



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

Weekly Report - Snowpack / Drought Monitor Update

Date: 31 March 2011

SNOTEL SNOWPACK AND PRECIPITATION SUMMARY

Snow: SNOTEL Snow-Water Equivalent percent of normal values for 31 March 2011 shows 1-Category gains (blue circles) over Oregon, the Great Basin, and northern Wyoming this week. Melt-out is nearing completion over much of the Southwest (1-Category loss with red circles) (Fig. 1). SNOTEL Snow-Water Equivalent percent of Normal peak shows recovery across parts of the Oregon Cascades; climatologically speaking, the snow season for the Northern Tier States is near peak accumulation. Most of the West is meeting or exceeding the long-term climatologically average snowpack. Melt-out nearly completed over the Southwest (Fig.1a). SNOTEL 7-day snow depth changes show significant gains over the Oregon Cascades, Wasatch, and Bighorns, and Colorado Rockies. After a record snowfall the previous week, the Sierra Nevada has lost some snowpack this week (Fig. 1b).

Temperature: Average SNOTEL temperatures were within $\pm 5^{\circ}\text{F}$ of the long term average for this time of year across the West (Fig. 2). ACIS 7-day average temperature anomalies show at the greatest positive temperature departures across southern New Mexico ($>+6^{\circ}\text{F}$) and the greatest negative departures over northeast Montana ($<-12^{\circ}\text{F}$) (Fig. 2a).

Precipitation: ACIS 7-day average precipitation amounts for the period ending 30 March shows the bulk of the heaviest precipitation confined to California, the Cascades, and the Olympic Mountains (Fig. 3). In terms of percent of normal, the precipitation was highest across California, the Great Basin, and the Pacific Northwest. Arizona, New Mexico, central Wyoming, and eastern Montana 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. One-category changes (\pm) are denoted by the circles (Fig. 3b).

The West: Unseasonably heavy rain and mountain snow persisted across the Pacific Coast States, while drought intensified in lower portions of the Four Corners Region. Over the past 6 months, precipitation has tallied 50 percent of normal or less from southeastern Arizona into southern and central New Mexico, with the greatest departures (locally less than 30 percent of normal) in southern-most portions of the region. The corresponding 6-month Standardized Precipitation Index (SPI) indicated D3 conditions across the southeastern corner of Arizona and adjacent portions of southern New Mexico. Consequently, Moderate to Extreme Drought (D1-D3) was expanded in the lower Four Corner region. In northeastern Arizona, 3- and 6-month SPI likewise supported modest expansion of Moderate Drought (D1). The D0 region along the Nevada-California border was removed as updated seasonal SPI (6 and 9 month) indicated mostly favorable conditions. In contrast, heavy rain and mountain snow were observed from California into the Northwest, providing an additional boost to mountain snowpack. Snow depths exceeded 100 inches at numerous locations in the Sierra Nevada, with some estimates in excess of 300 inches. Estimated weekly total liquid precipitation eclipsed 4 inches in northern portions of the California coast, and was locally more than 6 inches in the Sierra Nevada. In the Northwest, precipitation estimates of 2 to 8 inches (liquid equivalent) were noted from the

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Klamath Range into the Cascades and along the Pacific Coast. **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, 4a, and 4b).

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>

Weekly Snowpack and Drought Monitor Update Report

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

Weekly Snowpack and Drought Monitor Update Report

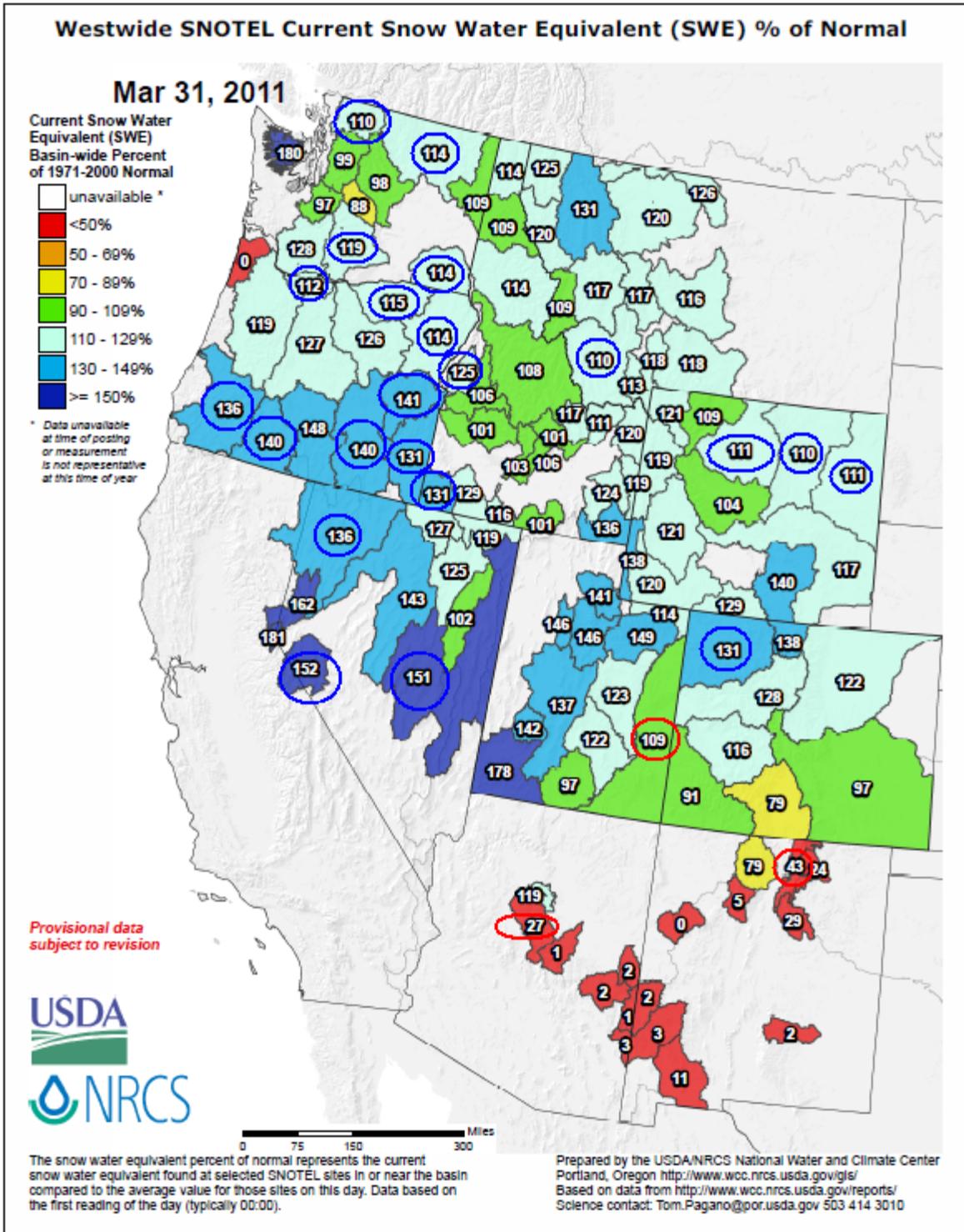


Fig. 1: SNOTEL Snow-Water Equivalent percent of normal values for 31 March 2011 shows 1-Category gains (blue circles) over Oregon, the Great Basin, and northern Wyoming this week. Melt-out is nearing completion over much of the Southwest (1-Category loss with red circles).

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

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SNOTEL Current Snow Water Equivalent (SWE) Percent of Normal Peak Mar 31, 2011

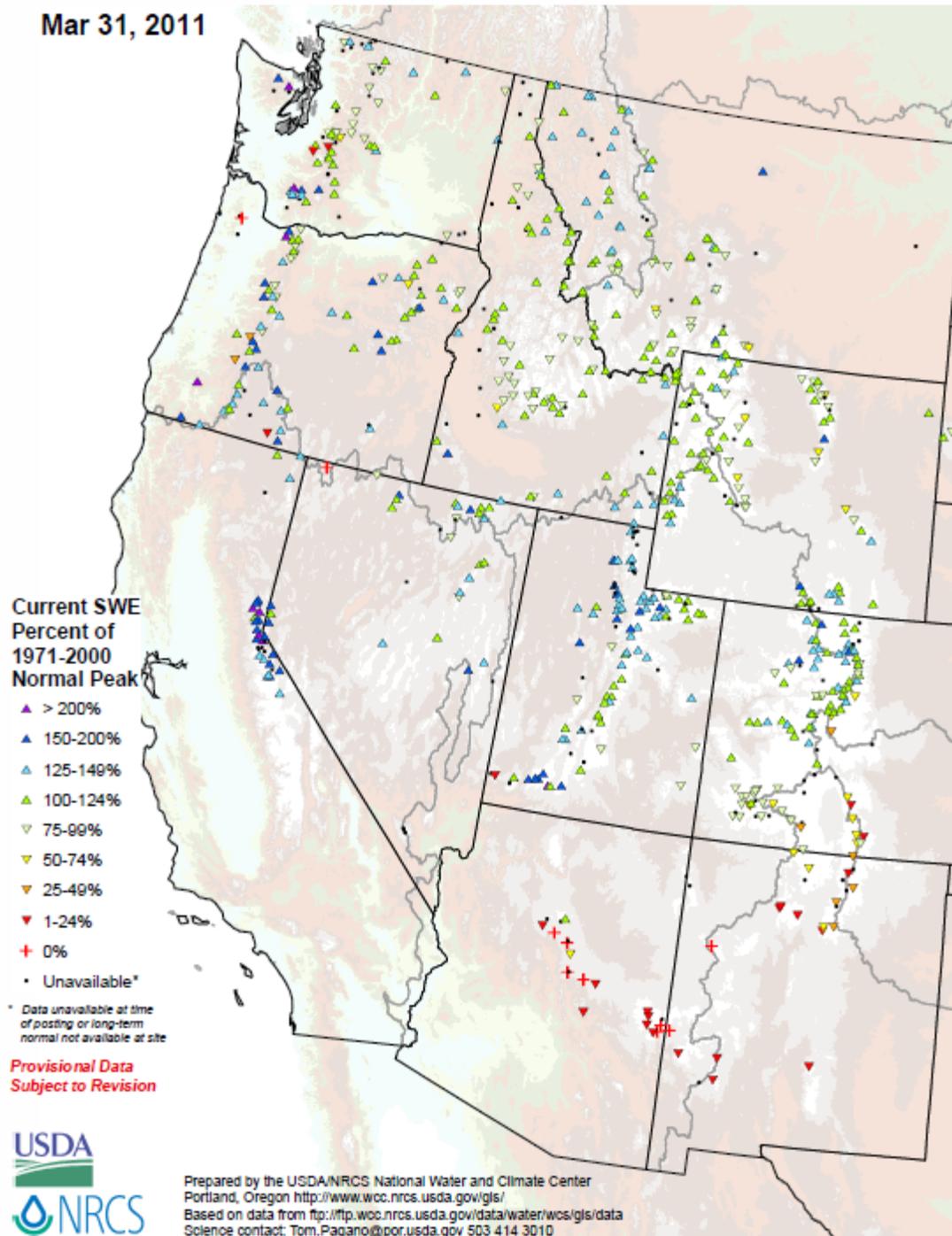


Fig. 1a: SNOTEL Snow-Water Equivalent percent of Normal peak shows recovery across parts of the Oregon Cascades; climatologically speaking, the snow season for the Northern Tier States is near peak accumulation). Most of the West is meeting or exceeding the long-term climatologically average snowpack with melt-out nearly completed over the Southwest.

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 31, 2011

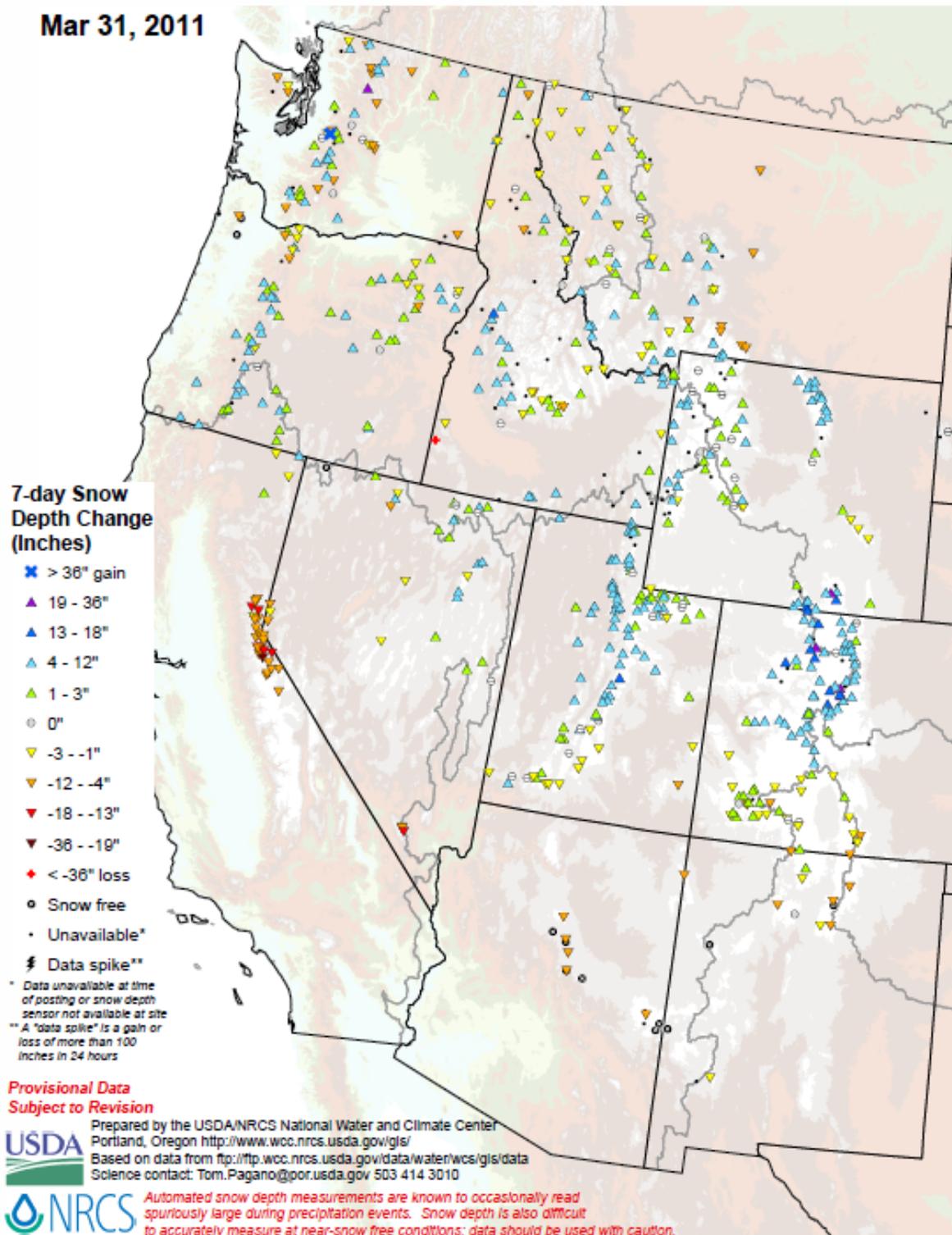


Fig. 1b: SNOTEL 7-day snow depth changes show significant gains over the Oregon Cascades, Wasatch, and Bighorns, and Colorado Rockies. After a record snowfall the previous week, the Sierra Nevada has lost some snowpack this week.

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 31, 2011

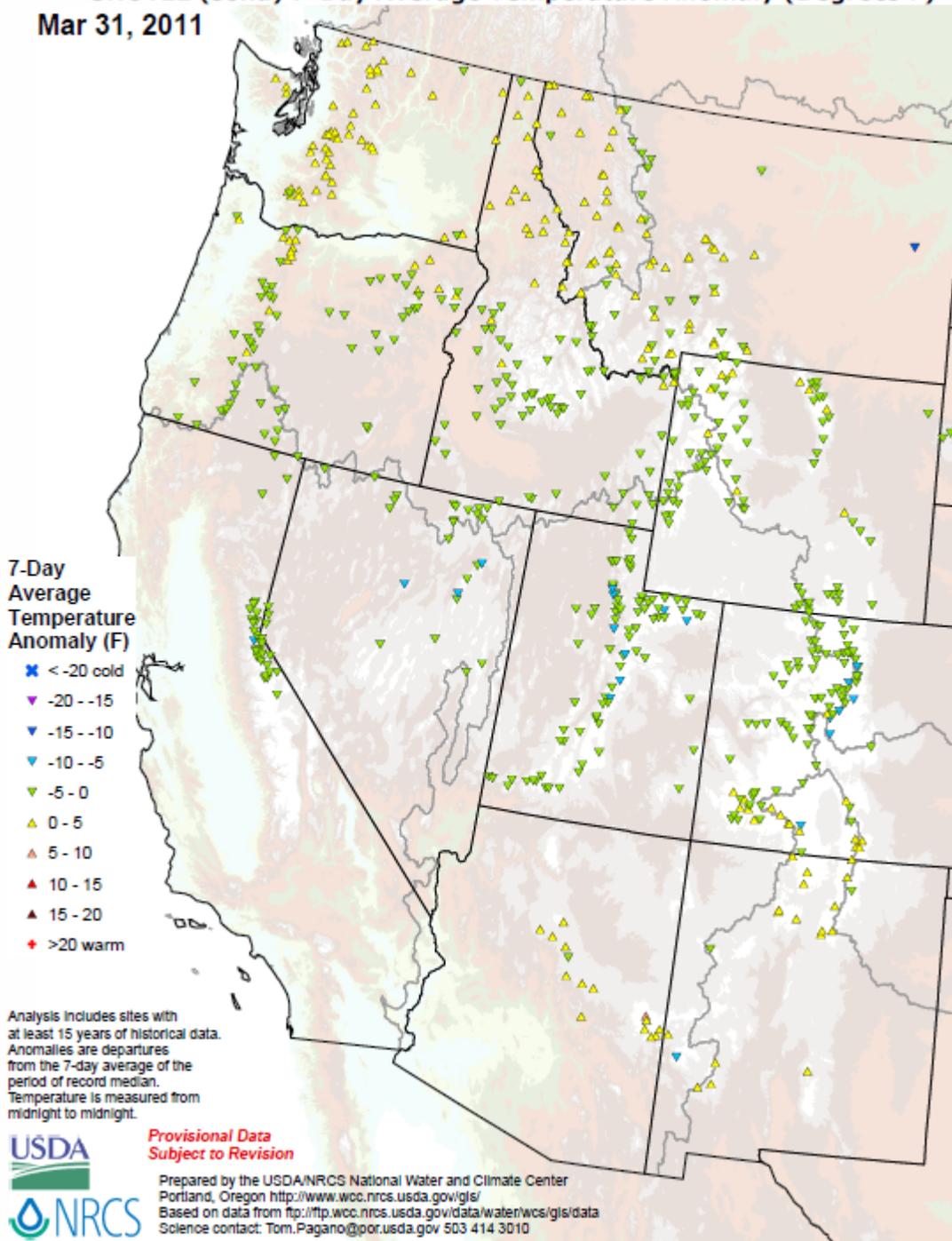
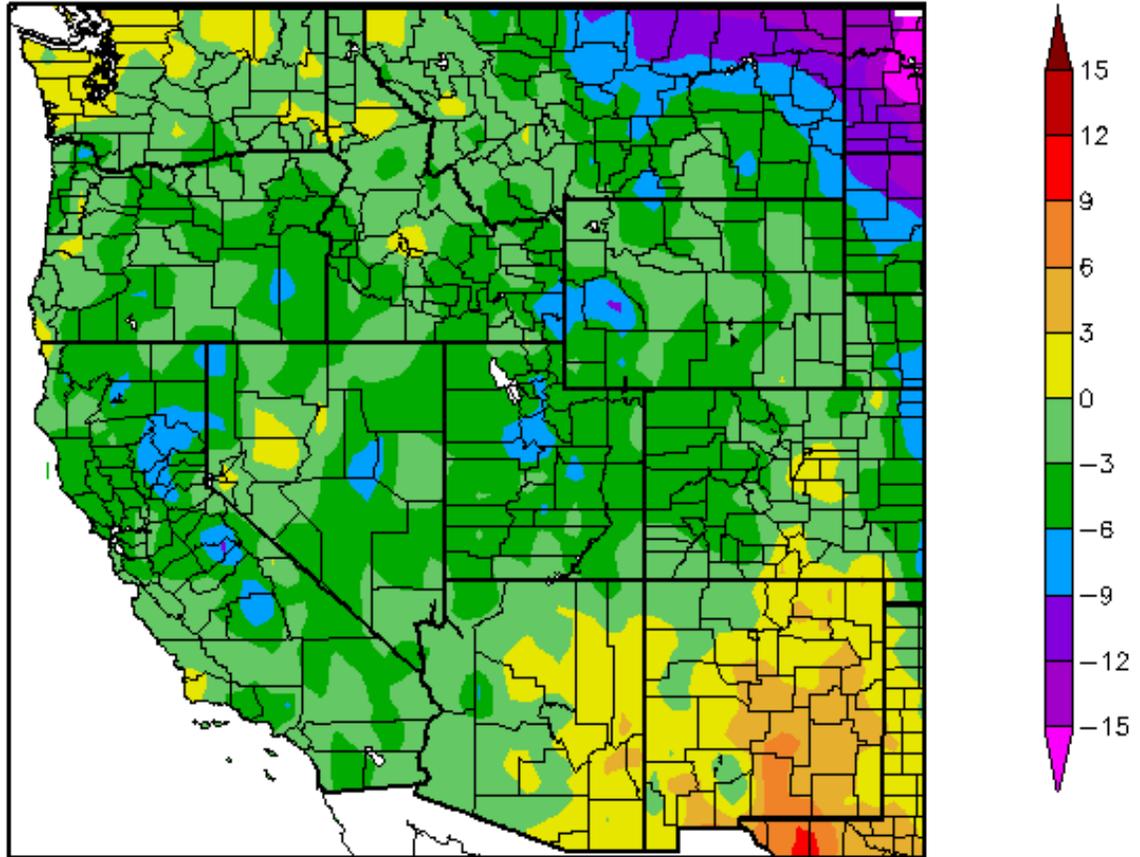


Fig. 2: Average SNOTEL temperatures were within $\pm 5^{\circ}\text{F}$ of the long term average for this time of year across the West.

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

Departure from Normal Temperature (F)
3/24/2011 – 3/30/2011



Generated 3/31/2011 at HPRCC using provisional data.

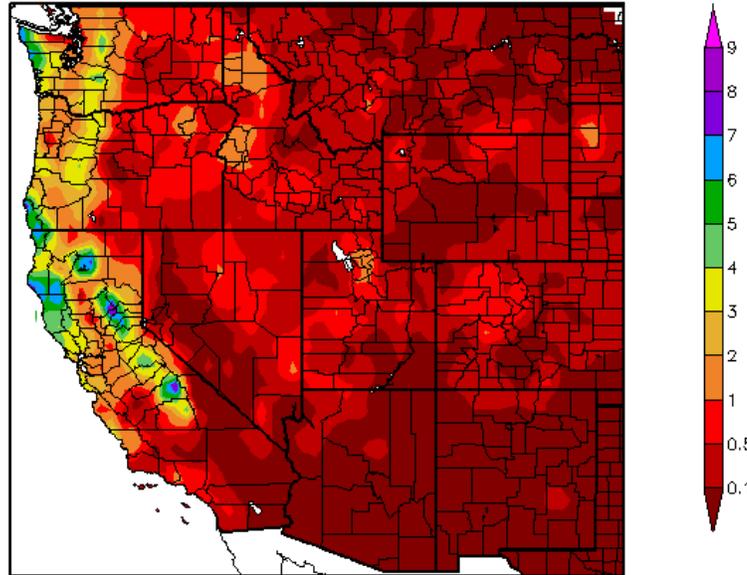
Regional Climate Centers

Fig. 2a: ACIS 7-day average temperature anomalies show that the greatest positive temperature departures across southern New Mexico (>+6°F) and the greatest negative departures over northeast Montana (<-12°F).

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

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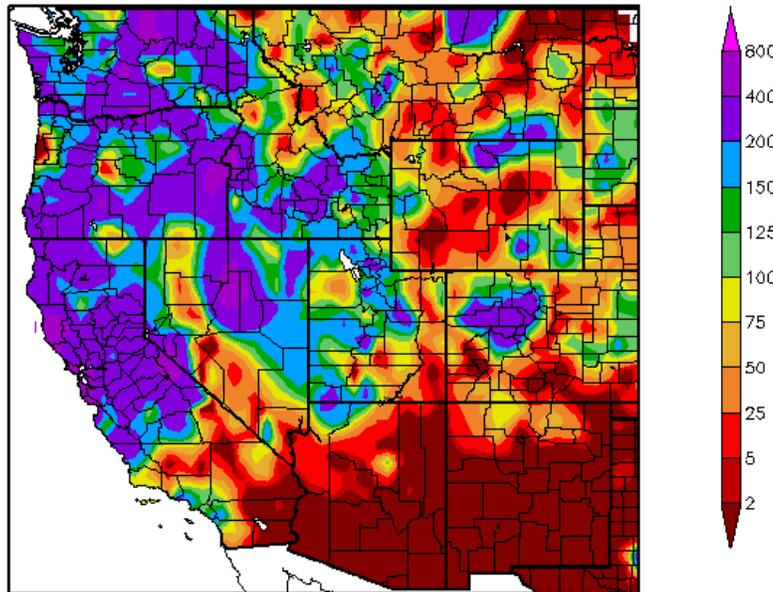
Precipitation (in)
3/24/2011 - 3/30/2011



Generated 3/31/2011 at HPRCC using provisional data.

Regional Climate Centers

Percent of Normal Precipitation (%)
3/24/2011 - 3/30/2011



Generated 3/31/2011 at HPRCC using provisional data.

Regional Climate Centers

Fig. 3 and 3a: ACIS 7-day average precipitation amounts for the period ending 30 March shows the bulk of the heaviest precipitation confined to California, the Cascades, and the Olympic Mountains (Fig. 3). In terms of percent of normal, the precipitation was highest across California, Great Basin, and the Pacific Northwest. Arizona, New Mexico, central Wyoming, and eastern Montana saw little precipitation this week (Fig 3a).

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

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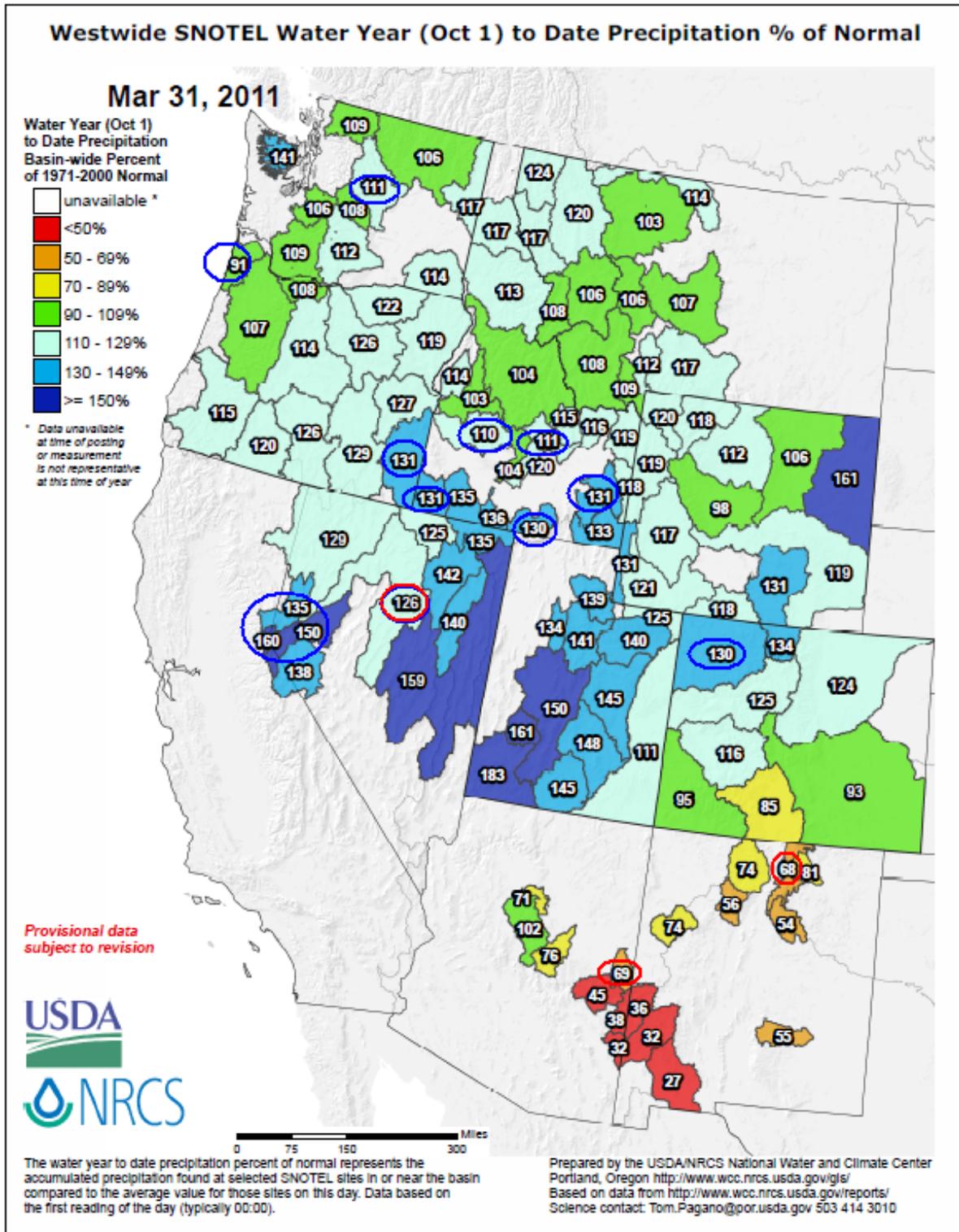
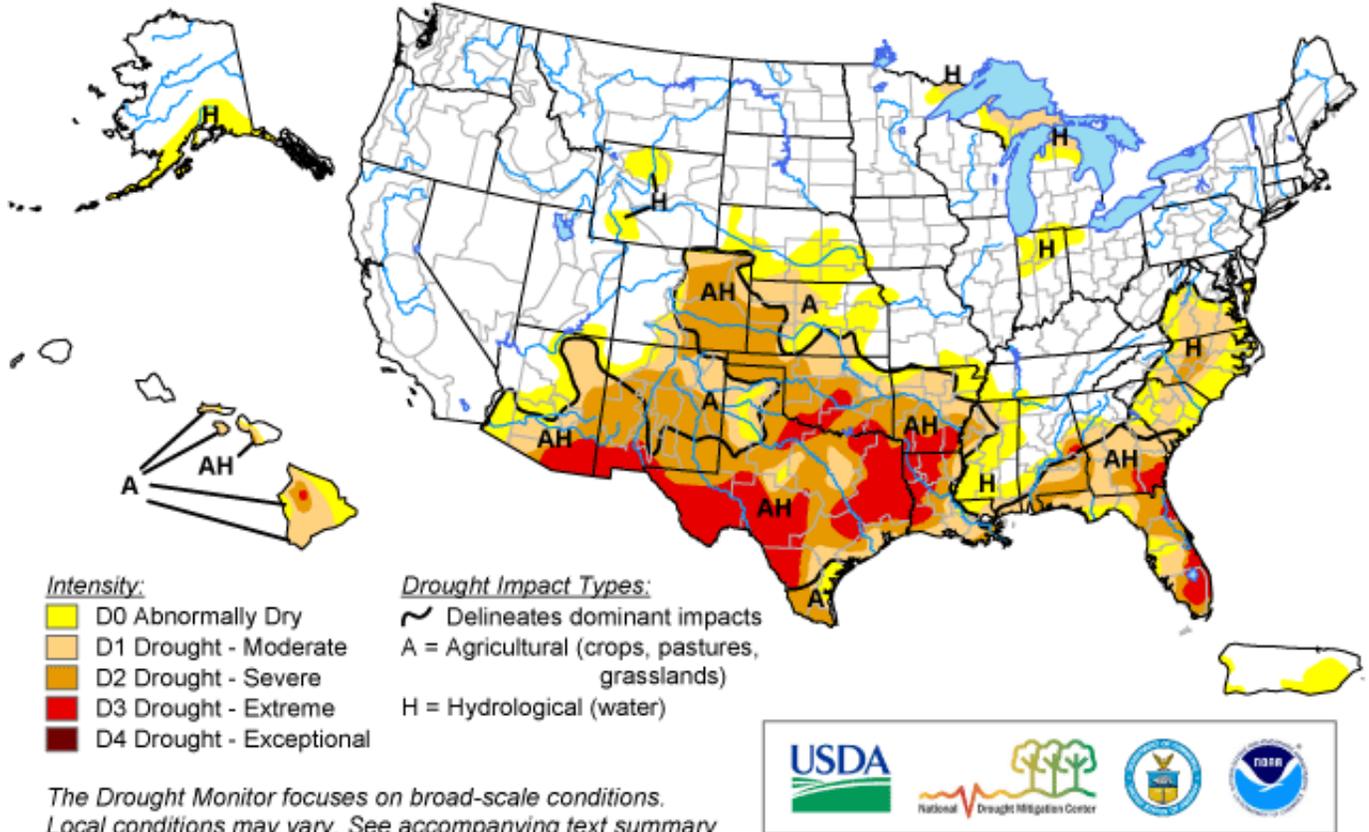


Fig 3b: For the 2011 Water-Year that began on 1 October 2010, the greatest deficits are found over the extreme southern reaches of the Southwest. Areas with the highest values are found over the Great Basin, most of Oregon, and parts of Northern and Central Rockies. One-category changes (\pm) are denoted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

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

U.S. Drought Monitor

March 29, 2011
Valid 8 a.m. EDT



Released Thursday, March 31, 2011

Author: Eric Luebehusen, U.S. Department of Agriculture

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

Fig. 4: Current Drought Monitor weekly summary. The severest D3 levels of drought are found on the Big Island of Hawaii, 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>

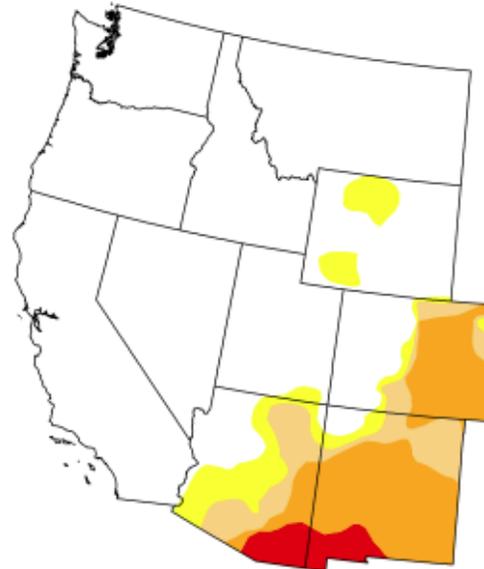
U.S. Drought Monitor

West

March 29, 2011
Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	76.08	23.92	18.56	13.12	2.12	0.00
Last Week (03/22/2011 map)	75.16	24.84	17.68	9.52	1.62	0.00
3 Months Ago (12/28/2010 map)	73.26	26.74	11.98	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 (03/23/2010 map)	39.94	60.06	22.45	5.40	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.

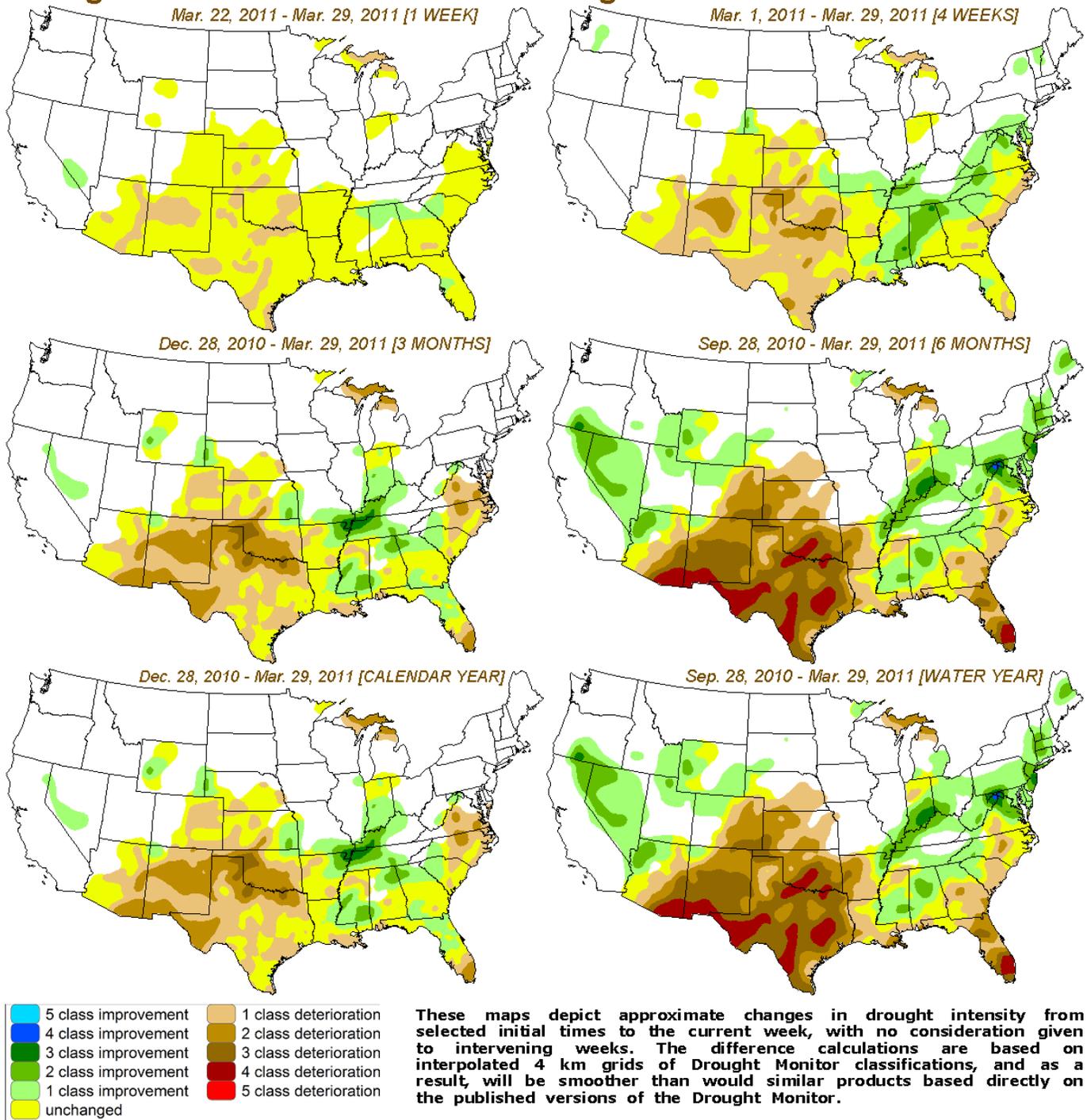


Released Thursday, March 31, 2011
Eric Luebehusen, United States Department of Agriculture

<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

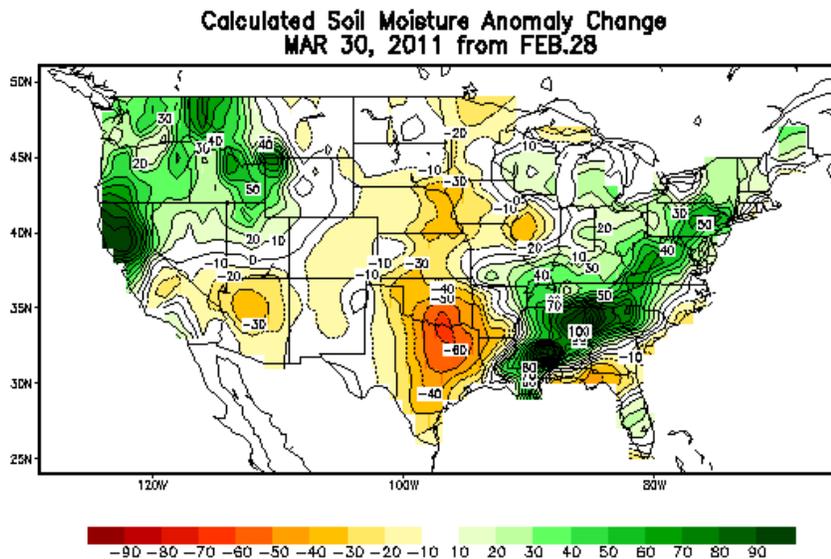
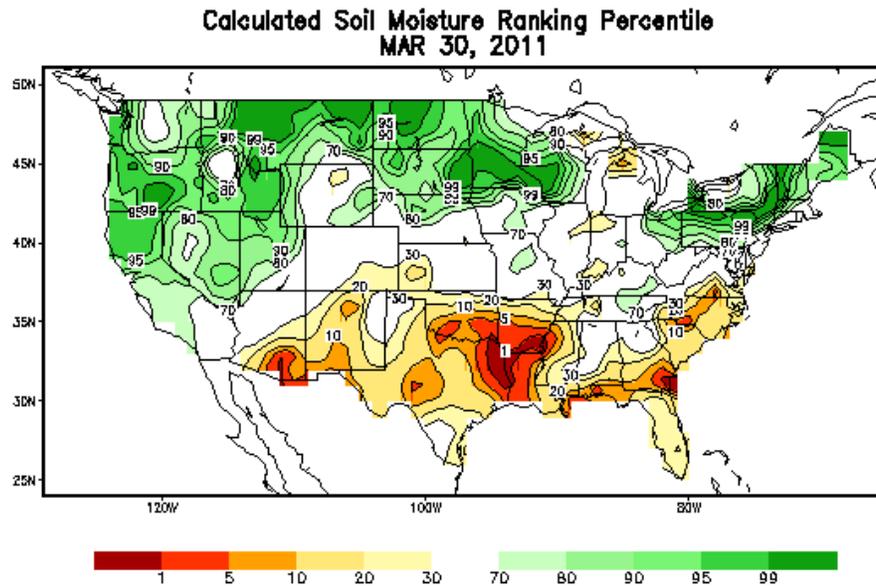
Drought Monitor Classification Changes for Selected Time Periods



These maps depict approximate changes in drought intensity from selected initial times to the current week, with no consideration given to intervening weeks. The difference calculations are based on interpolated 4 km grids of Drought Monitor classifications, and as a result, will be smoother than would similar products based directly on the published versions of the Drought Monitor.

Fig. 4b: Drought Monitor classification changes for various time periods. Note the developing drought over the south-central region of the country.

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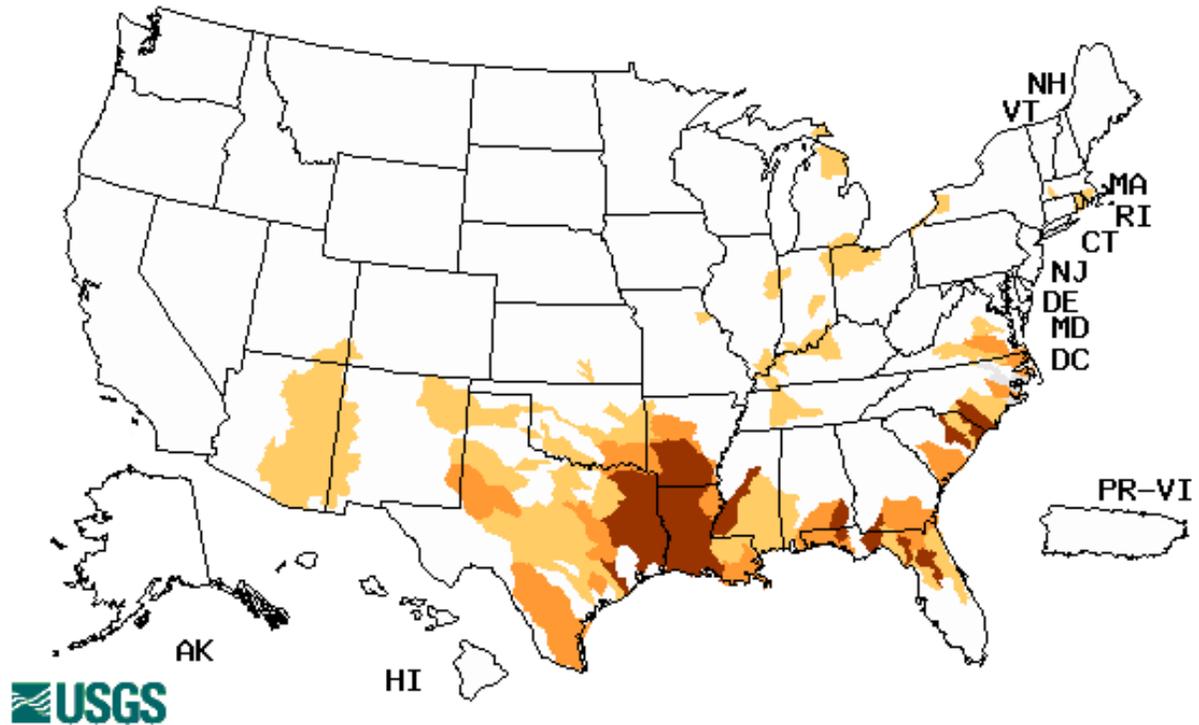


Figs. 5a and 5b: Soil Moisture ranking in percentile as of 30 March (Fig. 5) shows moist conditions over much of the Northern Tier States with dryness over Arizona and much of the Lower Mississippi River Valley and into the Mid-Atlantic States (top). For the month thus far, the Pacific Northwest Northern California, 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 30, 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 29, 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: Heavy rain eased drought across portions of the Southeast, while drought intensified across much of the south-central and southwestern U.S.

Midwest: Dry, cool weather prevailed over northern Indiana, where long-term precipitation deficits persist (4-6 inches below normal over the past 180 days). In the northern Great Lakes, Moderate Drought (D1) was introduced to northern-most portions of Michigan to account for below-normal snowfall and corresponding low 3- and 6-month Standardized Precipitation Indices.

The Mid-Atlantic: The recent wet, cool trend continued, although rainfall totals were mostly less than 1 inch. Lingering Abnormally Dry and Moderate Drought regions of the lower Delmarva and southern Virginia reported mostly less than 0.25 inch, which was not sufficient to further improve drought designation. Streamflows in the southern portions of the region continued to reflect D0 and D1 status.

Southeast: Locally heavy rain (2-4 inches) swept eastward from southern Tennessee and northern Alabama into Georgia and South Carolina, affording northern portions of the region relief from Moderate Drought (D1) and Abnormal Dryness (D0). Precipitation was somewhat lighter (less than 1.5 inches) in North Carolina's core Severe Drought (D2) area; with weekly normal precipitation over an inch, the rainfall was not enough to warrant drought reduction in this area. Moderate to heavy rain (2-4 inches, locally more) in central Florida also provided relief from Moderate to Severe Drought (D1 and D2), although the rain largely bypassed the southern Extreme Drought (D3) region. Consequently, modest drought improvement was noted in central Florida, while southern and eastern Florida remained largely unchanged. In northern Florida, D1 was expanded in eastern portions of the Panhandle, where precipitation deficits over the past 60 days have tallied 4 to 6 inches (less than 50 percent of normal). In southern Georgia, a small band of heavy showers (2-3 inches) led to a minor adjustment to Severe Drought (D2), while Severe and Extreme Drought were expanded westward over southern portions of the state to reflect declining soil moisture and streamflow percentiles.

Delta: Dry, warmer-than-normal weather (up to 9°F above normal) in southern portions of the region contrasted with periods of rain and below-normal temperatures farther north. Changes in drought across southern Louisiana were minor, with a slight eastward expansion of Severe Drought (D2) to reflect soil moisture rankings in the lowest 5th percentile and Standardized Precipitation Indices indicative of D2 conditions or worse. Farther north, upwards of 5 inches of rain in northeastern Mississippi led to 1-category improvements of the current drought depiction, while lesser totals (1-3 inches) resulted in minor improvements in D0 (Abnormal Dryness) across southern Missouri. It should be noted that the core D3 (Extreme Drought) regions of the

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Delta continue to wrestle with deficits locally in excess of 12 inches over the past 90 days and 15 to 20 inches (locally more) over the past 180 days (less than 50 percent of normal over both timescales).

Texas & Oklahoma: Dry, hot conditions led to widespread intensification and expansion of drought across Texas, where daytime highs routinely reached into the upper 80s and lower to middle 90s. In Oklahoma, despite somewhat cooler weather, conditions likewise deteriorated under sunny skies. By week's end, soil moisture percentile rankings depicted D3 (Extreme Drought) or worse from southeastern Oklahoma into most of central and eastern Texas. In addition, 6-, 9- and 12-month Standardized Precipitation Indices (SPI) likewise reflected D3 or D4 conditions over much of this same region. Remote sensing data (in particular, the Vegetation Health Index) depicted widespread vegetation stress across southern Oklahoma and much of Texas. Meanwhile, from South Texas into the Edwards Plateau and Trans-Pecos regions, 3- and 6-month SPI likewise correlated with Extreme Drought (D3) or greater. To further illustrate the drought's impacts, winter wheat crop condition rated 62 and 46 percent very poor to poor in Texas and Oklahoma, respectively, as of March 27. 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, intensification of the current drought is likely. The remaining drought regions in northern and central Texas continued to depict worsening conditions as well, as the lingering benefits of late-winter rainfall quickly give way to dry, hot weather.

Central Plains: Showers in northern and eastern portions of the region contrasted with expanding dryness in the south and west. In central and eastern Nebraska, light to moderate rain and wet snow (0.50-1.0 inch liquid equivalent) was sufficient to negate expansion of D0 (Abnormal Dryness) but not enough to warrant reduction. Across the southern tier of Nebraska and into central Kansas, Moderate Drought (D1) was expanded to reflect soil moisture rankings in the lowest 10th percentile as well as the 6-month Standardized Precipitation Index which correlated to D1 or worse. In addition, remote sensing data (in particular, the Vegetation Health Index) depicted an increase in vegetation stress across southwestern Kansas; Kansas winter wheat was rated 35 percent very poor to poor as of March 27. In Colorado, precipitation was generally light (less than 0.75 inch) and confined to northeastern-most portions of the state's D2 (Severe Drought) region. As of March 27, Colorado's winter wheat was rated 55 percent very poor to poor.

The West: Unseasonably heavy rain and mountain snow persisted across the Pacific Coast States, while drought intensified in lower portions of the Four Corners Region. Over the past 6 months, precipitation has tallied 50 percent of normal or less from southeastern Arizona into southern and central New Mexico, with the greatest departures (locally less than 30 percent of normal) in southern-most portions of the region. The corresponding 6-month Standardized Precipitation Index (SPI) indicated D3 conditions across the southeastern corner of Arizona and adjacent portions of southern New Mexico. Consequently, Moderate to Extreme Drought (D1-D3) was expanded in the lower Four Corner region. In northeastern Arizona, 3- and 6-month SPI likewise supported modest expansion of Moderate Drought (D1). The D0 region along the Nevada-California border was removed as updated seasonal SPI (6 and 9 month) indicated mostly favorable conditions. In contrast, heavy rain and mountain snow were observed from California into the Northwest, providing an additional boost to mountain snowpack. Snow depths exceeded 100 inches at numerous locations in the Sierra Nevada, with some estimates in excess of 300 inches. Estimated weekly total liquid precipitation eclipsed 4 inches in northern portions of the California coast, and was locally more than 6 inches in the Sierra Nevada. In the

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Northwest, precipitation estimates of 2 to 8 inches (liquid equivalent) were noted from the Klamath Range into the Cascades and along the Pacific Coast.

Hawaii, Alaska and Puerto Rico: In Hawaii, showers (locally more than 2 inches) across eastern portions of the Big Island afforded some reduction of Moderate Drought (D1). Rain elsewhere in Hawaii was generally light and not sufficient to warrant any changes to the current drought depiction. In Alaska, dry, unseasonably warm weather prevailed, although no changes were made to the Abnormal Dryness region which remains due in part to a drier-than-normal winter. In Puerto Rico, showers (locally more than 3 inches) across the northwestern quarter of the island provided some relief to western portions of the Abnormally Dry (D0) region, while D0 was expanded slightly on the southwestern tip of Puerto Rico in response to 90-day precipitation totaling less than 50 percent of normal.

Looking Ahead: A series of storm systems will maintain wet, cool weather across the eastern third of the nation, providing some additional drought relief to the southern Mid-Atlantic and Southeastern states. In contrast, mostly dry, increasingly warm conditions are anticipated from the central Gulf Coast into the central and southern Plains. Out west, the story of the past month will continue, with another round of locally heavy rain and mountain snow expected by the weekend from central and northern portions of California into the Northwest. However, little if any precipitation from this system is expected to reach the lower Four Corners region.

The CPC 6-10 day forecast (April 5-9) calls for drier-than-normal conditions from the southern Great Basin and Four Corners region into the central and southern Plains. In contrast, above-normal precipitation is expected across the eastern quarter of the nation, although southern Florida may remain abnormally dry. Abnormal warmth across the Gulf Coast region will contrast with near- to below-normal temperatures across the remainder of the U.S., including Alaska.

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 30, 2011