

**Winter  
2012**



**March 13<sup>th</sup>, 2012**

NIDIS - UPPER COLORADO BASIN PILOT PROJECT

**Weekly Climate, Water & Drought Assessment**

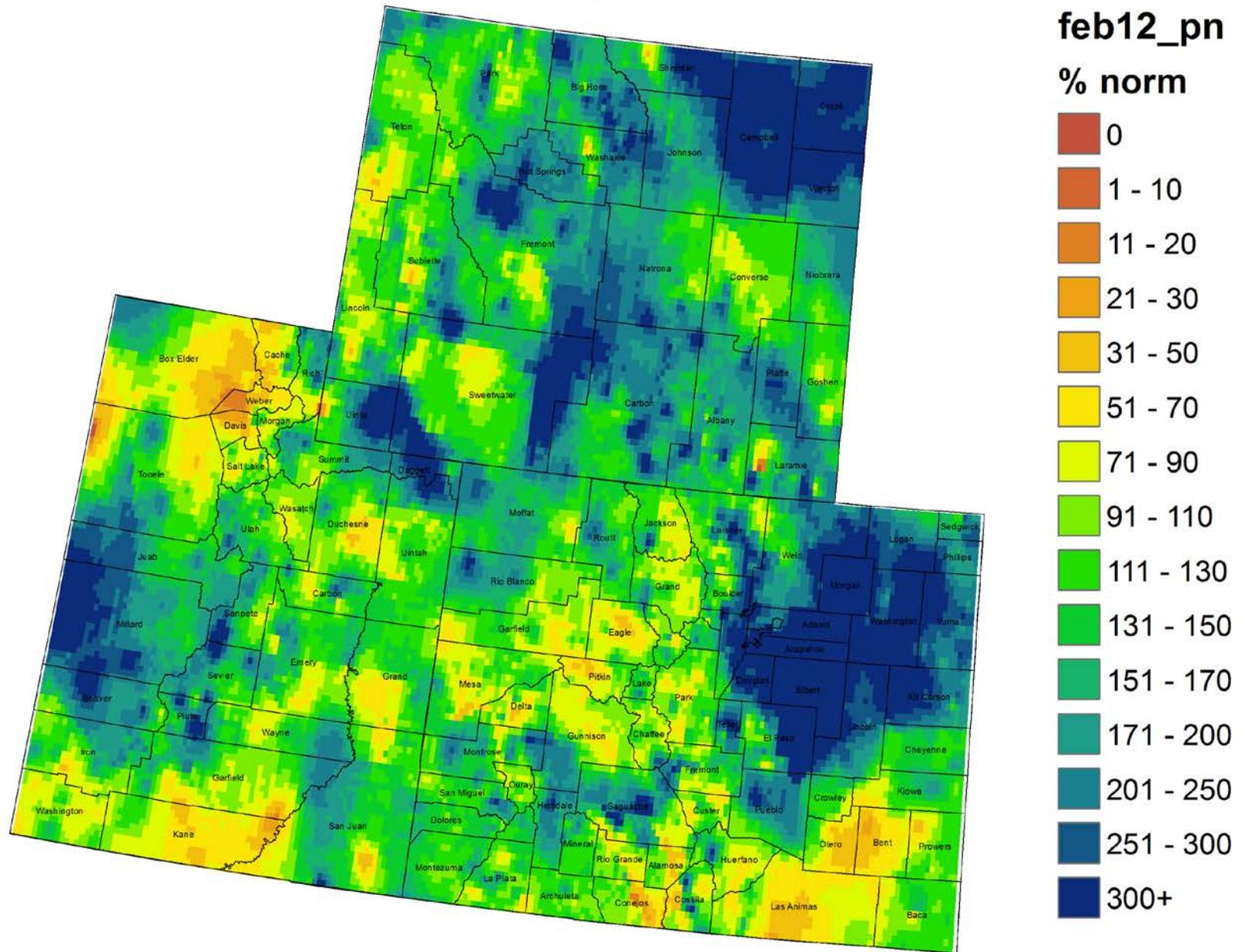
# Today's Agenda

- Assessment of current water conditions
- Precipitation Forecast
- Recommendations for Drought Monitor

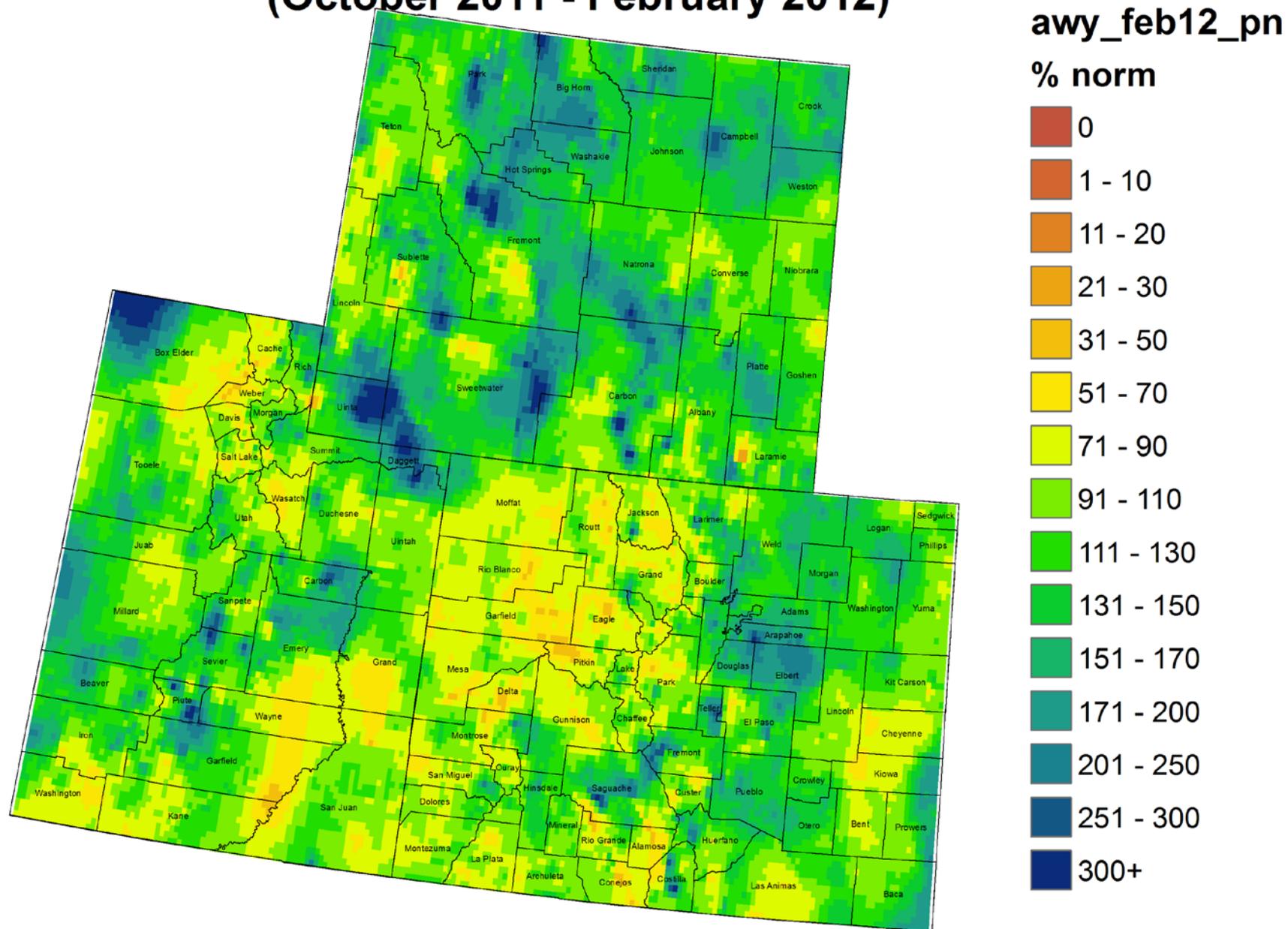
# Precipitation/Snowpack Update



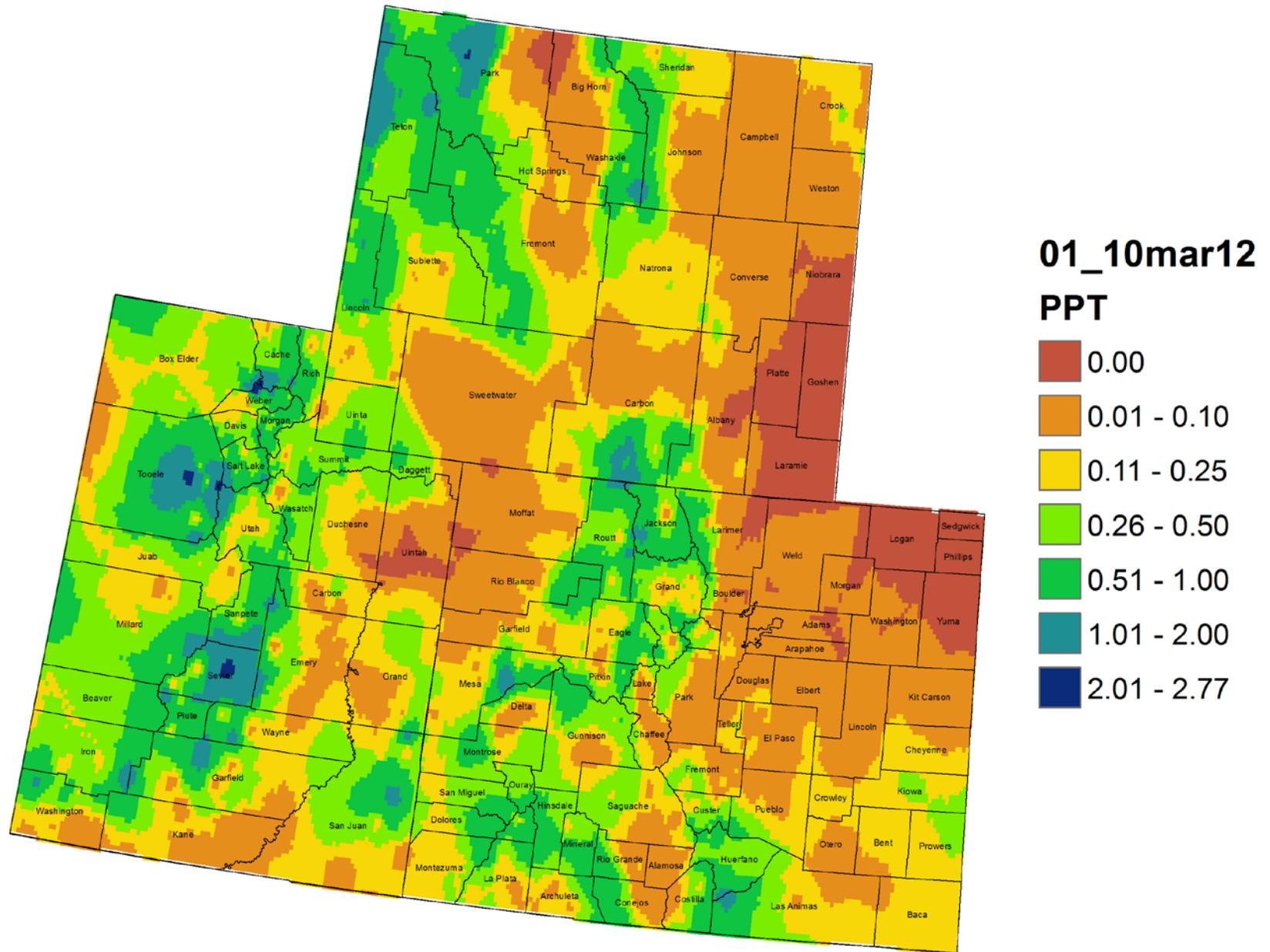
# Colorado, Utah and Wyoming February 2012 Precipitation as Percentage of Normal



# Colorado, Utah and Wyoming Water Year 2012 Precipitation as Percentage of Normal (October 2011 - February 2012)

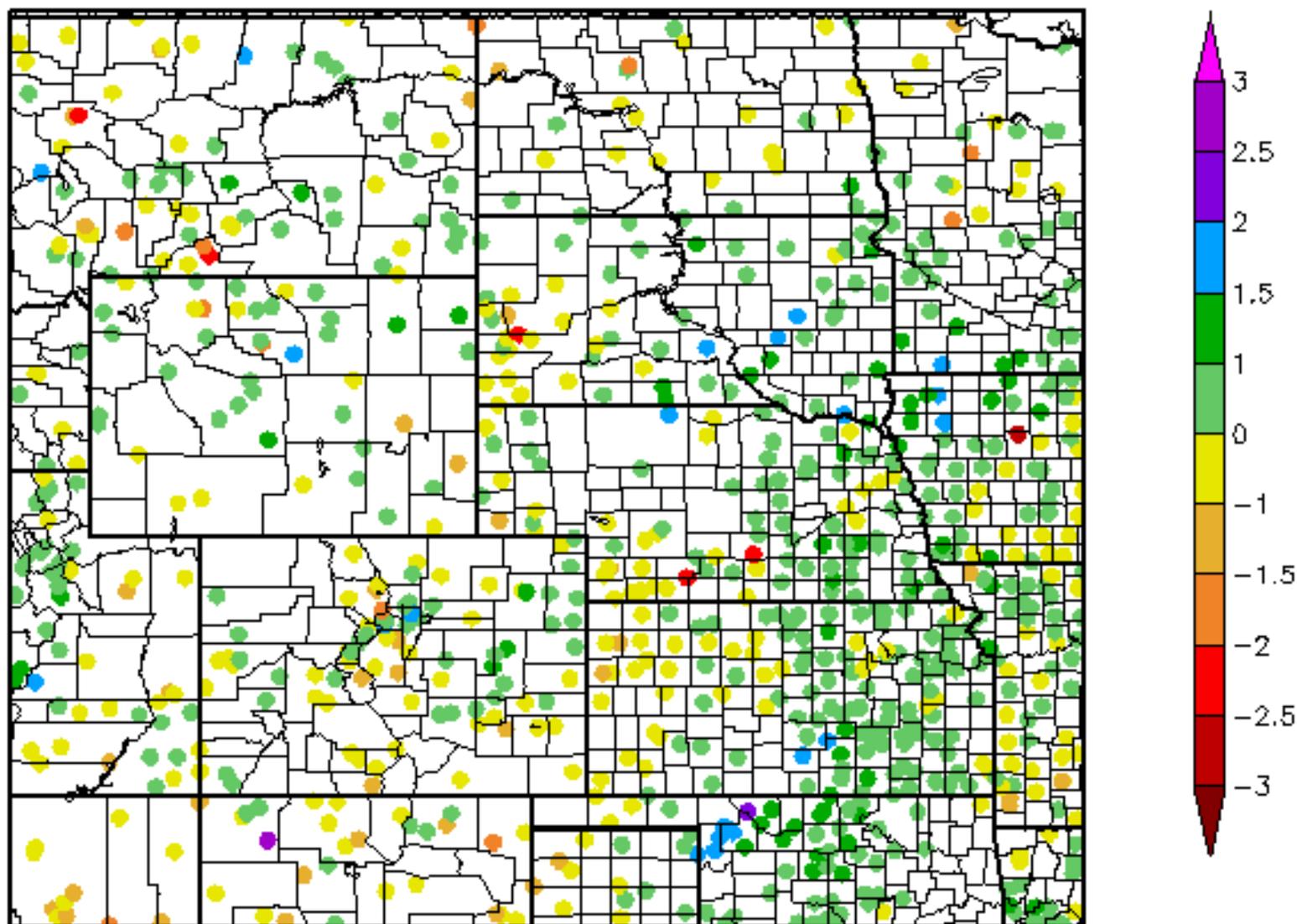


# Colorado, Utah and Wyoming Month to Date Precipitation (in) 1 - 10 March 2012



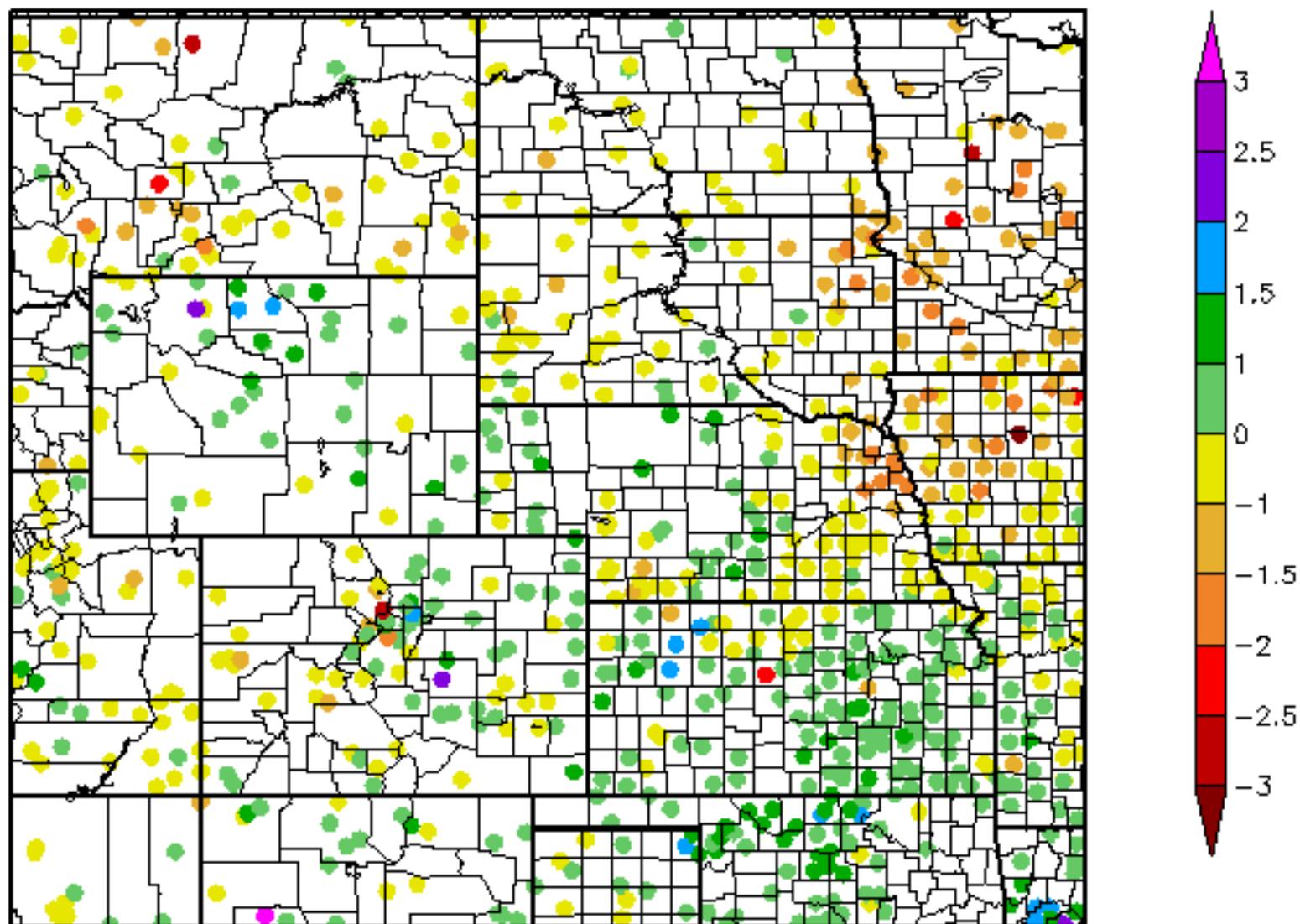
# 60 Day SPI

1/13/2012 - 3/12/2012

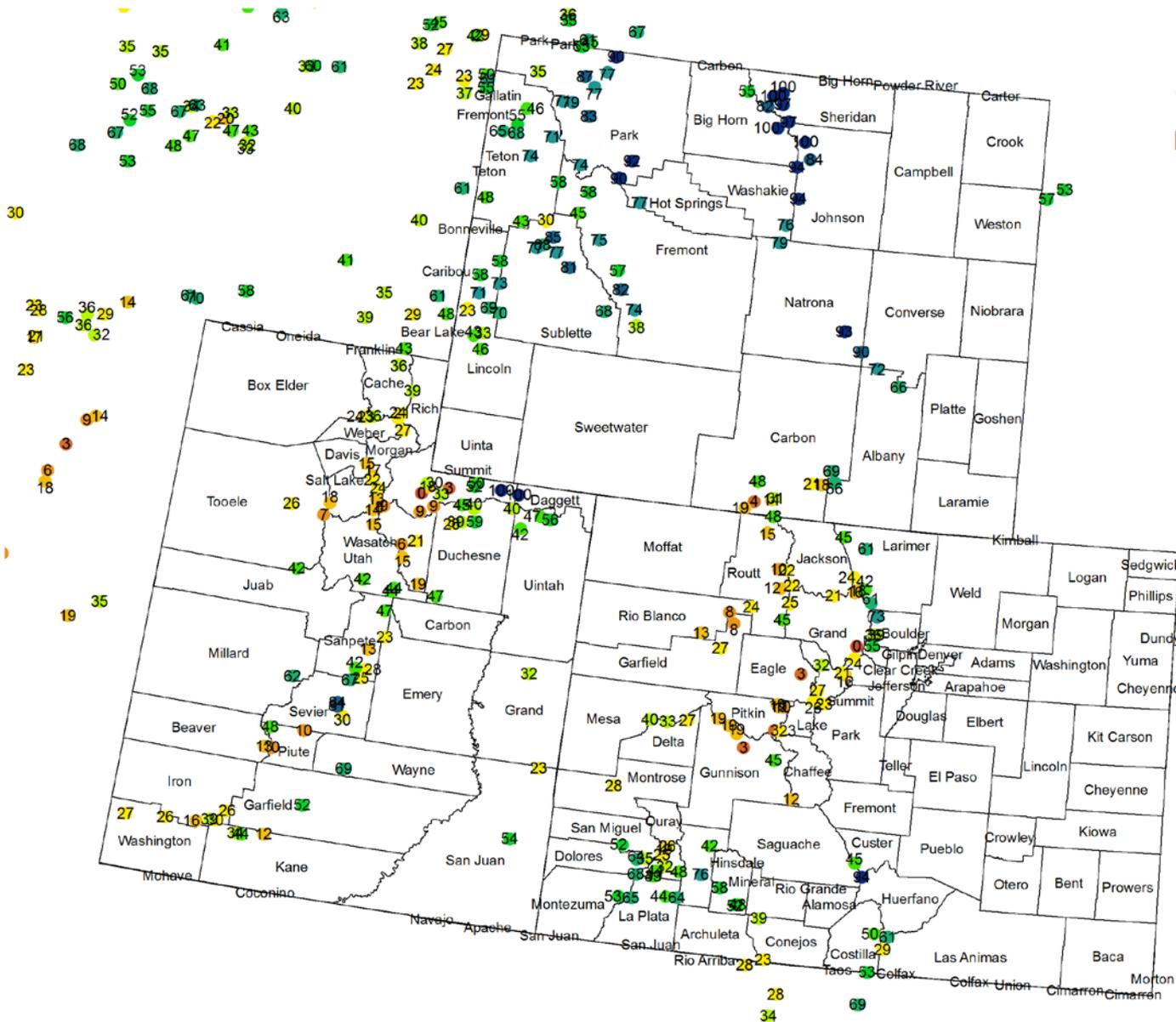


# 6 Month SPI

9/13/2011 - 3/12/2012



# Snotel Water Year Precipitation Percentile Ranking for 13 March 2012 (Stations with 15+ years of data only)



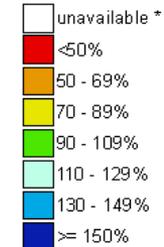
13Mar12\_ptile.tab Events  
pctile

- D4: 0 - 2
- D3: 3 - 5
- D2: 6 - 10
- D1: 11 - 20
- D0: 21 - 30
- Uncategorized: 31 - 40
- Uncategorized: 41 - 50
- Uncategorized: 51 - 60
- Uncategorized: 61 - 70
- Uncategorized: 71 - 80
- Uncategorized: 81 - 90
- Uncategorized: 91 - 100

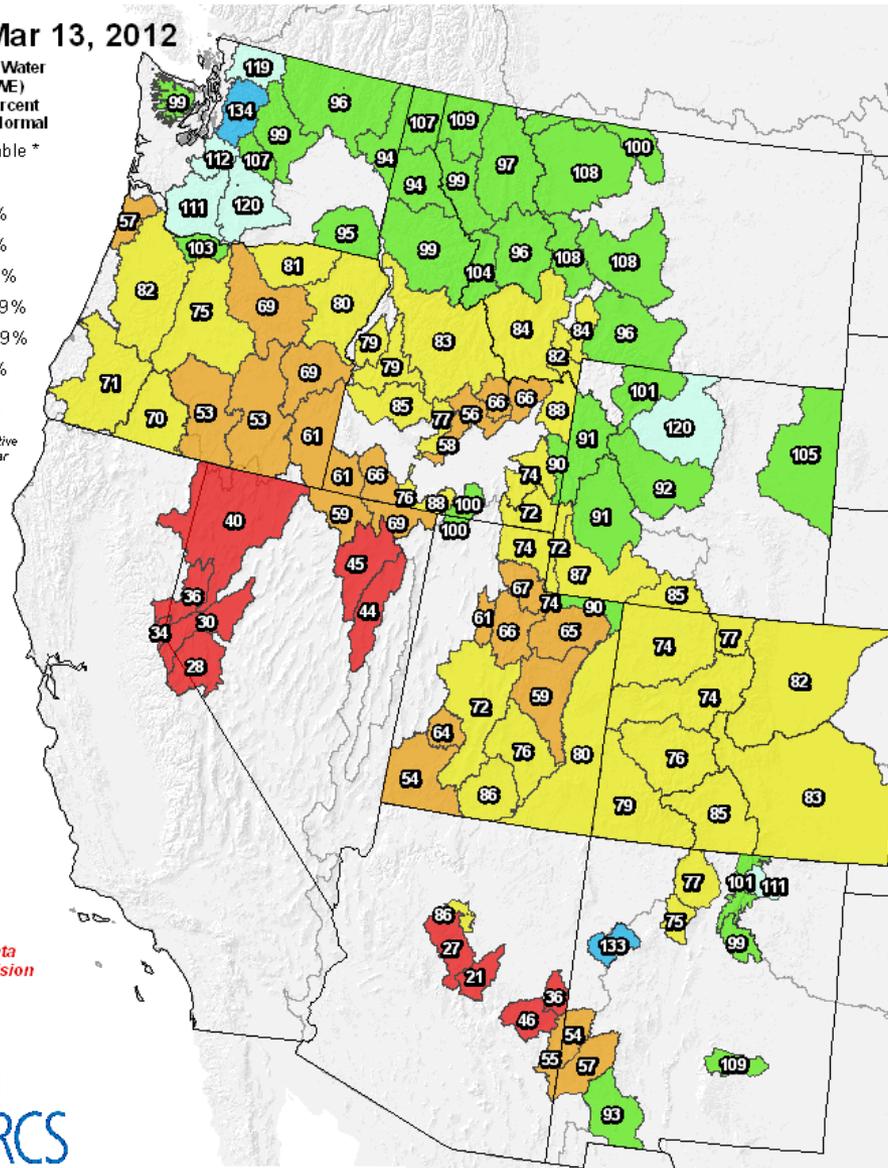
# Westwide SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Mar 13, 2012

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1971-2000 Normal



\* Data unavailable at time of posting or measurement is not representative at this time of year



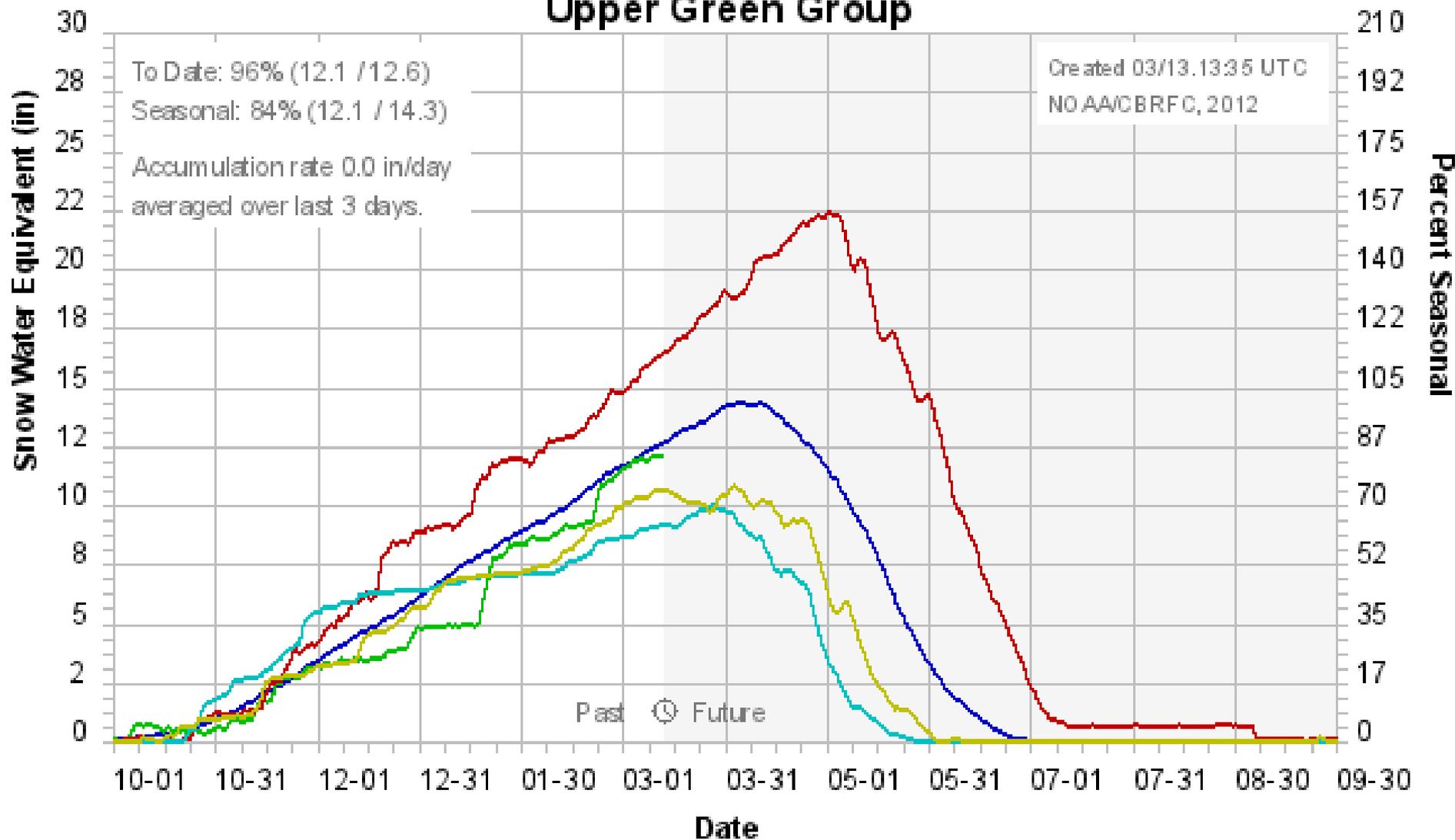
Provisional data subject to revision



The snow water equivalent percent of normal represents the current snowwater equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

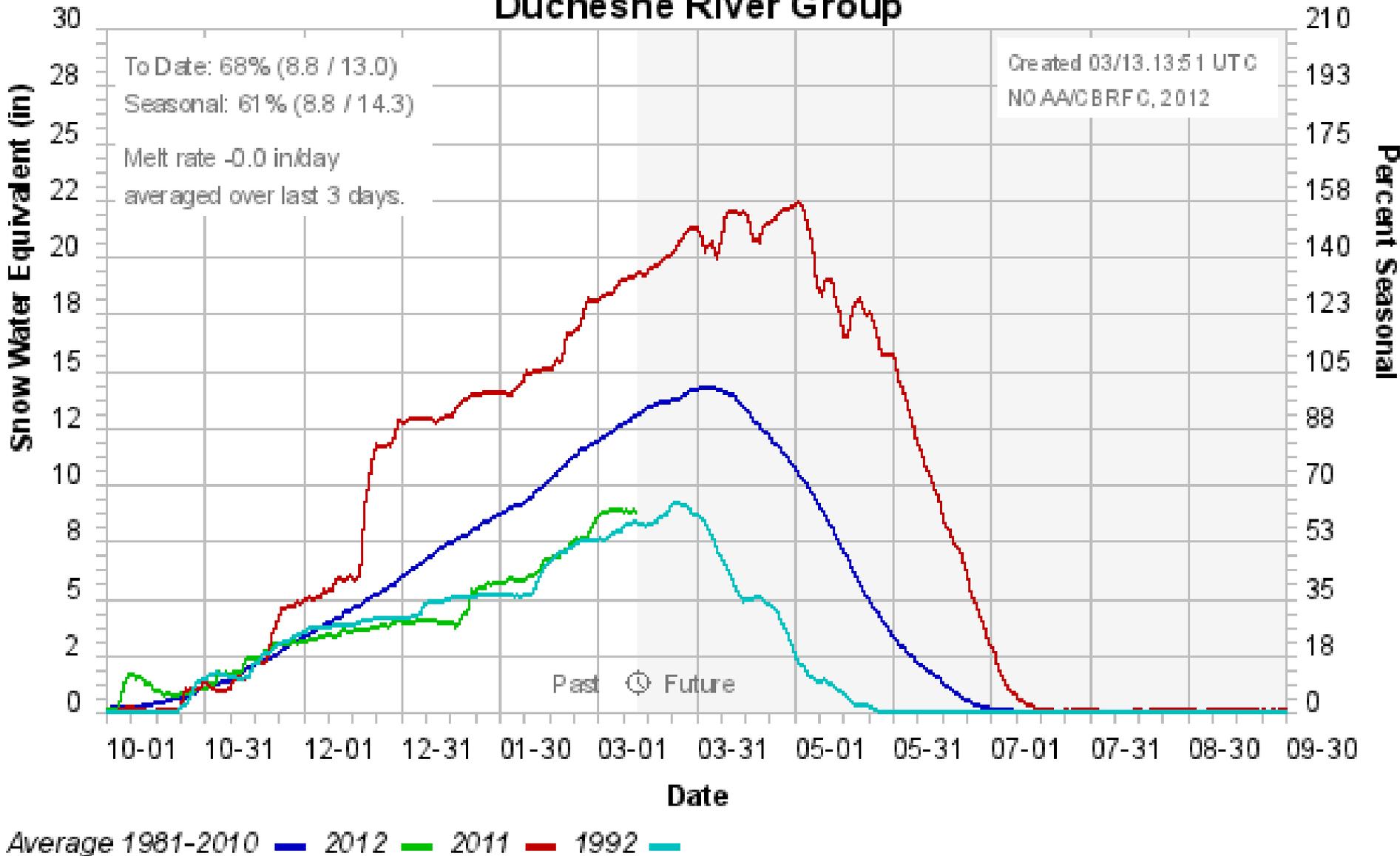
Prepared by the USDA NRCS National Water and Climate Center Portland, Oregon <http://www.wcc.nrcs.usda.gov/gis/>  
 Based on data from <http://www.wcc.nrcs.usda.gov/reports/>  
 Science contact: Jim.Marron@por.usda.gov 503 414 3047

# Colorado Basin River Forecast Center Upper Green Group

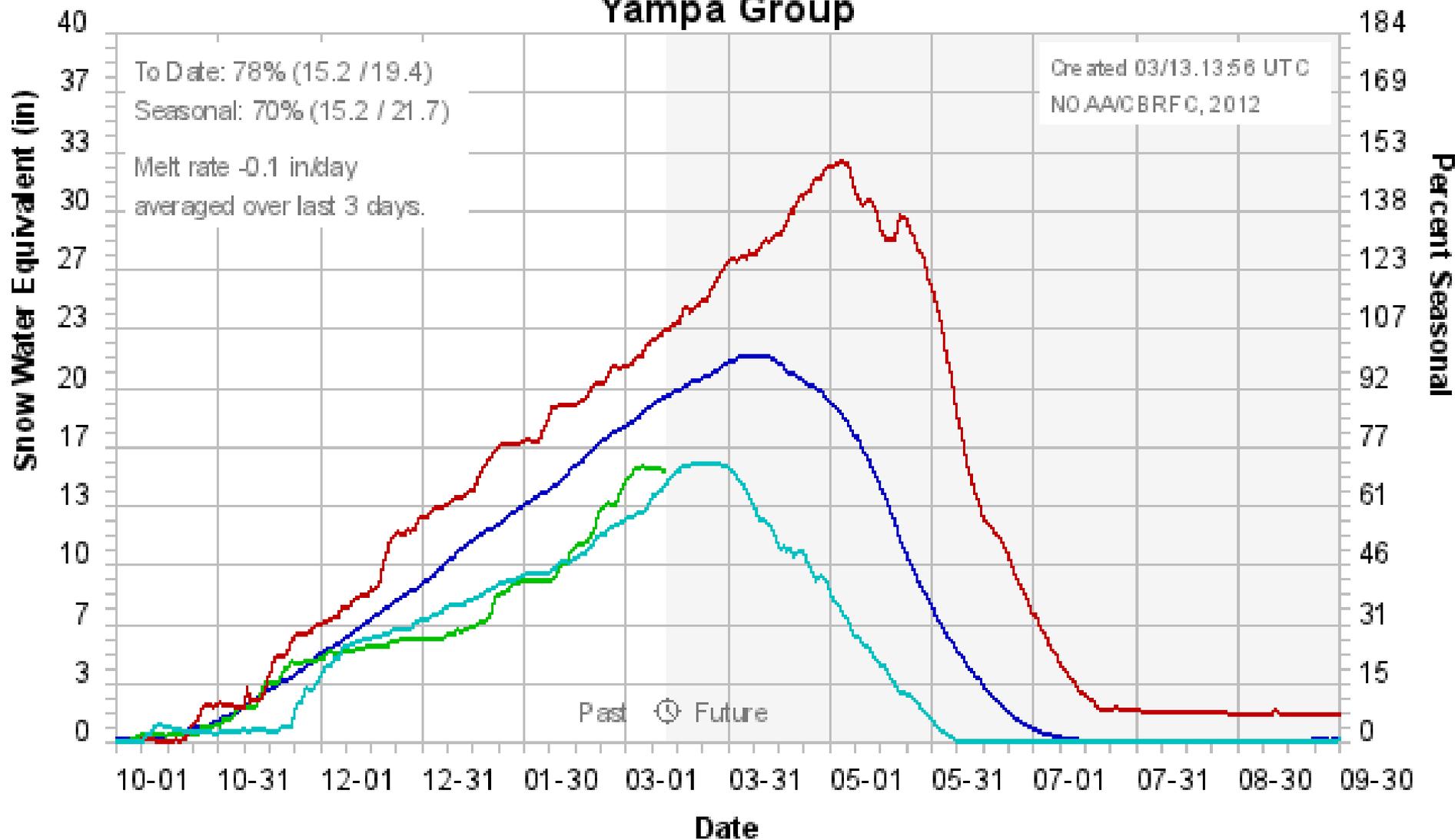


Average 1981-2010    2012    2011    1992    2007

# Colorado Basin River Forecast Center Duchesne River Group

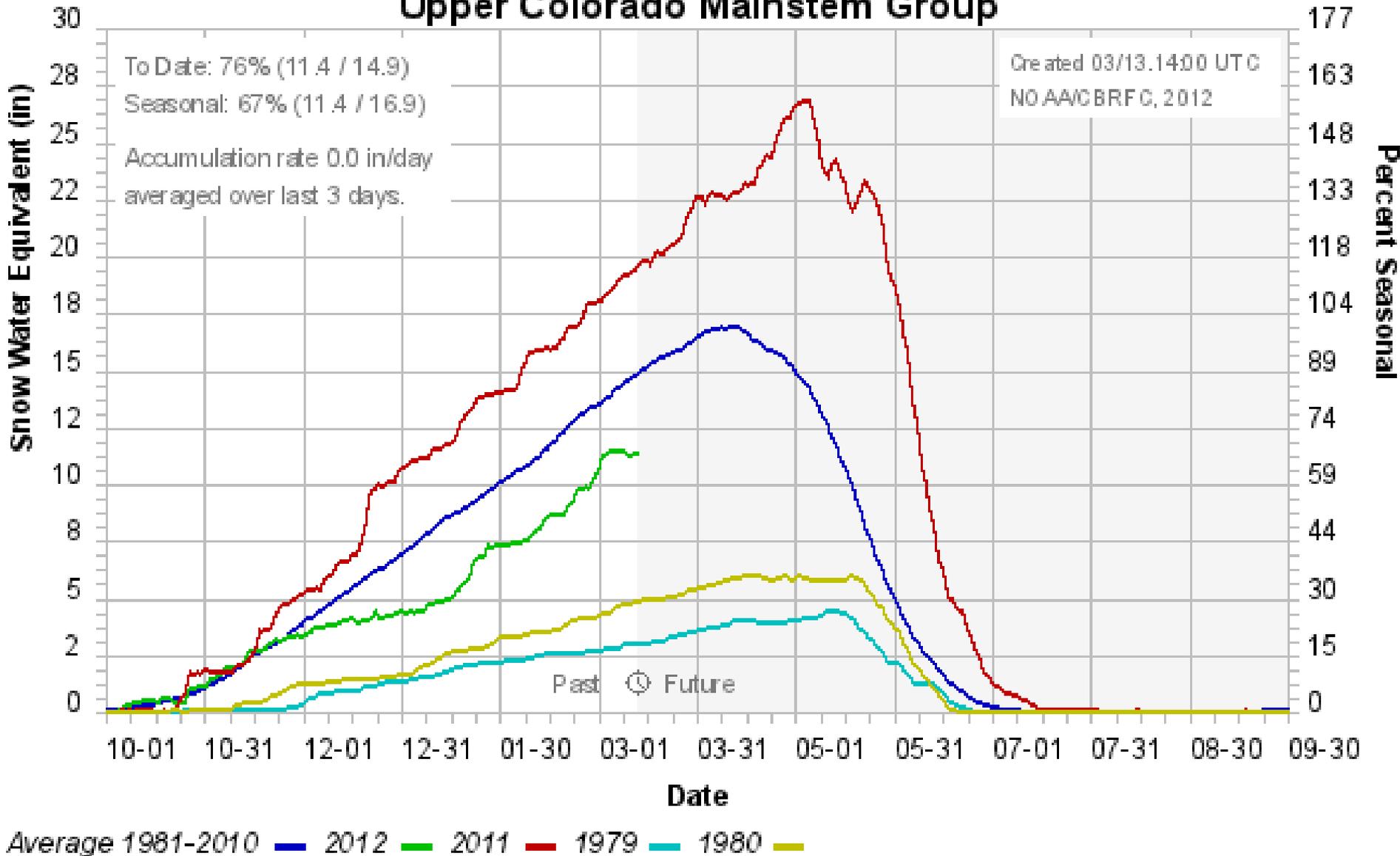


# Colorado Basin River Forecast Center Yampa Group

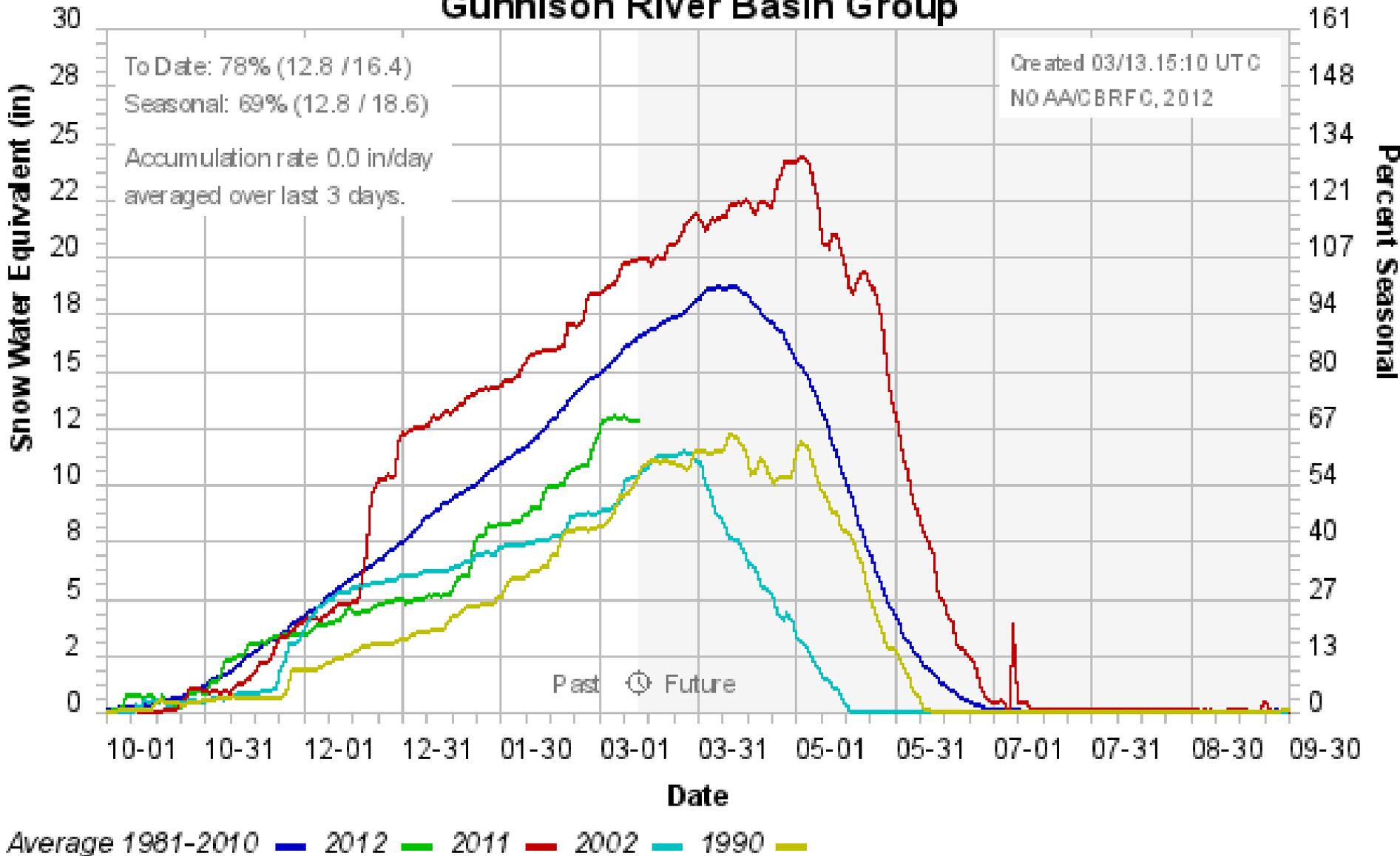


Average 1981-2010    2012    2011    2012

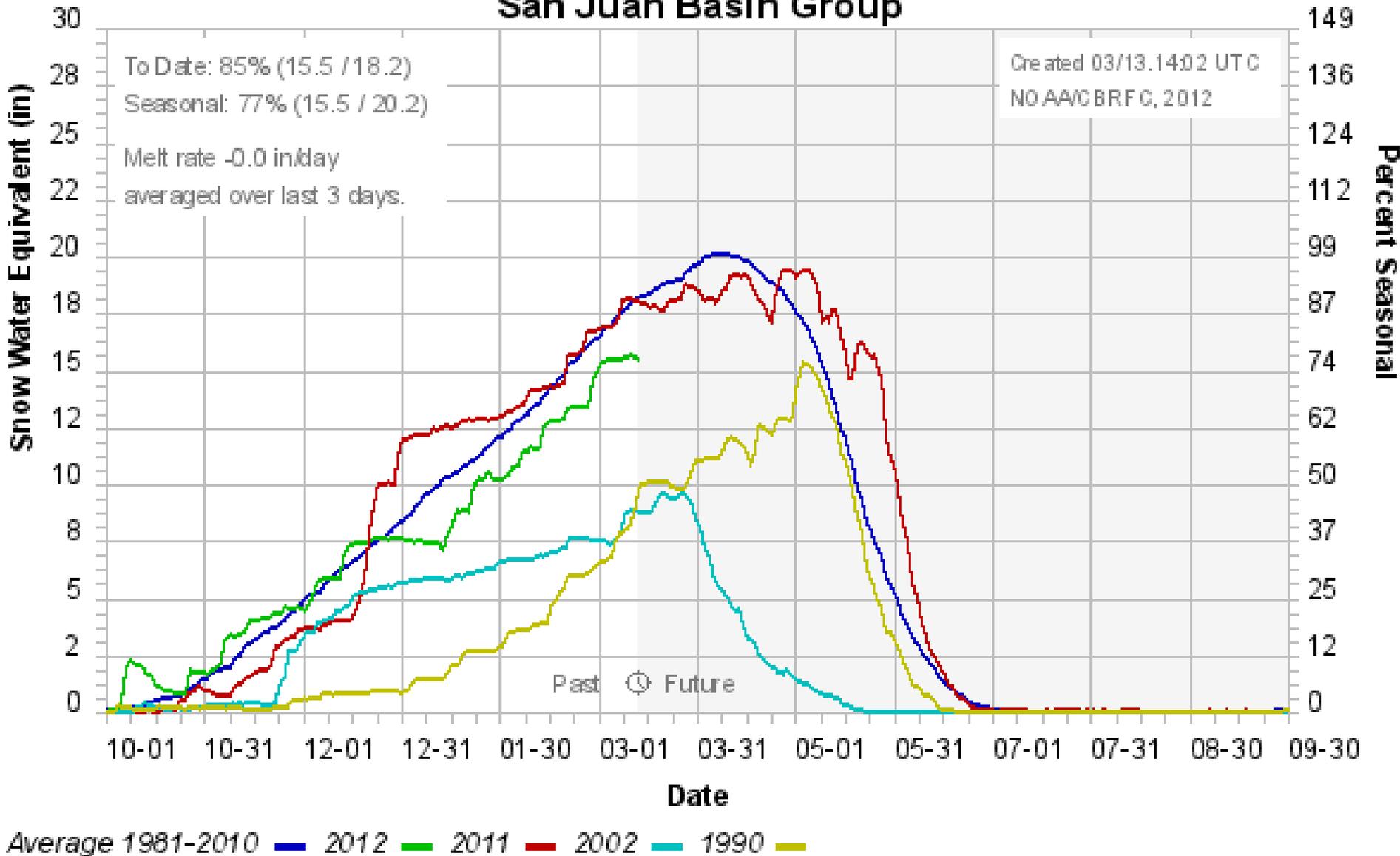
# Colorado Basin River Forecast Center Upper Colorado Mainstem Group



# Colorado Basin River Forecast Center Gunnison River Basin Group



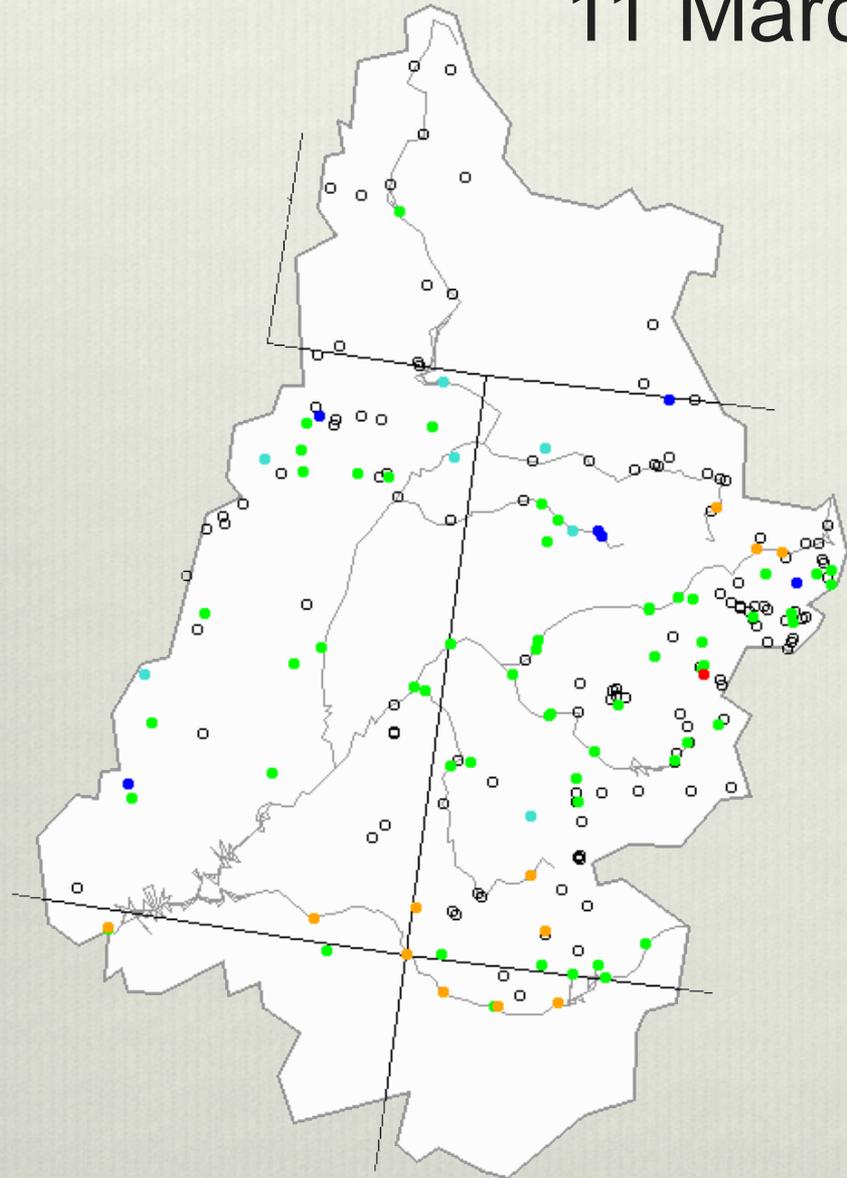
# Colorado Basin River Forecast Center San Juan Basin Group



# Streamflow Update



# 7-Day Average Streamflow 11 March 2012

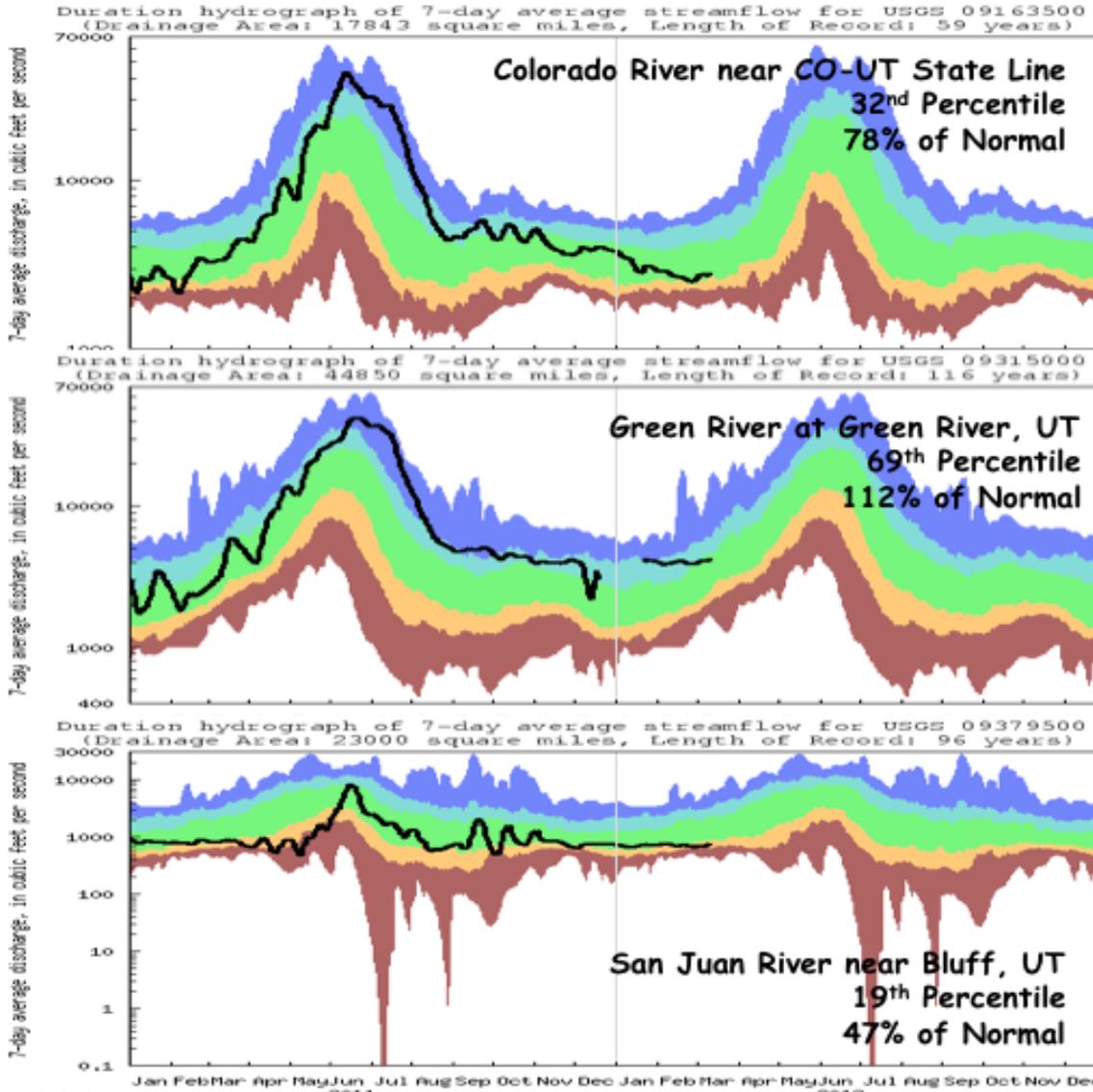


Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		

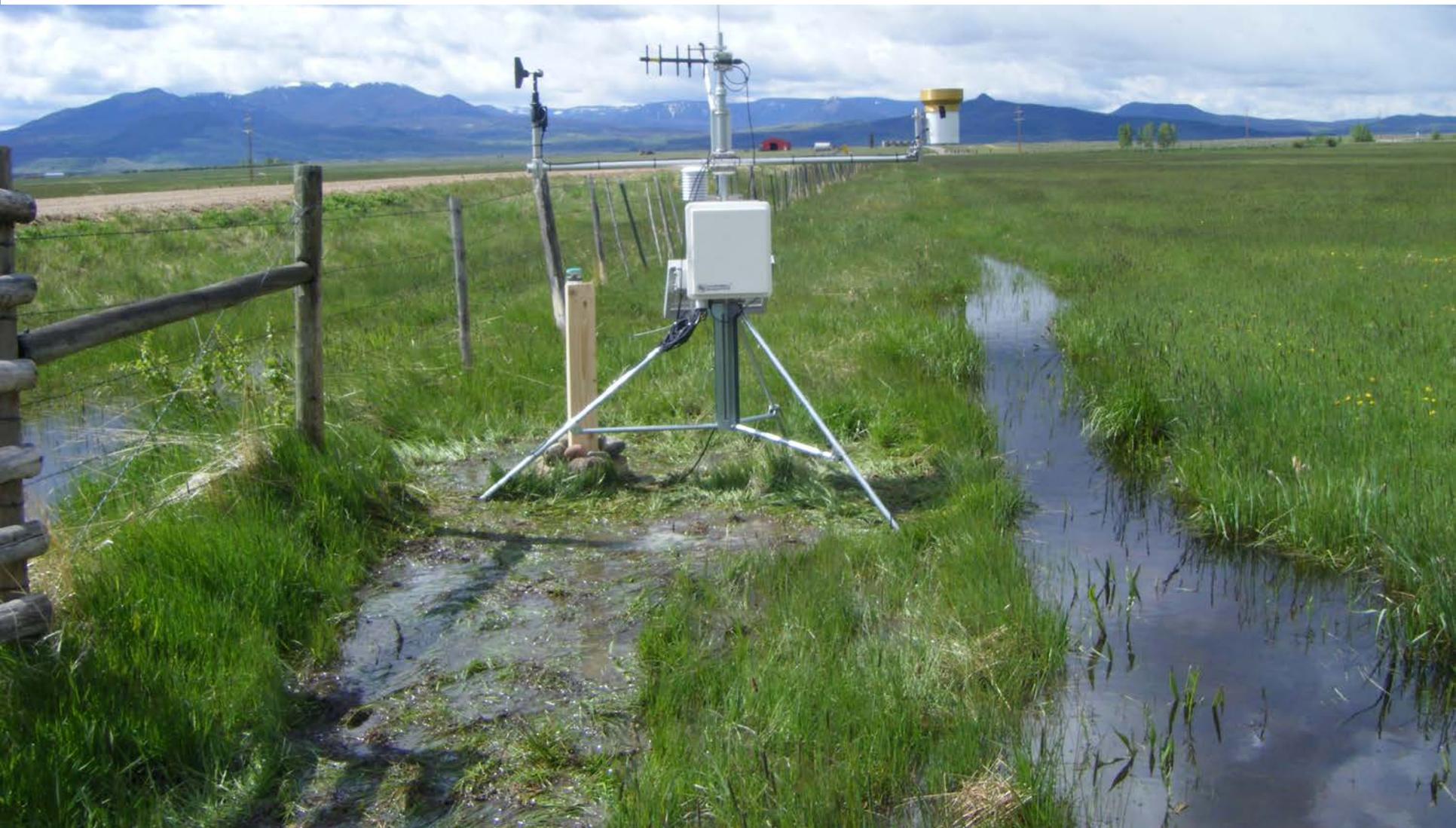
# 7-Day Average Hydrographs

## 11 March 2012

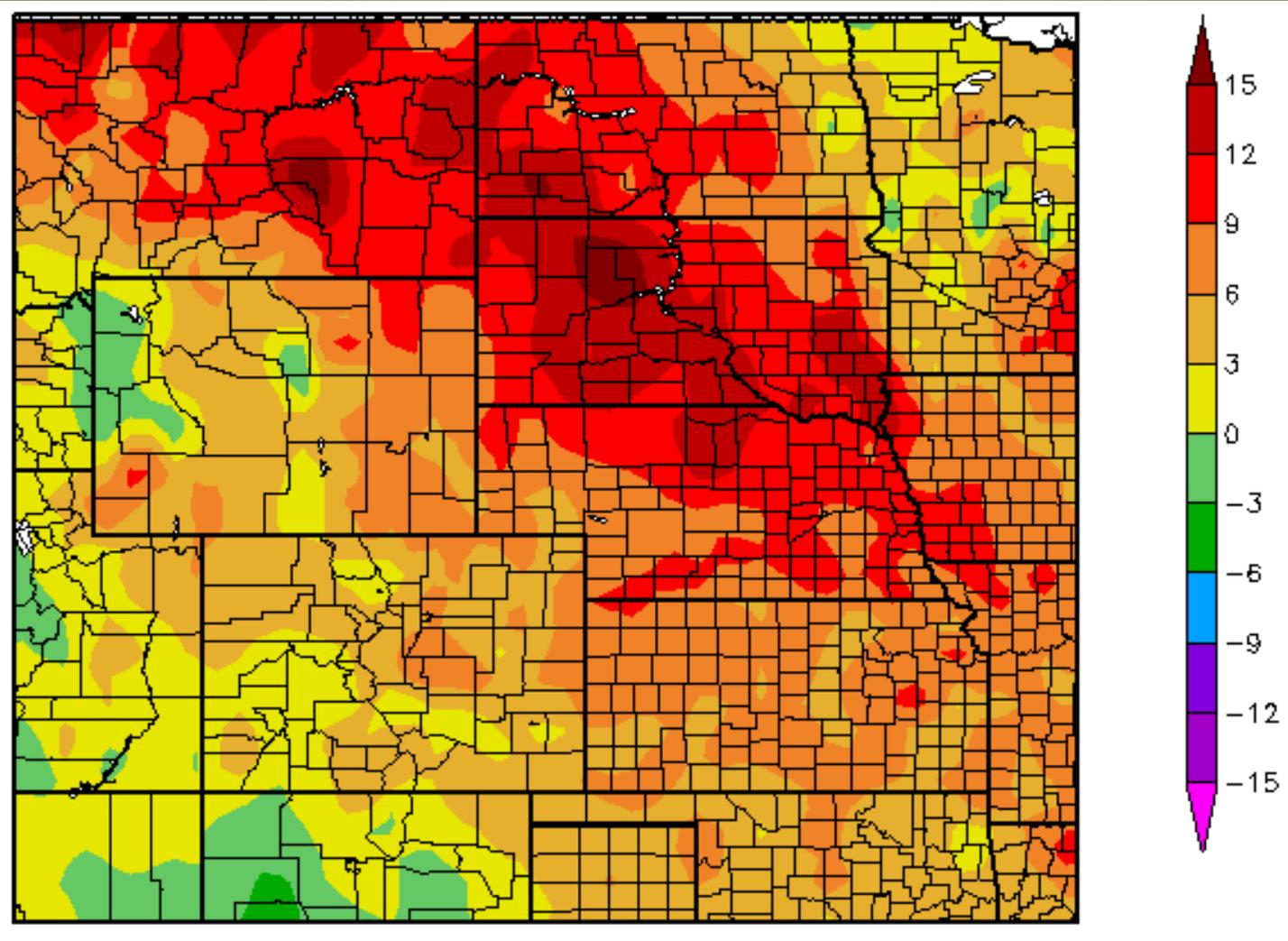
Explanation - Percentile classes							
●	●	●	●	●	●	●	○
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		



# Water Demand

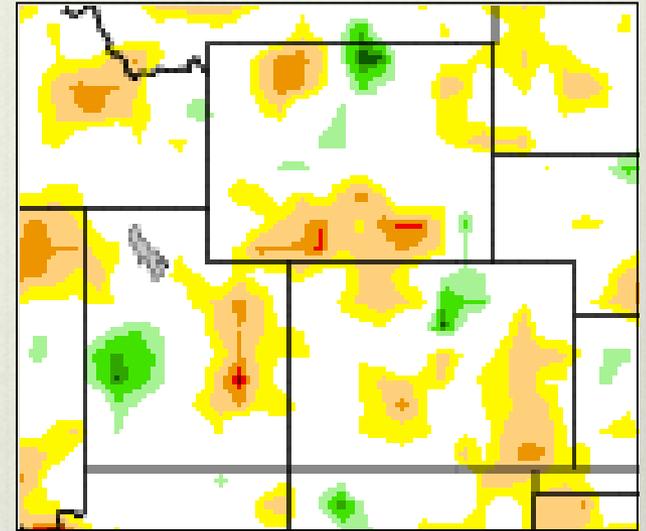
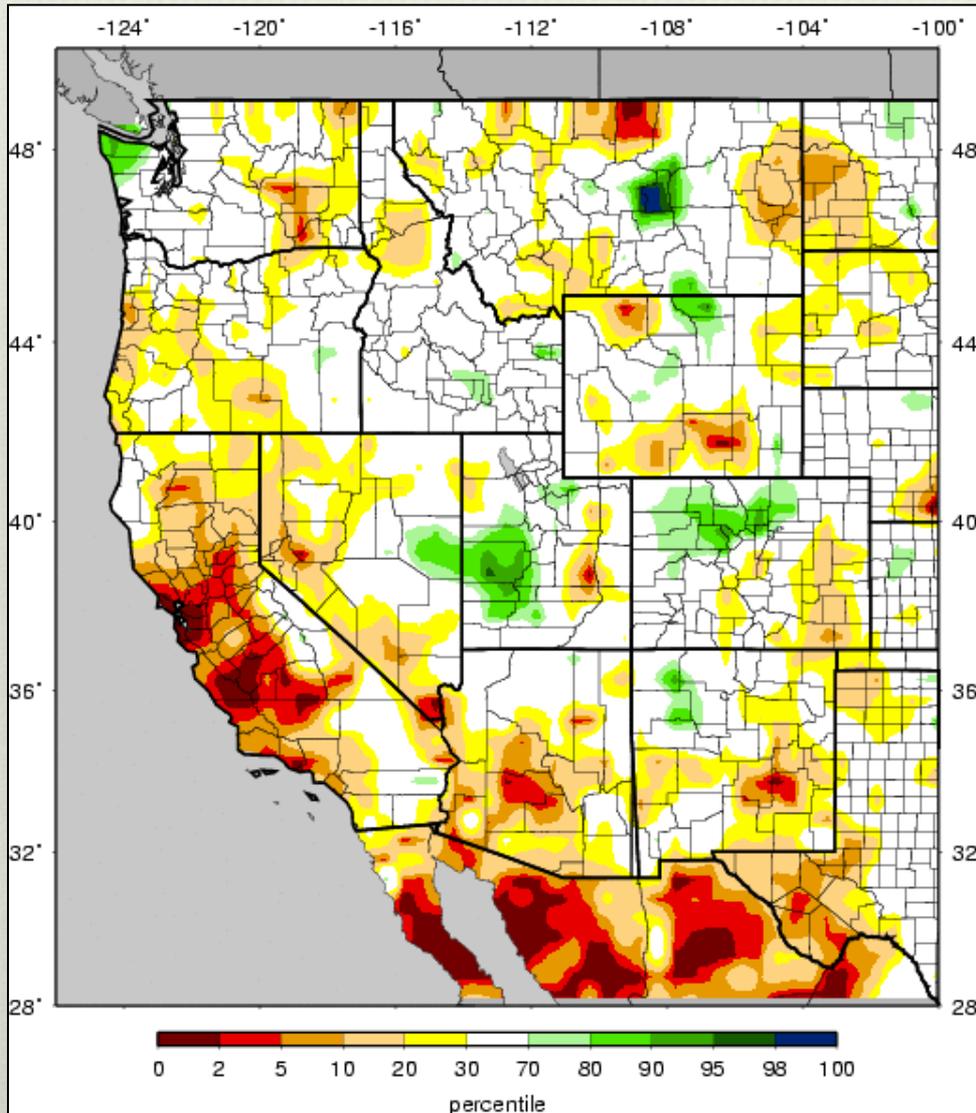


# Temperature Departure from Normal 03/05/2012 – 03/11/2012



# VIC Soil Moisture

## 11 March 2012

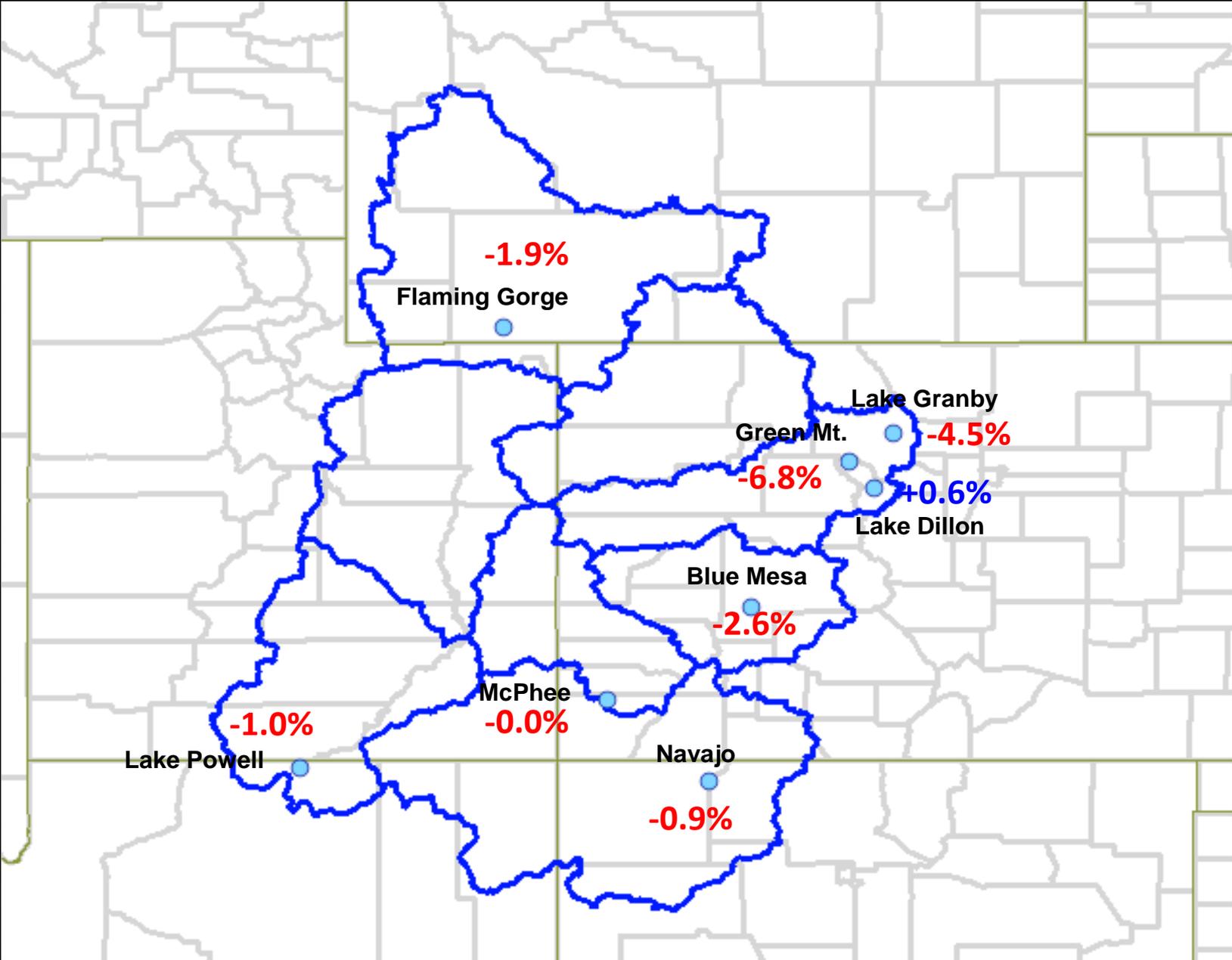


**SWE + SOIL MOISTURE =  
TOTAL MOISTURE  
STORAGE**

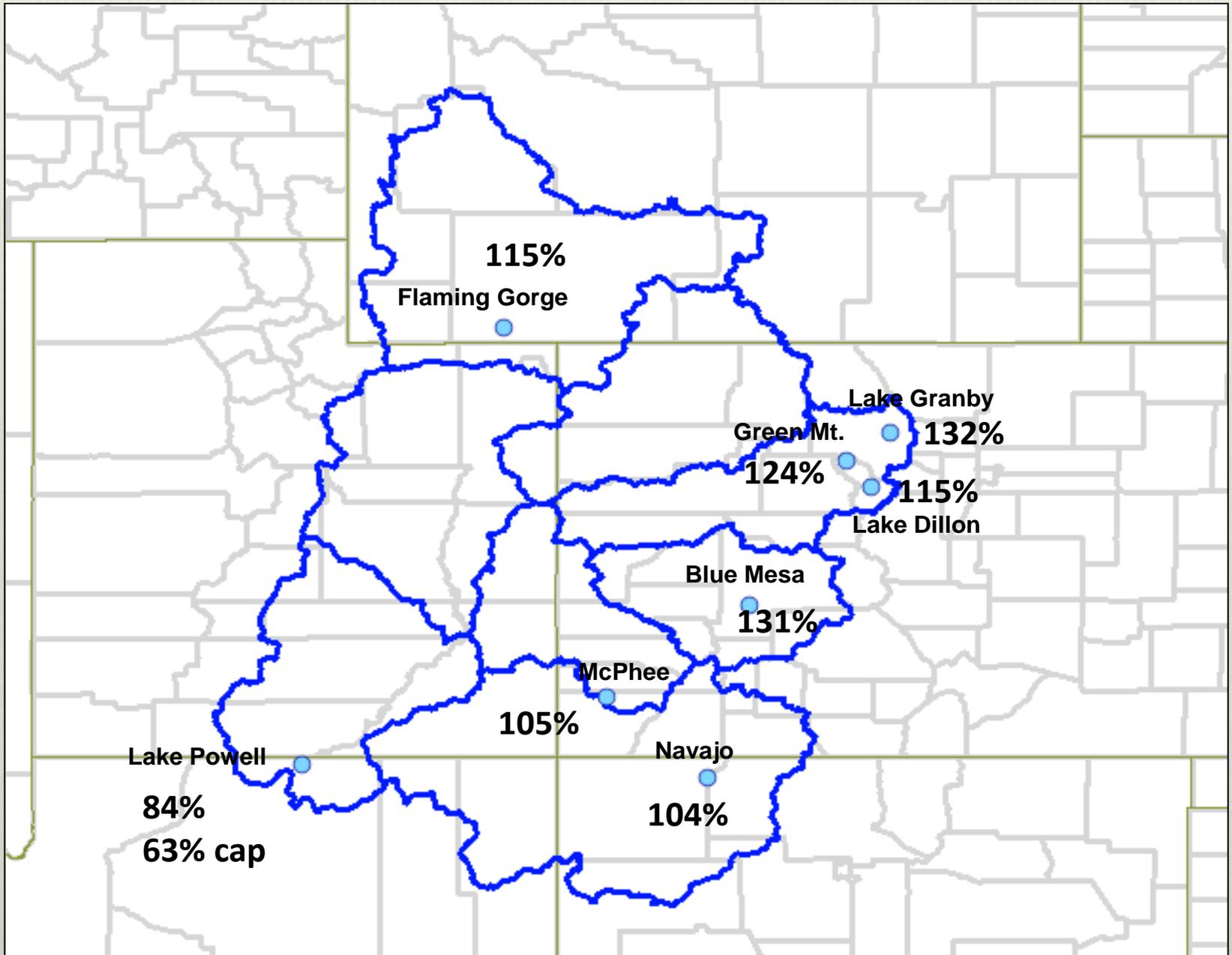
# Reservoir Update



# February Reservoir Storage Volume Change

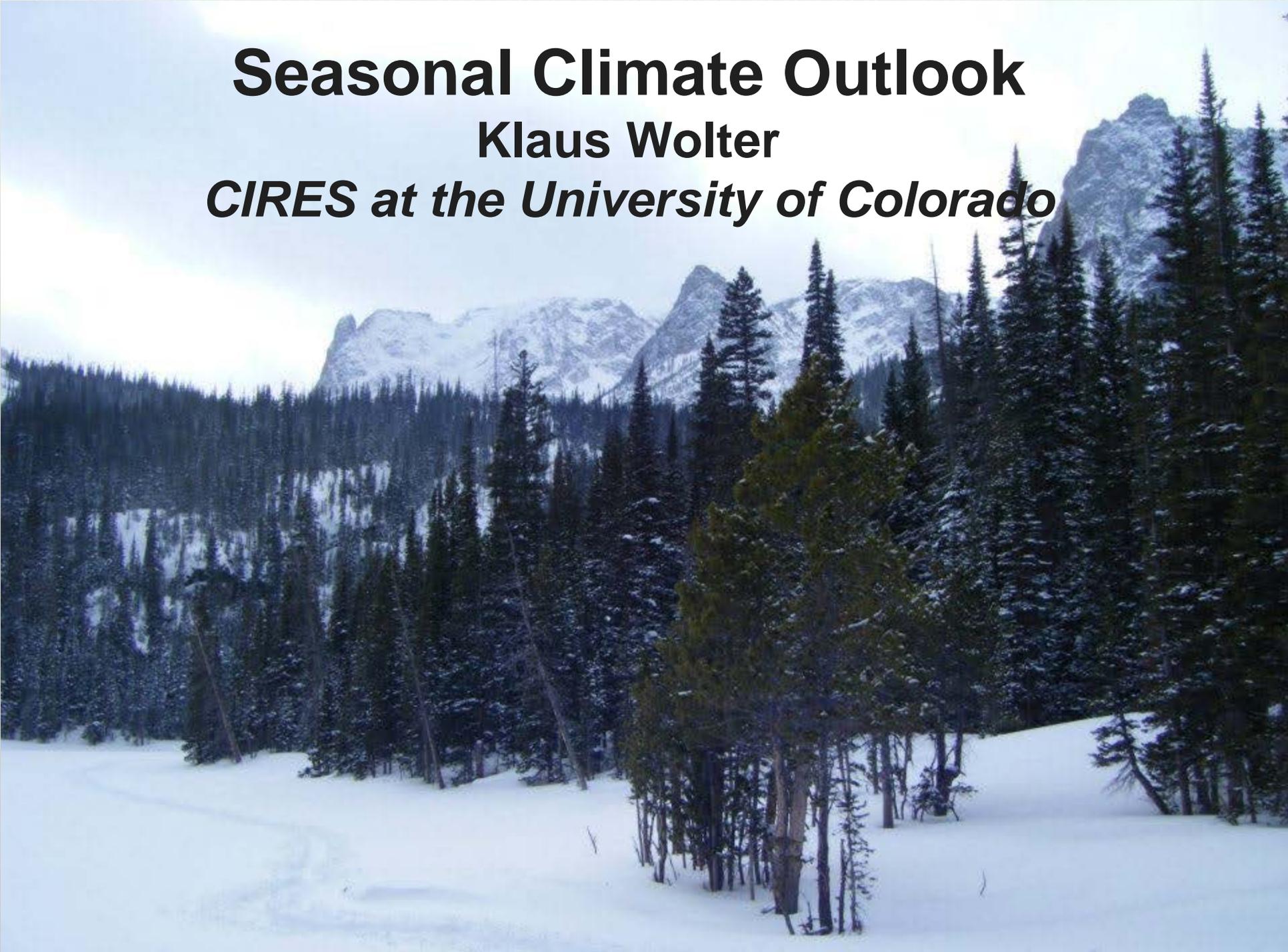


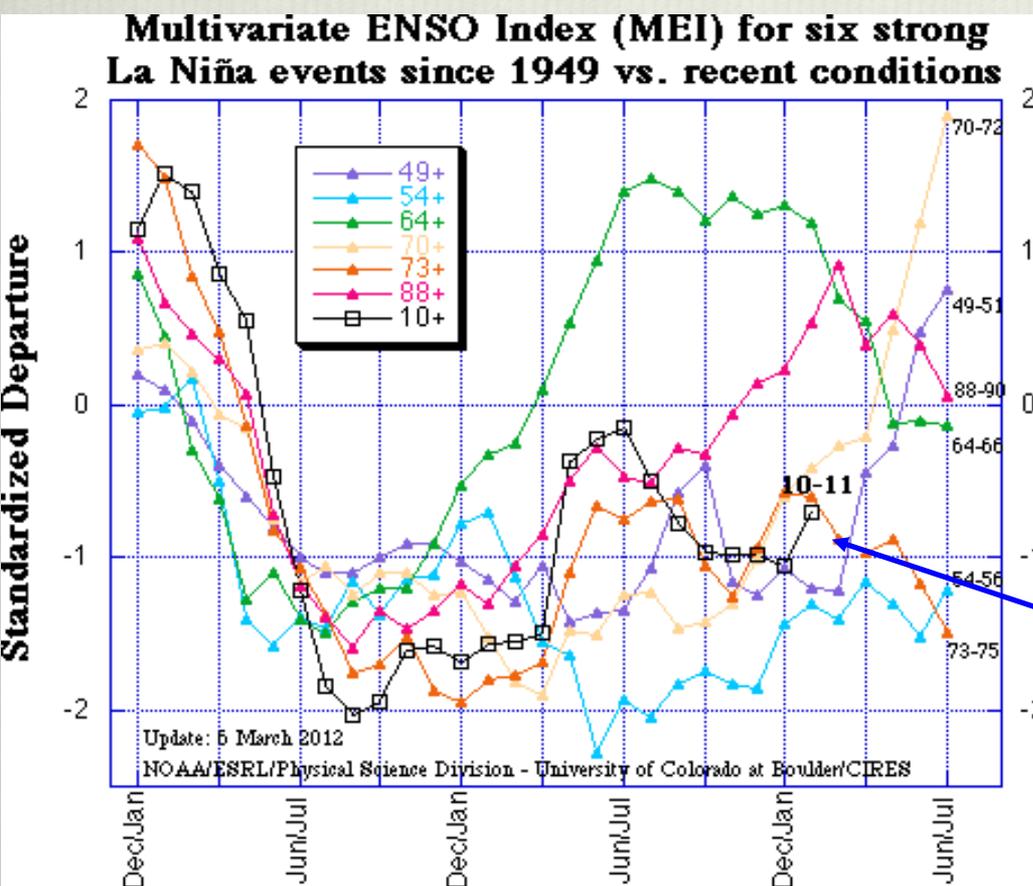
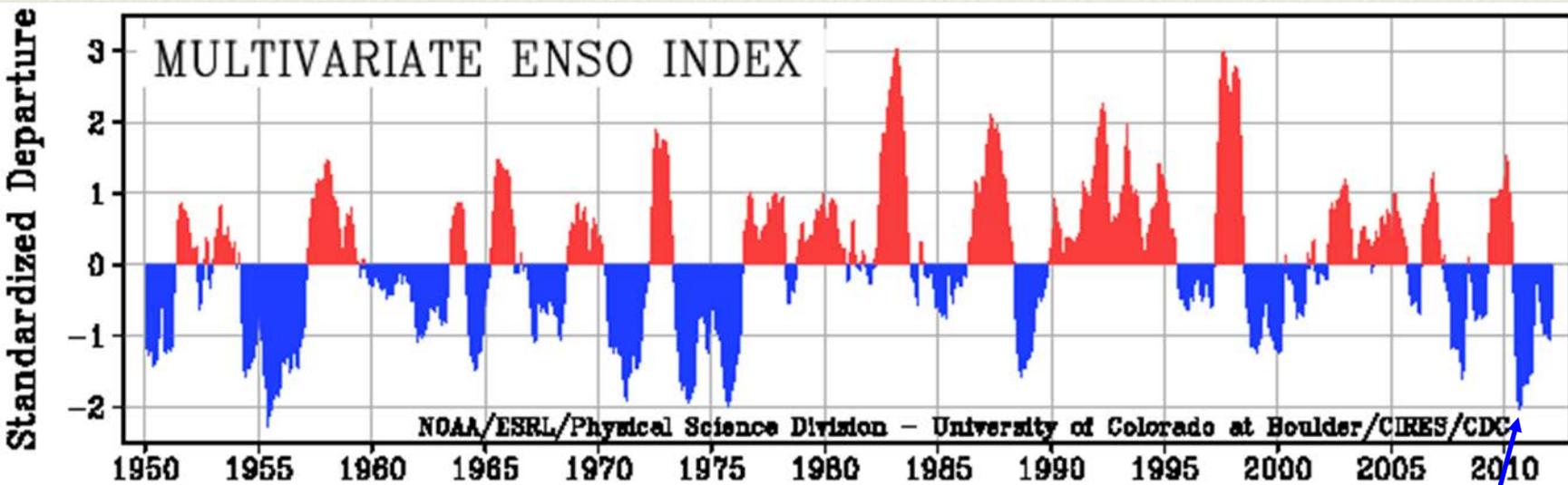
# Reservoir Storage as Percent of March Average



# Seasonal Climate Outlook

Klaus Wolter  
*CIRES at the University of Colorado*

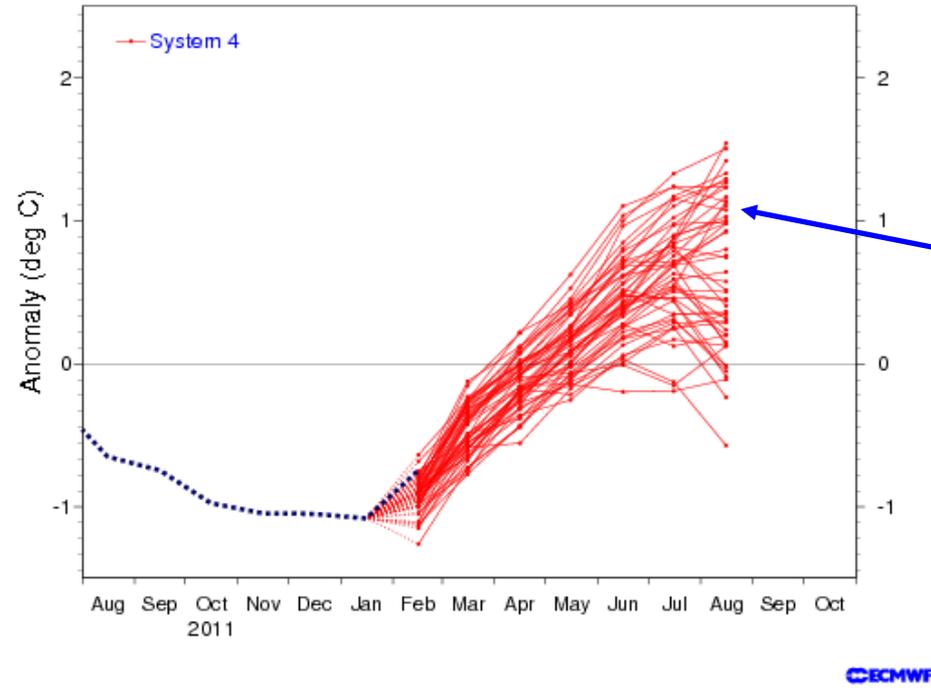




*Current La Niña event reached its first peak in late 2010, followed by a brief excursion to ENSO-neutral conditions during mid-2011; it reached its second peak in December-January 2011-12, weakening rapidly at this point.*

NINO3.4 SST anomaly plume  
ECMWF forecast from 1 Feb 2012

Monthly mean anomalies relative to NCEP OIv2 1981-2010 climatology

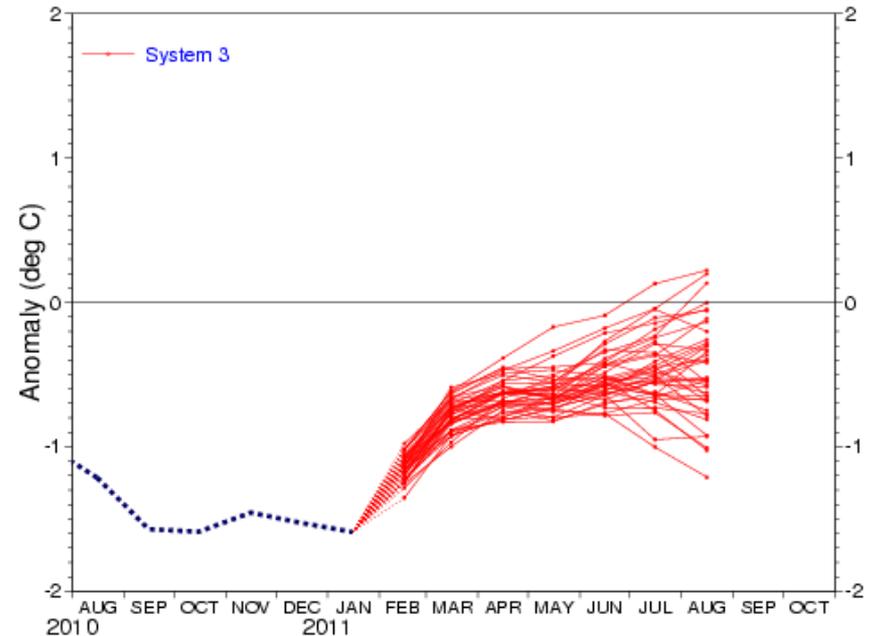


Last month's ECMWF forecast (left) shows a fairly dramatic transition *towards* El Niño during the next six months; about a quarter of the 50 ensemble members ('spaghetti plot') reach moderate strength ( $+1^{\circ}$  C) by August, while only five members hint at a return of La Niña ( $<0^{\circ}$  C) this far out.

Last year's forecast (right) kept most of its ensemble members below  $0^{\circ}$  C, correctly anticipating that the 2010-11 La Niña event might be in for an encore. *This model remains the 'gold standard' to for all ENSO forecast models.*

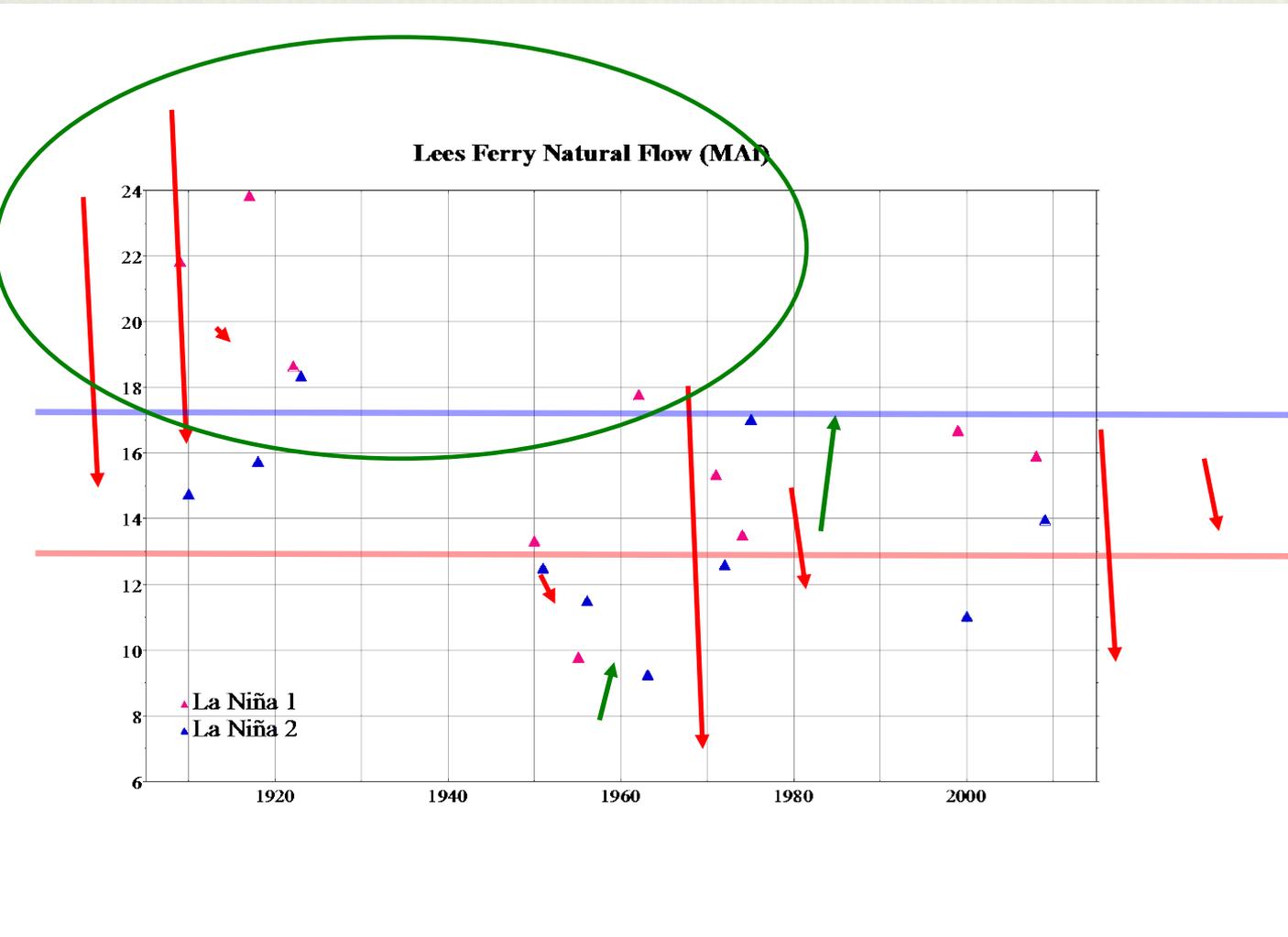
NINO3.4 SST anomaly plume  
ECMWF forecast from 1 Feb 2011

Monthly mean anomalies relative to NCEP adjusted OIv2 1971-2000 climatology



Forecast issue date: 15 Feb 2011

# What is difference for Year 1 vs. Year 2 Las Niñas?



**Mean flow for Year 1:  
16.75 MAF (= +1.7MAf)**

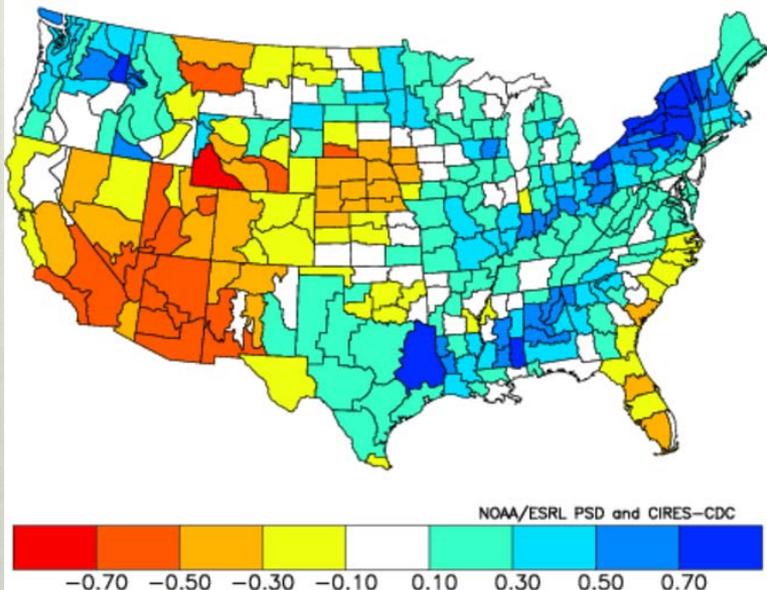
**Mean flow for Year 2:  
13.64 MAF (= -1.4MAf)**

**Difference significant,  
with more than 0.7  
standard deviations!**

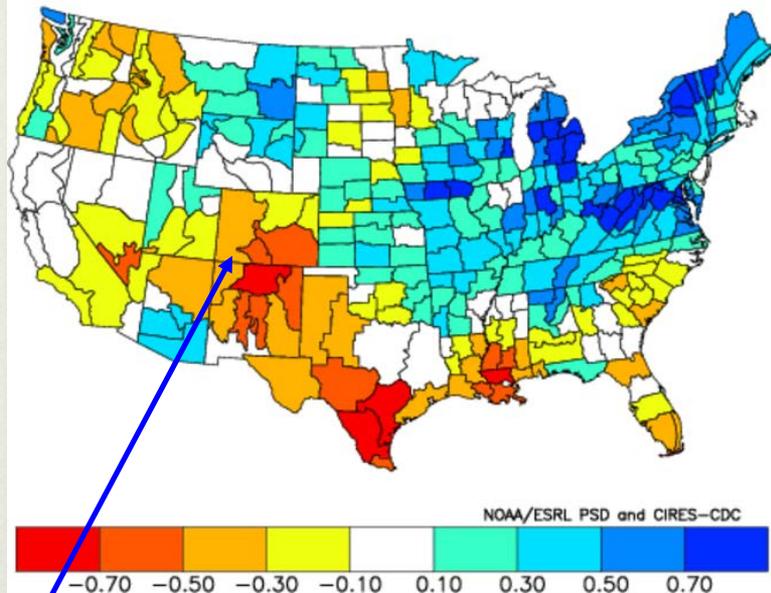
**In two-year La Niña events, 2<sup>nd</sup> year runoff has often been lower than 1<sup>st</sup> year runoff (8 of 10 cases) for the Colorado River. If we consider only cases above the 1<sup>st</sup> year mean, then the drop-off increases to 7.1MAF in the median case (or 13.4 MAF in 2012). A separate forecast based on Oct-Dec 2011 precipitation and mid-2011 ENSO behavior yields 11.2MAF.**

# Post-La Niña springs

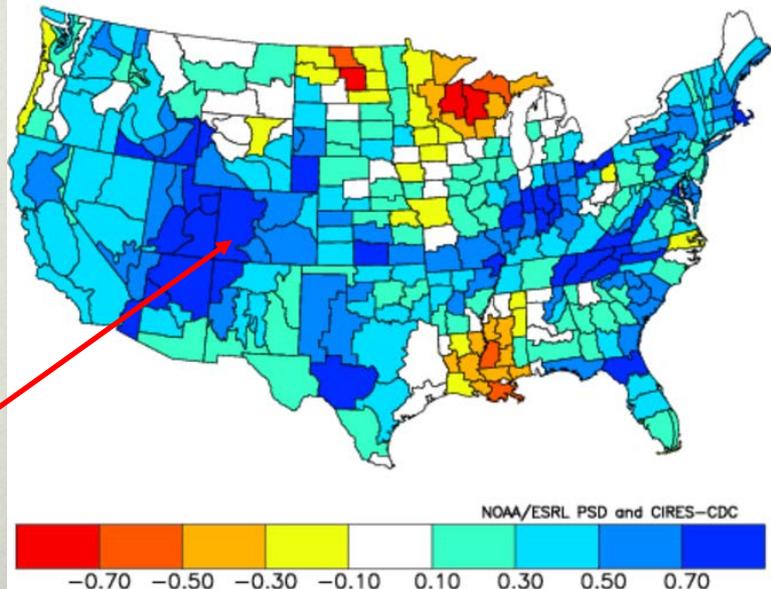
Composite Standardized Precipitation Anomalies  
Mar 1951,1963,1976,1989,2000,2001,2008,2009,2011  
Versus 1950–1995 Longterm Average



Composite Standardized Precipitation Anomalies  
Apr to Jun 1951,1963,1976,1989,2000,2001,2008,2009,2011  
Versus 1950–1995 Longterm Average



Composite Standardized Precipitation Anomalies  
Apr to Jun 1957,1965,1972,1997,2006,2009  
Versus 1950–1995 Longterm Average



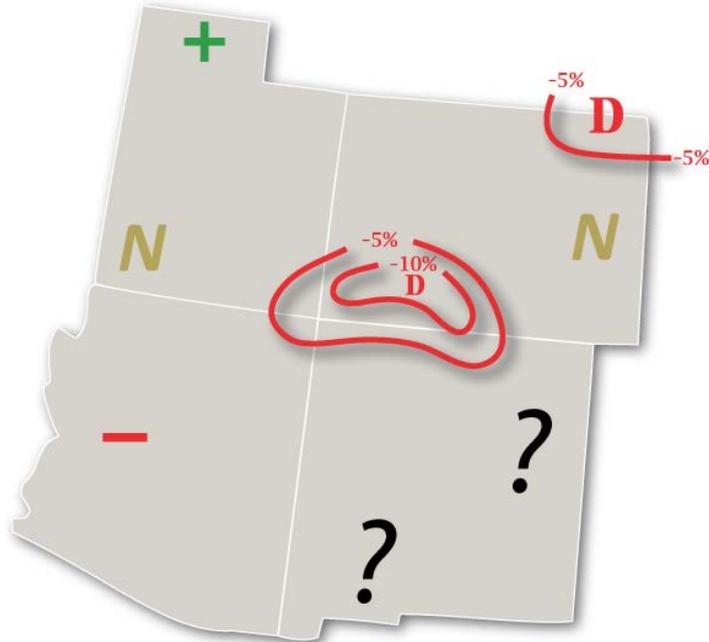
March is typically dry in the wake of La Niña in Colorado (top left). IF we go from La Niña in January-February to at least ENSO-neutral conditions by May-June, we tend to end up with a dry spring (top right). IF we relax the La Niña pre-condition to one month between December and February, plus **require El Niño conditions by May-June**, one gets a much wetter scenario (bottom right).

# Statistical Forecast for April-June 2012



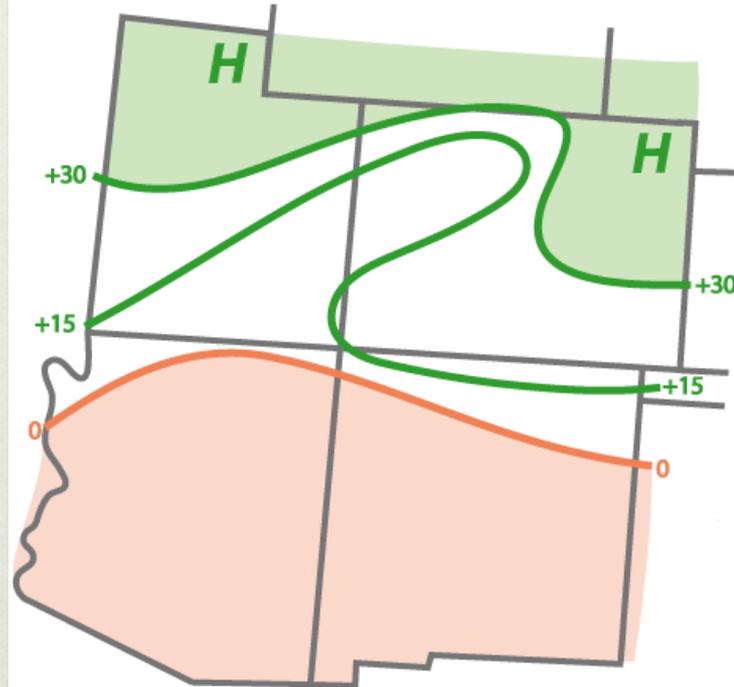
## Experimental PSD Precipitation Forecast Guidance

APR - JUN 2012 (Issued March 12, 2012)



## EXPERIMENTAL PSD PRECIPITATION FORECAST SKILL

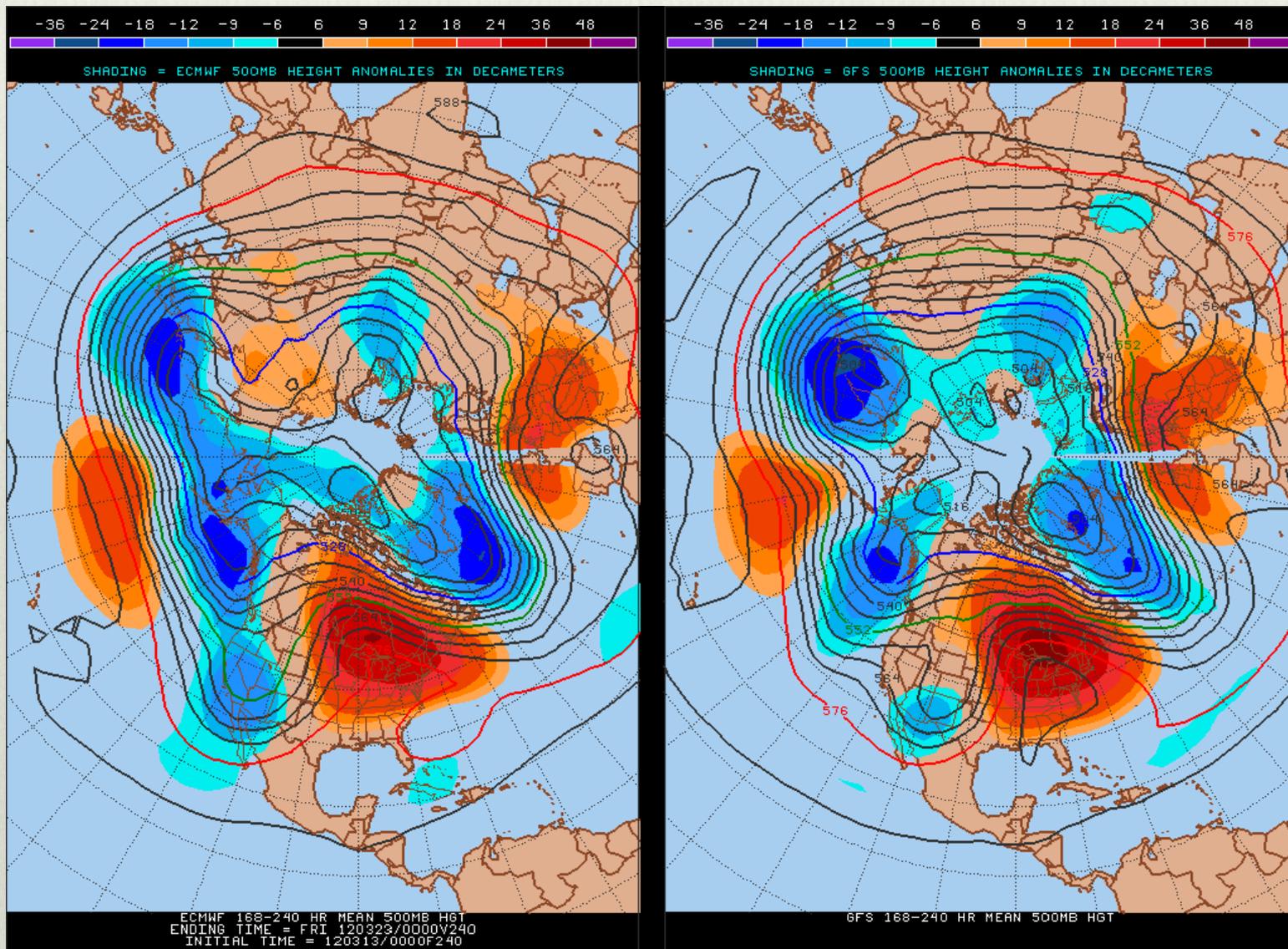
APR - JUN 2000-2009 (Lead: +0.5 Months)



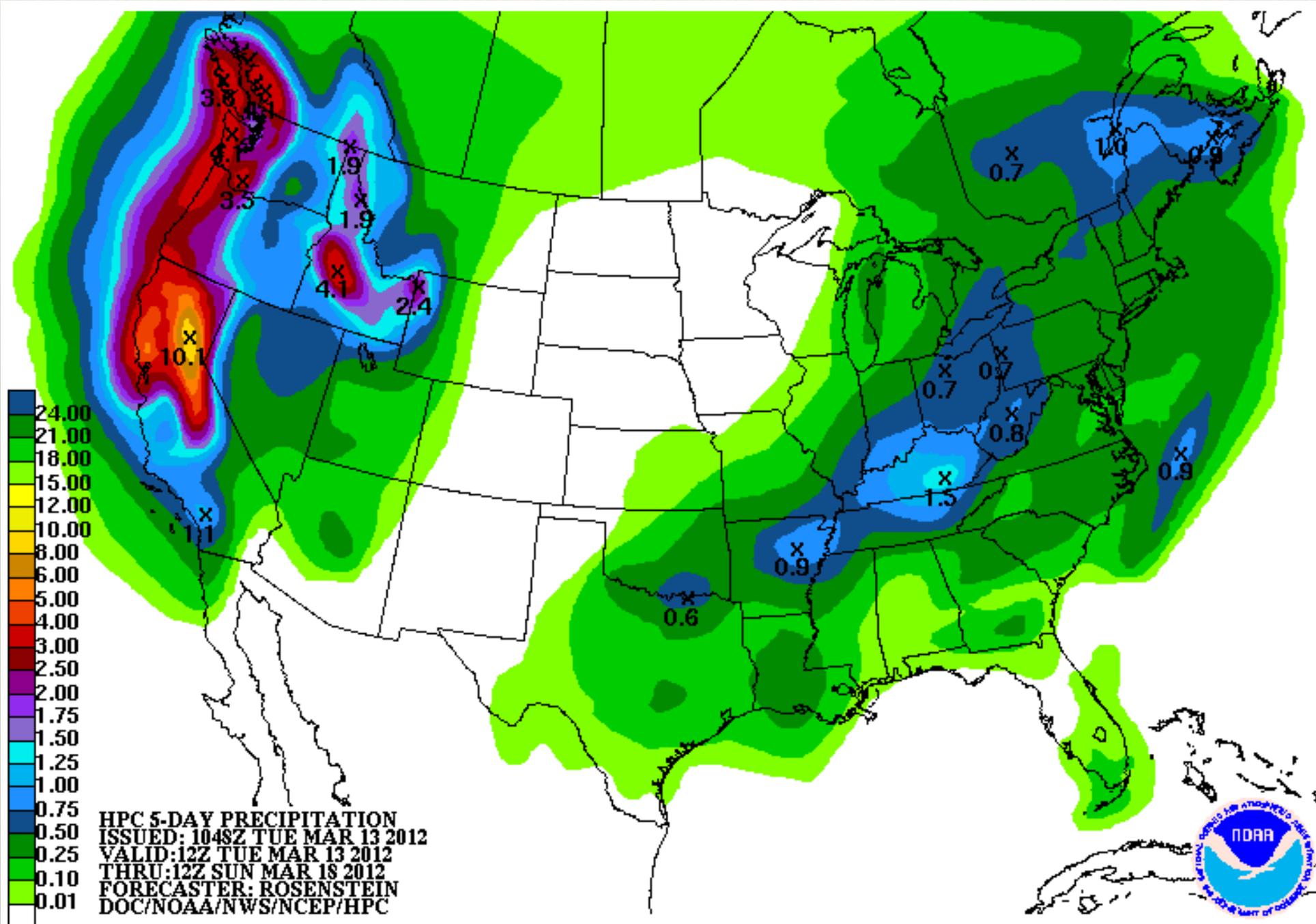
**My forecast for April-June 2012 (left) is fairly confident that SW Colorado will see below-normal moisture, with a smaller tilt in the odds for the NE. The eastern plains have a slight preference for near-normal spring moisture. The forecast map looks quite similar to my nine La Niña-neutral ENSO transition composite shown on last slide.**

***Historical skill over the last decade of experimental forecasts has been better for Utah and Colorado than for AZ and NM (right).***

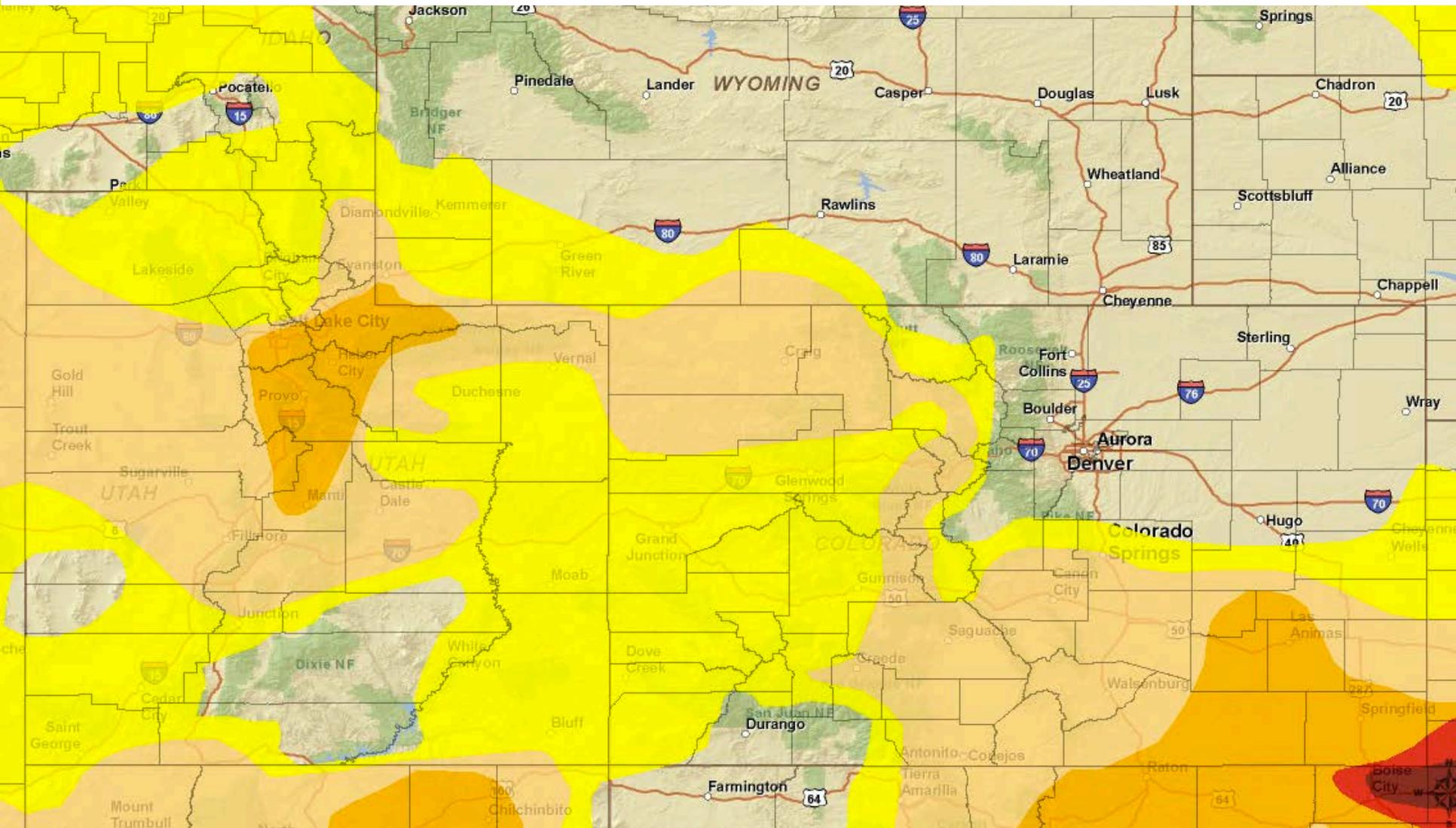
# Something to look forward to next week?!



*European & U.S. models show West Coast trough for the average circulation forecast 7-10 days out from last night – stay tuned for a possible major equinox storm for us!*



# Recommendations



**O  
F  
N  
I**



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**FORT COLLINS, CO 80523**

**970 - 491 - 8545**

**NIDIS - UPPER COLORADO BASIN PILOT PROJECT**

**F o r m o r e i n f o r m a t i o n**

# NIDIS Weekly Climate, Water and Drought Assessment Summary

Upper Colorado River Basin

March 13, 2012

# Precipitation and Snowpack

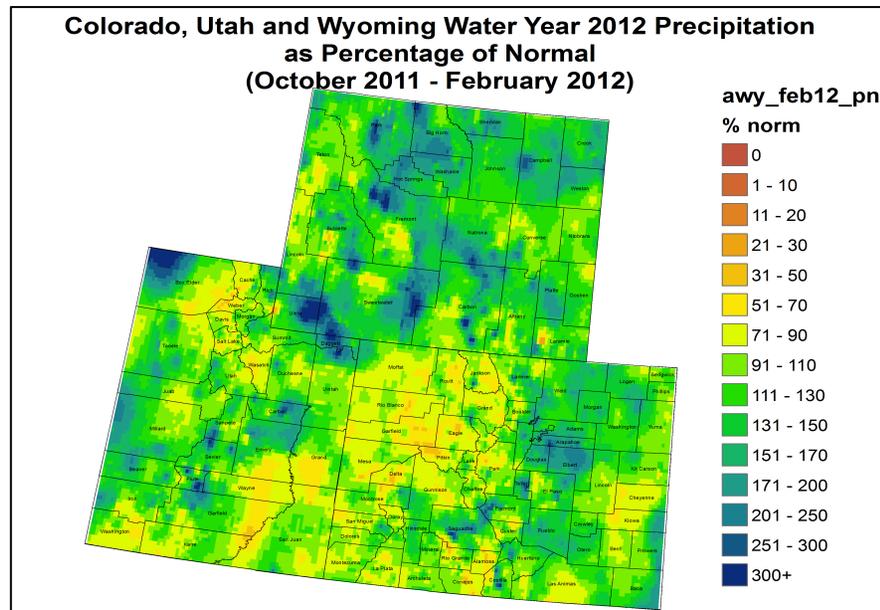


Fig. 1: Water-year-to-date precipitation as a percent of average.

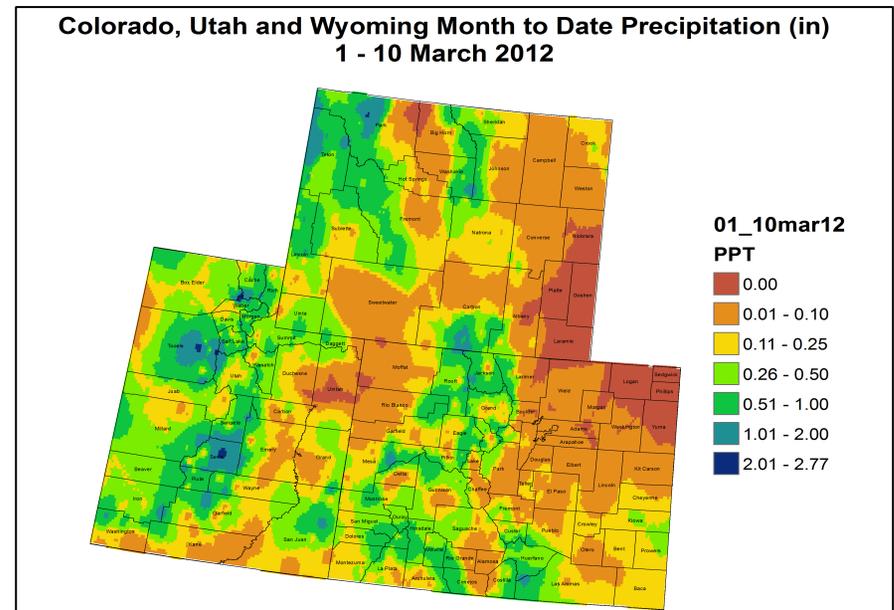


Fig. 2: March 1 – 10 precipitation in inches.

Water-year-to-date (WYTD), the Upper Colorado River Basin (UCRB) has seen varied precipitation conditions (Fig. 1). The northern mountains and valleys of Colorado, and along the Colorado River valley in Utah, have seen drier than average precipitation, WYTD, with percentages ranging from 50 to 90% of average. The Four Corners region and San Juan mountains have seen WYTD precipitation around 90% of average or higher. In the northern part of the UCRB, the Upper Green basin in southwest Wyoming has seen near to above average precipitation for the water year so far. In northeast UT, the Uintah mountains have seen above average precipitation while much of the Wasatch range has experienced drier than average conditions.

For the month of March so far, precipitation has been confined to the higher elevations in the UCRB (Fig. 2). The Wasatch and Uintahs in UT and the northern, central and San Juan mountains in CO have all seen accumulations between a quarter inch and 1 inch for the week (which is slightly below average to average for this time of year). The lower elevations and eastern CO have been drier month-to-date, with accumulations mainly under a quarter inch for most areas.

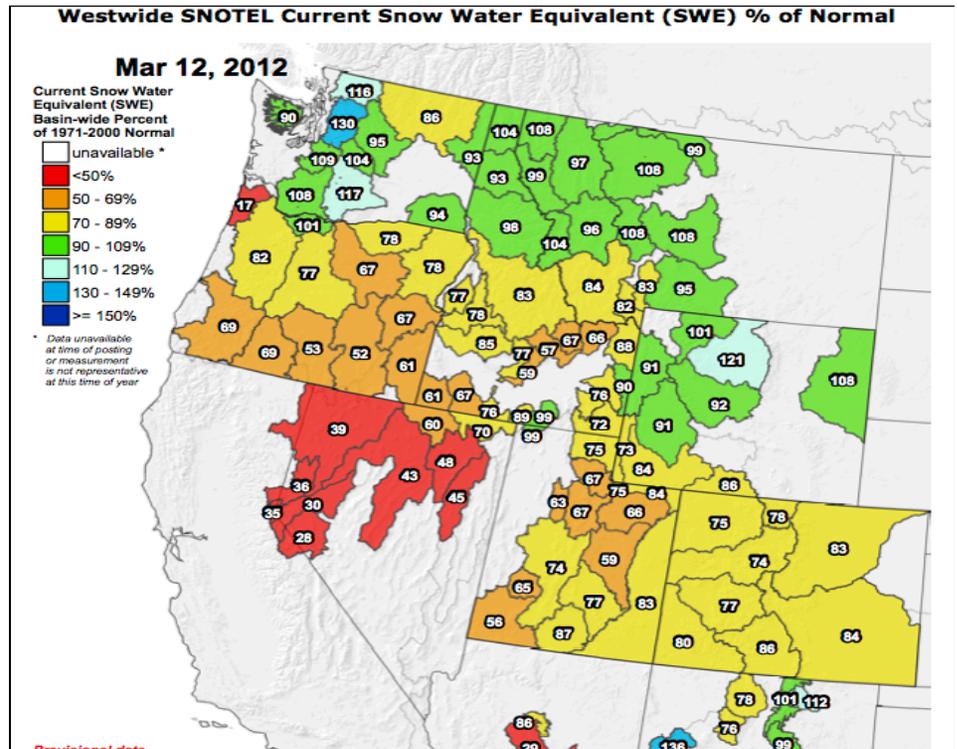
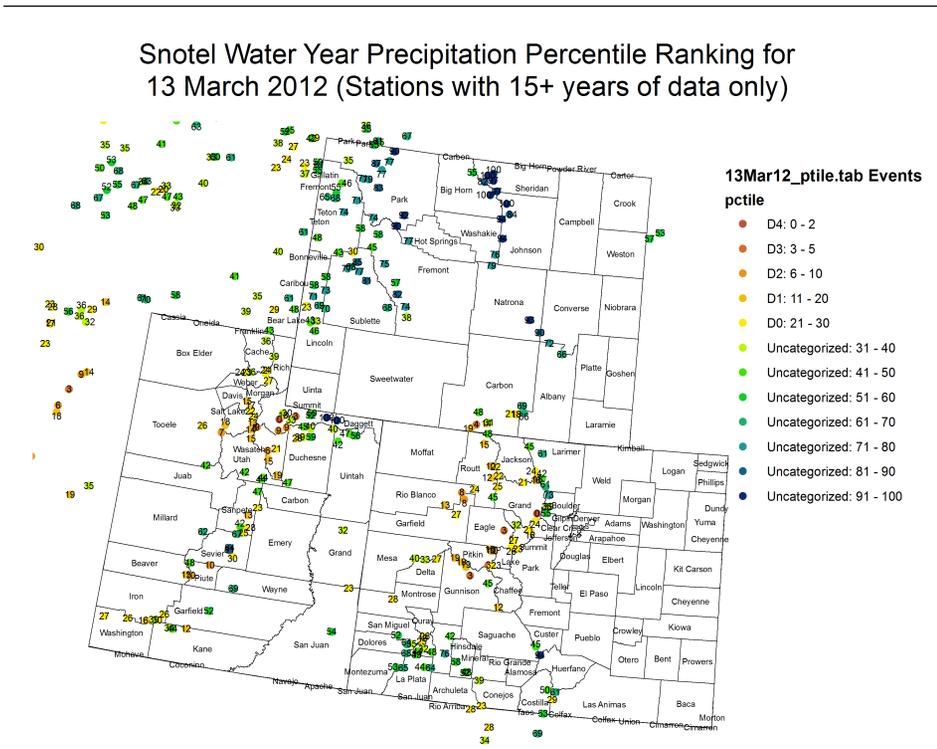


Fig. 3: SNOTEL WYTD precipitation percentiles (50% is median, 21 – 30% is Drought Monitor D0 category).

Fig. 4: Basin snow water equivalent (SWE) as a percent of average.

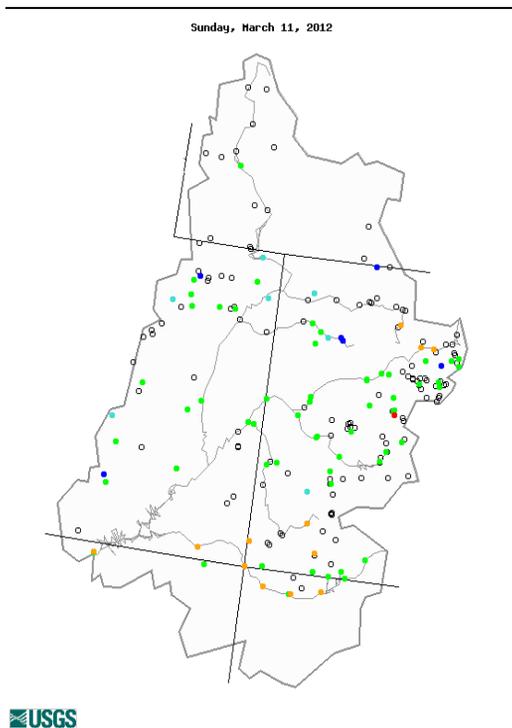
Water-year-to-date (WYTD), SNOTEL precipitation percentiles are lowest for the Wasatch range in UT, with percentiles ranging from single digits to around the 20<sup>th</sup> percentile, with higher percentiles along the Duchesne River in northeast UT (Fig. 3). The Yampa, Colorado, and Gunnison basins in CO are also fairly dry, with many SNOTEL sites showing percentiles in the 20s. SNOTEL percentiles in the Upper Green basin in WY are generally above the 70<sup>th</sup> percentile, and most in the San Juan basin in southern CO are near or above the 50<sup>th</sup> percentile.

Snowpack conditions around the UCRB are all below normal (Fig. 4) with all sub-basins showing a decrease in percents of average after a dry week. All of the sub-basins in western CO and eastern UT are recording mid-70s to mid-80s percent of average snowpack. The northeast UT sub-basins are drier, showing snowpack less than 70% of average, with parts of the Green River basin in UT at less than 60% of average. The sub-basins in southwest WY are showing 80 – 90% of average snowpack.

# Streamflow

As of March 11<sup>th</sup>, 86% of the USGS streamgages in the UCRB recorded normal (25<sup>th</sup> – 75<sup>th</sup> percentile) or above normal 7-day average streamflows (Fig. 5). About 17% of the gages in the basin are recording above normal flows, while about 14% of the gages in the basin are recording below normal flows. The number of reporting gages in the basin has increased from under 50 to nearly 80 in the past month, indicating warmer temperatures causing some early season melting. There are currently 13 gages recording below normal flows, most of them located in the San Juan basin.

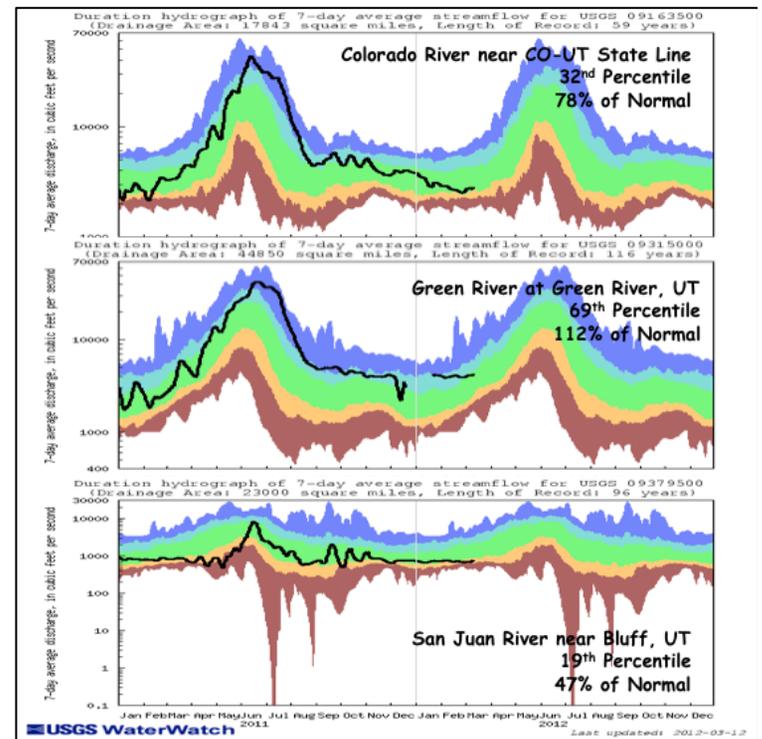
Key gages throughout the basin are showing variable conditions (Fig. 6). Flows on the Colorado River near the CO-UT state line have been steadily dropping since the beginning of the calendar year and are currently at the 32<sup>nd</sup> percentile. The San Juan River near Bluff, UT is recording below normal flows at the 19<sup>th</sup> percentile. The Green River near Green River, UT is now recording flows in the near normal range, at the 69<sup>th</sup> percentile.



Explanation - Percentile classes							
●	●	●	●	●	●	●	○
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		

Fig. 5: 7-day average discharge compared to historical discharge for March 11<sup>th</sup>.

Fig. 6: USGS 7-day average discharge over time at the CO-UT stateline (top), Green River, UT (middle) and Bluff, UT (bottom).



## Water Supply and Demand

Most of the UCRB continued to experience warmer than average temperatures last week, with the northern part of the basin seeing temperatures 3 to 9 degrees above average. The VIC model shows dry soil moisture conditions in southeast CO, in UT around the Colorado River valley, and in southern WY (Fig. 7). All of these dry regions have been expanding in areal size. The VIC shows wet soils around the Colorado headwaters region, though when VIC SWE and soil moisture are combined, this area shows a moisture storage deficit. Near normal soil moisture conditions are being observed in the Four Corners and San Juan region.

Most of the major reservoirs in the UCRB saw decreases in storage for the month of February, though that is normal for this time of year. McPhee levels stayed nearly steady for the month and Lake Dillon increased very slightly for the month (though it normally sees a decrease in storage). All of the reservoirs above Lake Powell are currently above their March storage averages. Lake Powell is currently at 84% of average and 63% of capacity (compared to 54% one year ago).

## Precipitation Forecast – Long term and short term

After a peak in December/January, La Niña conditions have rapidly weakened. The ECMWF (the European forecast model) currently shows an ensemble prediction toward a moderate El Niño signal by August. There is uncertainty in this forecast and other models predict a weakening to ENSO neutral conditions by the summer, but typically the ECMWF produces the most reliable ENSO forecasts. It is more likely that the La Niña will weaken to neutral by the summer, and historically this means that all of CO and the Four Corners region experience a drier than average spring, while the Wasatch mountains in UT could expect a wetter than average spring (Fig. 8). Klaus Wolter's also forecasts for drier than average conditions for the Four Corners region and northeast CO, with the possibility for greater than average precipitation in northern UT (Fig. 9). Short-term, a deep trough is forecast to move across the basin this weekend. Though there is uncertainty in the models, winds look to come from the southwest and favor heavier precipitation over the southern part of the basin. This storm could start as rain for much of the lower elevations, leading to further early season melting. Cooler temperatures and precipitation are expected over the UCRB by Sunday. Good placement of this storm could mean higher accumulations, but near average accumulations seem more likely at this time.

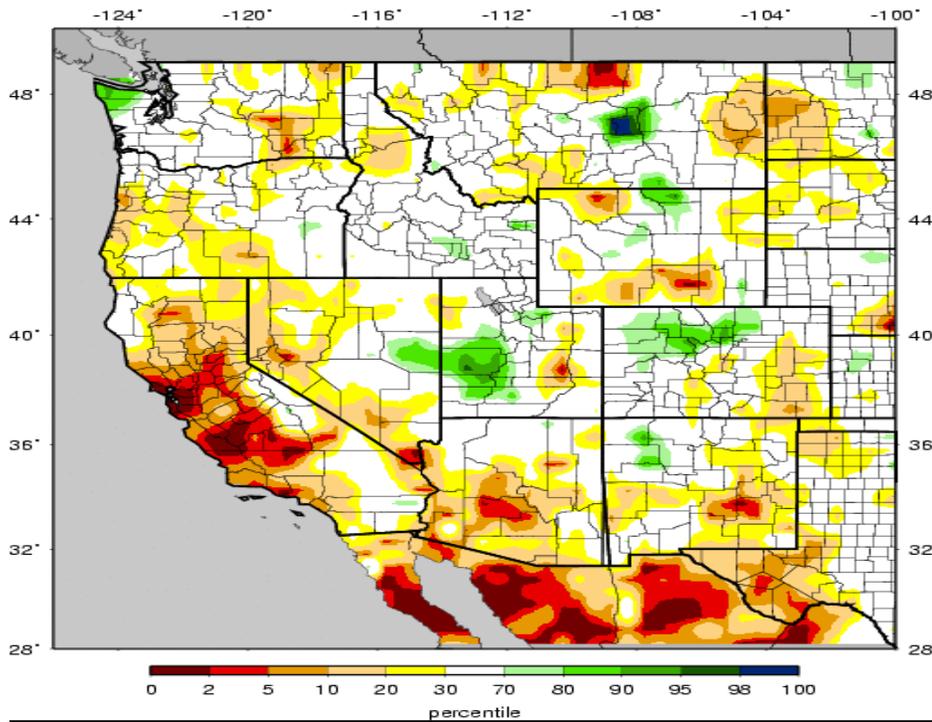


Fig. 7: VIC soil moisture percentiles as of March 11<sup>th</sup>.

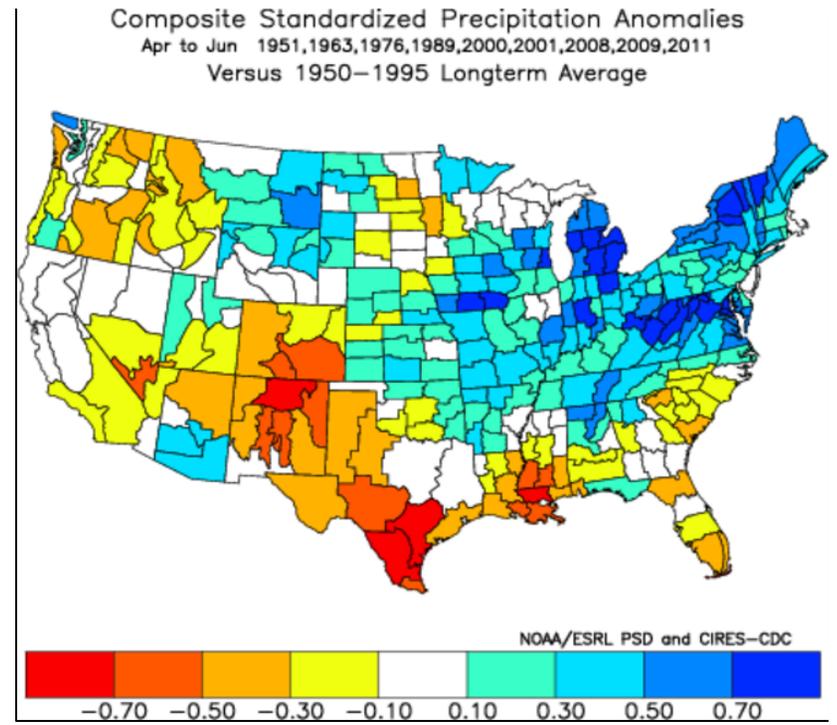
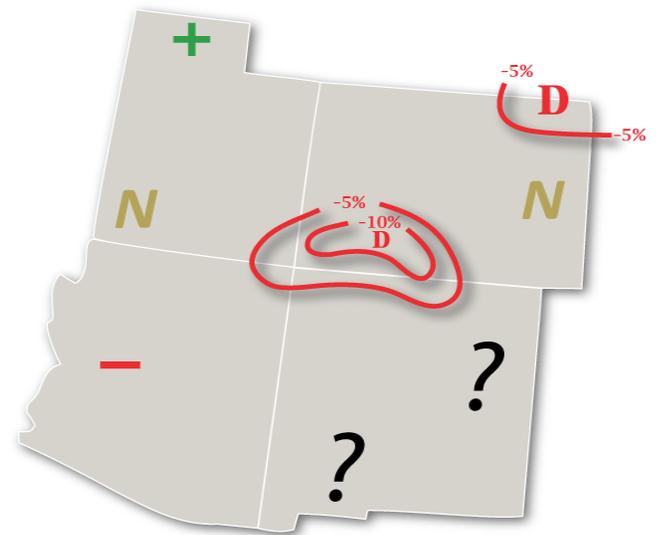


Fig. 8 (upper right): Composite of standardized precipitation anomalies for La Niña years transitioning to neutral conditions by summer.

Fig. 9 (lower right): Klaus Wolter's April – June precipitation forecast.

### Experimental PSD Precipitation Forecast Guidance

APR – JUN 2012 (Issued March 12, 2012)



# Drought and Water Discussion

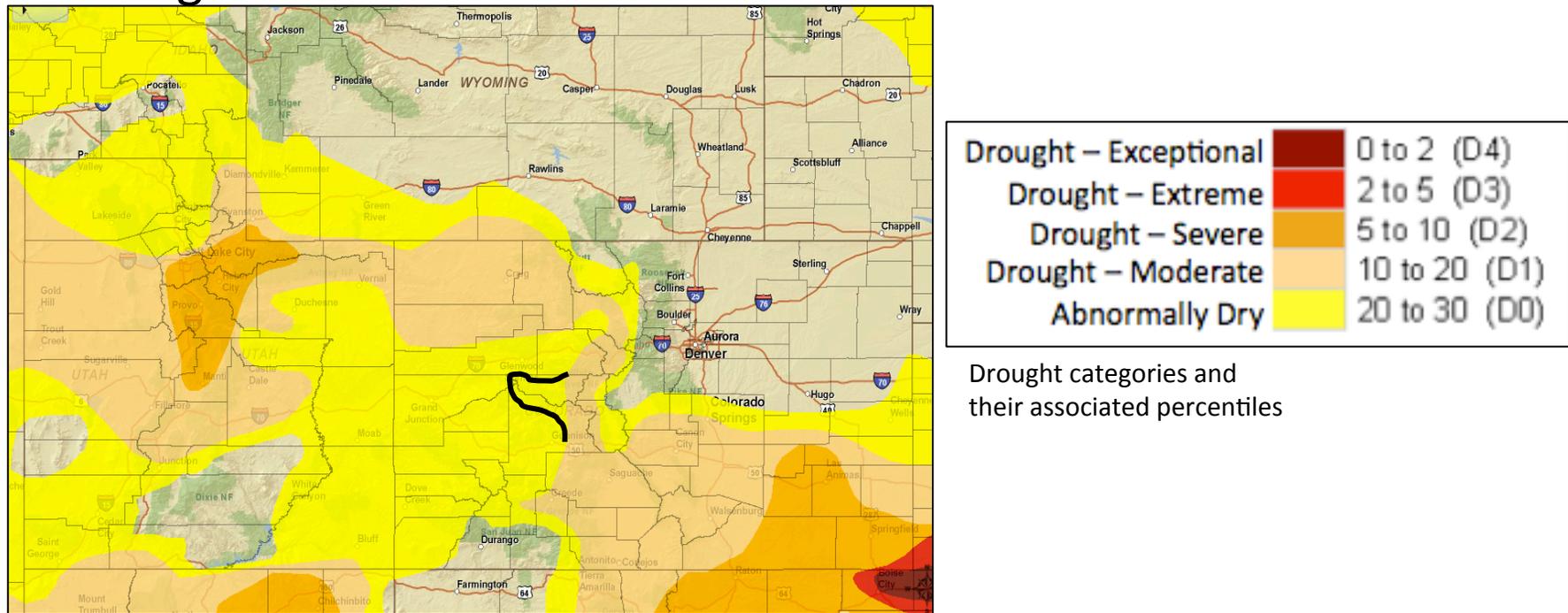


Fig. 10: March 6<sup>th</sup> release of U.S. Drought Monitor for the UCRB

Drought categories and their associated percentiles

On the current depiction of the U.S. Drought Monitor (USDM) map, it is recommended that the eastern extent of D1 (near the Arkansas headwaters) be expanded westward along the border of the Colorado and Gunnison sub-basins (Fig. 10, black line). SNOTEL precipitation along the Pitkin – Gunnison county line are generally around the 20<sup>th</sup> percentile. Snowpack for the two sub-basins are around 75% of average and have seen little to no SWE accumulations since the beginning of the month (a result of near average precipitation coupled with warmer than average temperatures).

Status quo is recommended for the rest of the UCRB and for the rest of Colorado.