



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

Weekly Report - Snowpack / Drought Monitor Update

Date: 24 March 2011

SNOTEL SNOWPACK AND PRECIPITATION SUMMARY

Snow: SNOTEL Snow-Water Equivalent percent of normal values for 24 March 2011 shows significant gains over Oregon and the Great Basin this week. Melt-out is nearing completion over much of the Southwest (Fig. 1). SNOTEL Snow-Water Equivalent percent of Normal peak shows recovery across parts of the Oregon Cascades (we are about 96% through the snow accumulation season; climatologically speaking, snow season for the Southwest is essentially over). Most of the West is meeting or exceeding the long-term climatologically average snowpack (Fig. 1a). SNOTEL 7-day snow depth changes show significant gains over the Oregon Cascades, Sierra Nevada, parts of the Great Basin, Northern Wasatch, and North-Central Rockies (Fig. 1b).

Temperature: Average SNOTEL temperatures were above the long term average for this time of year over much of Colorado and New Mexico. Much colder than normal temperatures dominated the Sierra Nevada. Elsewhere temperatures were within $\pm 5^{\circ}\text{F}$ (Fig. 2). ACIS 7-day average temperature anomalies show that the greatest positive temperature departures scattered across the Western High Plains ($>+9^{\circ}\text{F}$) and the greatest negative departures over northeast California ($<-9^{\circ}\text{F}$) (Fig. 2a).

Precipitation: ACIS 7-day average precipitation amounts for the period ending 23 March shows the bulk of the heaviest precipitation confined to California (Fig. 3). In terms of percent of normal, the precipitation was highest across California, and scattered across the Northern Tier States. New Mexico, eastern Colorado, and much of Wyoming saw little precipitation this week (Fig. 3a). For the 2011 Water-Year that began on 1 October 2010, the greatest deficits are found over the extreme southern reaches of the Southwest. Areas with the highest values are found over the Great Basin, most of Oregon, and parts of Northern and Central Rockies (Fig. 3b).

The West: Unseasonably heavy rain and mountain snow across the Pacific Coast States contrasted with ongoing drought in lower portions of the Four Corners Region. Water-year precipitation rankings are in the lowest 10th percentile across southwestern Arizona and southeastern portions of New Mexico, where Severe to Extreme (D2 and D3) Drought was expanded. Water-year precipitation to date ranked in the 10th to 30th percentile (D0 to D1 equivalent) in northern New Mexico and east-central Arizona. Current soil moisture percentile rankings and objective drought blends indicated conditions are deteriorating across New Mexico and Arizona, with further drought assessment necessary over the upcoming weeks. In contrast, heavy rain and mountain snow were observed in California, boosting mountain snowpack and eliminating lingering D0 (Abnormal Dryness) in northern portions of the state. Snow depths exceeded 100 inches at numerous locations in the Sierra Nevada, with some estimates in excess of 200 inches. Estimated weekly total liquid precipitation eclipsed 6 inches in southern and northern portions of the California coast, and was locally more than 8 inches in the Sierra Nevada. In the Northwest, precipitation estimates of 1 to 3 inches (liquid equivalent) in west-central Washington led to the removal of D0. Despite early melting of the Northwestern

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snowpack, most locations in the Northwest are reporting snow water equivalent in the 40th percentile or higher, with some locales in the 70 to 85th percentile.

Author: [Eric Luebehusen, United States Department of Agriculture](#)

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. 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 and 4a).

SOIL MOISTURE

Soil moisture (Figs. 5a and 5b) is estimated by a one-layer hydrological model ([Huang et al., 1996](#), [van den Dool et al., 2003](#)). The model takes observed precipitation and temperature and calculates soil moisture, evaporation and runoff. The potential evaporation is estimated from observed temperature.

http://www.cpc.ncep.noaa.gov/soilmst/index_jh.html

U.S. HISTORICAL STREAMFLOW

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

This map, (Fig. 6) 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.

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>

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

/s/ JEFF GOEBEL
Acting Director, Resource Inventory Division

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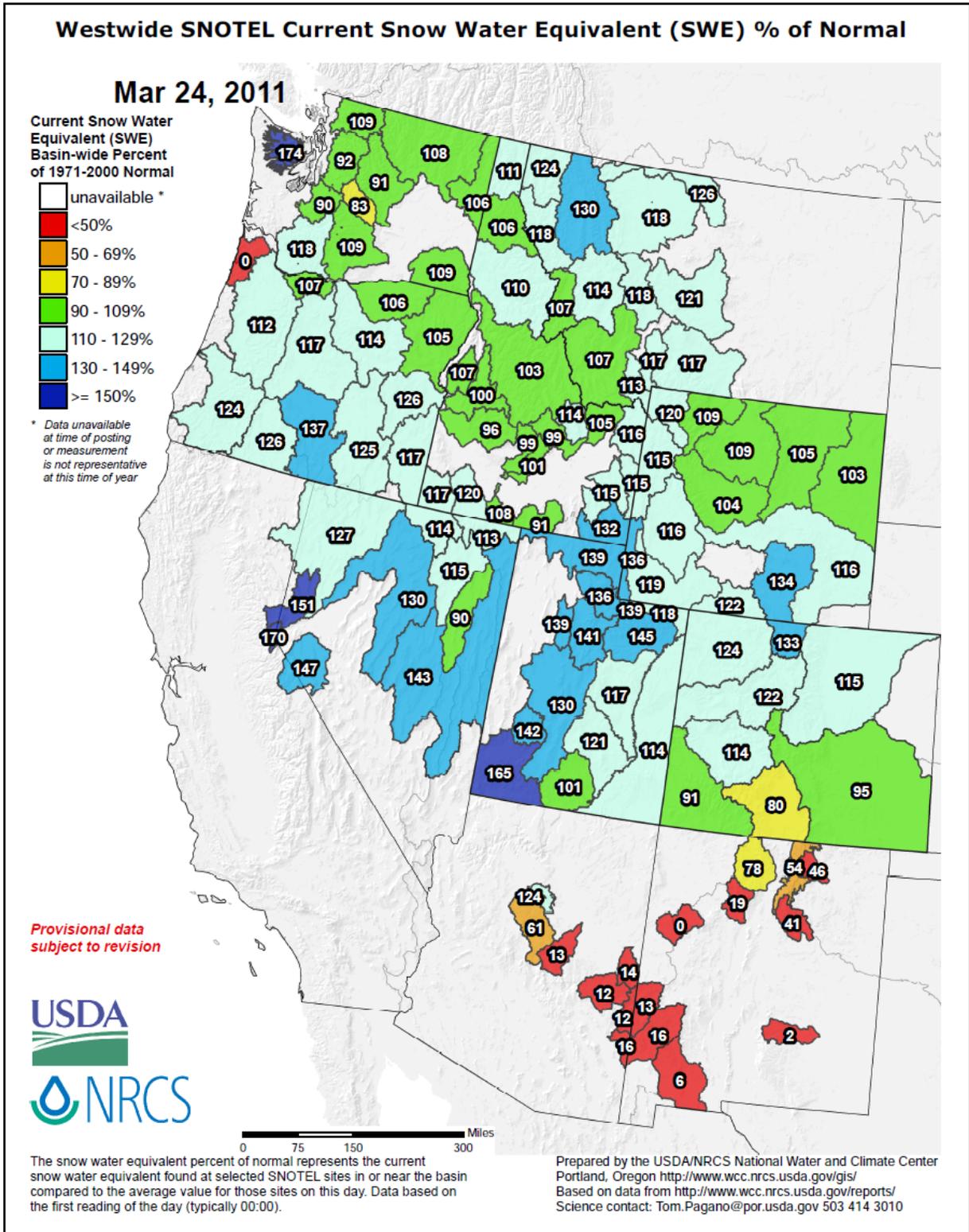


Fig. 1: SNOTEL Snow-Water Equivalent percent of normal values for 24 March 2011 shows significant gains over Oregon and the Great Basin this week. Melt-out is nearing completion over much of the Southwest.

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

SNOTEL Current Snow Water Equivalent (SWE) Percent of Normal Peak
Mar 24, 2011

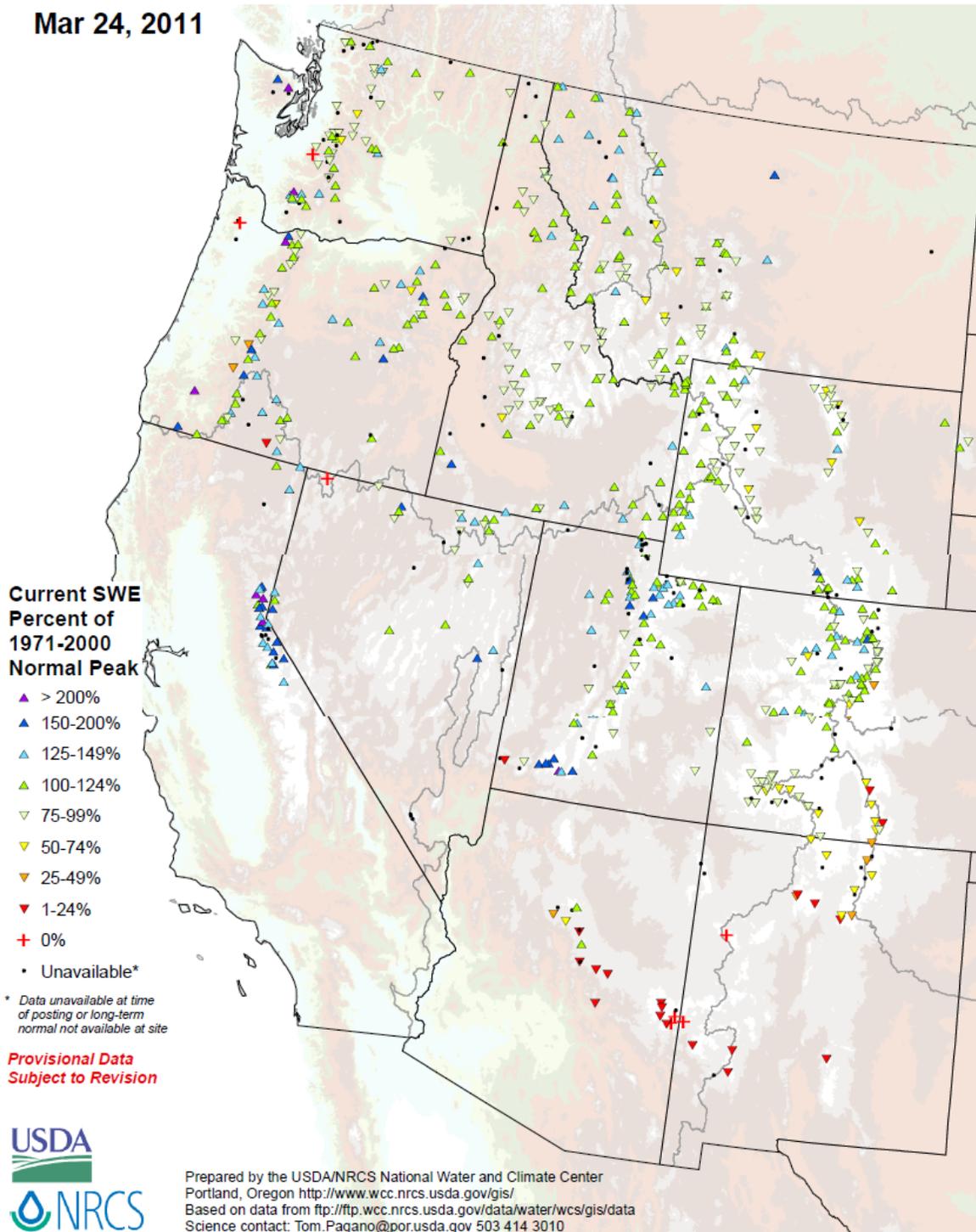


Fig. 1a: SNOTEL Snow-Water Equivalent percent of Normal peak shows recovery across parts of the Oregon Cascades (we are about 96% through the snow accumulation season; climatologically speaking, snow season for the Southwest is essentially over). Most of the West is meeting or exceeding the long-term climatologically average snowpack.

Ref: <http://www.wcc.nrcs.usda.gov/ftpref/data/water/wcs/gis/maps/WestwideSWEPercentPeak.pdf>

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SNOTEL 7-Day Snow Depth Change (Inches)

Mar 23, 2011

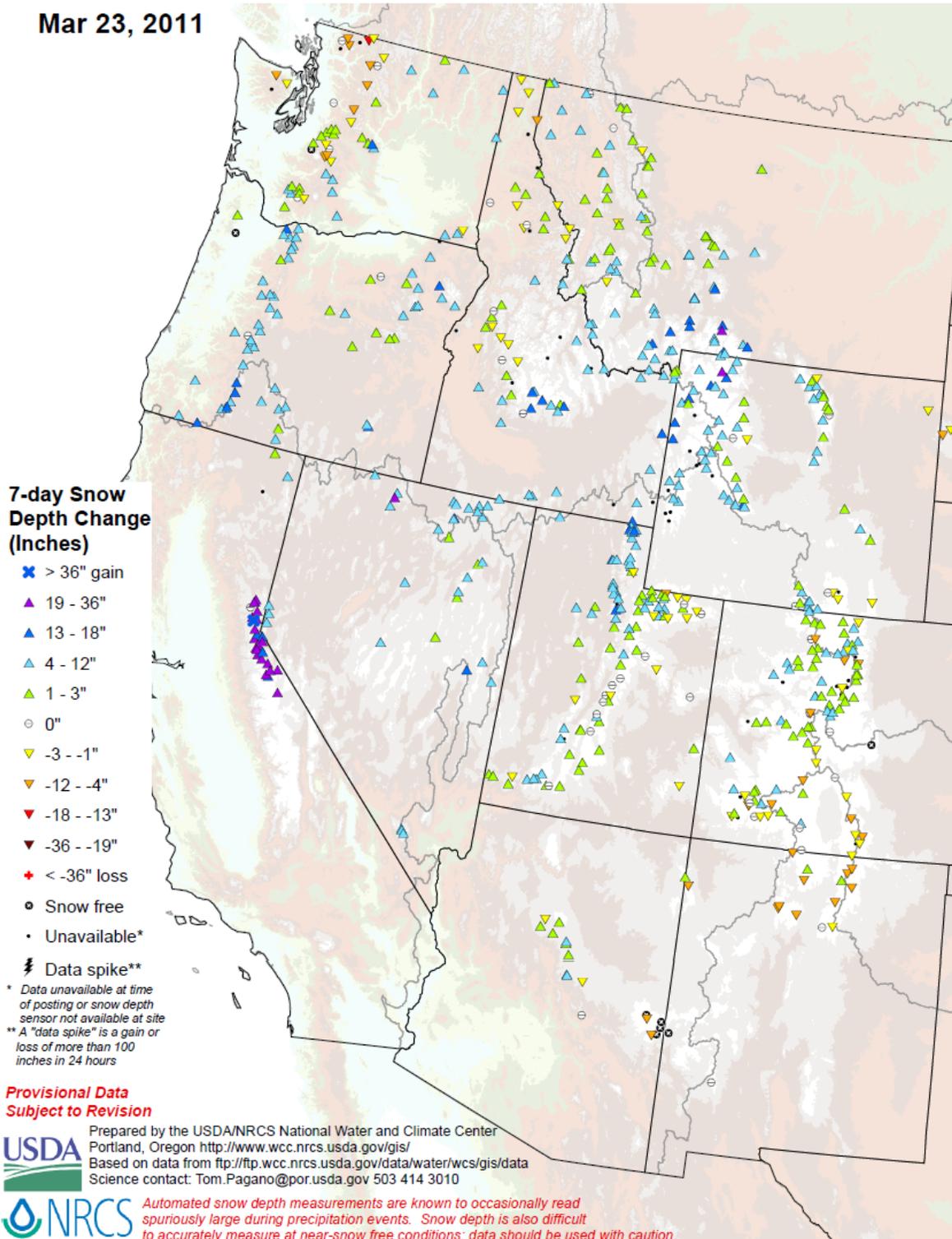


Fig. 1b: SNOTEL 7-day snow depth changes show significant gains over the Oregon Cascades, Sierra Nevada, parts of the Great Basin, Northern Wasatch, and North-Central Rockies.

Ref: http://www.wcc.nrcs.usda.gov/ftpref/data/water/wcs/gis/maps/west_snowdepth_7ddelta.pdf

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SNOTEL (solid) 7-Day Average Temperature Anomaly (Degrees F) Mar 23, 2011

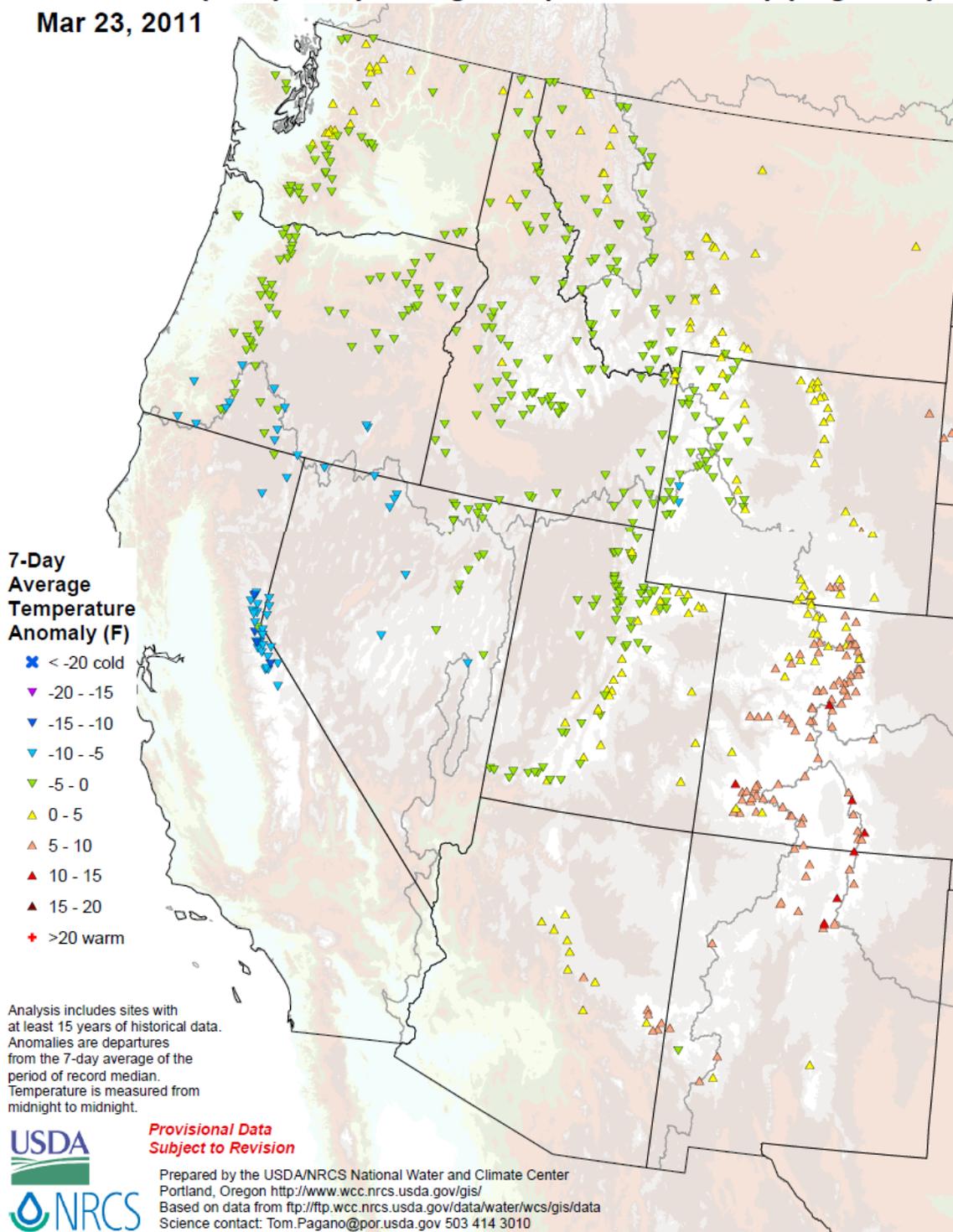
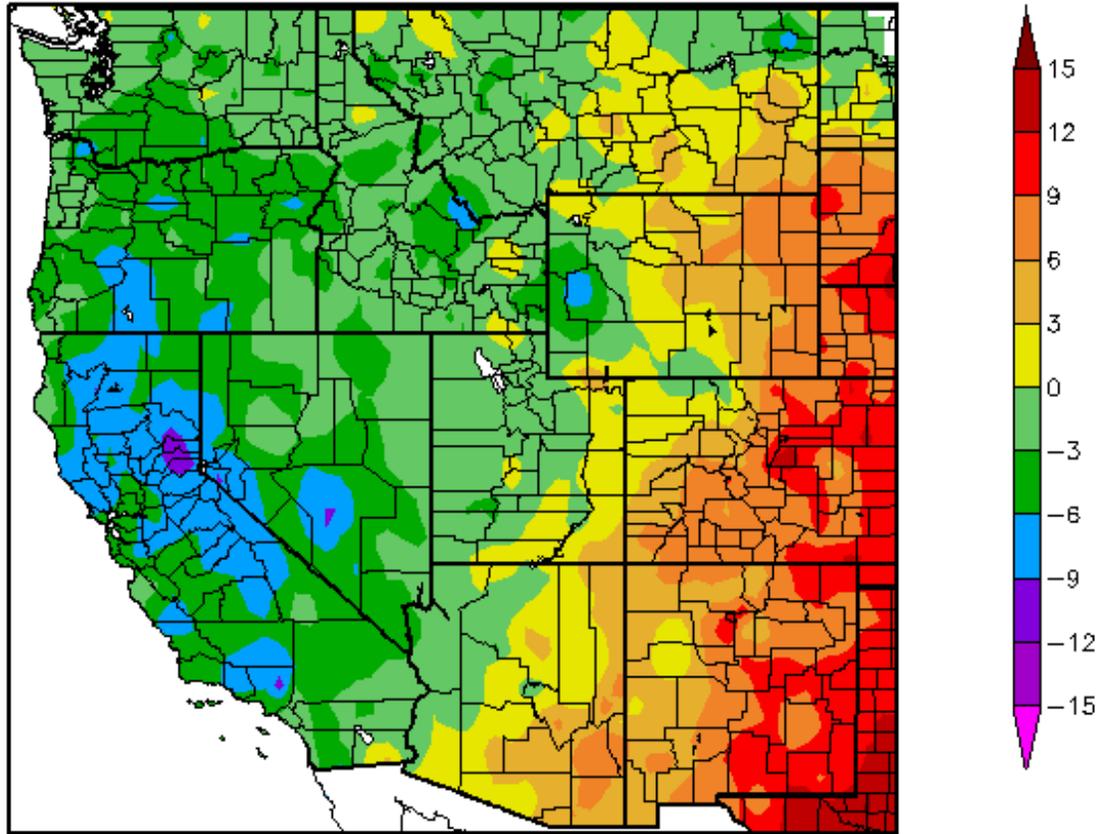


Fig. 2: Average SNOTEL temperatures were above the long term average for this time of year over much of Colorado and New Mexico. Much colder than normal temperatures dominated the Sierra Nevada. Elsewhere temperatures were within $\pm 5^{\circ}\text{F}$.

Ref: <http://www.wcc.nrcs.usda.gov/ftpref/data/water/wcs/gis/maps/WestwideTavg7dAnomaly.pdf>

Departure from Normal Temperature (F)
3/17/2011 – 3/23/2011



Generated 3/24/2011 at HPRCC using provisional data.

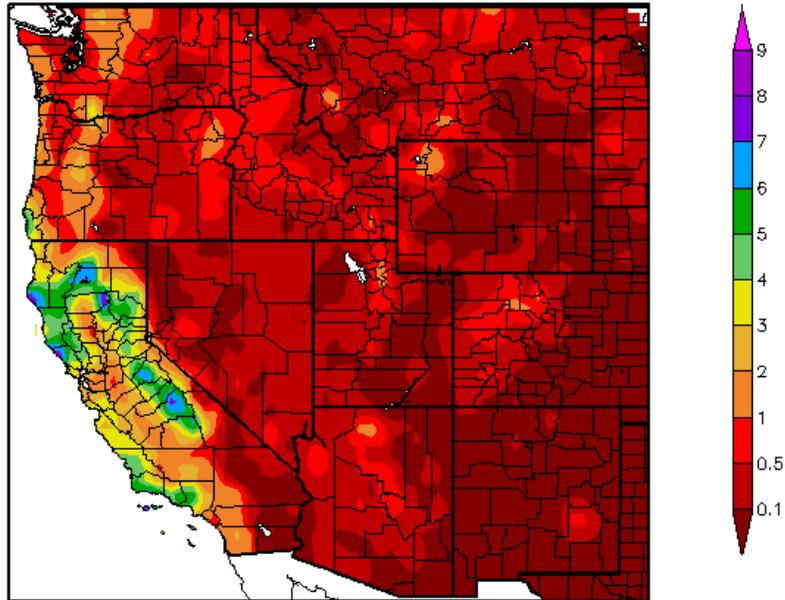
Regional Climate Centers

Fig. 2a: ACIS 7-day average temperature anomalies show that the greatest positive temperature departures scattered across the Western High Plains (>+9°F) and the greatest negative departures over northeast California (<-9°F).

Ref: http://www.hprcc.unl.edu/maps/current/index.php?action=update_daterange&daterange=7d

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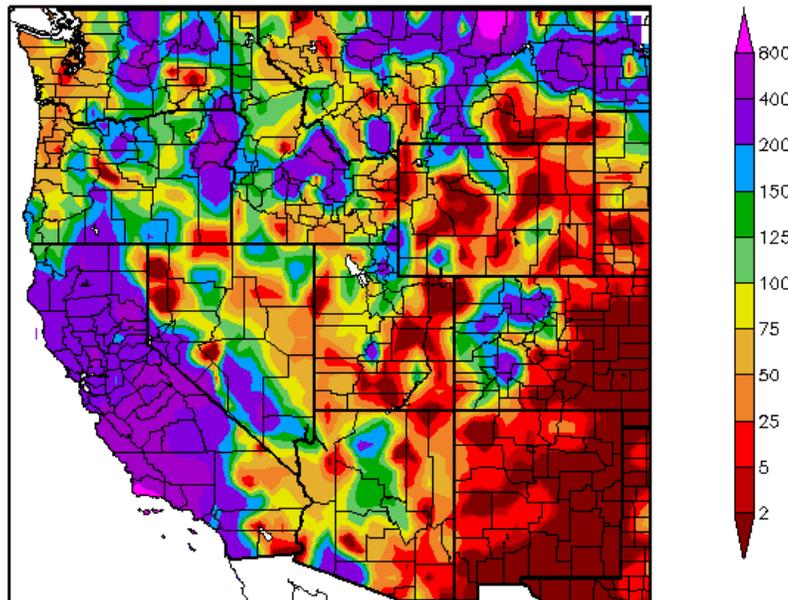
Precipitation (in)
3/17/2011 – 3/23/2011



Generated 3/24/2011 at HPRCC using provisional data.

Regional Climate Centers

Percent of Normal Precipitation (%)
3/17/2011 – 3/23/2011



Generated 3/24/2011 at HPRCC using provisional data.

Regional Climate Centers

Fig. 3 and 3a: ACIS 7-day average precipitation amounts for the period ending 23 March shows the bulk of the heaviest precipitation confined to California (Fig. 3). In terms of percent of normal, the precipitation was highest across California, and scattered across the Northern Tier States. New Mexico, eastern Colorado, and much of Wyoming saw little precipitation this week.

Ref: <http://www.hprcc.unl.edu/maps/current/>

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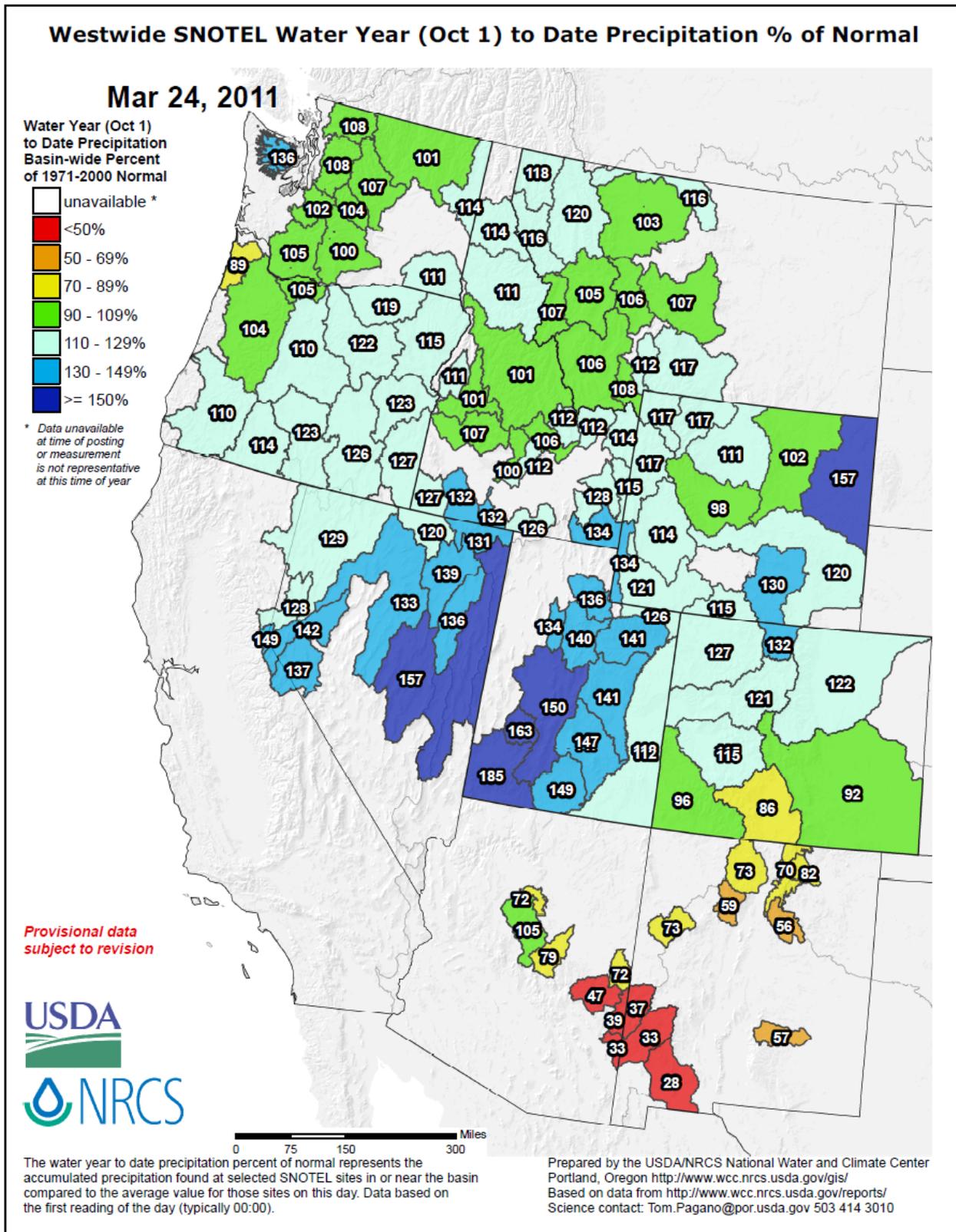


Fig 3b: For the 2011 Water-Year that began on 1 October 2010, the greatest deficits are found over the extreme southern reaches of the Southwest. Areas with the highest values are found over the Great Basin, most of Oregon, and parts of Northern and Central Rockies.

Ref: http://www.wcc.nrcs.usda.gov/ftpref/data/water/wcs/gis/maps/west_wytdprecpcnormal_update.pdf

U.S. Drought Monitor

March 22, 2011
Valid 8 a.m. EDT

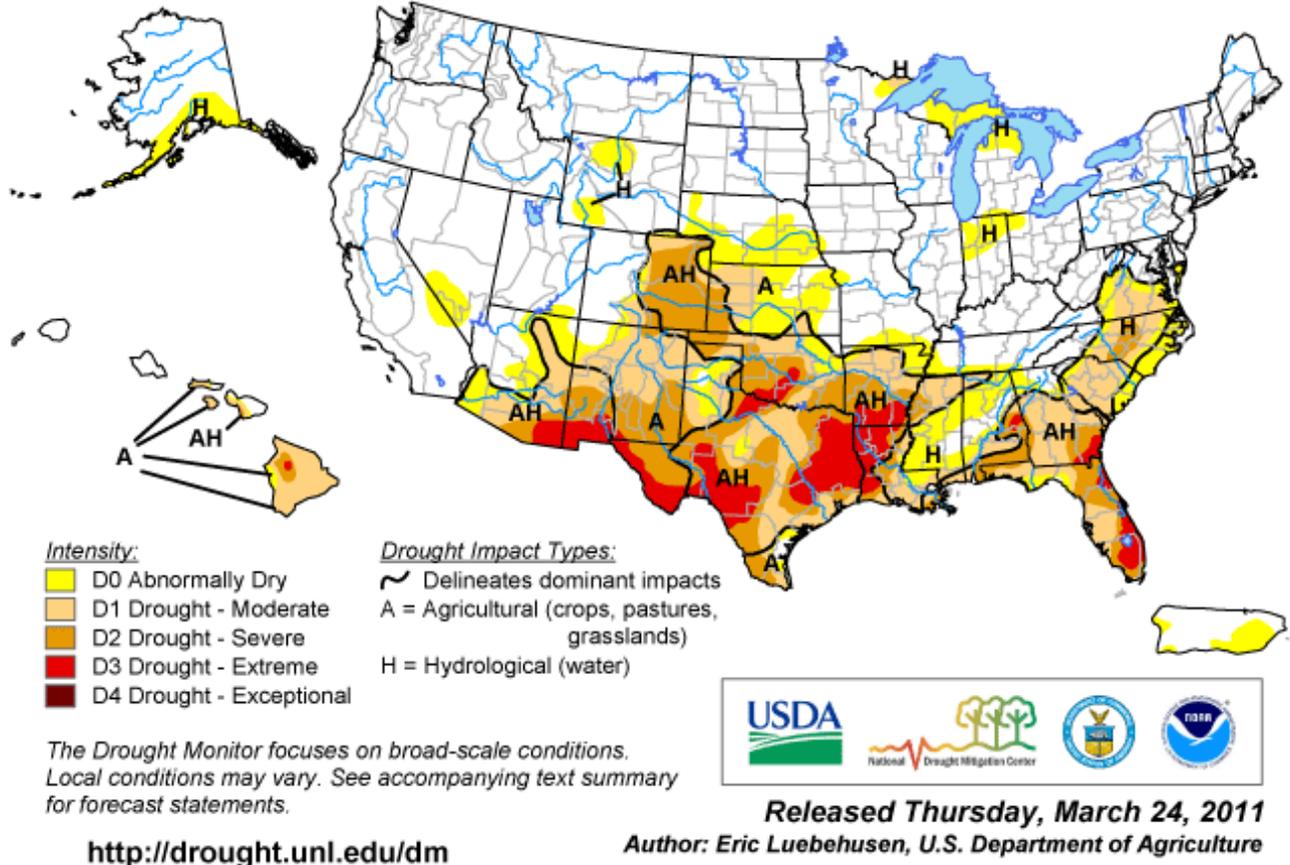


Fig. 4: Current Drought Monitor weekly summary. The severest D3 levels of drought are found on the Big Island of Hawaii and is scattered across southern Arizona and New Mexico, Texas, Oklahoma, Louisiana, southwest Arkansas, east-central Alabama, southeast Georgia, and eastern Florida.

Ref: <http://www.drought.unl.edu/dm/monitor.html>

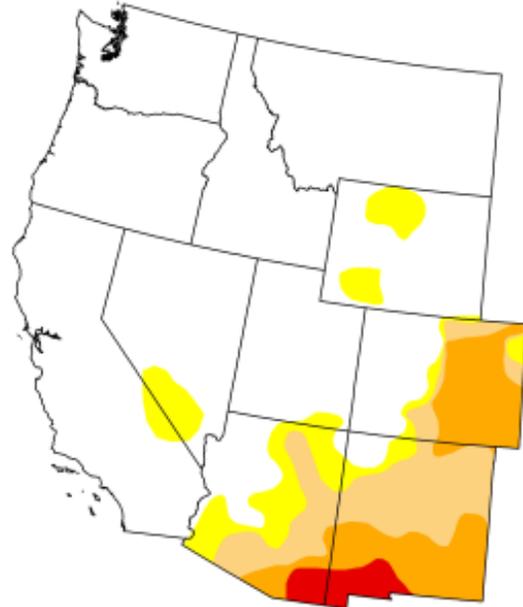
U.S. Drought Monitor

West

March 22, 2011
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	75.16	24.84	17.68	9.52	1.62	0.00
Last Week (03/15/2011 map)	74.39	25.61	17.06	7.78	1.52	0.00
3 Months Ago (12/21/2010 map)	68.16	31.84	13.00	0.89	0.00	0.00
Start of Calendar Year (12/28/2010 map)	73.26	26.74	11.98	0.89	0.00	0.00
Start of Water Year (09/28/2010 map)	62.50	37.50	8.14	0.56	0.00	0.00
One Year Ago (03/16/2010 map)	38.12	61.88	22.29	5.60	0.00	0.00



Intensity:

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

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

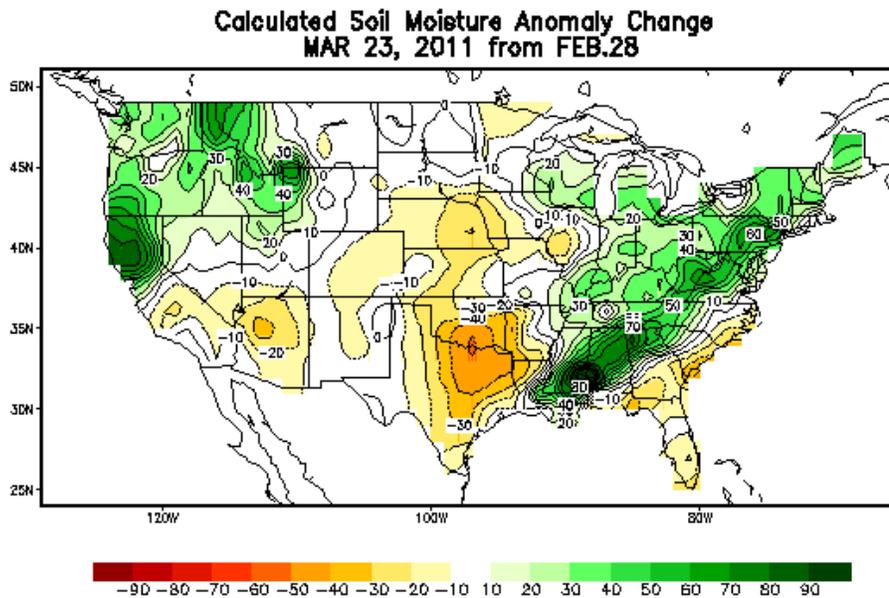
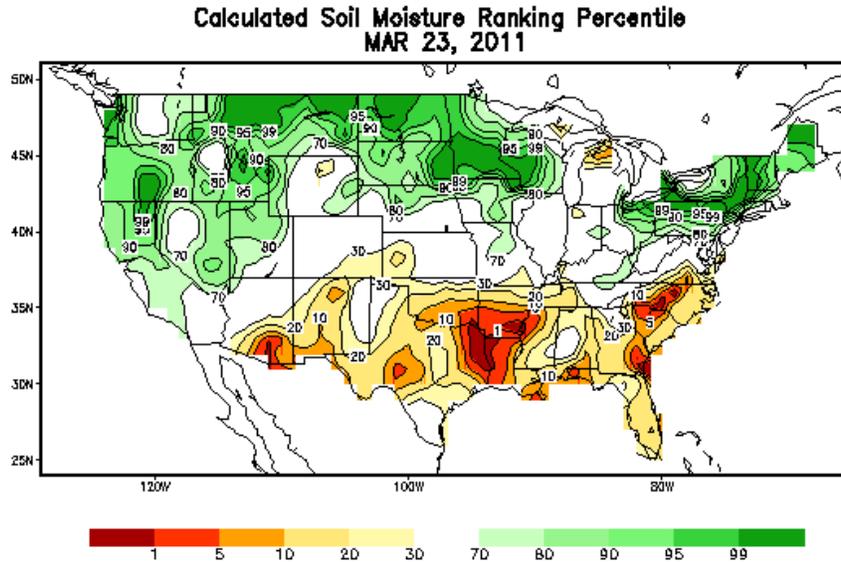


Released Thursday, March 24, 2011
Eric Luebehusen, United States Department of Agriculture

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

Fig. 4a: Drought Monitor for the Western States with statistics over various time periods. Regionally there was some deterioration in the D2 categories during the past week. Ref: http://www.drought.unl.edu/dm/DM_west.htm

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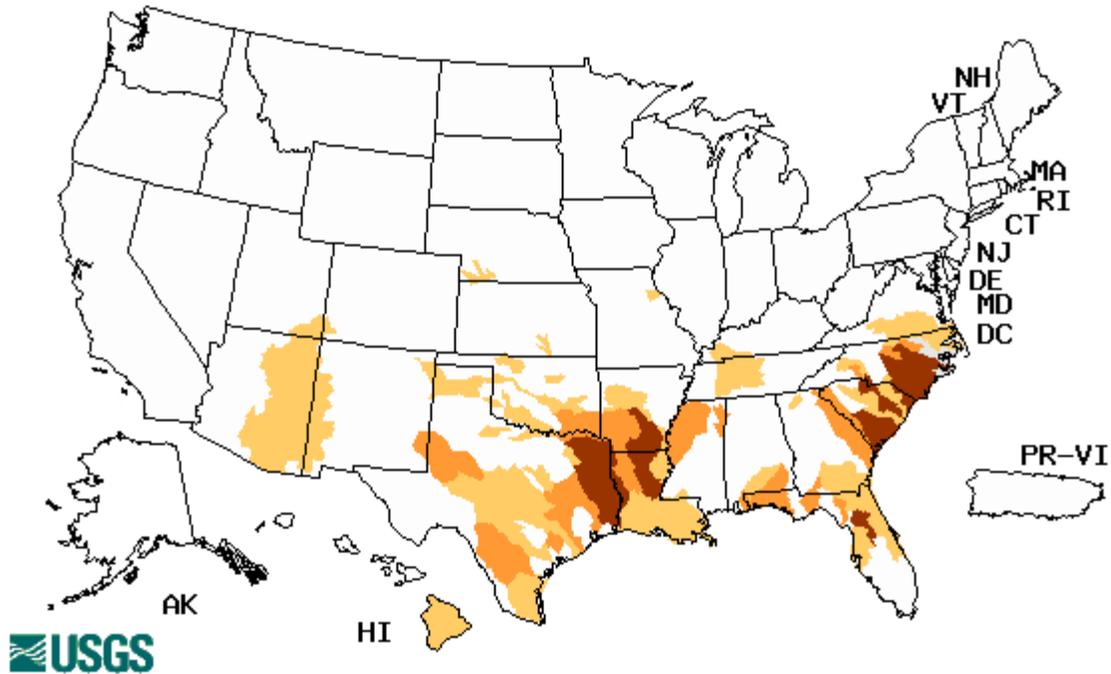


Figs. 5a and 5b: Soil Moisture ranking in percentile as of 23 March (Fig. 5) shows moist conditions over much of the Northern Tier States with dryness over Arizona and much of the Lower Mississippi River Valley and into the Mid-Atlantic States (top). For the month thus far, the Pacific Northwest and the eastern third of the country has experienced significant increases while Texas-Oklahoma are drying out.

Ref: http://www.cpc.ncep.noaa.gov/products/Soilmst_Monitoring/US/Soilmst/Soilmst.shtml#

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Wednesday, March 23, 2011



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. 6: Map of below normal 7-day average streamflow compared to historical streamflow for the day of year. Portions of the eastern Texas, Louisiana, Arkansas, North and South Carolina, and central Florida are indicating severe conditions. Note: northern site gauges are less accurate as rivers and streams are probably frozen.

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

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National Drought Summary -- March 22, 2011

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/>.

Overview: Drought intensified across much of the south-central U.S., while locally heavy rain eased dryness in the Mid-Atlantic and Pacific Coast States.

Midwest: Recent wet weather over central Indiana led to a reduction of Abnormal Dryness (D0) and Moderate Drought (D1). However, long-term indicators (such as the 6- and 9-month Standardized Precipitation Indices and corresponding 6-month percent-of-normal precipitation) showed lingering precipitation shortfalls in northern portions of Indiana, so D0 (H) was maintained. Light precipitation (less than 0.50 inch) in the northern Great Lakes did not warrant any changes to the lingering D0 and D1 in this region.

The Mid-Atlantic: The recent wet trend continued, with locally more than 1 inch of rain easing Moderate Drought (D1) and Abnormal Dryness (D0) in northern Virginia and the lower Delmarva Peninsula. Most short-term indicators, including 30-day precipitation and soil moisture, reflect moist conditions. However, seasonal precipitation deficits (90-day) and locally low streamflows warranted maintaining Moderate Drought and Abnormal Dryness over southern portions of the region.

Southeast: Precipitation remained north of the worst drought areas. Consequently, the current depiction of Severe Drought (D2) was maintained in central North Carolina, in line with latest soil moisture percentiles and Standardized Precipitation Indices. Over the last 90 days, precipitation deficits in excess of 6 inches have been noted in portions of the D2 area. Streamflows and short-term precipitation shortfalls closer to the coast bear watching, with some eastward expansion of drought possible if rain does not materialize soon. Farther south, Abnormal Dryness and Moderate Drought (D1) were expanded east in southern South Carolina and eastern Georgia to account for streamflows which are consistently below the 10th percentile as well as D1-equivalent soil moisture percentile rankings. In Florida, a lack of rainfall during the past week coupled with rapidly declining soil moisture and an increasing wildfire threat led to the expansion of Extreme Drought (D3) across southern portions of the state. There were no changes made to the current drought designation in northern Florida, where Moderate to Extreme Drought remained firmly entrenched.

Delta: Reduction of the Extreme Drought (D3) in southern Louisiana was noted as soil moisture percentiles and Standardized Precipitation Indices continued to reflect improvement from recent heavy rain. However, conditions remained unfavorably dry across coastal Louisiana, where soil moisture rankings slipped below the 10th percentile. In the northern Delta, drought expanded in southeastern Arkansas and west-central Mississippi in response to 90-day precipitation totals that are less than 30 percent of normal (deficits of 10 inches or more). Soil moisture was also

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ranked in the lowest 5th percentile, likewise supporting an eastward expansion of the Severe to Extreme Drought in the northern Delta.

Texas & Oklahoma: Dry, unseasonably warm weather led to widespread intensification and expansion of drought. Temperatures averaged up to 18°F above normal across the region, with highs reaching the lower 90s; consequently, crop and pasture moisture demands were higher than normal. In eastern Texas, the expanded Extreme Drought (D3) region aligned with soil moisture percentile rankings consistently in the lowest 5th percentile. 90-day rainfall deficits in eastern portions of Texas averaged 4 to 8 inches, with smaller deficits (2 inches or less) in the remaining D0 and D1 areas of central Texas. It should be noted that many drought indicators in east-central Texas have reached the Exceptional Drought (D4) level, and if rain does not materialize soon, worsening of the current drought depiction is highly likely. In western Texas, Extreme Drought (D3) was expanded in response to 180-day rainfall values that are 10 percent of normal or less. In south Texas and the Lower Valley, where precipitation has averaged 10 to 30 percent of normal over the past 90 days, Moderate to Severe Drought (D1 and D2, respectively) were expanded. Likewise in northern Texas and western Oklahoma, severely dry conditions over the past 90 days coupled with unseasonable warmth led to an expansion of drought. Most notably, Extreme Drought now stretches from just east of Oklahoma City southwestward into north-central Texas; many locales in the heart of the expanded D3 region have reported less than 20 percent-of-normal precipitation over the past 90 days. Severe Drought (D2) also expanded across western portions of Oklahoma, reflecting soil moisture rankings in the lowest 20th percentile.

Central Plains: From eastern Colorado into central Kansas and southern Nebraska, Abnormal Dryness (D0) and Moderate (D1) to Severe (D2) Drought were expanded. Precipitation over the last 2 months has been less than 60 percent of normal in many of these locales, and has tallied less than 30 percent of normal in southwestern Kansas and southeastern Colorado. Soil moisture rankings are below the 20th percentile in northwestern Kansas and southeastern Nebraska, and have dipped below the 5th percentile from southwestern Kansas into eastern portions of Colorado.

The West: Unseasonably heavy rain and mountain snow across the Pacific Coast States contrasted with ongoing drought in lower portions of the Four Corners Region. Water-year precipitation rankings are in the lowest 10th percentile across southwestern Arizona and southeastern portions of New Mexico, where Severe to Extreme (D2 and D3) Drought was expanded. Water-year precipitation to date ranked in the 10th to 30th percentile (D0 to D1 equivalent) in northern New Mexico and east-central Arizona. Current soil moisture percentile rankings and objective drought blends indicated conditions are deteriorating across New Mexico and Arizona, with further drought assessment necessary over the upcoming weeks. In contrast, heavy rain and mountain snow were observed in California, boosting mountain snowpacks and eliminating lingering D0 (Abnormal Dryness) in northern portions of the state. Snow depths exceeded 100 inches at numerous locations in the Sierra Nevada, with some estimates in excess of 200 inches. Estimated weekly total liquid precipitation eclipsed 6 inches in southern and northern portions of the California coast, and was locally more than 8 inches in the Sierra Nevada. In the Northwest, precipitation estimates of 1 to 3 inches (liquid equivalent) in west-central Washington led to the removal of D0. Despite early melting of the Northwestern snowpack, most locations in the Northwest are reporting snow water equivalent in the 40th percentile or higher, with some locales in the 70 to 85th percentile.

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Hawaii, Alaska and Puerto Rico: In Hawaii, mostly dry, warmer-than-normal conditions were noted, with no changes to the current drought depiction. A wildfire on the southeastern edge of the Big Island was responsible for burning more than 1100 acres, and corresponded to the current location of D1 (Moderate Drought). In Alaska, unseasonably cold, dry weather prevailed, with temperatures averaging up to 6°F below normal. No changes were made to the Abnormal Dryness region in Alaska. In Puerto Rico, showers (locally more than 2 inches) across northern portions of the island contrasted with dry conditions in the south and west, where Abnormal Dryness (D0) was expanded slightly. Areas within the current D0 have received less than 50 percent-of-normal precipitation over the past 3 months.

Looking Ahead: A late-season winter storm will track from the Corn Belt to the Mid-Atlantic coast, producing a wide swath of rain and snow across the northeastern quarter of the nation. Meanwhile, a trio of Pacific storms will bring additional heavy rain and mountain snow to much of the western U.S., with precipitation totals expected to exceed 7 inches (liquid equivalent) in portions of the Sierra Nevada over the next 5 days. Moisture from these systems will reach the central and northern portions of the Plains by week's end, with some beneficial rain expected as far south as Oklahoma and northern Texas. Moderate to locally heavy rain will spread across the nation's southeastern quadrant over the weekend, with snow possible on the storm's northern edge. Despite the active weather pattern, little if any precipitation is expected from southern Arizona into central and southern Texas.

The CPC 6-10 day forecast (March 29- April 2) calls for wetter- and cooler-than-normal weather from the Delta to the Atlantic Coast, including the Mid-Atlantic and Northeast. In addition, above-normal precipitation is expected to linger in the Northwest. In contrast, drier- and mostly warmer-than-normal weather is expected to persist from the lower Four Corners Region into western and southern portions of Texas, with drier-than-normal conditions also developing across the Upper Midwest.

Author: [Eric Luebehusen, United States Department of Agriculture](#)

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 March 23, 2011