



Natural Resources Conservation Service
P.O. Box 2890
Washington, D.C. 20013

Weekly Report - Snowpack / Drought Monitor Update **Date:** **2 July 2009**

SNOTEL SNOWPACK AND PRECIPITATION SUMMARY

Snow: Snow-water equivalent percent to date shows a few basins holding on to surplus amounts although snow data statistics become less reliable at the end of the water year when any snow on the ground is rare except at the highest elevations (Fig 1).

Temperature: SNOTEL and ACIS-day station average temperature anomalies were near average over most of the West with the exception of California which experienced above normal conditions (Fig. 2). ACIS 7-day average temperature anomalies show that the greatest positive temperature departures occurred over areas of north-central California and northwest Nevada (**>+8F**) and the greatest negative departures occurred over northwest Washington, northern Idaho, and southwest New Mexico (**<-2F**) (Fig. 2a).

Precipitation: ACIS 7-day average precipitation anomaly for the period ending 1 July shows precipitation falling from much of the eastern half of Southwest and over western Wyoming. The remainder of the West was very dry (Fig 3). Note that during this time of year when rainfall is generally light, it doesn't require very much precipitation to exaggerate the percent of normal values (Fig. 3a). Seasonal precipitation (rain & snow water equivalent) as a percent of normal for the 2009 Water Year that began on October 1, 2008 shows values essentially unchanged since last week. Note the surplus region from eastern Nevada across southern Idaho into western Wyoming (Fig. 3b). The driest areas remain over the extreme Northern Tier States and over the extreme Southwest.

WESTERN DROUGHT STATUS

The West: Substantial changes, generally for the worse, were introduced across Montana this week. Abnormally dry conditions now cover much of the state, the moderate to severe drought in northwestern sections expanded slightly this week, and most notably, a re-assessment of impacts and precipitation observations for the past 3 to 6 months (near or slightly more than half of normal) led to the introduction of moderate to severe drought in parts of northeastern Montana as well. Note that while this represents a decline of 2 drought classifications from last week in most of this region, this is not meant to imply that conditions got that much worse last week. Only that a thorough re-analysis of the region led to its current, more serious drought assessment.

Elsewhere, moderate rains eroded the extent of abnormal dryness and moderate drought in different parts of southeastern Arizona while seasonably dry weather in other parts of the West left D0 to D2 conditions unchanged. Author: Rich Tinker, CPC/NCEP/NWS/NOAA.

A comprehensive narrative describing drought conditions for the nation can be found at the end of this document.

DROUGHT IMPACTS DEFINITIONS (<http://drought.unl.edu/dm/classify.htm>)

The possible impacts associated with **D4 (H, A)** drought include widespread crop/pasture losses and shortages of water in reservoirs, streams, and wells creating water emergencies.

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The possible impacts associated with **D3 (H, A)** drought include major crop/pasture losses and widespread water shortages or restrictions. Possible impacts from **D2 (H, A)** drought are focused on water shortages common and water restrictions imposed and crop or pasture losses likely. The possible impacts associated with **D1 (H, A)** drought are focused on water shortages developing in streams, reservoirs, or wells, and some damage to crops and pastures (Figs. 4, 4a, and 4b).

SOIL MOISTURE

Soil moisture (Figs. 5a and 5b), is simulated by the [VIC macroscale hydrologic model](#). The detailed, physically-based VIC model is driven by observed daily precipitation and temperature maxima and minima from approximately 2130 stations, selected for reporting reliably in real-time and for having records of longer than 45 years (and various other criteria). Another good resource can be found at: <http://www.emc.ncep.noaa.gov/mmb/nldas/drought/>.

OBSERVED FIRE DANGER CLASS

The [adjective class rating](#) is a method of normalizing rating classes across different fuel models, indexes, and station locations. It is based on the primary fuel model cataloged for the station, the fire danger index selected to reflect staffing levels, and climatological class breakpoints. This information is provided by local station managers. About 90% use the Burning Index (BI); others use Energy Release Component (ERC). Staffing class breakpoints are set by local managers from historical fire weather climatology (Figs. 6).

Only reporting station locations are indicated with a marker on the maps. Values between stations are estimated with an inverse distance-squared technique on a 10-km grid. This works pretty well in areas of relatively high station density, but has obvious shortcomings in other areas.

VEGETATION STRESS

(http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_currentImage.php)

Image Interpretation

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, which changes from 0 to 100 characterizing change in vegetation conditions from extremely poor (0) to excellent (100). Fair conditions are coded by green color (50), which changes to brown and red when conditions deteriorate and to blue when they improve. The VT reflects indirectly a combination of chlorophyll and moisture content in the vegetation and also changes in thermal conditions at the surface. This new approach combines the visible, near infrared and thermal radiances in a numerical index characterizing vegetation health. This approach is extremely useful in detecting and monitoring such complex and difficult-to-identify phenomenon as drought. The VT values below 35 are used for identifying vegetation stress which is an indirect drought indicator. The VT is very useful for early drought detection, assessing drought area coverage, duration, and intensity, and for monitoring drought impacts on vegetation and agricultural crops.

Background of the Tool

Monitoring vegetation health (condition), including drought detection and watch, is based on radiance measurements in the visible (VIS), near infrared (NIR), and 10.3-11.3 micrometers thermal (T) bands (channels) of the Advanced Very High Resolution Radiometer (AVHRR). These measurements are processed to reduce long-term noise. The VIS and NIR values were converted to the Normalized Difference Vegetation Index [$NDV = (NIR - VIS) / (NIR + VIS)$] and the T to brightness temperature (BT) using a look-up table. The NDVI and BT were filtered in

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order to eliminate high frequency noise. They were also adjusted for a non-uniformity of the land surface due to climate and ecosystem differences using multi-year NDVI and BT data. The NDVI and BT were converted to the Vegetation Condition Index (VCI), Temperature Condition Index (TCI), and their combination (VT).

U.S. HISTORICAL STREAMFLOW

This map, (Fig. 8) shows the 7-day average streamflow conditions in hydrologic units of the United States and Puerto Rico for the day of year. The colors represent 7-day average streamflow percentiles based on historical streamflow for the day of the year. Thus, the map shows conditions adjusted for this time of the year. Only stations having at least 30 years of record are used. Sub-regions shaded gray indicate that insufficient data were available to compute a reliable 7-day average streamflow value. During winter months, this situation frequently arises due to ice effects. The data used to produce this map are provisional and have not been reviewed or edited. They may be subject to significant change.

http://water.usgs.gov/cgi-bin/waterwatch?state=us&map_type=dryw&web_type=map.

STATE ACTIVITIES

State government drought activities can be tracked at the following URL:

<http://drought.unl.edu/mitigate/mitigate.htm>. NRCS SS/WSF State Office personnel are participating in state drought committee meetings and providing the committees and media with appropriate SS/WSF information - <http://www.wcc.nrcs.usda.gov/cgibin/bor.pl>. Additional information describing the products available from the Drought Monitor can be found at the following URL: <http://drought.unl.edu/dm/> and <http://drought.gov>.

FOR MORE INFORMATION

The National Water and Climate Center Homepage provide the latest available snowpack and water supply information. Please visit us at <http://www.wcc.nrcs.usda.gov>. This document is available from the following location on the NWCC homepage - <http://www.wcc.nrcs.usda.gov/water/drought/wdr.pl>

This report uses data and products provided by the Interagency Drought Monitor Consortium members and the National Interagency Fire Center.

/s/ NOLLER HERBERT
Director, Conservation Engineering Division

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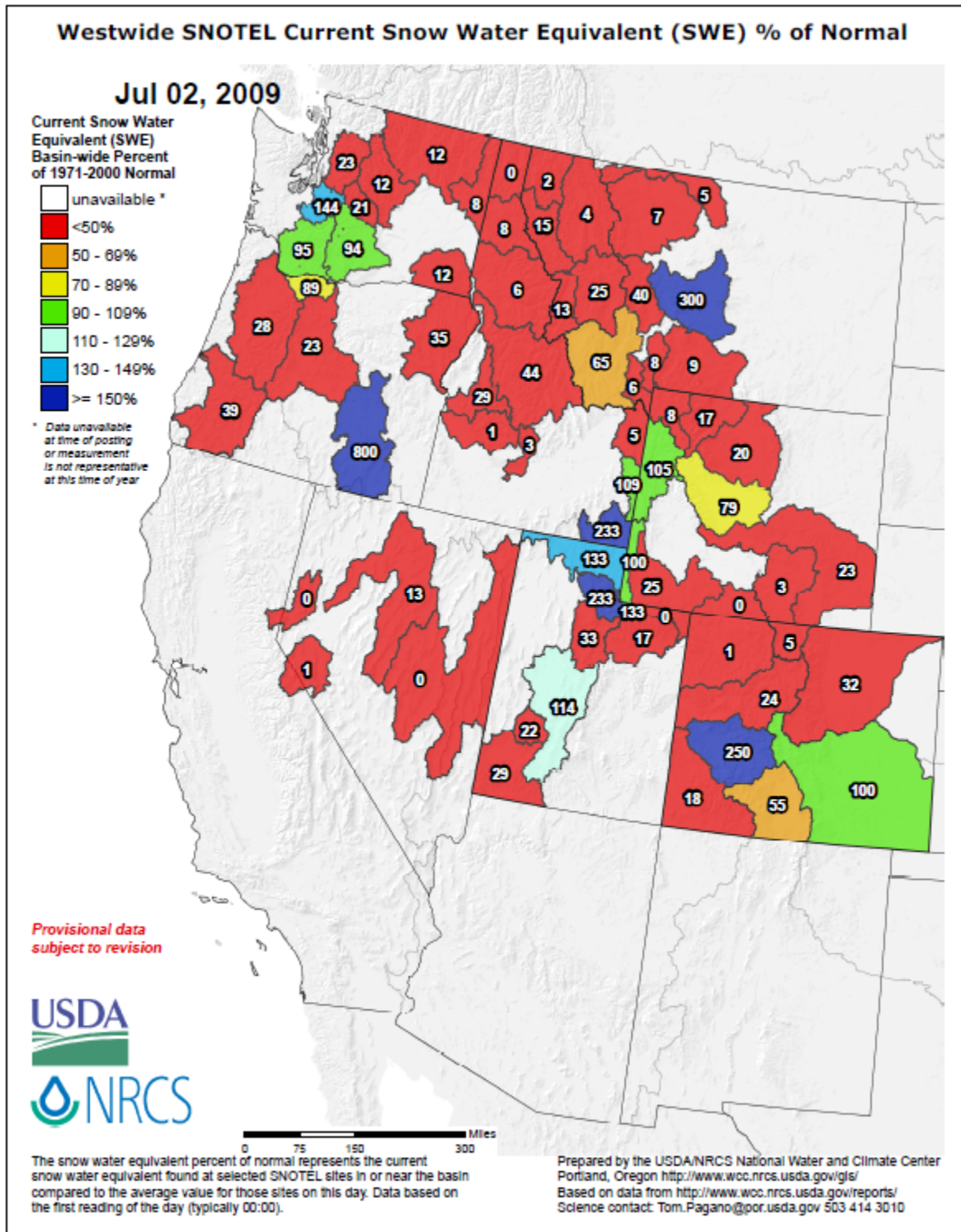


Fig. 1. Snow-water equivalent percent to date shows a few basins holding on to surplus amounts although snow data statistics become less reliable at the end of the water year when any snow on the ground is rare except at the highest elevations.

Ref: http://ftp.wcc.nrcs.usda.gov/data/water/wcs/gis/maps/west_swepctnormal_update.pdf

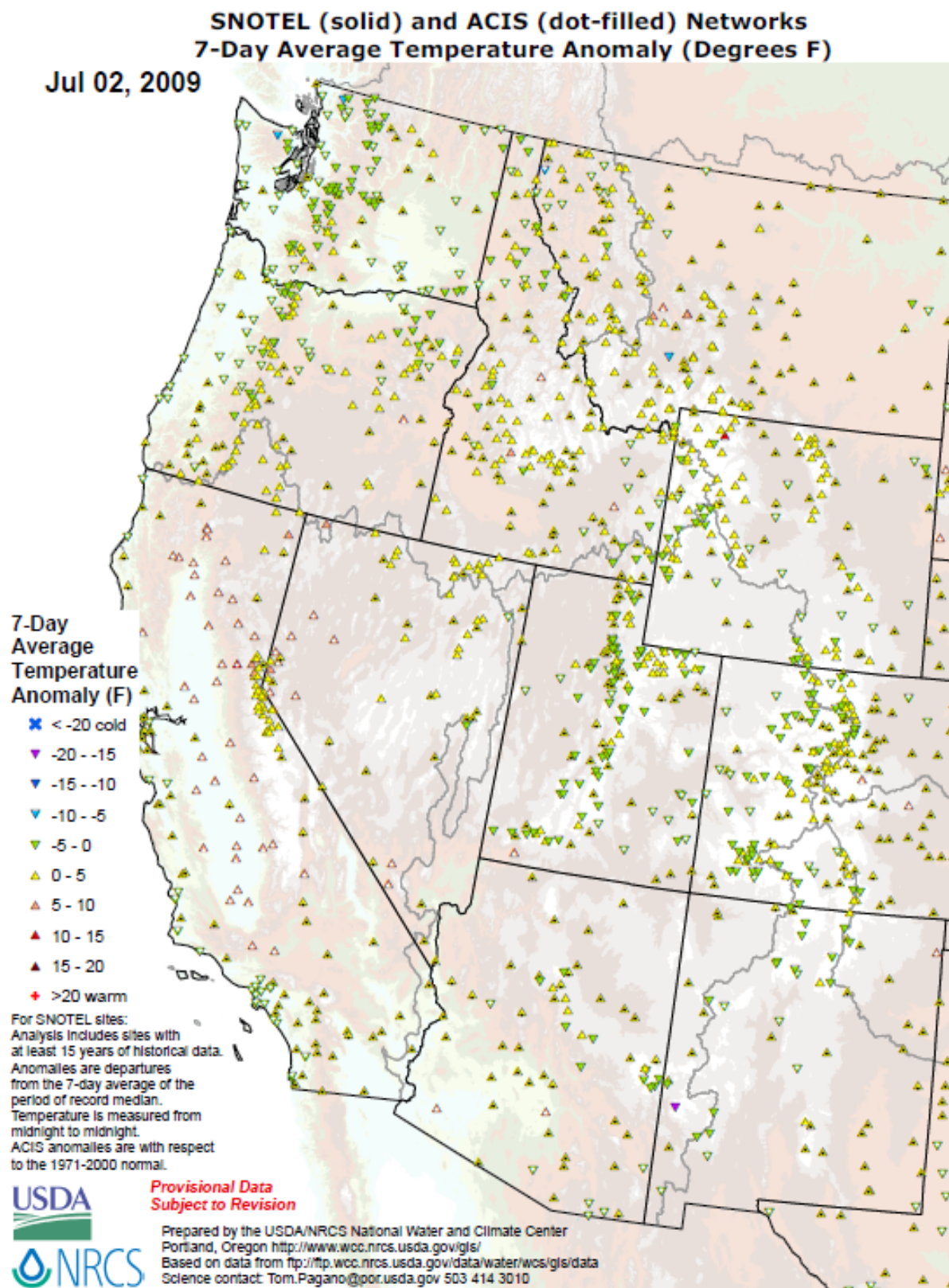
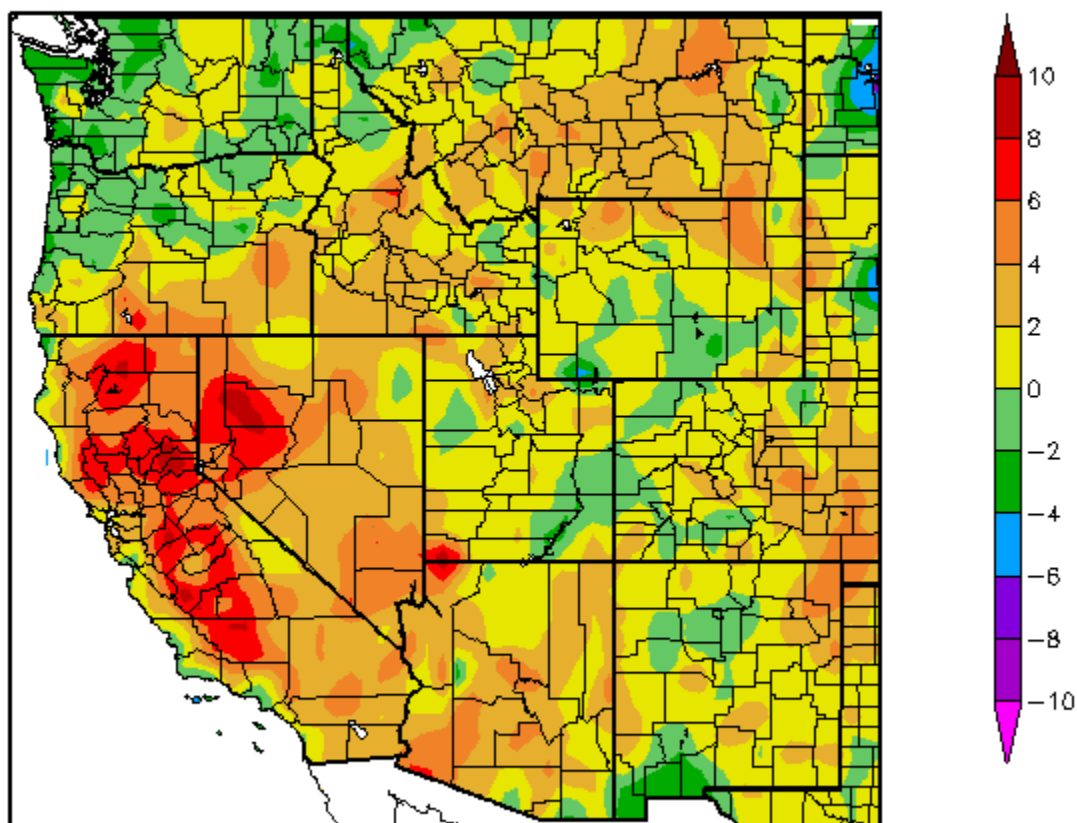


Fig. 2. SNOTEL and ACIS-day station average temperature anomalies were near average over most of the West with the exception of California which experienced above normal conditions.

Ref: <ftp://ftp.wcc.nrcs.usda.gov/data/water/wcs/gis/maps/WestwideTavg7dAnomalyAcis.pdf>

Departure from Normal Temperature (F)
6/25/2009 – 7/1/2009



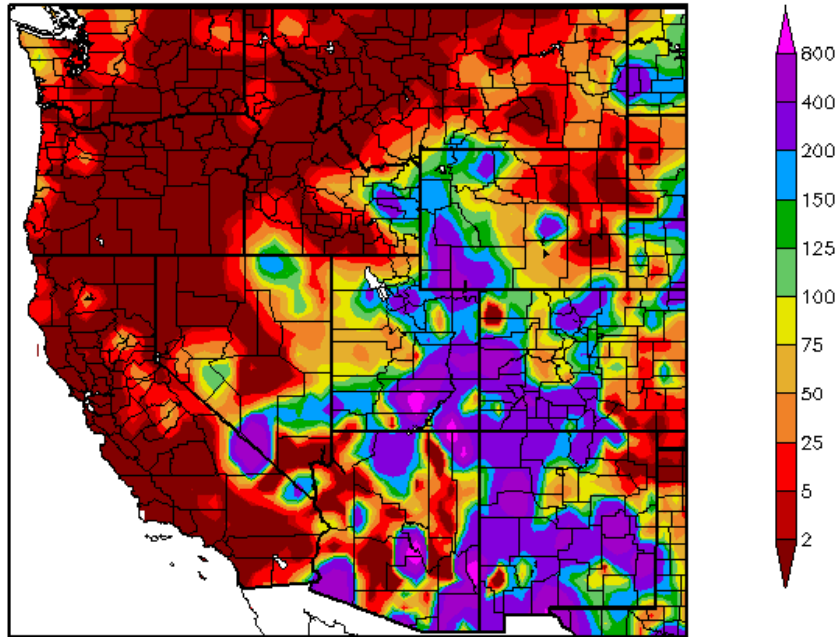
Generated 7/2/2009 at HPRCC using provisional data.

NOAA Regional Climate Centers

Fig. 2a. ACIS 7-day average temperature anomalies show that the greatest positive temperature departures occurred over areas of north-central California and northwest Nevada ($>+8^{\circ}\text{F}$) and the greatest negative departures occurred over northwest Washington, northern Idaho, and southwest New Mexico ($<-2^{\circ}\text{F}$). Ref: http://www.hprcc.unl.edu/maps/current/index.php?action=update_product&product=TDDept

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Percent of Normal Precipitation (%)
6/25/2009 – 7/1/2009



Precipitation (in)
6/25/2009 – 7/1/2009

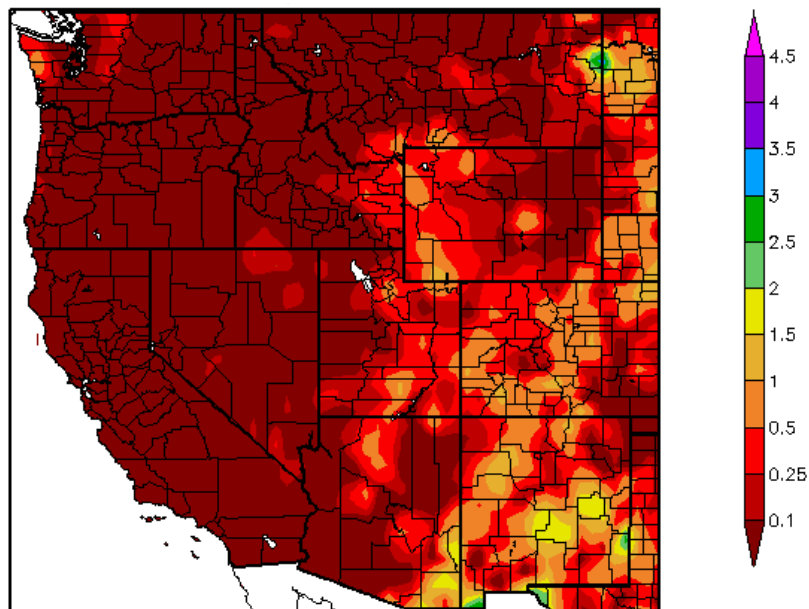


Fig. 3. and 3a. ACIS 7-day average precipitation anomaly for the period ending 1 July shows precipitation falling from much of the eastern half of Southwest and over western Wyoming. The remainder of the West was very dry. Note that during this time of year when rainfall is generally light, it doesn't require very much precipitation to exaggerate the percent of normal values.

Ref: http://www.hprcc.unl.edu/maps/index.php?action=update_product&product=PNorm

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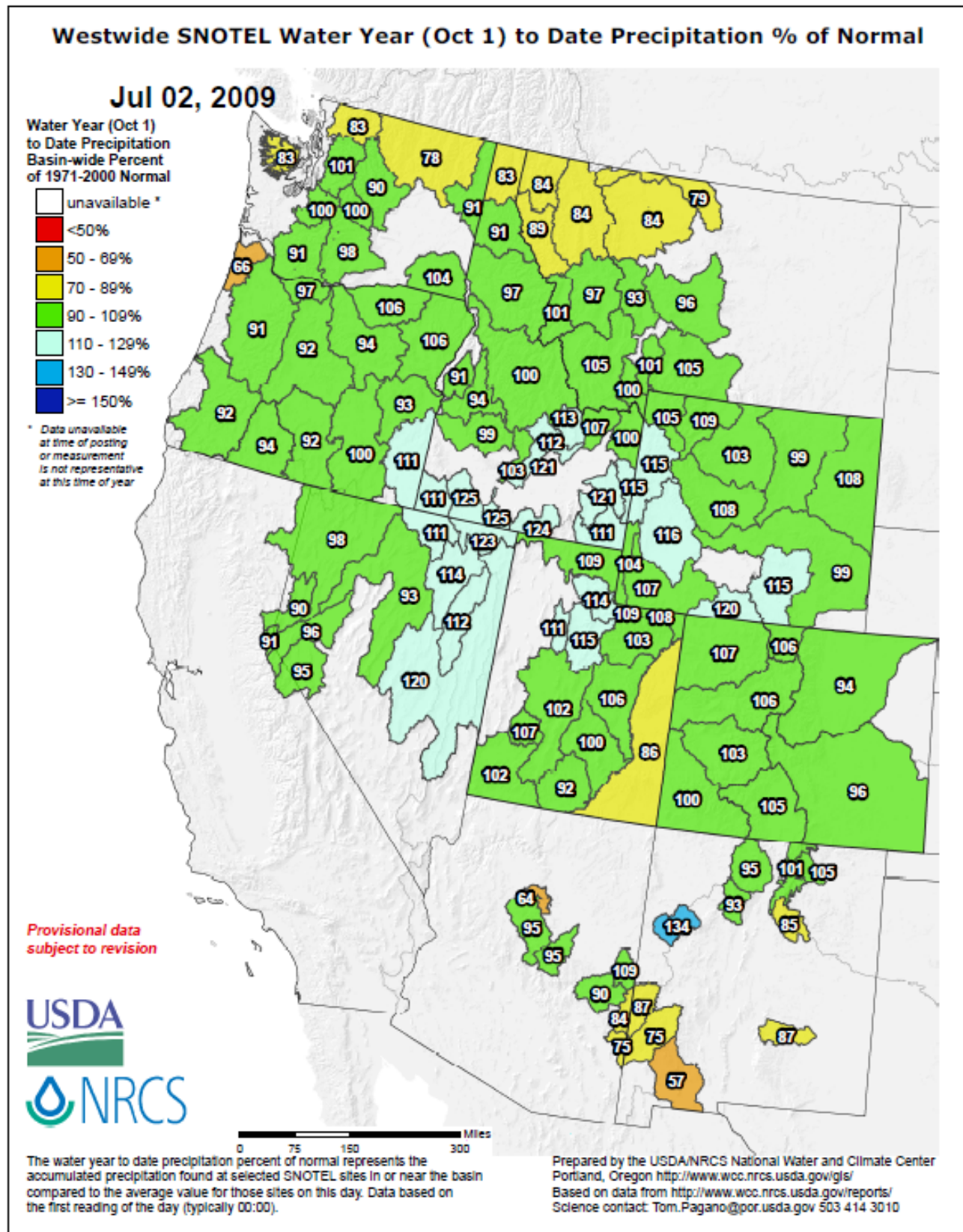


Fig 3b. Seasonal precipitation (rain & snow water equivalent) as a percent of normal for the 2009 Water Year that began on October 1, 2008 shows values essentially unchanged since last week. Note the surplus region from eastern Nevada across southern Idaho into western Wyoming.

Ref: ftp://ftp.wcc.nrcs.usda.gov/data/water/wcs/gis/maps/west_wytdprecptnormal_update.pdf

U.S. Drought Monitor

June 30, 2009
Valid 8 a.m. EDT

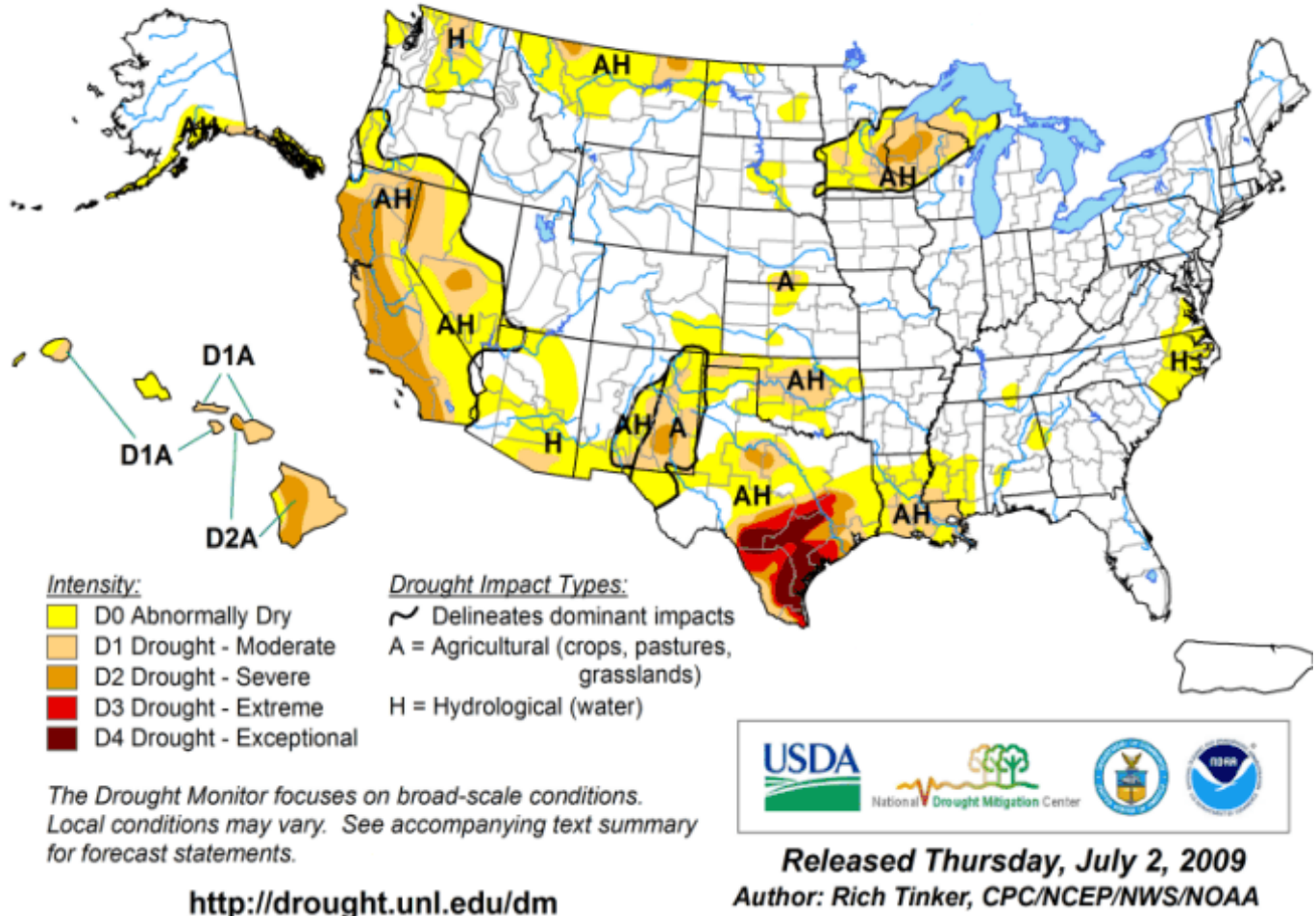


Fig. 4. Current Drought Monitor weekly summary.

Ref: National Drought Mitigation Center (NDMC) - <http://www.drought.unl.edu/dm/monitor.html>

U.S. Drought Monitor

West

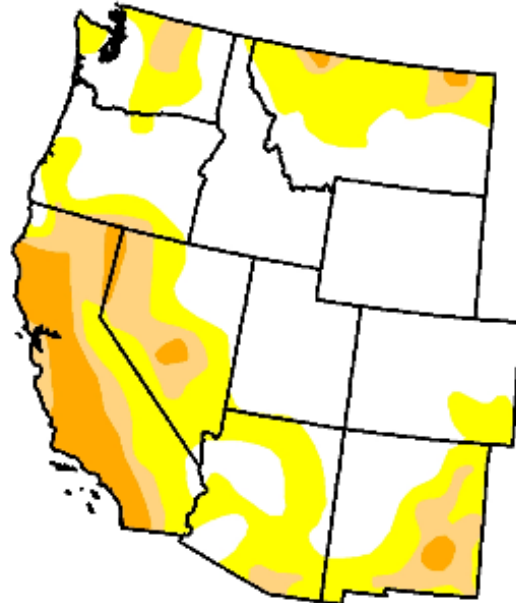
June 30, 2009

Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	55.1	44.9	17.9	7.1	0.0	0.0
Last Week (06/23/2009 map)	54.7	45.3	18.6	7.4	0.0	0.0
3 Months Ago (04/07/2009 map)	36.5	63.5	26.3	7.1	0.0	0.0
Start of Calendar Year (01/06/2009 map)	37.4	62.6	28.9	8.8	0.4	0.0
Start of Water Year (10/07/2008 map)	41.3	58.7	28.6	10.4	0.1	0.0
One Year Ago (07/01/2008 map)	40.6	59.4	35.2	9.2	1.7	0.0

Intensity:

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



The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. See accompanying text summary
for forecast statements

<http://drought.unl.edu/dm>



Released Thursday, July 2, 2009

Author: R. Tinker, CPC/NOAA

Fig. 4a. Drought Monitor for the Western States with statistics over various time periods.
Regionally, conditions have remained unchanged during the past week. Ref:
http://www.drought.unl.edu/dm/DM_west.htm. For the California Drought: An update for June 2009, see
http://www.water.ca.gov/drought/docs/Drought_report_30june2009_web.pdf.

U.S. Drought Monitor

Texas

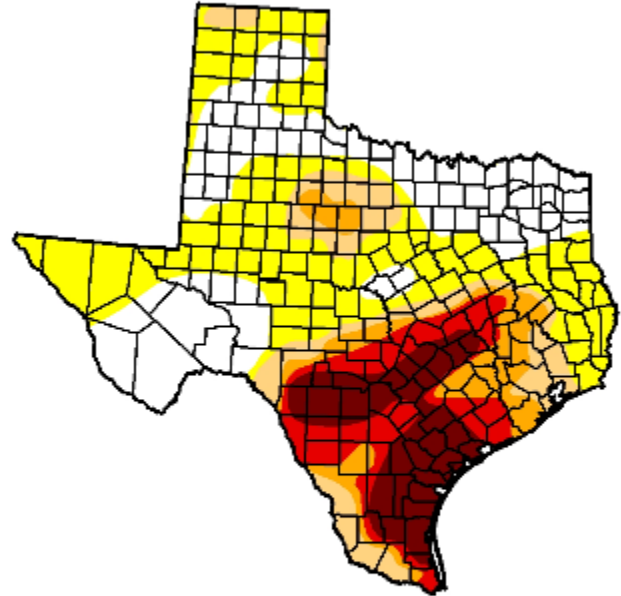
June 30, 2009

Valid 7 a.m. EST

	Drought Conditions (Percent Area)					
	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	28.2	71.8	38.4	27.9	20.0	11.1
Last Week (06/23/2009 map)	29.7	70.3	38.9	24.1	15.5	8.2
3 Months Ago (04/07/2009 map)	6.7	93.3	79.1	53.5	24.6	7.1
Start of Calendar Year (01/06/2009 map)	41.7	58.3	24.5	15.0	9.1	4.2
Start of Water Year (10/07/2008 map)	67.2	32.8	20.5	11.0	3.6	0.0
One Year Ago (07/01/2008 map)	8.0	92.0	65.3	44.4	24.9	4.2

Intensity:

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



The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements

<http://drought.unl.edu/dm>



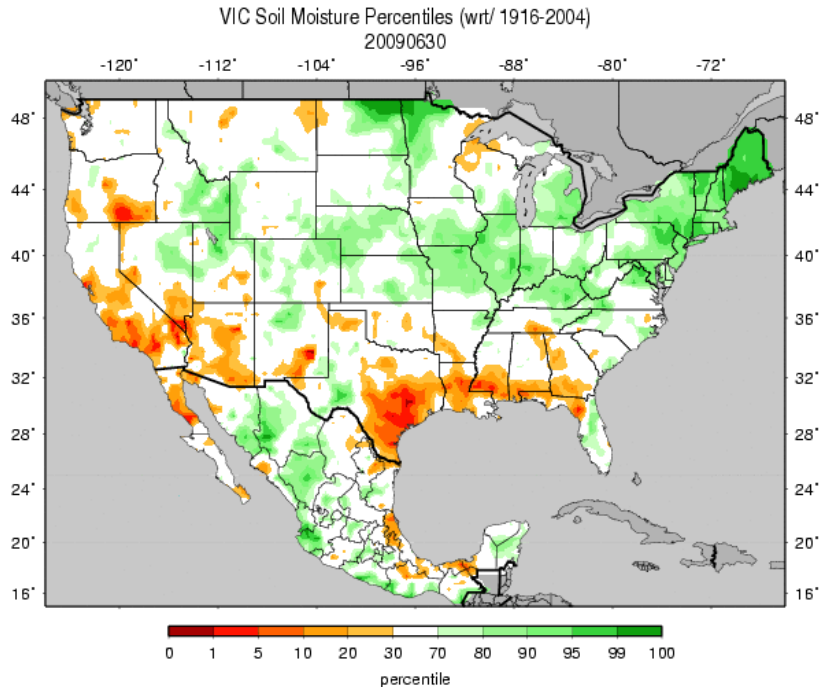
Released Thursday, July 2, 2009

Author: R. Tinker, CPC/NOAA

Fig. 4b: Texas is the only state with D4 drought condition in the US. Note conditions have deteriorated in the D4 category since last week (noted circled values).

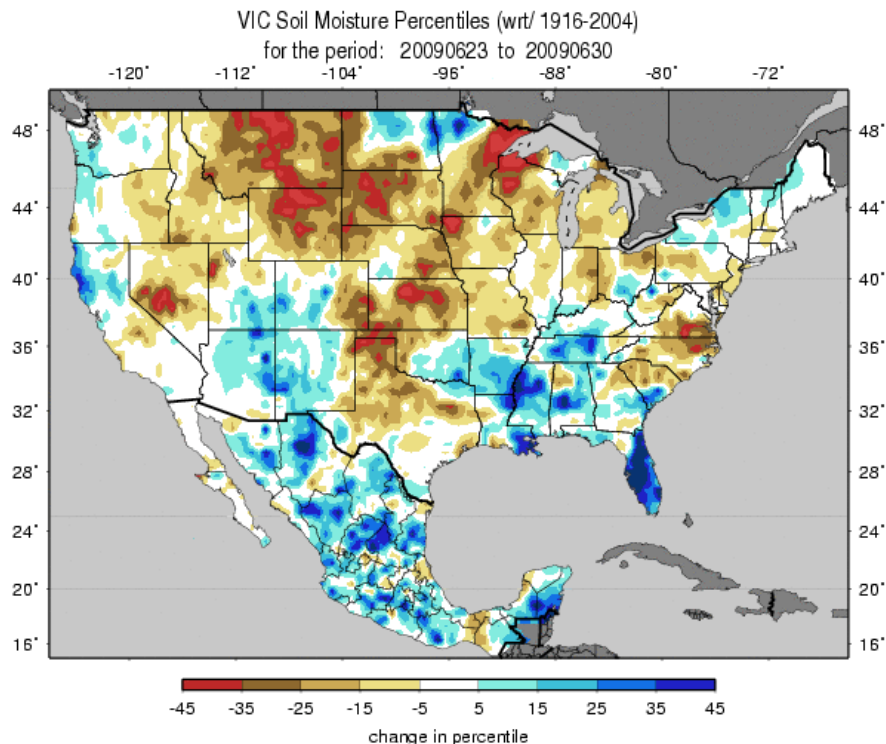
Ref: http://www.drought.unl.edu/dm/DM_state.htm?TX,S

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Figs. 5a: Soil Moisture ranking in percentile based on 1916-2004 climatology as of 30 June. Near saturation exists over the extreme Northern Plain and New England, while excessive dryness is scattered across the West from northern Florida southern California and southern Oregon. Ref:

http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/CONUS.MEXICO.vic.sm_gnt.gif



Figs. 5b: Soil Moisture change in percentile based on 1916-2004 climatology for this past week. There was significant moistening over the Southeast. Excessive drying (due largely to excess heat) is noted over the Northern Rockies and much of the Great Plains. Ref:

http://www.hydro.washington.edu/forecast/monitor/curr/conus.mexico/CONUS.MEXICO.vic.sm_gnt_1wk.gif

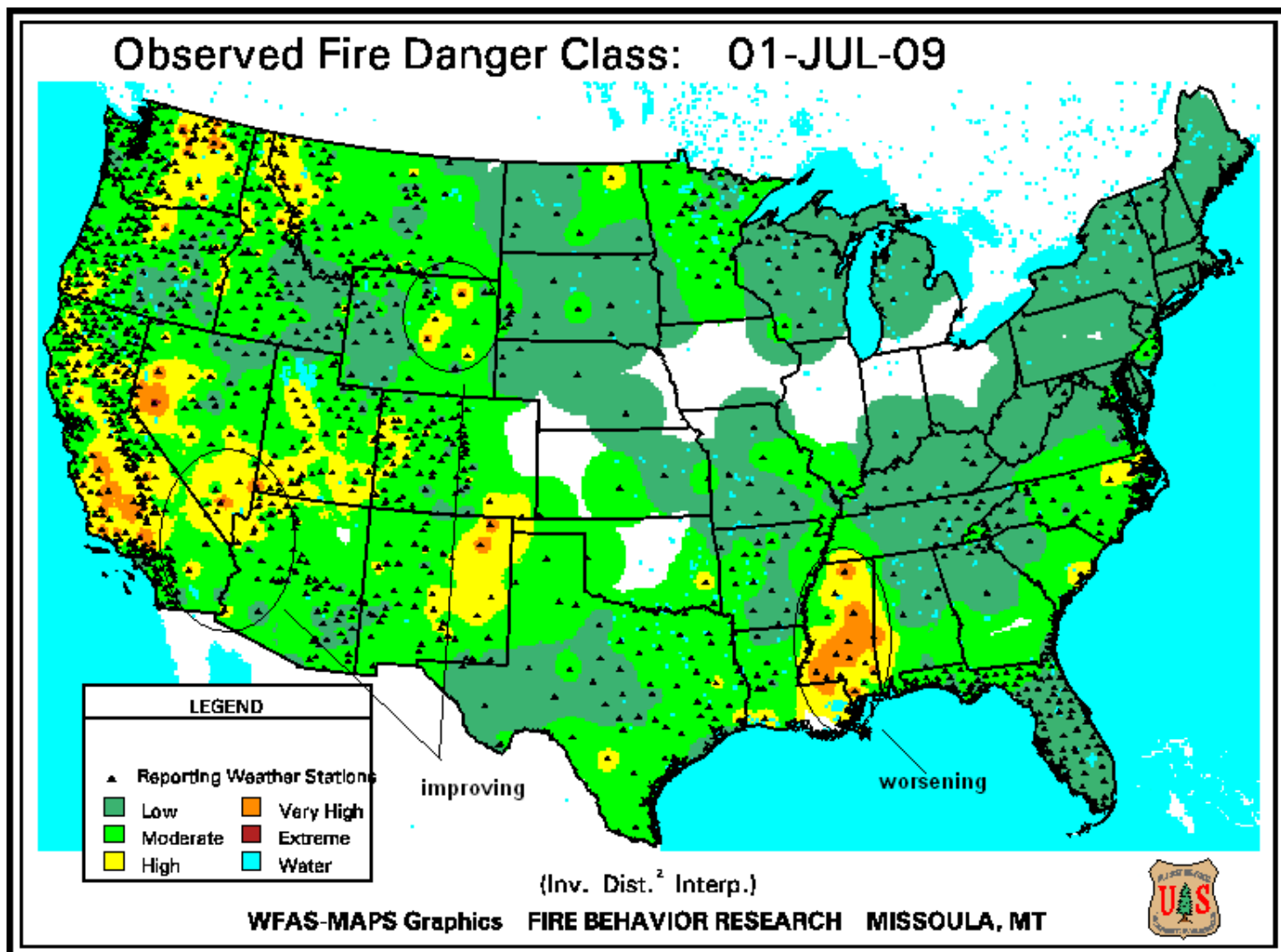
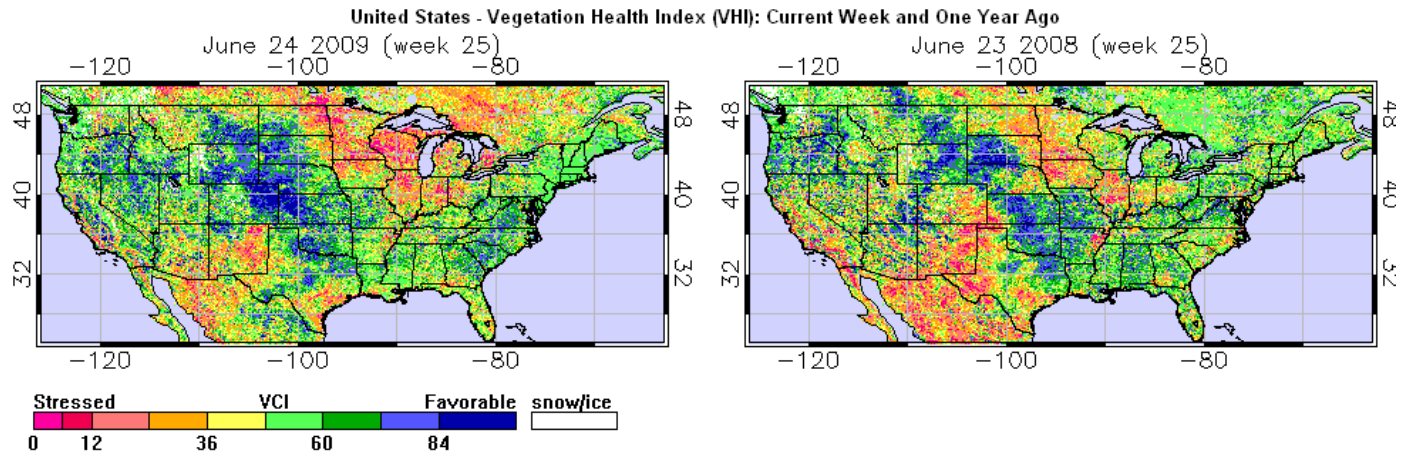


Fig. 6. Observed Fire Danger Class. Conditions have improved over the West (circled areas) and worsened over Alabama since last week.

Ref: http://www.wfas.net/images/firedanger/fd_class.gif

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Note: For the area without vegetation (desert, high mountains, etc.), the displayed indices characterize surface conditions.

*** Data source: GVI-x derived vegetation indices; 'week' defined here is based on 'day of the year', i.e. week 1 covers day-of-the-year 1 to 7.

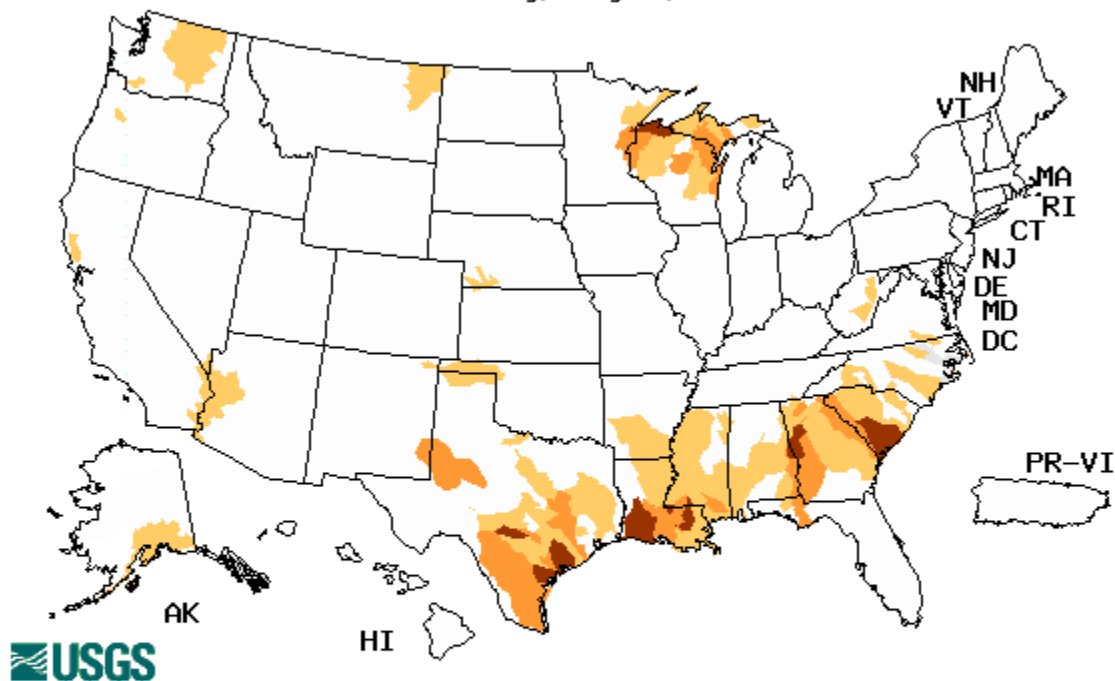
*** (Images will be updated on Thursday in 2009.)

Fig. 7. Vegetation Drought Response Index: Note the comparison to last year. The upper mid-west, New Mexico, and southern Texas are significantly stressed while the Western Plains show favorable conditions this week. (Note these charts are a week old).

Ref: http://www.star.nesdis.noaa.gov/smcd/emb/vci/VH/vh_currentImage.php

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Wednesday, July 01, 2009



Explanation - Percentile classes				
Low	<=5	6-9	10-24	Insufficient data for a hydrologic region
Extreme hydrologic drought	Severe hydrologic drought	Moderate hydrologic drought	Below normal	

Fig. 8. Map of below normal 7-day average streamflow compared to historical streamflow for the day of year. Conditions over parts of Texas and eastward into South Carolina are considered severe. Northern Wisconsin is also showing severe streamflow levels.

Ref: <http://water.usgs.gov/waterwatch/?m=dryw&w=map&r=us>

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National Drought Summary – June 30, 2009

The discussion in the Looking Ahead section is simply a description of what the official national guidance from the National Weather Service (NWS) National Centers for Environmental Prediction is depicting for current areas of dryness and drought. The NWS forecast products utilized include the HPC 5-day QPF and 5-day Mean Temperature progs, the 6-10 Day Outlooks of Temperature and Precipitation Probability, and the 8-14 Day Outlooks of Temperature and Precipitation Probability, valid as of late Wednesday afternoon of the USDM release week. The NWS forecast web page used for this section is:
<http://www.cpc.ncep.noaa.gov/products/forecasts/>.

The last half of June was dominated by hot and dry weather from western Oklahoma and the central tier of Texas eastward through the lower Mississippi Valley and occasionally through Georgia and the Carolinas, causing drought to worsen where it already existed, and raising concerns about developing dryness in other parts of the region. Above-normal temperatures also dominated the dry areas near the Great Lakes, where precipitation was not as markedly low, though deterioration was observed in more areas than was improvement. In contrast, widespread moderate rains last week made the southeastern Rockies and southern High Plains the one part of the country where dryness improved on a fairly large scale. Finally, seasonably dry weather kept significant areas of dryness and drought intact across the West.

The East: Moderate rain eliminated abnormally dry conditions across Ohio. However, farther south, rainfall has slackened since the start of June across eastern North Carolina and adjacent areas, and after mid-month, substantially drier than normal weather has dominated most locations from Georgia and central Tennessee westward through the lower Mississippi Valley. Rainfall amounts at least 1.5 inches below normal for the two weeks ending June 30, 2009 were common across this region, and temperatures averaging a few degrees above normal during the same period allowed concerns about developing dryness to increase quickly. At this time, broad scale drought expansion seems premature, but abnormally dry conditions were introduced in areas where temperature and precipitation were both well removed from normal for June as a whole, or where long-term precipitation totals remained below normal because of prior drought conditions. Specifically, eastern North Carolina and nearby adjacent areas, and a few small areas in southwestern, east-central, and north-central Alabama and neighboring sections of south-central Tennessee and west-central Georgia.

Florida: Continued widespread heavy rains finally eliminated a small area of abnormal dryness in southwestern parts of the state, which was the last vestige of severely dry conditions that dominated the state earlier in the year.

Upper Midwest: Generally warmer and drier than normal conditions led to some D0 to D2 expansion, primarily northward (in northwestern Wisconsin and east-central Minnesota) and eastward (through much of Michigan's Upper Peninsula and adjacent northeastern Wisconsin). In addition, a new area of moderate drought was assessed in part of interior west-central Minnesota where April – June precipitation was at least 5 inches below normal. On the other hand, some areas of improvement were also identified, specifically along the northwestern fringe of the region where moderate precipitation was enough to end abnormal dryness, and in part of west-central Wisconsin and adjacent Minnesota where conditions improved to D1 following moderate rains last week.

The Plains: The part of the country where two weeks of hot and dry weather would be least welcome was the one where such conditions were most persistent; specifically, the southern Great Plains, part of which is experiencing the worst drought currently affecting the country (D4, or exceptional drought, which has been entrenched across parts of central and southern

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Texas for many weeks). Last week, measurable rain fell on only a few peripheral parts of the large drought area encompassing much of the southern half of the state, thus drought conditions in this region almost universally deteriorated. By the time June ended, San Antonio, TX had officially endured its driest 22-month period since records began back in 1885 (23.90 inches, breaking the old record of 26.33 inches from December 1908 through September 1910). The additional fact that June 2009 was one of the five warmest Junes ever experienced there only increased drought stress. Farther east, record low combined May-June rainfall was reported at both Houston, TX and Galveston, TX, with measurements dating back 118 years in both cities. College Station, TX reported its second-driest May-June period on record, and received no measurable rain during June.

Farther north and east, most locations were also warmer and drier than normal last week, but rainfall was not so absolutely absent as it was across the southern half of Texas, and in fact rainfall was sufficiently heavy and widespread to ease dryness in some areas. Most notably, many locations from interior north-central Texas westward through the southern High Plains and southeastern Rockies received at least an inch of rain for the week, with up to 3 inches dousing some areas that have been in drought. As a result, moderate to severe drought coverage declined across both interior north-central Texas and eastern New Mexico, and abnormal dryness was removed from part of west-central Texas. Meanwhile, abnormal dryness and moderate drought both expanded in Oklahoma, far eastern Texas, much of Louisiana, and the southern half of Mississippi. Scattered light rainfall was observed in most of these regions, although as a second consecutive hot week concluded, even scattered moderate to heavy thunderstorms, accompanied by 1 to locally 5 inches of rain, were not enough to prevent some expansion of moderate drought from southeastern Louisiana northward and westward into adjacent Mississippi and southwestern Louisiana.

Finally, scattered D0 areas were again identified from the Dakotas southward through Kansas, though D0 conditions noted last week in northeastern Nebraska and parts of southern and eastern South Dakota were eliminated. The small area of moderate drought in southern Nebraska last week expanded eastward and southward into Kansas this week following only a few tenths of an inch of precipitation this past week.

The West: Substantial changes, generally for the worse, were introduced across Montana this week. Abnormally dry conditions now cover much of the state, the moderate to severe drought in northwestern sections expanded slightly this week, and most notably, a re-assessment of impacts and precipitation observations for the past 3 to 6 months (near or slightly more than half of normal) led to the introduction of moderate to severe drought in parts of northeastern Montana as well. Note that while this represents a decline of 2 drought classifications from last week in most of this region, this is not meant to imply that conditions got that much worse last week. Only that a thorough re-analysis of the region led to its current, more serious drought assessment.

Elsewhere, moderate rains eroded the extent of abnormal dryness and moderate drought in different parts of southeastern Arizona while seasonably dry weather in other parts of the West left D0 to D2 conditions unchanged.

Alaska and Hawaii: Significantly below-normal precipitation on 1- to 3-month time scales is now reported by most locations throughout the southern tier of Alaska from the Panhandle westward through eastern portions of the Aleutians, with the largest deficits (several inches below and less than half of normal for the last 3 months) noted from the southeastern mainland through the west-central islands of the Panhandle. As a result, D0 was expanded to cover most of Alaska's southern tier, and D1 was extended southeastward into the west-central Panhandle.

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In Hawaii, scattered light to moderate rainfall was not enough to change conditions from those assessed last week.

Looking Ahead: During the next 5 days (July 1 – 5, 2009, few of the areas now experiencing abnormal dryness or drought are expected to receive heavy rain, but there are a few small exceptions, specifically eastern North Carolina (0.5 to 1.5 inches in most areas), the northern Texas and Oklahoma Panhandles and adjacent New Mexico and Colorado (1 to locally 3 inches), and areas near the southern reaches of the Arizona / New Mexico border, fueled by monsoon-related showers (0.5 to 1.5 inches). Those areas now experiencing severe to exceptional drought are forecast to receive a few tenths of an inch of precipitation at best.

For the next 5 days (July 6 – 10, 2009), the odds favor above-normal rainfall for current areas of dryness and drought in southwestern Alaska, the Rockies and High Plains, the central and northern Great Plains, and Minnesota. In contrast, the odds favor drier than normal weather for California and western Oregon, the central Great Lakes region, the lower Mississippi Valley and adjacent Southeast, much of Oklahoma, and unfortunately for the southeastern two-thirds of Texas, including the state's broad, parched area of severe to exceptional drought.

Author: Rich Tinker, CPC/NCEP/NWS/NOAA.

Dryness Categories

D0 ... Abnormally Dry ... used for areas showing dryness but not yet in drought, or for areas recovering from drought.

Drought Intensity Categories

D1 ... Moderate Drought

D2 ... Severe Drought

D3 ... Extreme Drought

D4 ... Exceptional Drought

Drought or Dryness Types

A ... Agricultural

H ... Hydrological

Updated July 2, 2009