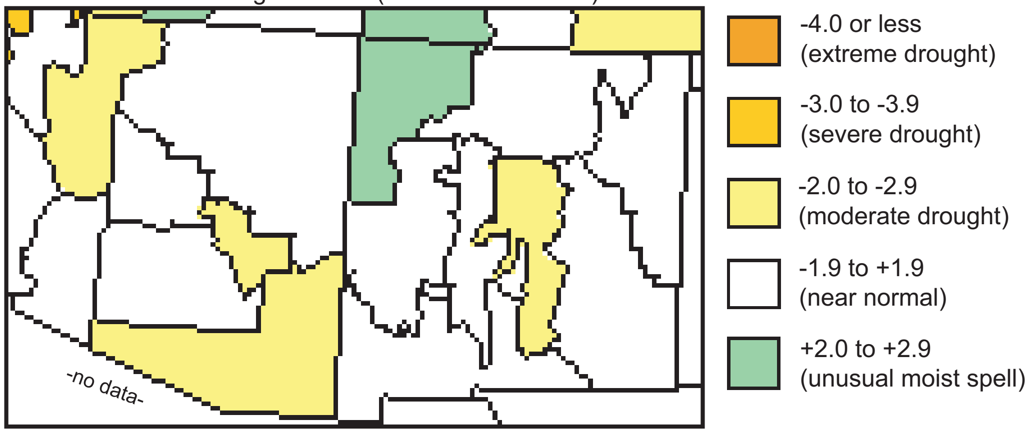


Notes: Changes made to the New Mexico drought status map, updated by the New Mexico Natural Resource Conservation Service (NRCS) on April 14, 2003, signals significant modifications in both the interpretation and graphical representation of drought conditions in the state. According to Dan Murray of the New Mexico NRCS, the new drought map reflects changes in the 'trigger mechanisms' used to determine drought conditions in New Mexico, including a greater emphasis on more long-term and hydrologic drought measures when compared to previous New Mexico drought maps. The monthly production of two drought maps representing meteorological and hydrological drought separately, as well as documentation of the changes made in the production of the New Mexico Drought graphic above, are expected to be made available in the next few months.

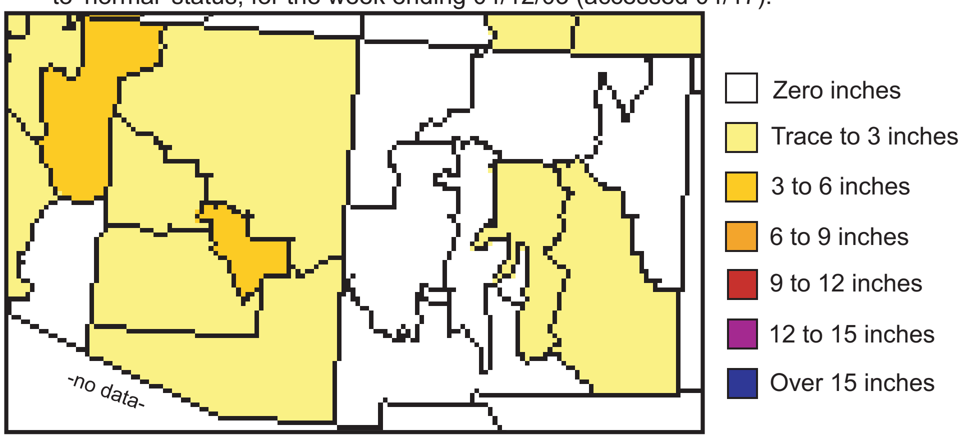
The New Mexico map (http://www.nm.nrcs.usda.gov/drought/drought.htm), currently is produced monthly, but when near-normal conditions exist, it is updated quarterly. Contact Matt Parks at ADEM at (602) 392-7510 for more information on Arizona regional drought declarations and situation reports.

5. PDSI Measures of Recent Conditions (up to 04/12/03) Source: NOAA Climate Prediction Center

5a. Current weekly Palmer Drought Severity Index (PDSI), for the week ending 04/12/03 (accessed 04/17/03).



5b. Precipitation needed to bring current weekly PDSI assessment to 'normal' status, for the week ending 04/12/03 (accessed 04/17).



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.

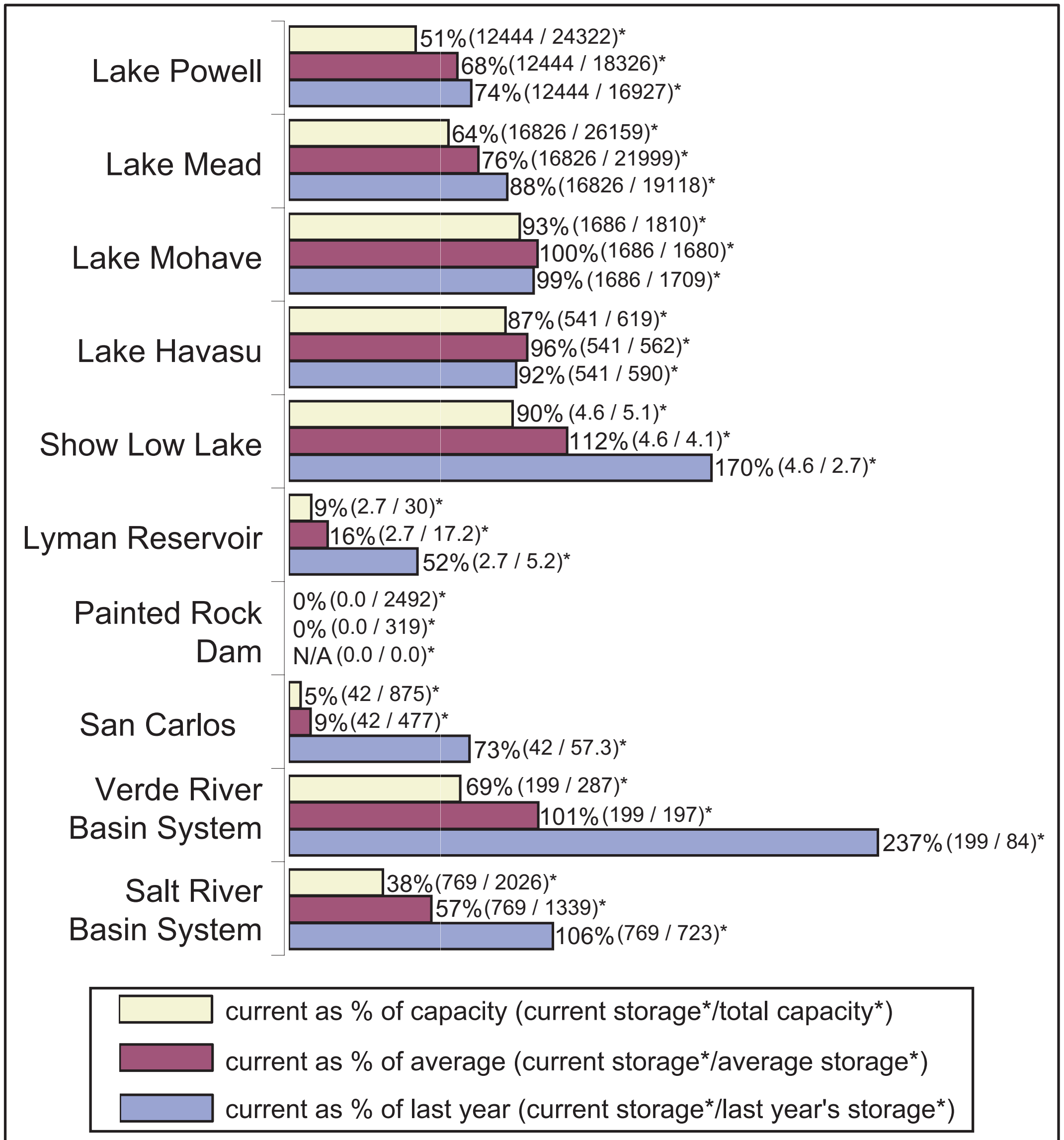
These maps are issued weekly by the NOAA CPC.

Highlights: Since March 2003, short-term drought conditions increased slightly for southeastern Arizona, and the spatial extent of unusually moist conditions in northern New Mexico has decreased (Figure 5a). Figure 5b shows an increase in the amount of precipitation necessary to ameliorate meteorological drought conditions in the high plains of southeastern New Mexico, which was hit by a severe mid-April dust storm. Precipitation required for drought amelioration in Arizona has remained the same since March 2003.

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 March 2003) Source: USDA NRCS



*Units are in thousands of acre-feet

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 04/10/03, Arizona's report had been updated through the end of March.

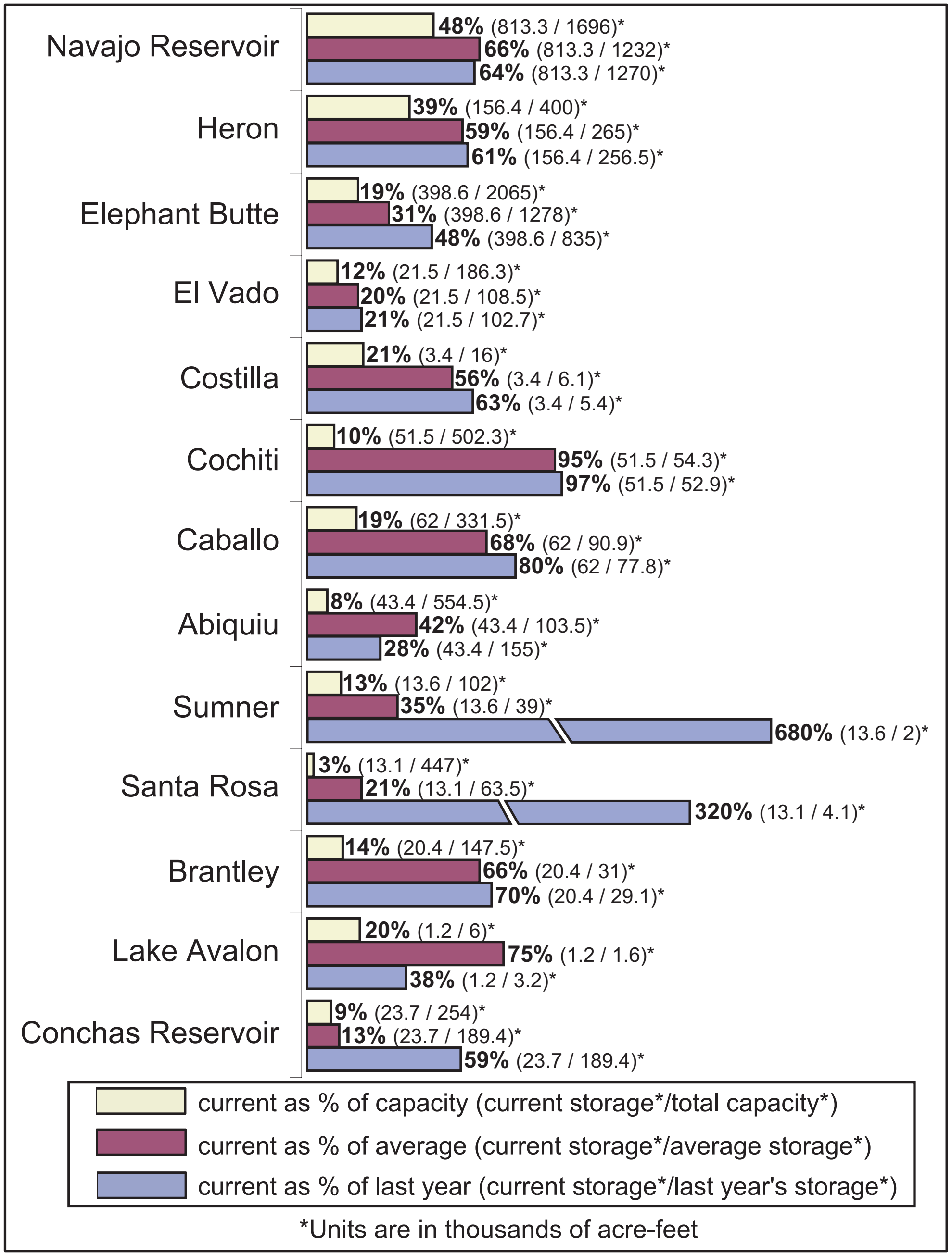
For additional information, contact Tom Pagano of the NWCC-NRCS-USDA (tpagano@wcc.nrcs.usda.gov; 503-414-3010) or Larry Martinez, NRCS, USDA, 3003 N. Central Ave, Suite 800, Phoenix, Arizona 85012-2945; 602-280-8841; Larry.Martinez@az.usda.gov)

Highlights: Levels in most Arizona reservoirs have held steady or increased slightly; reservoir storage continues to be below average for this time of year. Verde River Basin reservoir levels have improved substantially since March 2003; however, Salt River system levels are well below average. San Carlos reservoir and Lyman Lake are at exceedingly low levels.

The U.S. Bureau of Reclamation officials caution that if the current drought continues Lake Powell might drop so low that it will stop feeding the hydroelectric penstocks that generate $70 million in power yearly for 1.7 million people throughout the Southwest (*Sacramento Bee*, March 31, 2003).

The *Arizona Republic* (April 7, 2003) reported that drought and the expense of new water distribution projects will likely bring a halt to a decade-long golf course development boom in Scottsdale. The Flagstaff City Council approved a series of permanent conservation measures that include a ban on outdoor watering during daylight (*Arizona Republic*, April 14, 2003).

7. New Mexico Reservoir Levels (through the end of March 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 04/10/03, New Mexico's report has been updated through the end of March.

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)

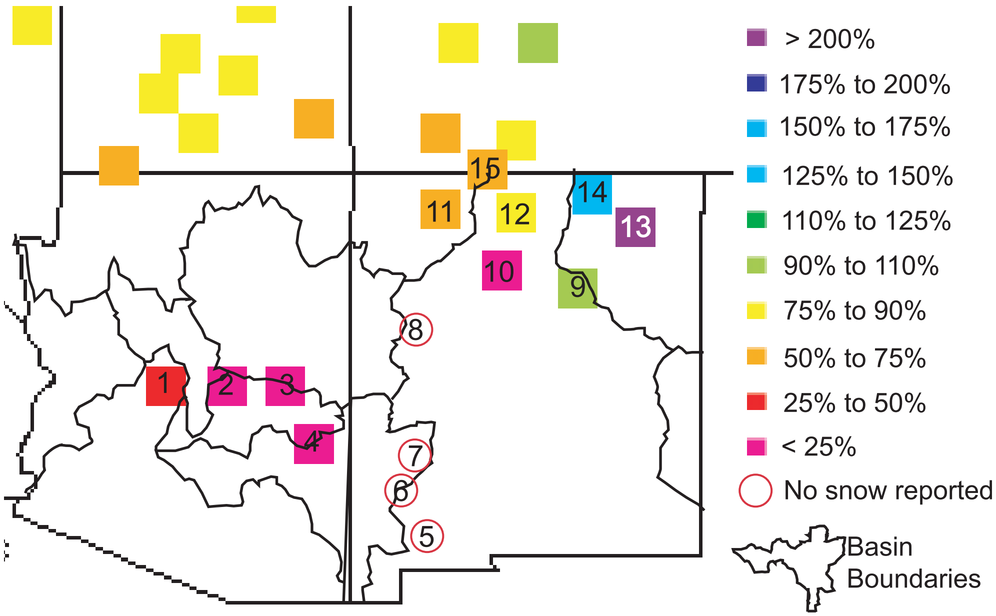
Highlights: New Mexico reservoir levels have mostly held steady or slightly increased their levels. However, all New Mexico reservoirs are still reporting levels ***far below average***.

The *Santa Fe New Mexican* (April 1, 2003) reported that Santa Fe will maintain its Stage 3 water restrictions despite modest increases in city reservoir levels. Moreover, a recent proposed Santa Fe law would require new homes and buildings to have water-harvesting systems to improve conservation efforts (*Santa Fe New Mexican*, April 9, 2003).

Recent news with implications for the Rio Grande Compact (an agreement among Texas, New Mexico, and Colorado) reports that Texas recently rejected New Mexico's offer to release water from Elephant Butte Reservoir in exchange for allowing New Mexico to store a similar amount of water in its upstream reservoirs. New Mexico requires water in upstream reservoirs to meet irrigation needs and Rio Grande flows necessary to protect the endangered silvery minnow and replenish water supplies for Santa Fe. The issue has the potential to create divisions between constituents in northern New Mexico urban areas, such as Santa Fe, and the recreation-based economy in the Elephant Butte area (*Santa Fe New Mexican*, April 12, 2003).

8. Snowpack in the Southwestern United States (updated 04/17/03) ♦ Source: USDA NRCS, WRCC

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



Arizona Basins	New Mexico Basins	
1 Verde River Basin	5 Mimbres River Basin	11 San Miguel, Dolores, Animas, and San Juan River Basins
2 Central Mogollon Rim	6 San Francisco River Basin	12 Rio Chama River Basin
3 Little Colorado - Southern Headwaters	7 Gila River Basin	13 Cimarron River Basin
4 Salt River Basin	8 Zuni/Bluewater River Basin	14 Sangre de Cristo Mountain Range Basin
	9 Pecos River	15 San Juan River Headwaters
	10 Jemez River Basin	

Highlights: As of April 21, 2003, snow water content (SWC) is well below the 1971-2000 average for the majority of river basins in Arizona and New Mexico. Northeastern New Mexico river basins remain well above average; however, moisture-depleted soils are expected to absorb much of the snowmelt runoff. Upper Colorado and Upper Rio Grande River Basin SWC totals continue to be below average at SNOTEL sites in other western states (Wyoming, Utah, and Colorado). In Utah, mid-April temperatures that were 9-13°F above average resulted in 15-30% loss of snowpack with little runoff and, thus, little contribution to Colorado River streamflow. Little snowpack and decreasing reservoir levels have raised concerns among Lake Powell region tourism-based businesses and Colorado River Basin water managers (*Sacramento Bee*, March 31, 2003). Despite late-winter storms, below-normal snowpack will add to a water supply deficit that has accumulated over the past several 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

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. ***NOTE: stations not reporting SWC this month (but that did so previously) are circled in red.***

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

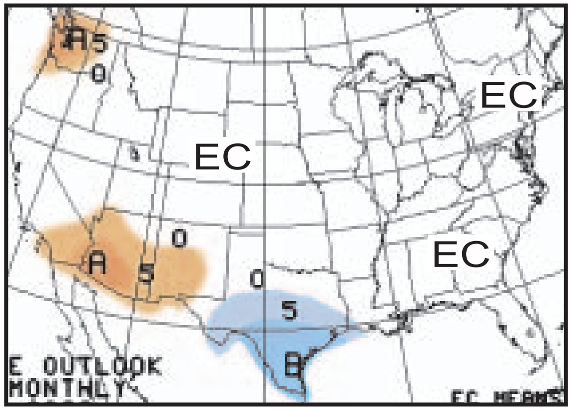
These data are provisional and subject to revision. They have not been processed for quality assurance. However, they provide the best available land-based estimates during the snow measurement season.

Section C

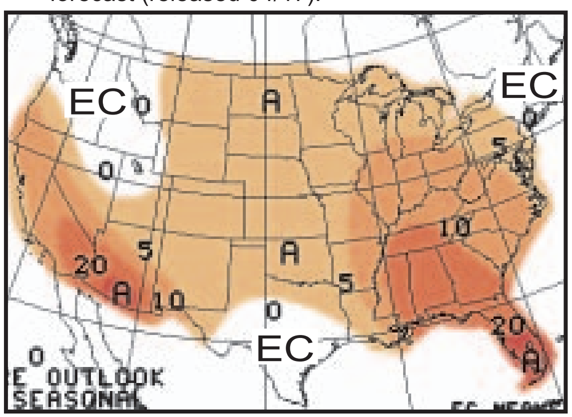
FORECASTS

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

9a. May 2003 U.S. temperature forecast (released 04/17)



9b. May - July 2003 U.S. temperature forecast (released 04/17).



Percent Likelihood of Above and Below Average Temperatures*

A = Above: 20% - 30%; 10% - 20%; 5% - 10%; 0% - 5%

B = Below: 0% - 5%; 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 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 NOAA-CPC temperature outlook for May (Figure 9a) indicates slightly increased probabilities (33% to 43% likelihood) of above-average temperatures for much of the Southwest. The CPC May-July seasonal outlook (May-July; Figure 9b) shows much higher increases in the probability of above-average temperatures (33%-63% likelihood), especially across western and southern Arizona. The International Research Institute (IRI) for Climate Prediction also indicates an increase in the chances of above-average temperatures in the Southwest for May-July (not pictured), with a region of 50% likelihood of above-average temperatures centered over northern Mexico and the southernmost reaches of Arizona and New Mexico. The CPC predictions are based chiefly on the consistency of statistically-based relationships between present ocean-atmosphere conditions and U.S. temperature, as well as historical long-term temperature trends. 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

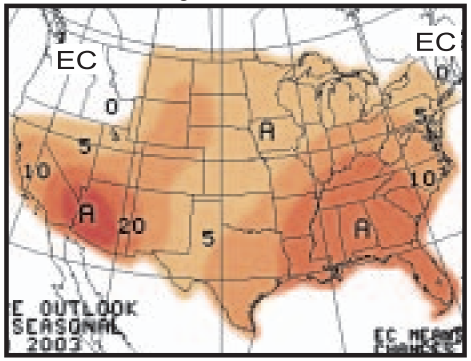
Please note that this website has many graphics and may load slowly on your computer.

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

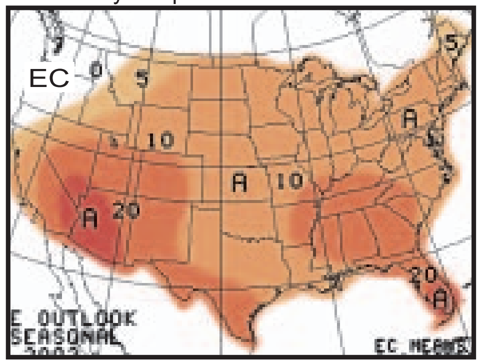
10. Temperature: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead temperature forecasts (released 04/17/03).

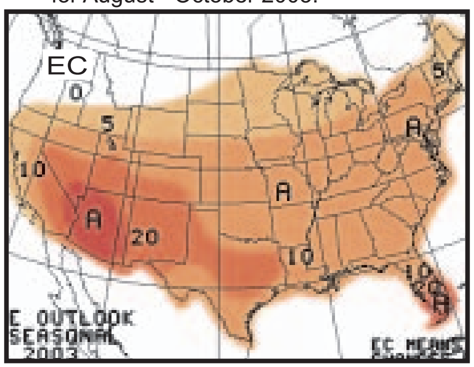
10a. Long-lead national temperature forecast for June - August 2003.



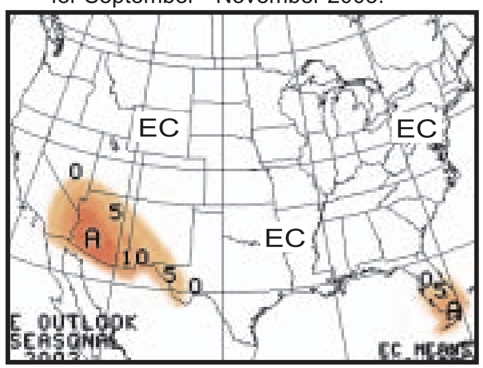
10b. Long-lead national temperature forecast for July - September 2003.



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



10d. Long-lead national temperature forecast for September - November 2003.



Percent Likelihood of Above and Below Average Temperatures*

- 30% - 40%
- 20% - 30%
- 10% - 20% A = Above
- 5% - 10%
- 0% - 5%

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

Highlights: The NOAA-CPC temperature outlooks for June-November 2003 show increased probabilities of above-average temperatures for most of the United States until the September-November season (Figures 10a-d), with maximum forecast confidence centered over Arizona and southern Florida. There is a high probability of above-average temperatures across Arizona and New Mexico during the forecast period, with the likelihood of above-average temperatures reaching 53 to 63% over western Arizona throughout the summer and early fall. These forecasts are based chiefly on long-term trends toward above-average temperatures, reinforced by the consistency of statistical and dynamical forecast models. Forecast evaluation research by CLIMAS shows high skill for our region and exceptional skill across southern and western Arizona for CPC summer and early fall temperature forecasts made during April. IRI temperature forecasts (not pictured) also indicate an increased likelihood of the above-average temperatures across our region for the June-October forecast period.

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.

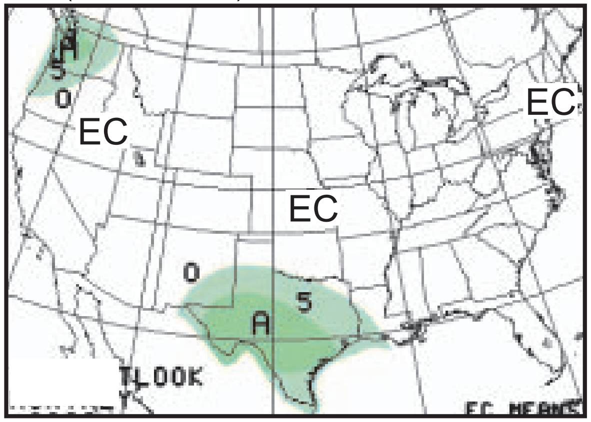
Thus, using the NOAA CPC excess likelihood forecast, in areas with light brown shading (0-5% excess likelihood of above average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average temperature.

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

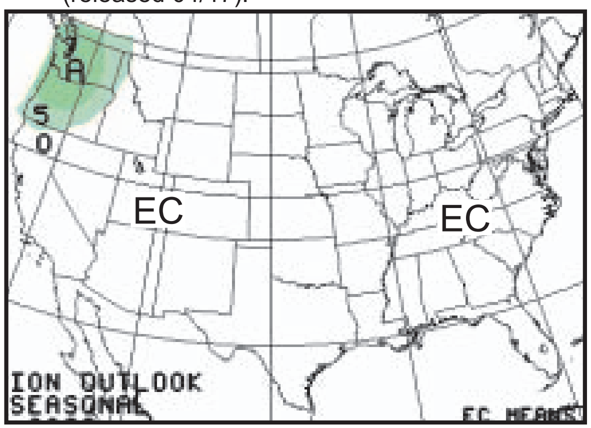
Equal Chances (EC) indicates areas where reliability (i.e., the 'skill') of the forecast is poor and no anomaly prediction is offered.

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

11a. May 2003 U.S. precipitation forecast (released 04/17).



11b. May - July 2003 U.S. precipitation forecast (released 04/17).



Percent Likelihood of Above Average Precipitation*

- 20% - 30%
- 10% - 20%
- 5% - 10%
- 0% - 5%

A = Above

*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.

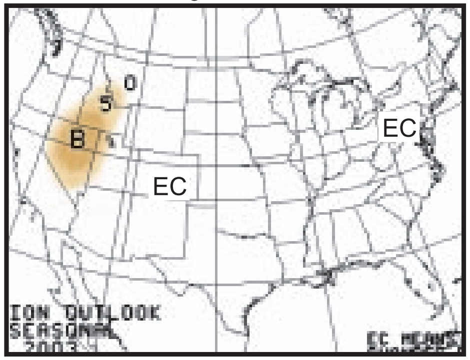
Highlights: The official NOAA-CPC precipitation outlook for May shows slightly increased chances (33-43% likelihood) of above-average precipitation for southeastern New Mexico. Forecasters have withheld judgment for most of the Southwest for May and all of the Southwest for the May-July forecast period. The forecast shows greater chances of above-average precipitation in southeastern New Mexico (Figure 11a), based in part on excess soil moisture in South Texas and the high plains of southeastern New Mexico, which may be recycled into the atmosphere during the late spring. The May-July precipitation forecast from the International Research Institute (IRI) for Climate Prediction (not pictured) also withholds judgment 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/

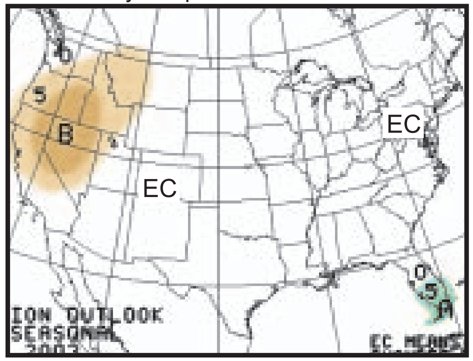
12. Precipitation: Multi-season Outlooks ♦ Source: NOAA Climate Prediction Center

Overlapping 3-month long-lead precipitation forcasts (released 04/17/03).

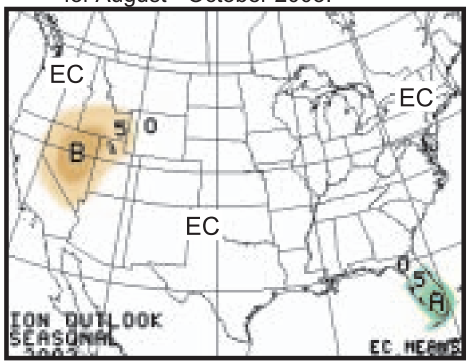
12a. Long-lead U.S. precipitation forecast for June - August 2003.



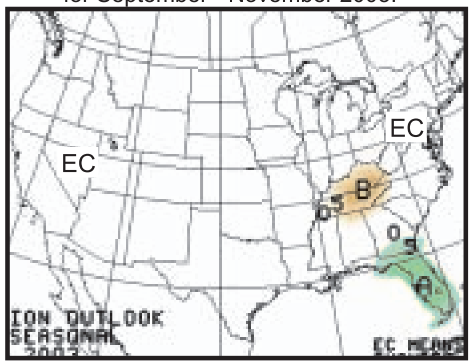
12b. Long-lead U.S. precipitation forecast for July - September 2003.



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



12d. Long-lead U.S. precipitation forecast for September - November 2003.



Percent Likelihood of Above or Below Average Precipitation*

5% - 10% Above
0% - 5%

0% - 5% Below
5% - 10%

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

Highlights: NOAA-CPC forecasters have withheld judgment with regard to precipitation forecasts for the summer and fall (Figures 12a-d), which is a time period well-known for a lack of forecast skill. Some El Niño and other late-winter weather effects may carry over into the late spring and summer through indirect agents such as excess soil moisture recycled into the atmosphere. 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 later 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/

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.

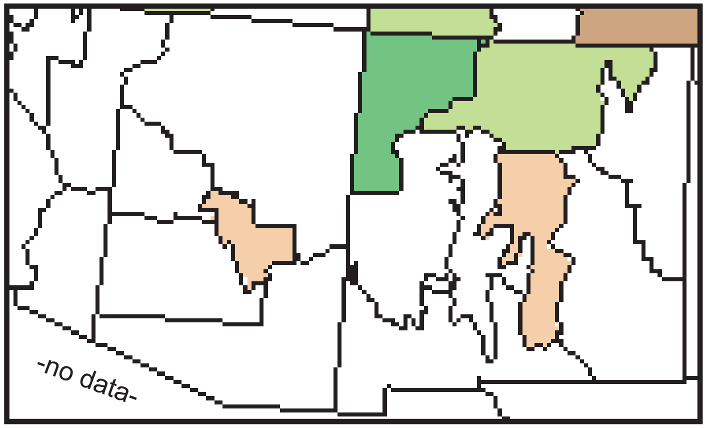
Thus, using the NOAA CPC excess likelihood forecast, in areas with light green shading (0-5% excess likelihood of above-average) there is a 33.3-38.3% chance of above-average, a 33.3% chance of average, and a 28.3-33.3% chance of below-average precipitation.

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.

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

13a. Short-term Palmer Drought Severity Index (PDSI) forecast through 04/19/03 (accessed 04/17).



-3.0 to -3.9 (severe drought)

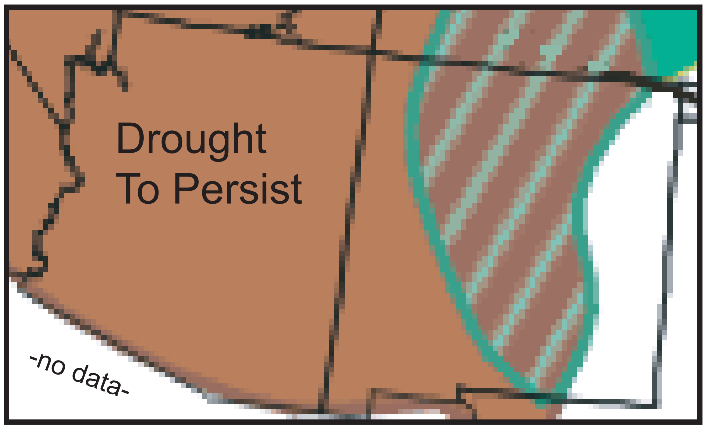
-2.0 to -2.9 (moderate drought)

-1.9 to +1.9 (near normal)

+2.0 to +2.9 (unusually moist spell)

+3.0 to +3.9 (very moist spell)

13b. Seasonal drought outlook through July 2003 (accessed 04/17).



Drought to persist or intensify

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.

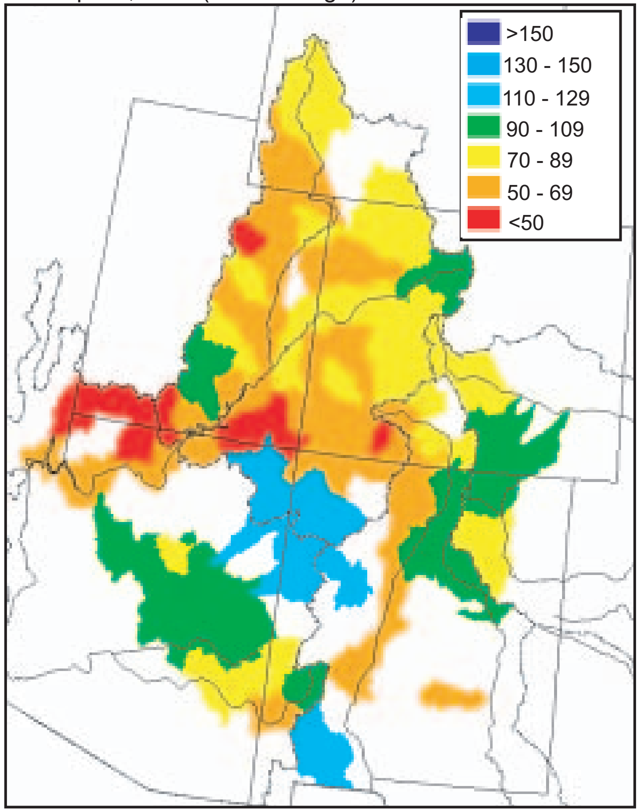
The delineated areas in the Seasonal Drought Outlook are defined subjectively and are based on expert assessment of numerous indicators including outputs of short- and long-term forecast models.

Highlights: The short-term Palmer Drought Severity Index (PDSI) forecast (Figure 13a) shows near-normal conditions across most of Arizona and New Mexico, with relatively wet conditions across most of northern New Mexico and moderate short-term drought conditions in central Arizona and central New Mexico. The NOAA-Climate Prediction Center (CPC) suggests ongoing drought throughout Arizona and western New Mexico (Figure 13b). Improvements to water supplies in most of the Southwest will be limited due to relatively low snowpack levels and diminishing prospects for significant precipitation until the summer. Forecasted improvements in drought conditions in central New Mexico are due chiefly to substantial mid-March precipitation in north-central New Mexico.

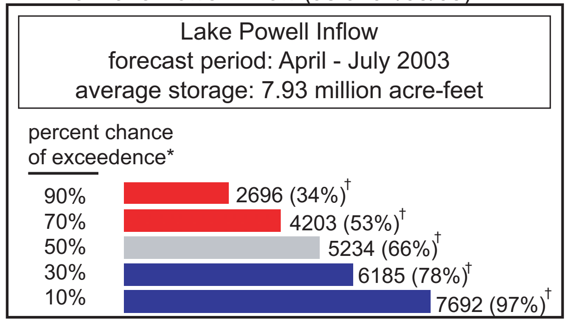
For more information, visit: http://www.drought.noaa.gov/

14. Streamflow Forecast for Spring and Summer ♦ Source: USDA NRCS National Water and Climate Center

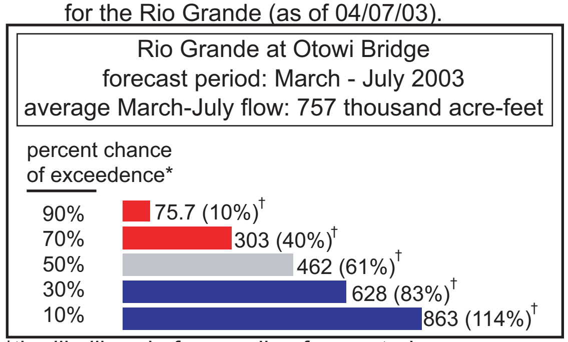
14a. NRCS spring and summer streamflow forecast as of April 1, 2003 (% of average).



14b. NRCS percent exceedence forecast chart for Lake Powell inflow (as of 04/03/03)



14c. NRCS percent exceedence forecast chart for the Rio Grande (as of 04/07/03).



*the likelihood of exceeding forecasted streamflow volume.

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

Highlights: April 1, 2003, forecasts for spring and summer indicate wide variation in expected streamflow in Southwest river basins. Below-average streamflow is forecast for large basins in most of the Upper Colorado River Basin states (WY, UT, CO), including the Virgin River (Figure 14a). Lake Powell inflow is predicted to be well below average April-July levels (Figure 14b). Streamflow forecasts for major New Mexico river basins include well below (Rio Hondo, San Juan), well below to near average (Canadian River, Rio Grande [Figure 14c], San Francisco/Upper Gila), near average (Pecos), and above-average (Mimbres, Zuni/Bluewater). Forecast models project that despite possible near average streamflow, summer reservoir storage in the Rio Grande and Pecos basins will be even lower than at present. Consequently New Mexico drought planners have declared ***emergency drought status*** for these basins. Arizona streamflow forecasts are for average runoff in the Verde Basin, near-average runoff in the Salt and Little Colorado basins, and below average runoff in the Gila River Basin, where water users who depend on stream diversions for irrigation are expected to experience shortages later this season.

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

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

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

Notes:

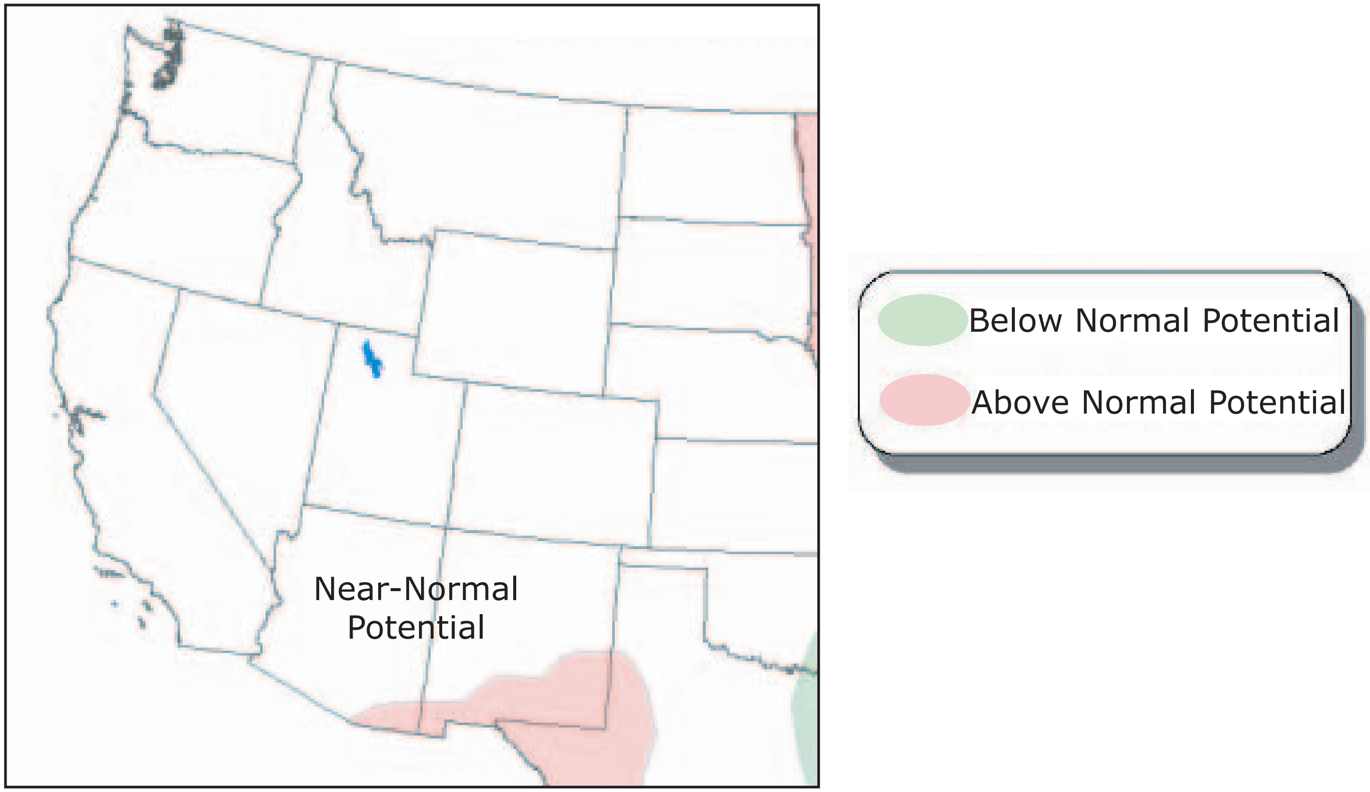
The forecast information provided in Figures 14a-c is updated monthly and is provided by the National Resources Conservation Service (NRCS). Unless otherwise specified, all streamflow forecasts are for streamflow volumes that would occur naturally without any upstream influences, such as reservoirs and 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 628 acre-feet of water (83% of average), and a 70% chance that it will not. 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 (valid April 1st–30th, 2003) ♦ Source: National Interagency Fire Center

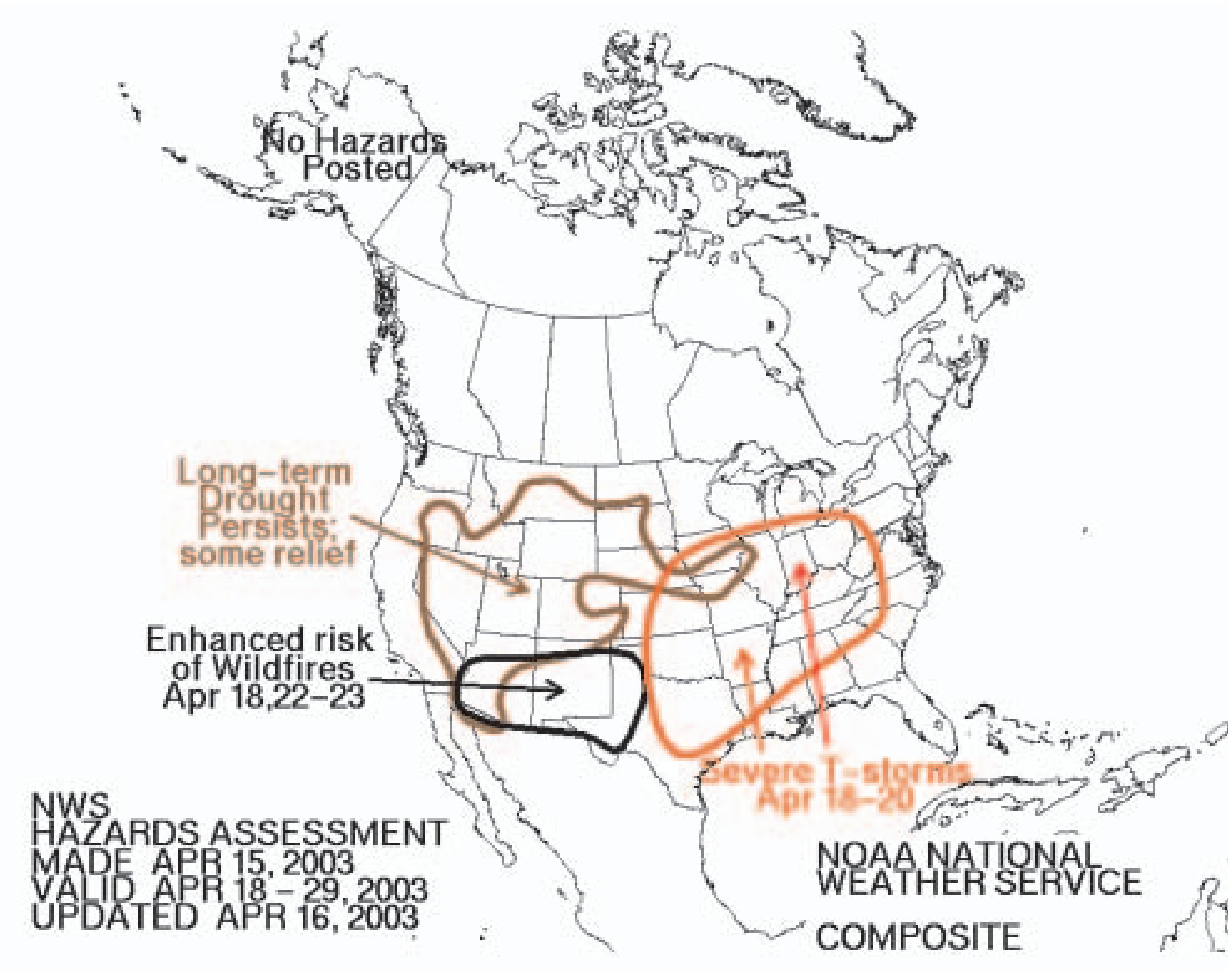


Notes: The National Interagency Coordination Center (NICC) at the National Interagency Fire Center (NIFC) produces monthly wildland fire outlooks (Figure 15). These forecasts consider climate forecasts and surface-fuels conditions to assess fire potential. They are subjective assessments, based on synthesis of regional fire danger outlooks.

Highlights: The Wildland Fire Outlook for April 2003 indicates above-normal fire potential for southeastern Arizona, the southern tier of New Mexico, and Southwest Texas; however, fire potential for the rest of the western United States remains at about normal (Figure 15). Forecasters at the Southwest Coordination Center (SWCC; a regional multiagency federal-state operation for coordinating fire-related information, resources, and firefighting mobilization) also indicate a region of below-normal fire danger for a region stretching from approximately Santa Fe, New Mexico to the Colorado border, encompassing the Sangre de Christo Mountains. SWCC specialists caution that although cumulative fire activity for the first 3 ½ months of 2003 has been well below normal levels, fire danger at elevations below 8500 feet, especially on mid-level slopes and rangelands in the southern portions of Arizona and New Mexico, has the potential to elevate to very high-to-extreme levels. They expect windy conditions for the rest of April, which cause a quicker drying of fuels. This year, a 1000-acre fire has already burned near the Arizona-Mexico border.

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)

16. U.S. Hazards Assessment Forecast (valid April 18th – 29th, 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

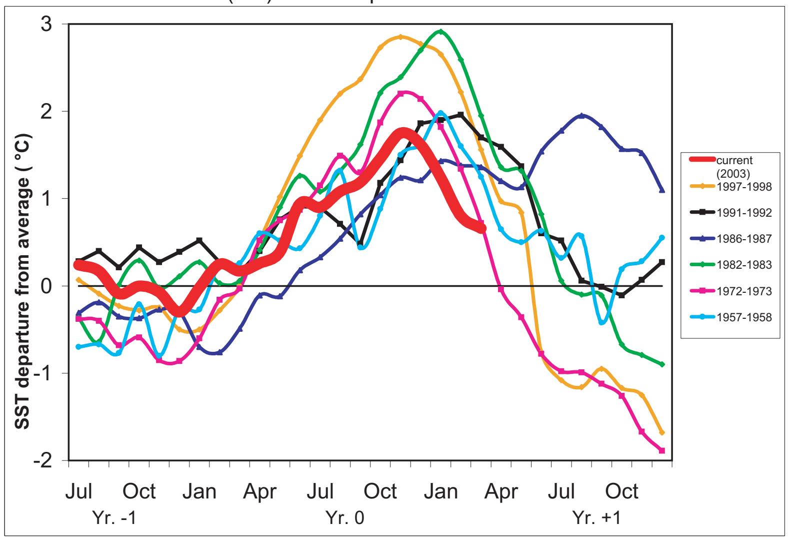
Soil and/or Fire:
http://www.cpc.ncep.noaa.gov/products/predictions/threats/s_threats.gif

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

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

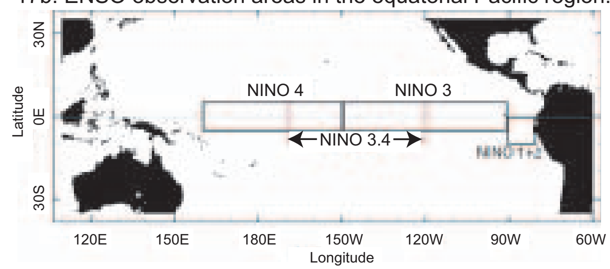
17a. Past and current (red) El Niño episodes.



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.

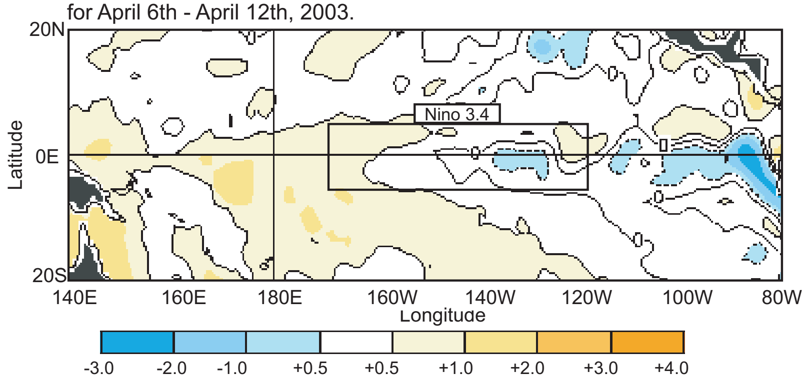
Each line on the graph represents SST departures for previous El Niño events, beginning with the year before the event began (Yr. –1), continuing through the event year (Yr. 0), and into the decay of the event during the subsequent year (Yr. +1).

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

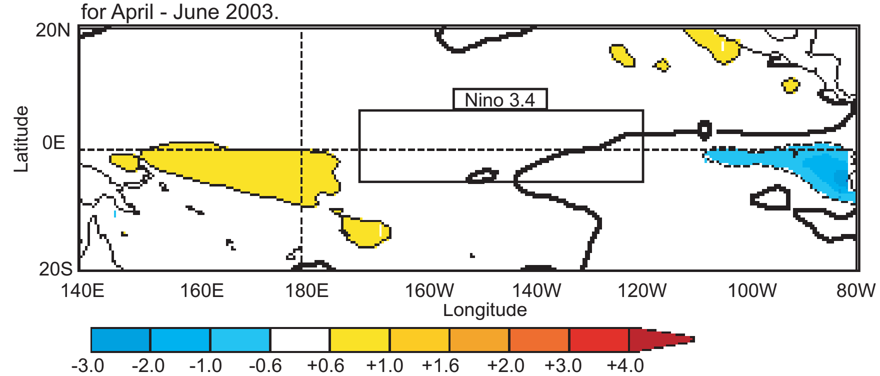


This year's SST departures are plotted as a red line (Figure 17a). The magnitude of the SST departure, its timing during the seasonal cycle, and its exact location in the equatorial Pacific Ocean are some of the factors that determine the degree of impacts experienced in the Southwest.

17c. 7-day averaged South Pacific sea surface temperature anomalies (°C) for April 6th - April 12th, 2003.



17d. Forecasted South Pacific sea surface temperature anomalies (°C) for April - June 2003.



Highlights: El Niño conditions continued to weaken in March (Figure 17a), as sea surface temperature anomalies (SSTAs) decreased in the central and especially in the eastern equatorial Pacific Ocean (Figure 17c). SSTAs are still slightly positive (Figure 17c) in the central and western Pacific Ocean, where El Niño-like impacts are still present in the tropical atmosphere (Figure 17c). The magnitude and extent of the subsurface temperature anomalies, which sustain El Niño activity, have steadily decreased. The evolution of El Niño conditions during the past several months is typical during the decay phase of an El Niño episode. Both the NOAA Climate Prediction Center (CPC; Figure 17d) and the International Research Institute for Climate Prediction (IRI) indicate that the remaining El Niño conditions are likely to dissipate by the end of spring. However, forecasts beyond June 2003 are uncertain. According to the IRI, about 50% of the models predict neutral conditions throughout the end of 2003, while the remaining 50% predict either El Niño or La Niña conditions. The skill of SST forecast models is relatively low at this time of year.

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

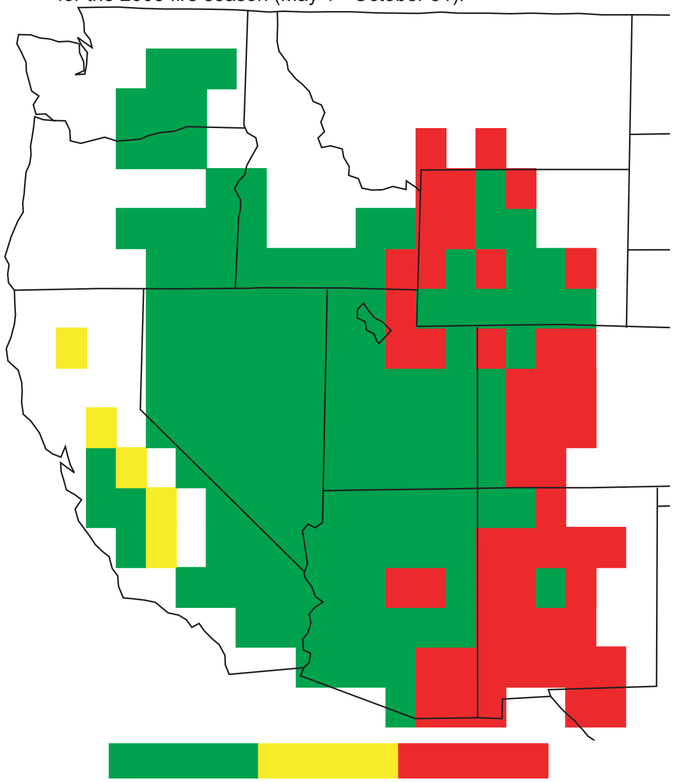
For more information about El Niño and to access the graphics found on this page, visit: http://iri.columbia.edu/climate/ENSO/

Section D

FOCUS ON WILDFIRE FORECASTS AND PINE MORTALITY

18. Statistical Wildfire Forecast for the Western United States Sources: California Applications Program

18a. Forecast of wildfire burn acreage (as tercile of historical distribution) for the 2003 fire season (May 1 - October 31).



Notes:

Wildfire burn acreage is forecasted using a statistical methodology called canonical correlation analysis (CCA). CCA matches large-scale patterns in the monthly U.S. climate division Palmer Drought Severity Index (PDSI) with spatial patterns in seasonal area burned in order to predict area burned one season in advance.

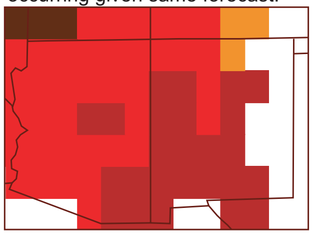
Forecasts of wildfire burn acreage are assigned to one of three classes based on the historical distribution of acreage burned during the annual fire season (May 1 – October 31): bottom tercile (green; relatively small burn acreage forecast), middle tercile (yellow; relatively intermediate burn acreage forecast), and top tercile (red; relatively large burn acreage forecast). Areas of 'no forecast' are in white in Figures 18a-e.

Forecast accuracy is based on cross-validation of data from 1980-2000. With interest greatest for forecasts of small and large acreage burns, forecast accuracy for each grid cell is based on the following conditions: the probability (%) of forecasted top tercile acreage burned occurring (Figure 18b), bottom tercile acreage burned given a top tercile forecast (Figure 18c), forecasted bottom tercile acreage burned occurring (Figure 18d), and top tercile acreage burned given a bottom tercile forecast (Figure 18e).

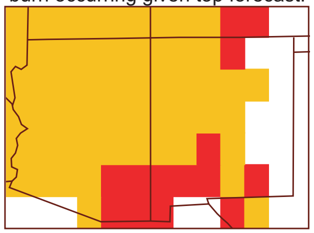
Based on data for 1980-2001, bottom and top tercile wildfire burn acreage forecasts are successful better than 50% of the time for large parts of Arizona and New Mexico (Figures 18b and 18d).

The CCA wildfire forecast for the western United States was issued in April 2003 by Dr. Anthony Westerling of Scripps Institution of Oceanography, San Diego, California.

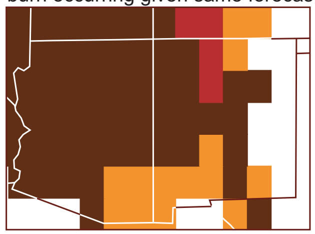
18b. Probability of a top tercile burn occurring given same forecast.



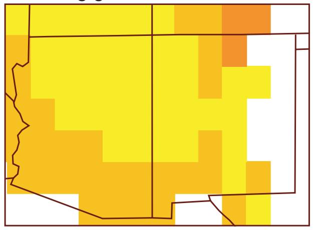
18c. Probability of a bottom tercile burn occurring given top forecast.

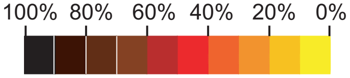


18d. Probability of a bottom tercile burn occurring given same forecast.



18e. Probability of a top tercile burn occurring given a bottom forecast.



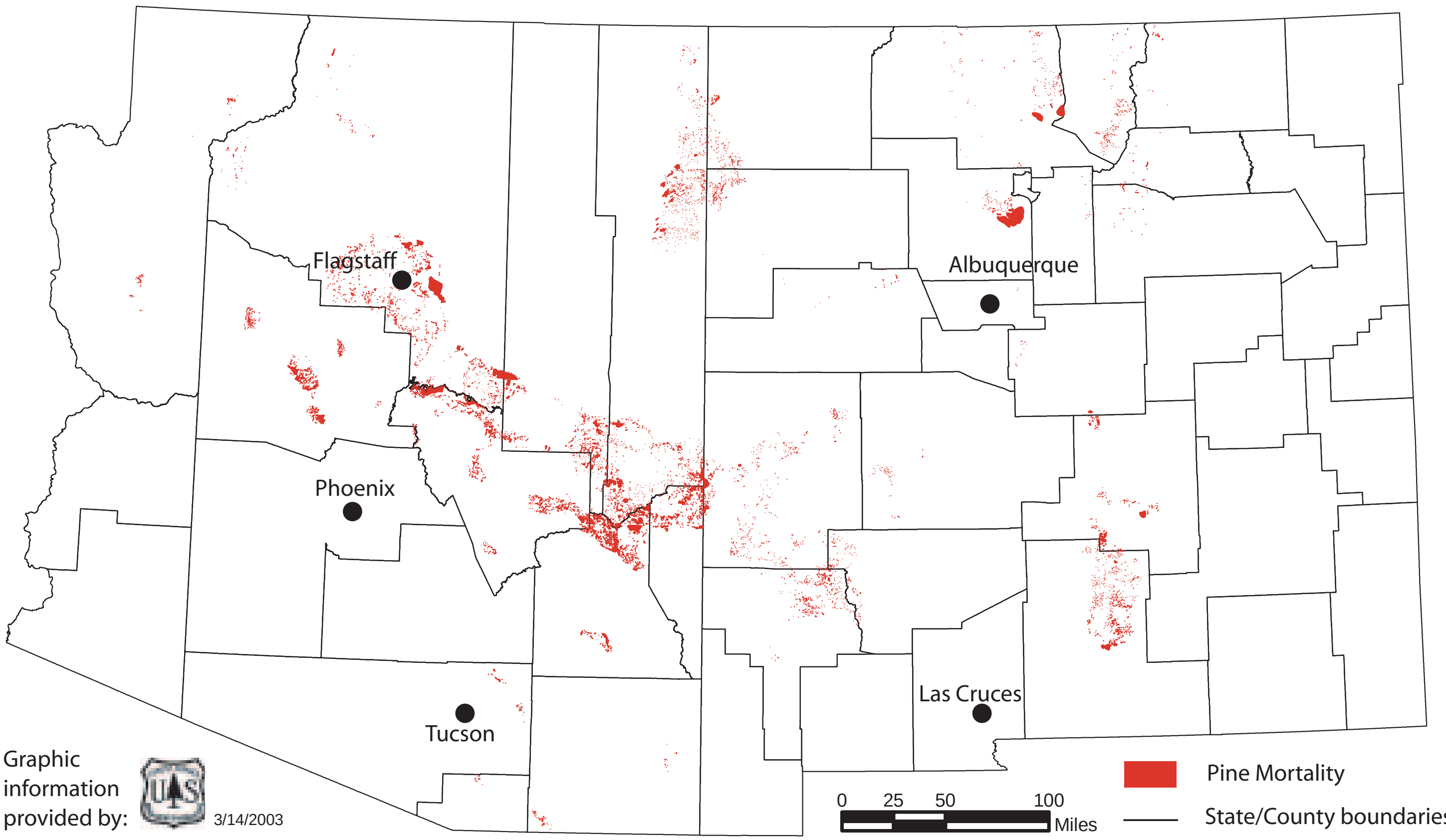


Probability Key

Highlights: The Scripps experimental wildfire forecast (Figure 18a) indicates bottom tercile acres burned by wildfire (green) for much of Arizona during the forecast period (May 1 – October 31, 2003). Top tercile acreage burned (red) is forecasted for southeastern Arizona and on the Mogollon rim. Much of New Mexico is forecasted to have top tercile acreage burn due to wildfire, except for the Four-Corners area in northwestern New Mexico. Bottom tercile forecasts in Arizona and northwestern New Mexico are associated with higher condidence (Figure 18d; probabilities mostly greater than 70%) than the top tercile forecasts (Figure 18b; probabilities mostly between 40% and 60%) in southeastern Arizona and much of New Mexico.

For more detailed discussions, visit Scripps Wildfire Forecast: http://meteora.ucsd.edu/%7Emeyer/caphome.html

19. Pine Mortality in Arizona and New Mexico, 2002 ♦ Source: USDA FS, Southwestern Region



Notes: This dataset provides a consistent record of damage caused by insect, disease, and abiotic factors (e.g., drought, fire) across Arizona and New Mexico. The data are generated by a mapping technique known as 'aerial sketch mapping' which involves mapping surface conditions visible from an aerial survey. Aerial sketch mapping is an efficient and economical method of detecting and monitoring forest health over large areas.

Arizona surveys were conducted in July through September 2002 by USDA Forest Service Southwestern Region personnel and specialists from the University of Arizona's Arizona Forest Health Program. New Mexico surveys were conducted in July and August 2002 by USDA Forest Service Southwestern Region personnel and New Mexico State University Cooperative Extension specialists.

End InSight would like to thank Daniel Ryerson of the USDA Forest Service, New Mexico Zone office for providing us with the image and information for this page.

Highlights: The image above shows areas of pine forests (in red) in Arizona and New Mexico that have experienced considerable tree mortality during 2002. Most of the damage can be attributed to insects, such as bark beetles, other disease, and drought.

In Arizona, large sections of pine forest along the Mogollon Rim have been affected, including the area burned by the Rodeo-Chediski fire in 2002. Smaller forested areas, such as the San Francisco peaks near Flagstaff and areas on the Navajo Reservation in northeastern Arizona/northwestern New Mexico, also have been affected.

Forested areas of New Mexico generally have been less afflicted, although substantial pine mortality has occurred in the Lincoln National Forest in the south central part of the state and in the Gila National Forest in eastern New Mexico.