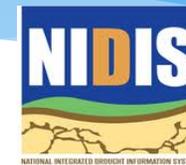


# Pacific Northwest Drought Outlook

PNW Drought Early Warning System  
Kickoff Meeting  
February 2, 2016

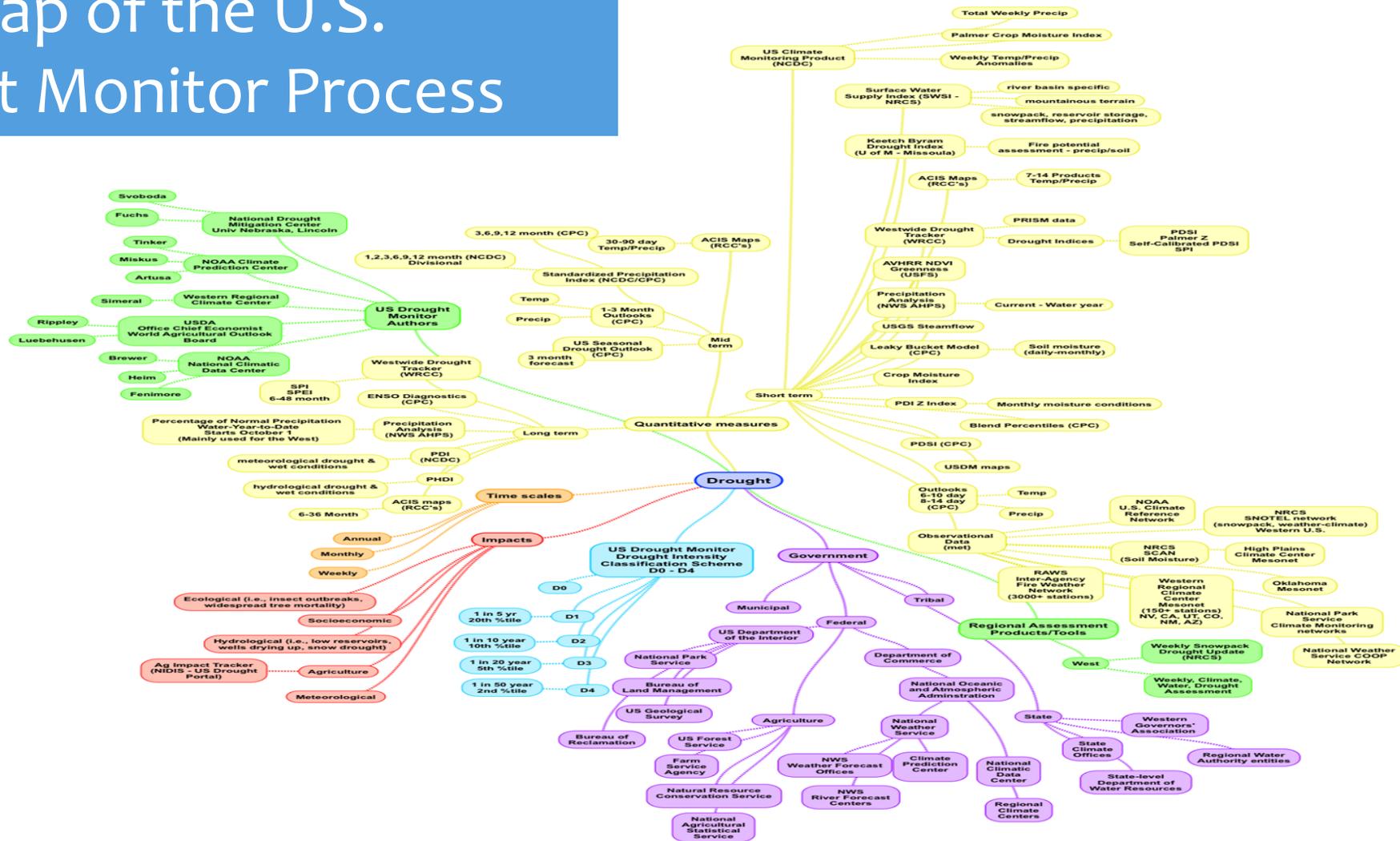
David B. Simeral  
Associate Research Scientist – Climatology  
U.S. Drought Monitor Author  
Desert Research Institute – Division of Atmospheric Sciences  
Western Regional Climate Center



# Objectives

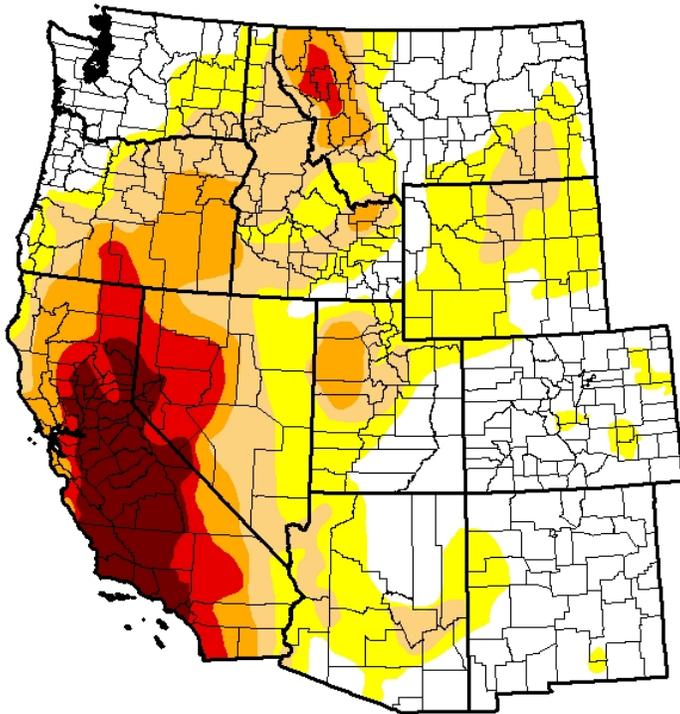
- \* Provide a brief overview of the current drought conditions across the Pacific Northwest.
- \* Provide input as to “areas of opportunity” to enhance and improve coordination and monitoring activities with the U.S Drought Monitor authors.
- \* Introduce the Klamath Basin Weather & Climate Dashboard.

# Mind Map of the U.S. Drought Monitor Process



# Current PNW Drought Status

## U.S. Drought Monitor West



**January 26, 2016**

(Released Thursday, Jan. 28, 2016)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
<b>Current</b>	37.80	62.20	38.45	21.59	11.69	5.81
<b>Last Week</b> <i>1/19/2016</i>	37.36	62.64	40.19	21.59	12.26	6.14
<b>3 Months Ago</b> <i>10/27/2015</i>	26.79	73.21	55.42	41.21	26.23	7.62
<b>Start of Calendar Year</b> <i>1/22/2015</i>	33.17	66.83	45.07	29.30	15.92	6.85
<b>Start of Water Year</b> <i>9/29/2015</i>	22.77	77.23	57.81	42.42	26.50	7.62
<b>One Year Ago</b> <i>1/27/2015</i>	31.10	68.90	53.77	33.36	18.72	6.96

Intensity:



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

**Author:**

Mark Svoboda  
National Drought Mitigation Center



<http://droughtmonitor.unl.edu/>

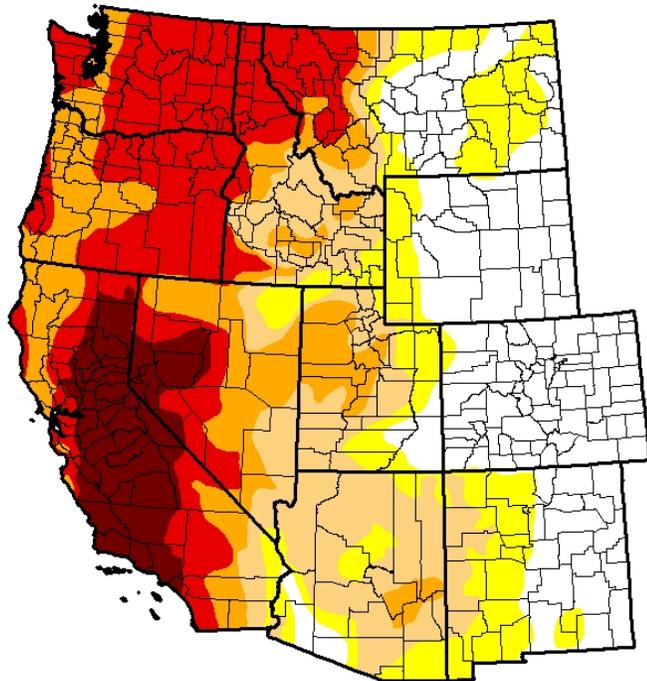
- \* Above normal precipitation (late autumn-early winter) led to significant improvements in western Oregon and across Washington.
- \* Western portions of Oregon and Washington have gone from D2/D3 range in late August to D1/D0/D-nada at present.
- \* South-central and eastern Oregon as well as east-central, southeastern, and northern Idaho have been slower to recover.
- \* Longer-term hydrologic impacts (below-normal reservoir storage levels) persist in central and eastern Oregon, and southern Idaho.
- \* An initial report from the WA Dept. of Agriculture is estimates the economic impact of the 2015 drought on the state's agricultural industry at more than \$335 million.

# Drought Status – cont.

August 25, 2015

**U.S. Drought Monitor  
West**

**August 25, 2015**  
(Released Thursday, Aug. 27, 2015)  
Valid 8 a.m. EDT



Intensity

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

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

**Author:**  
Anthony Artusa  
NOAA/NWS/NCEP/CPC

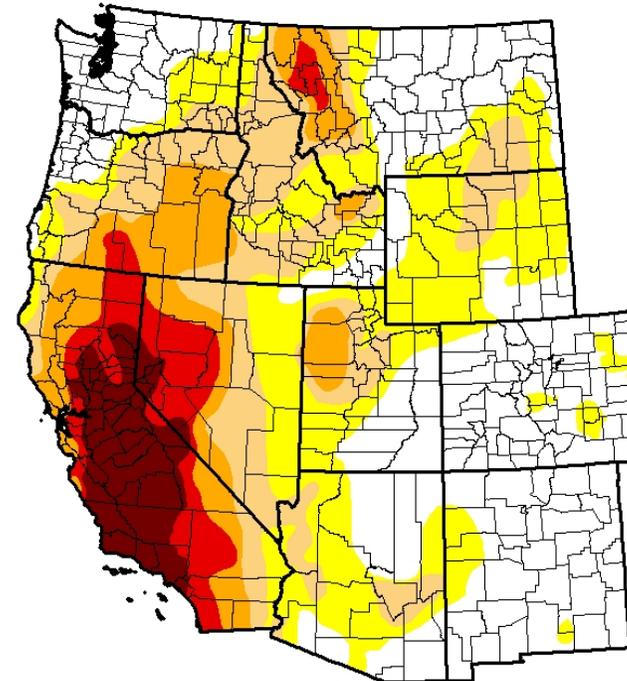


<http://droughtmonitor.unl.edu/>

January 26, 2016

**U.S. Drought Monitor  
West**

**January 26, 2016**  
(Released Thursday, Jan. 28, 2016)  
Valid 7 a.m. EST



Intensity

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

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

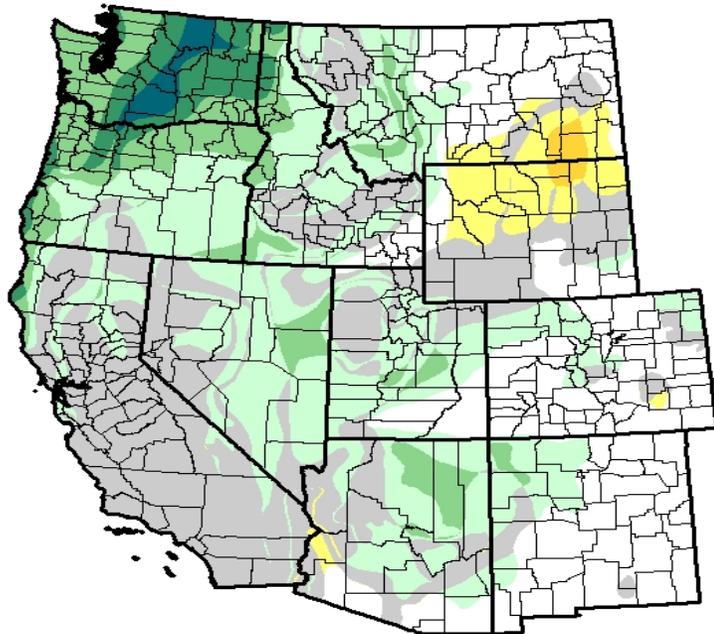
**Author:**  
Mark Svoboda  
National Drought Mitigation Center



<http://droughtmonitor.unl.edu/>

# Drought Status – cont.

U.S. Drought Monitor Class Change - West  
3 months



January 26, 2016  
compared to  
November 3, 2015



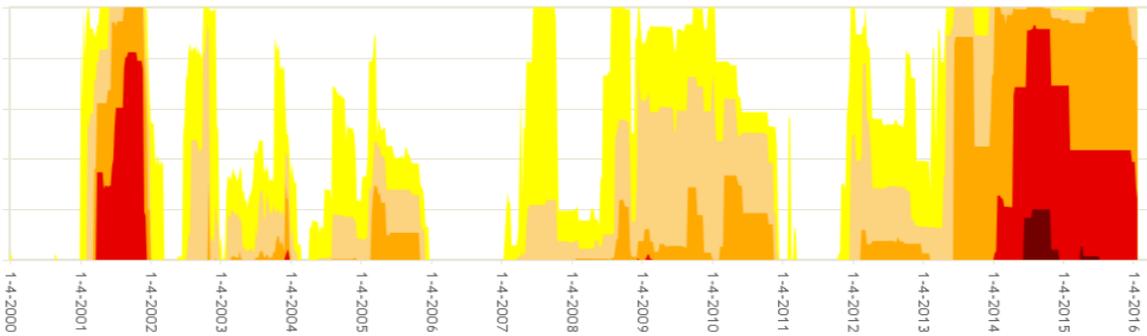
\* In Washington, the governor's emergency drought declaration was not extended into 2016.

# Drought Status – cont.

## Time-Series Graphs of Drought (2000-2016)

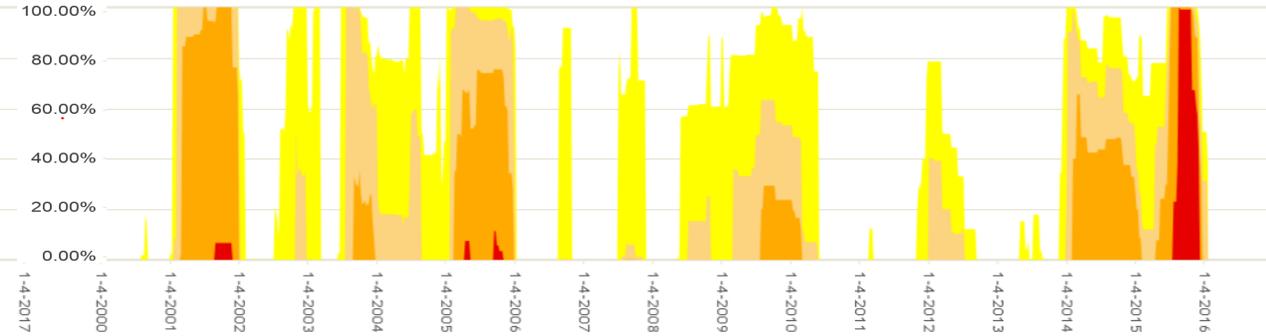
### Klamath River Basin

180102 (Klamath) Percent Area



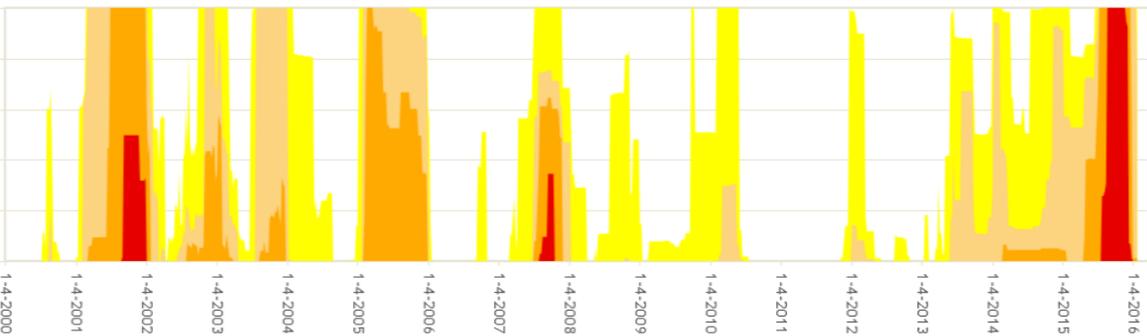
### Upper Columbia River Basin

1702 (Upper Columbia) Percent Area



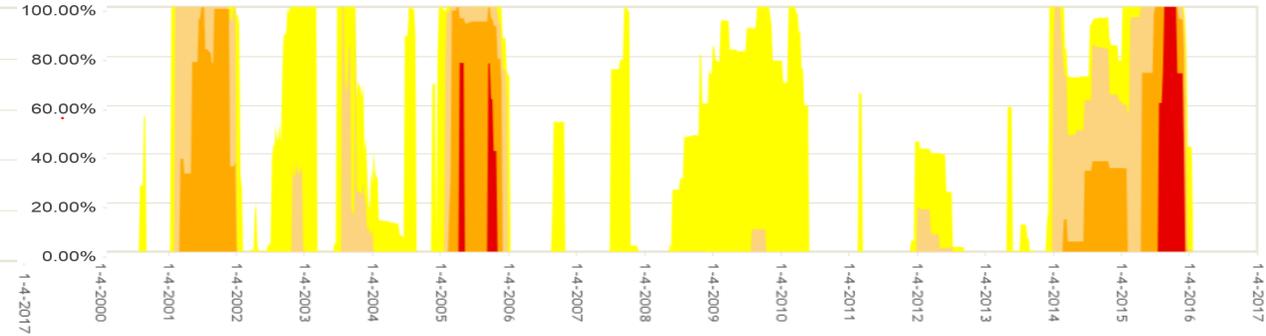
### Lower Snake River Basin

170601 (Lower Snake) Percent Area



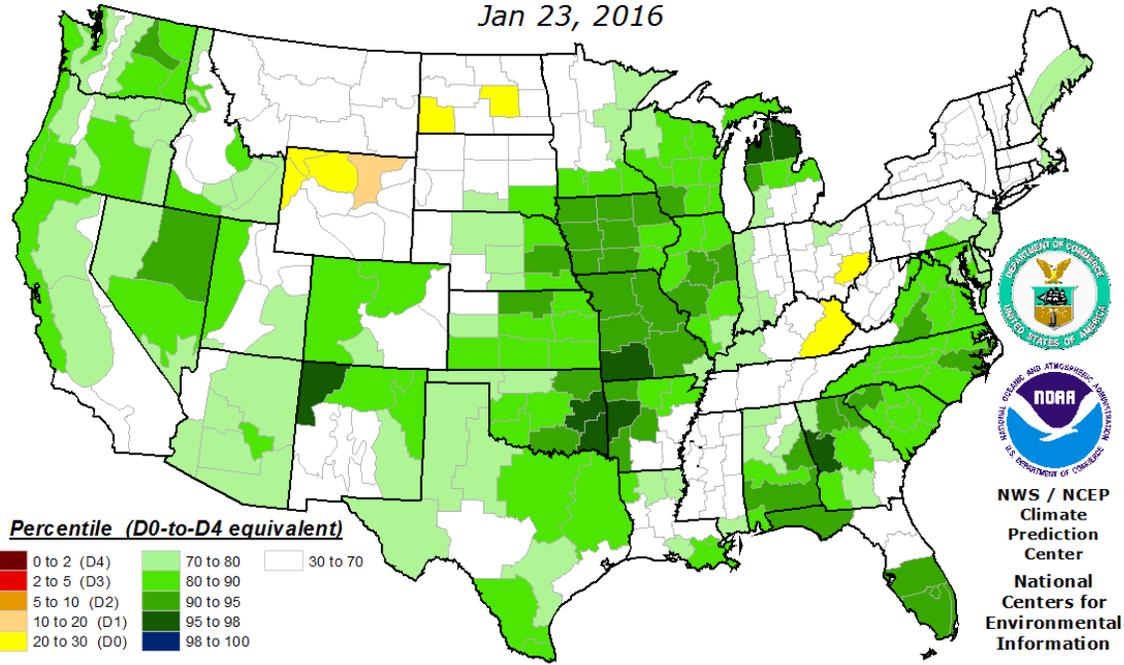
### Yakima River Basin

170300 (Yakima) Percent Area



# Objective Blends Drought Indicators

**Objective Short-Term Drought Indicator Blend Percentiles**  
Jan 23, 2016



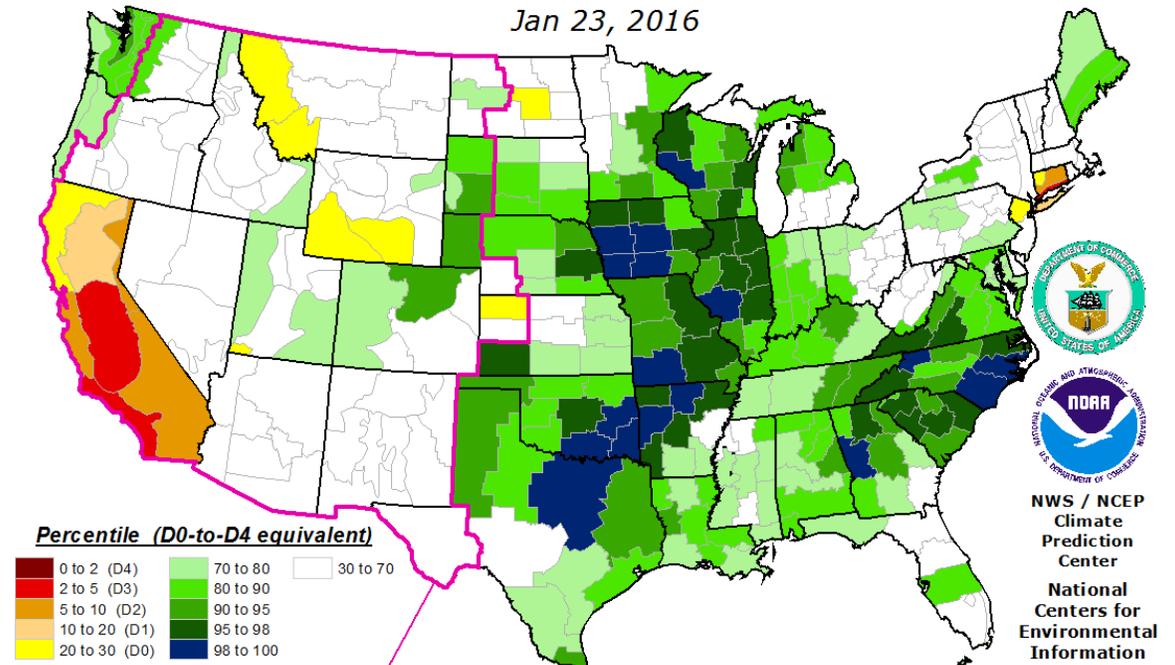
**Inputs (as percentiles):**

- 35% Palmer Z-Index
- 25% 3-Month Precipitation
- 20% 1-Month Precipitation
- 13% CPC Soil Moisture Model
- 7% Palmer Drought Index

This map approximates impacts that respond to precipitation over several days to a few months, such as agriculture, topsoil moisture, unregulated streamflows, and most aspects of wildfire danger. The relationship between indicators and impacts can vary significantly with location and season. Do not interpret this map too literally.

This map is based on preliminary climate division data. Local conditions and/or final data may differ. See the detailed product suite description for more details.

**Objective Long-Term Drought Indicator Blend Percentiles**  
Jan 23, 2016



**Inputs (as percentiles):**

- 25% Palmer Hydrologic Index
- 20% 24-Month Precipitation
- 20% 12-Month Precipitation
- 15% 6-Month Precipitation
- 10% 60-Month Precipitation
- 10% CPC Soil Moisture Model

**Western Formulation  
Inputs (as percentiles):**

- 30% Palmer Hydrologic Index
- 30% 60-Month Average Z-Index
- 10% 24-Month Precipitation
- 10% 12-Month Precipitation
- 10% CPC Soil Moisture Model

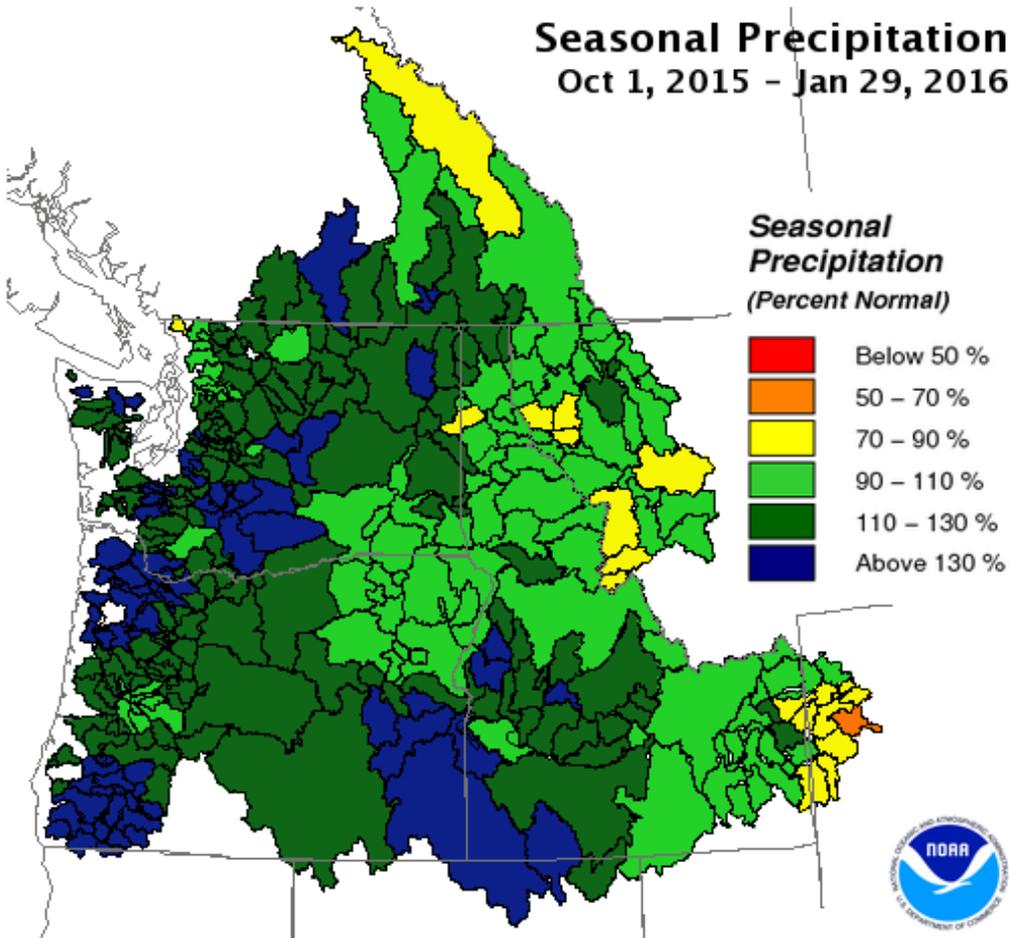
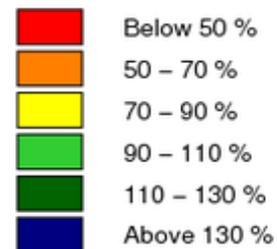
This map approximates impacts responding to precipitation over the course of several months to a few years, such as reservoir content, groundwater, and lake levels. HOWEVER, THE RELATIONSHIP BETWEEN INDICATORS AND WATER SUPPLIES CAN VARY MARKEDLY WITH LOCATION, SEASON, SOURCE, AND MANAGEMENT PRACTICE. Do not interpret this map too literally.

This map is based on preliminary climate division data. Local conditions and/or final data may differ. See the detailed product suite description for more details.

# Water-Year-To-Date Precipitation

Seasonal Precipitation  
Oct 1, 2015 - Jan 29, 2016

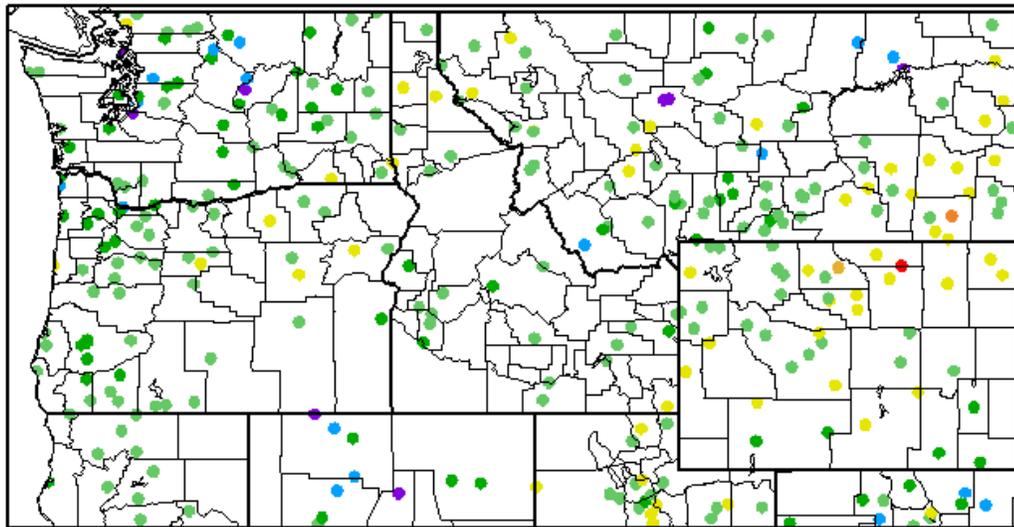
Seasonal  
Precipitation  
(Percent Normal)



- \* **Water-Year-To-Date** - normal to above-normal precipitation across nearly the entire region with exception of portions of southeastern & northern Idaho and in the headwaters of the Columbia River Basin.
- \* **December 2015** - well above-normal precipitation across most the region.

# Precipitation – cont.

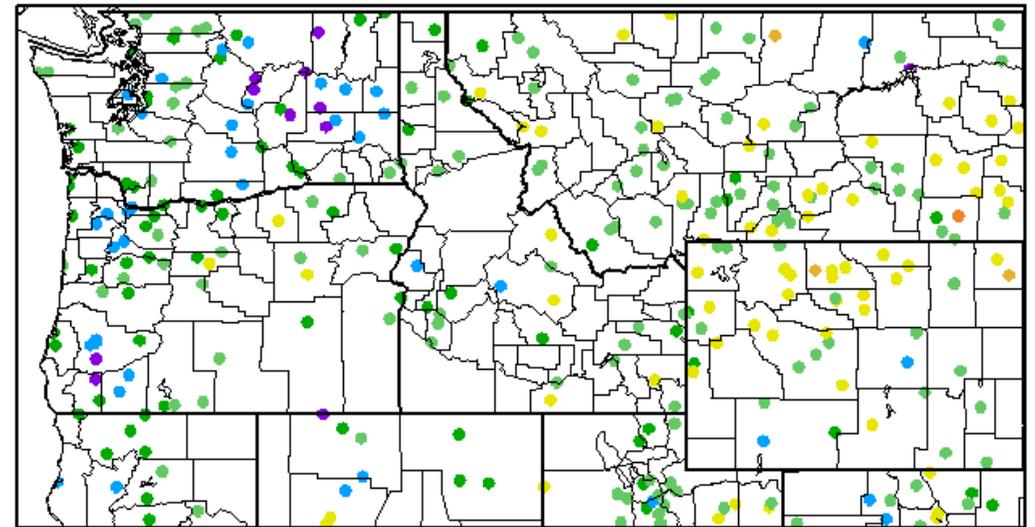
Water Year SPI  
10/1/2015 – 1/31/2016



Generated 2/1/2016 at HPRCC using provisional data.

Regional Climate Centers

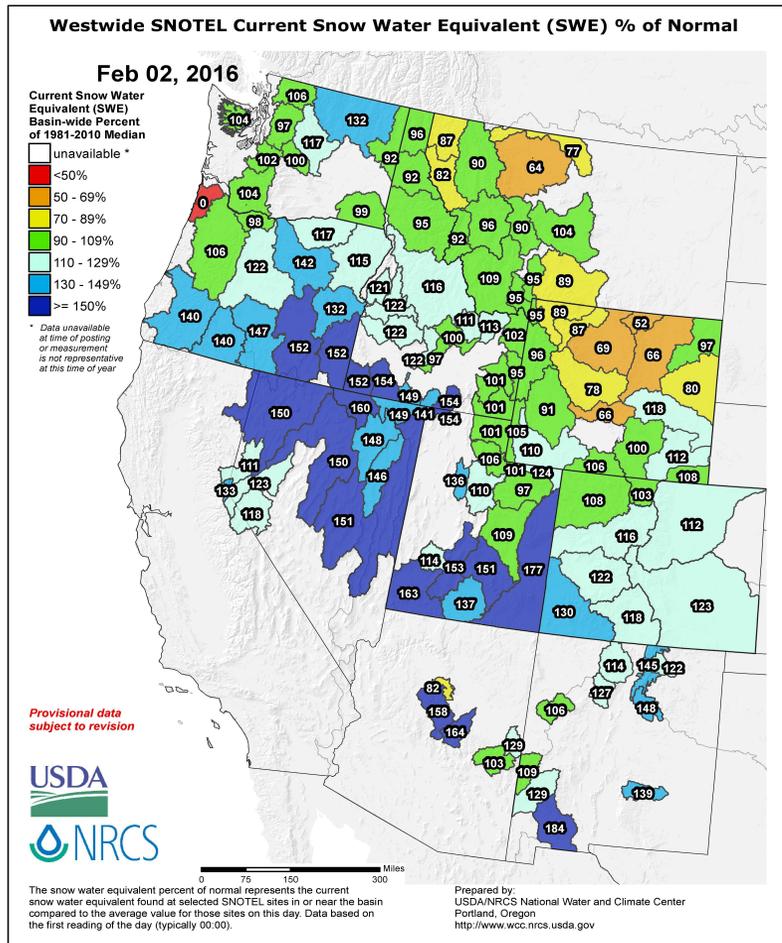
60 Day SPI  
12/3/2015 – 1/31/2016



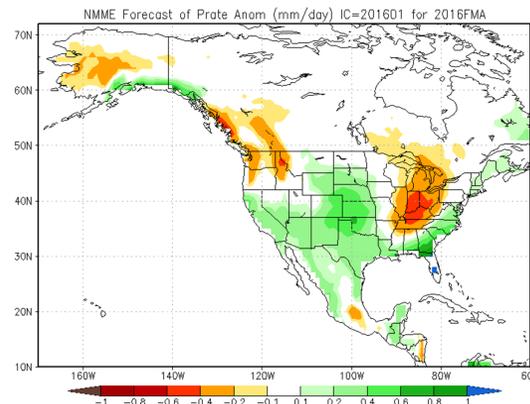
Generated 2/1/2016 at HPRCC using provisional data.

Regional Climate Centers

# Current Snowpack

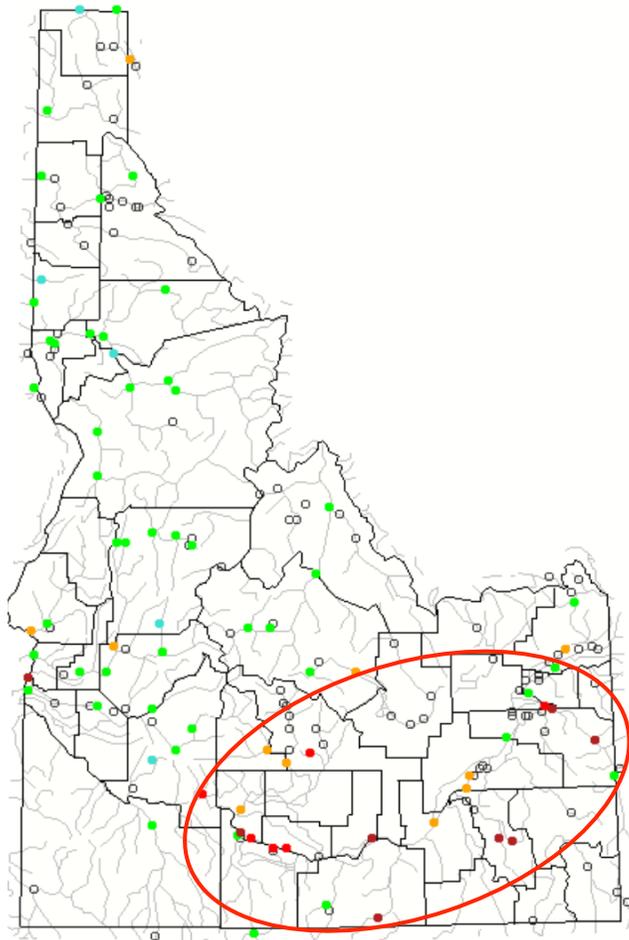


- \* Normal to above-normal snow water equivalent (SWE) across most of the region with exception of the Idaho Panhandle.
- \* Unlike winter of 2014-15, the PNW is not currently experiencing a “snow drought”.
- \* Will the trend continue? The latest NMME forecast is calling for **below-normal precipitation across the Cascades and northern Idaho for FMA 2016.**

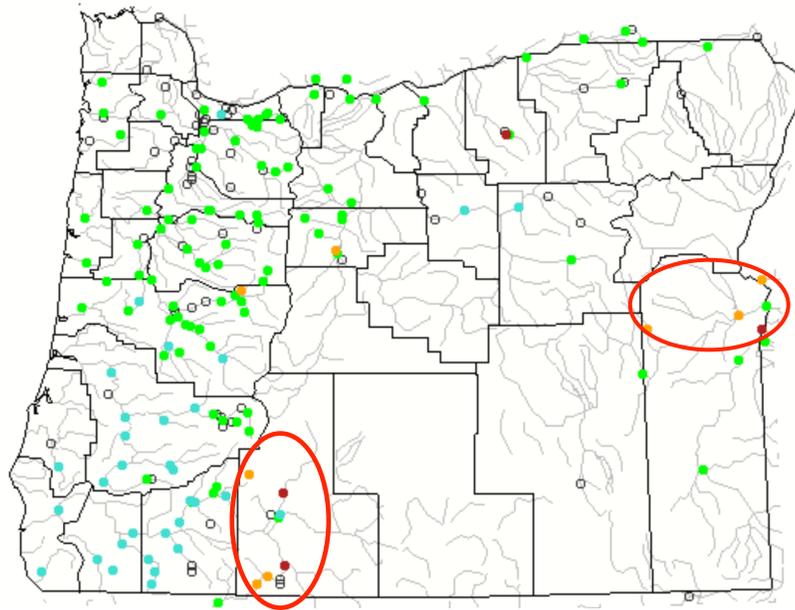


# Current Streamflow (28-day)

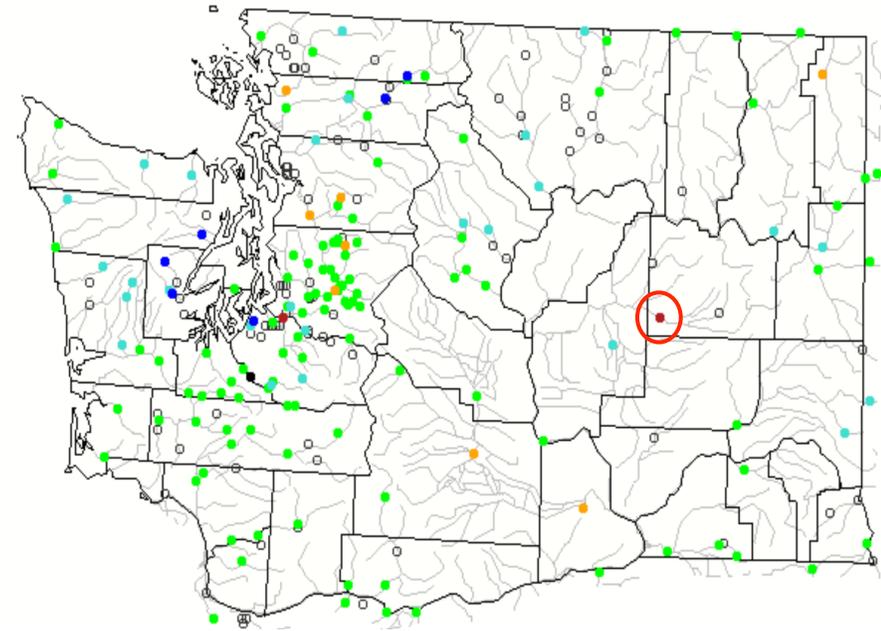
Saturday, January 30, 2016



Saturday, January 30, 2016

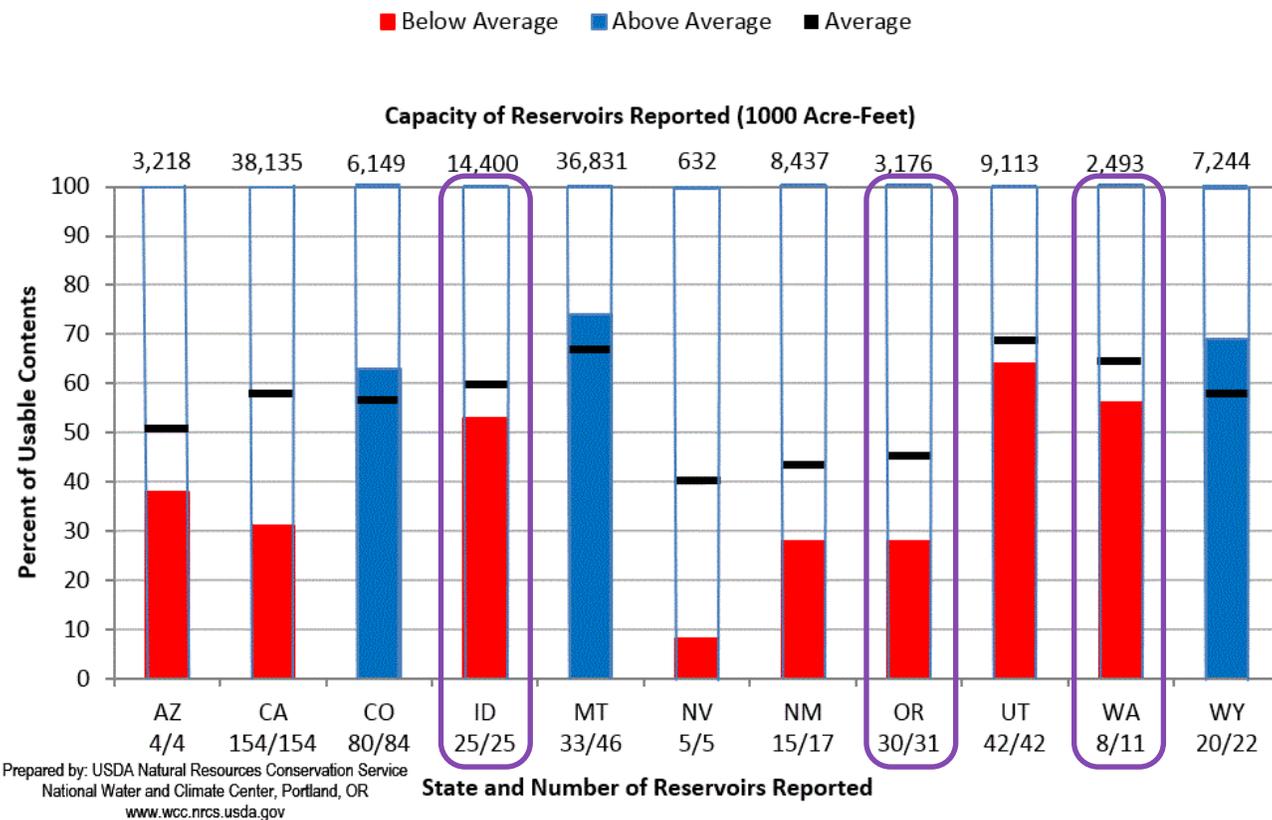


Saturday, January 30, 2016



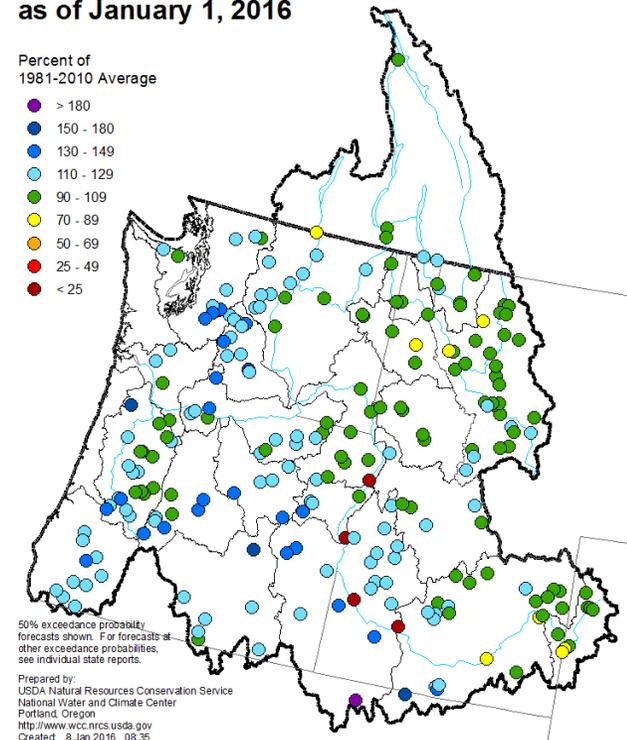
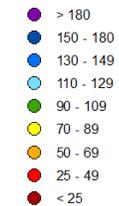
# West-Wide Reservoir Storage

## Reservoir Storage as of January 1, 2016

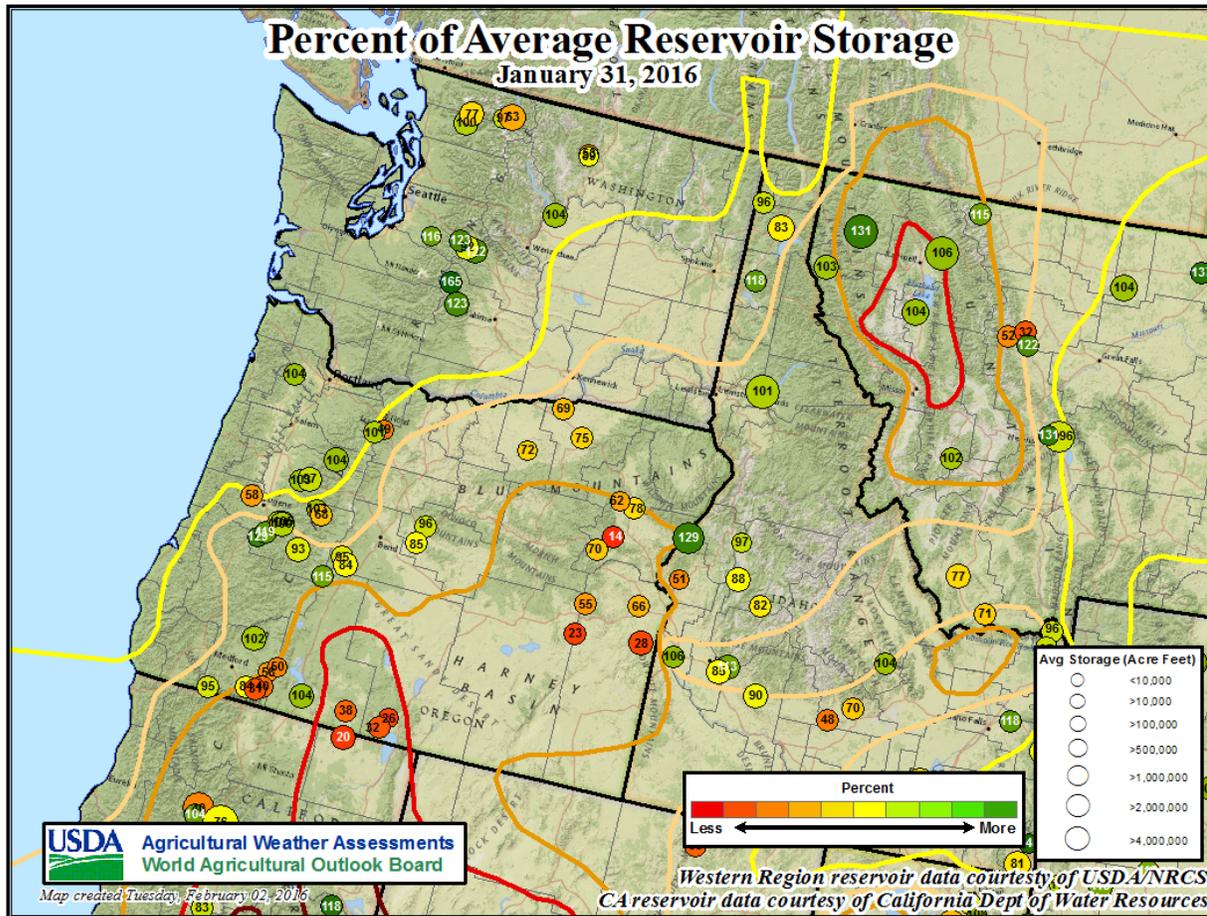


## Columbia River and Pacific Coastal Basins Spring and Summer Streamflow Forecasts as of January 1, 2016

Percent of  
1981-2010 Average



# Current Reservoir Storage Levels



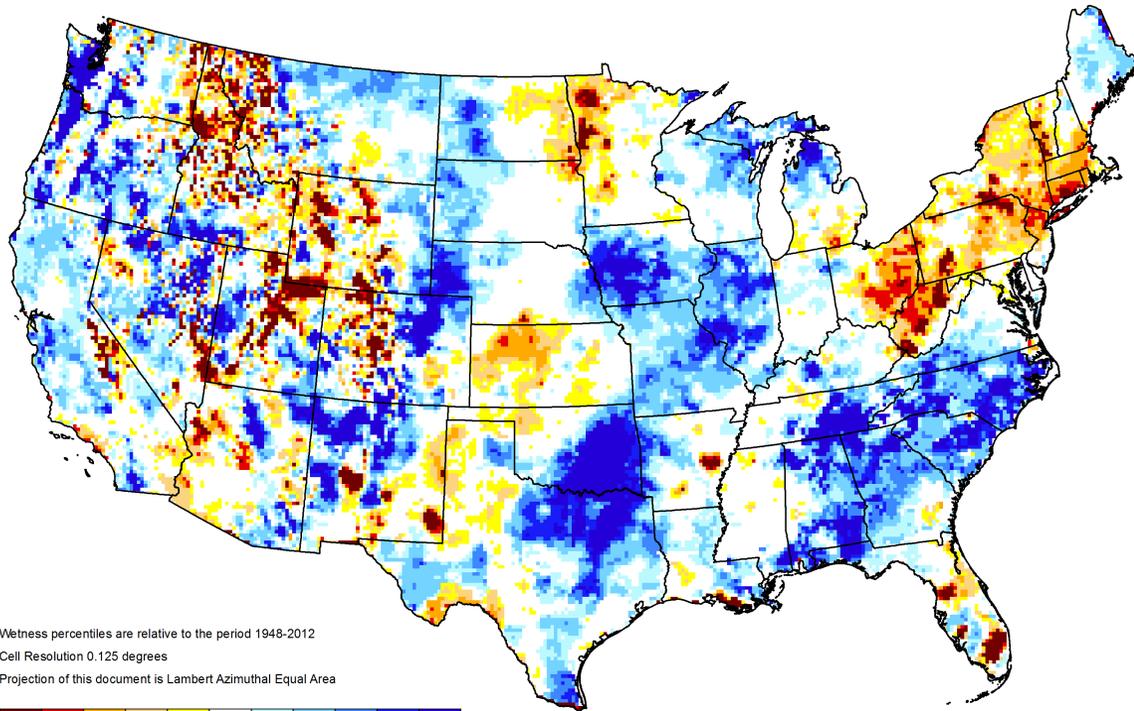
- \* **Basin-wide totals near-normal to above-normal (as of Feb 1 – current % of avg):** Idaho – Clearwater (101%); Panhandle (102%); West Central (93%); Southside Snake (104%); Upper Snake (93%); **Oregon** - Rogue/Umpqua (86%); Upper Deschutes/Crooked (90%); Willamette (96%); **Washington** - Central Columbia (104%); Lower Snake/Grande Ronde/Clearwater (101%); (Spokane (118%); Upper Yakima (112%); Lower Yakima (127%);
- \* **Below-normal levels in the Klamath (69%); Owyhee/Malheur (30%); Upper Columbia (71%); Wood/Lost River (64%).**

# Current Groundwater



## GRACE-Based Shallow Groundwater Drought Indicator

January 25, 2016



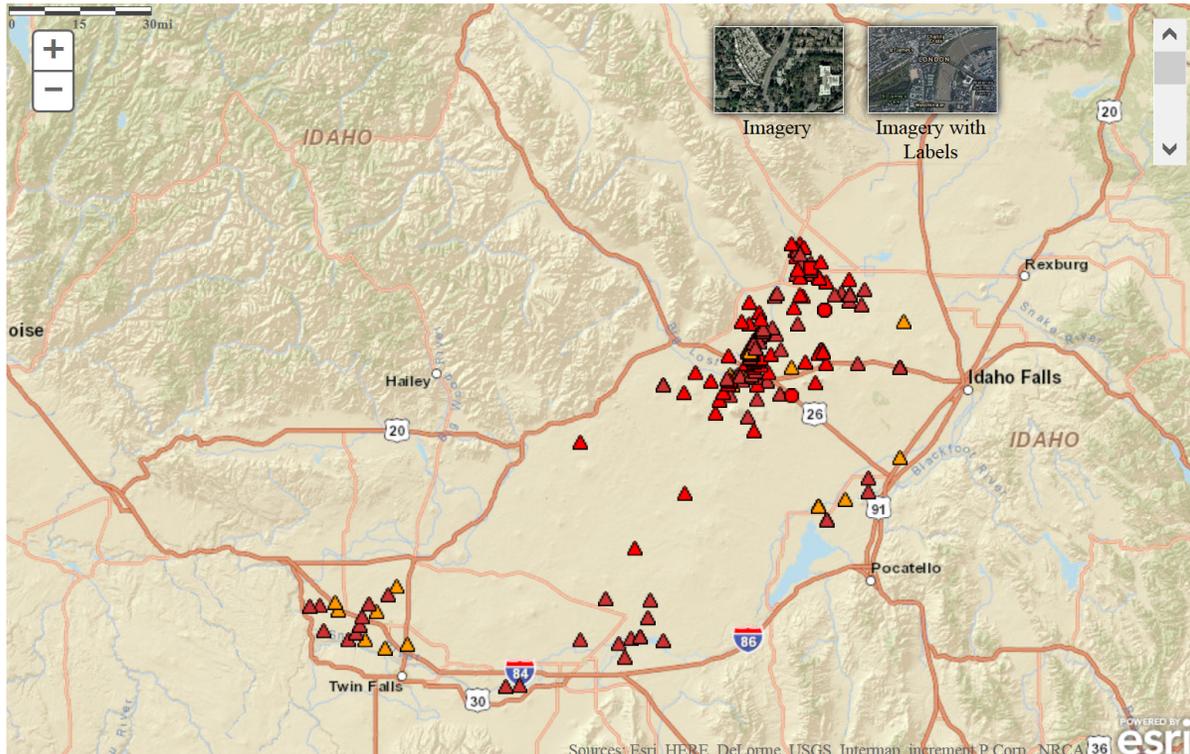
<http://drought.unl.edu/MonitoringTools/NASAGRACEDataAssimilation.aspx>

# Groundwater – cont.

## Snake River Plain & Klamath River Basin

### Idaho Below Normal Groundwater Levels

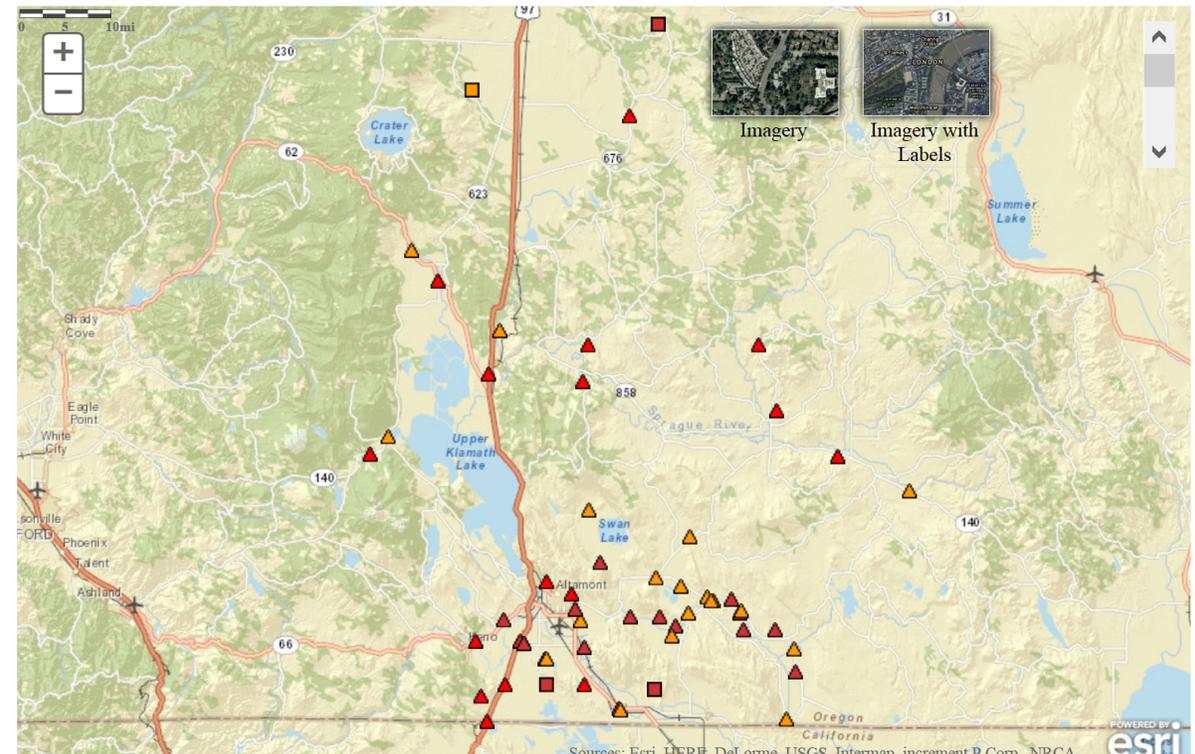
Click site symbol to open information pop-up. Click Station ID in pop-up for information and data.



Explanation - Percentile classes (symbol color based on most recent measurement)						Wells		Springs		
● Low	● <10	● 10-24	● 25-75	● 76-90	● >90	● High	● Not Ranked	○ Real-Time	□ Continuous	□ Periodic Measurements
	● Much Below Normal	● Below Normal	● Normal	● Above Normal	● Much Above Normal			○	□	□

### Oregon Below Normal Groundwater Levels

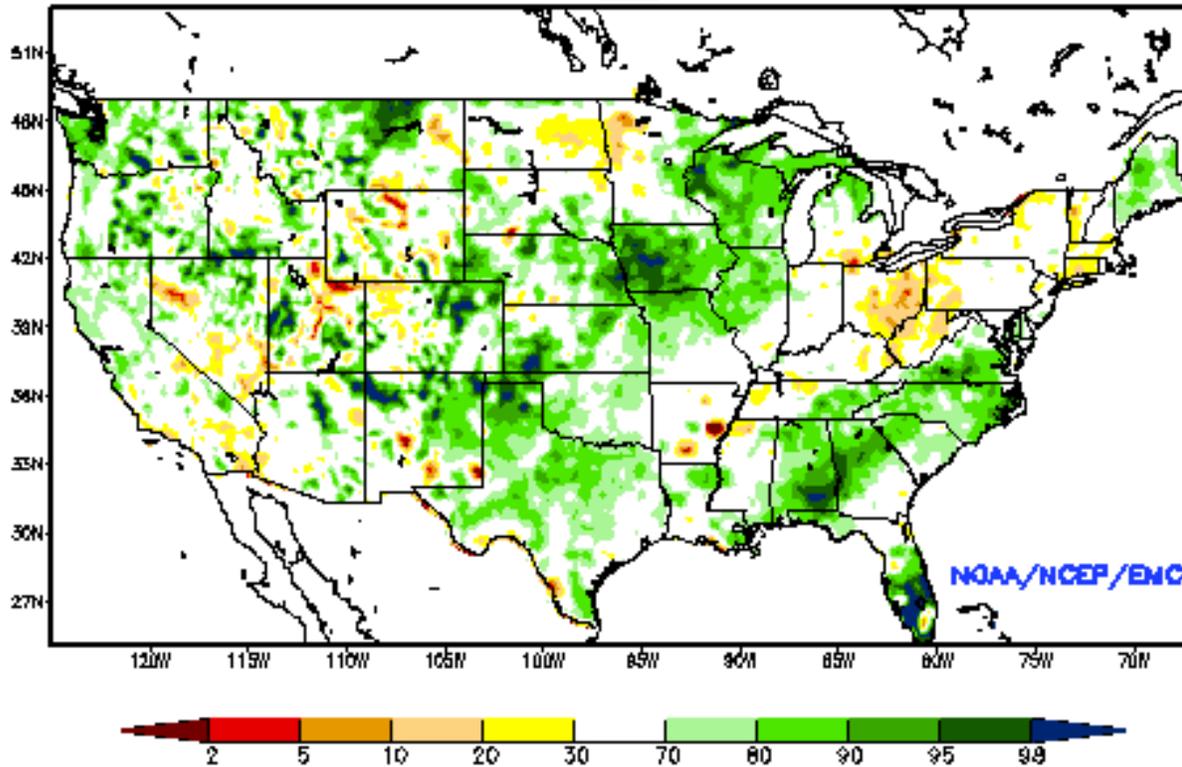
Click site symbol to open information pop-up. Click Station ID in pop-up for information and data.



Explanation - Percentile classes (symbol color based on most recent measurement)						Wells		Springs		
● Low	● <10	● 10-24	● 25-75	● 76-90	● >90	● High	● Not Ranked	○ Real-Time	□ Continuous	□ Periodic Measurements
	● Much Below Normal	● Below Normal	● Normal	● Above Normal	● Much Above Normal			○	□	□

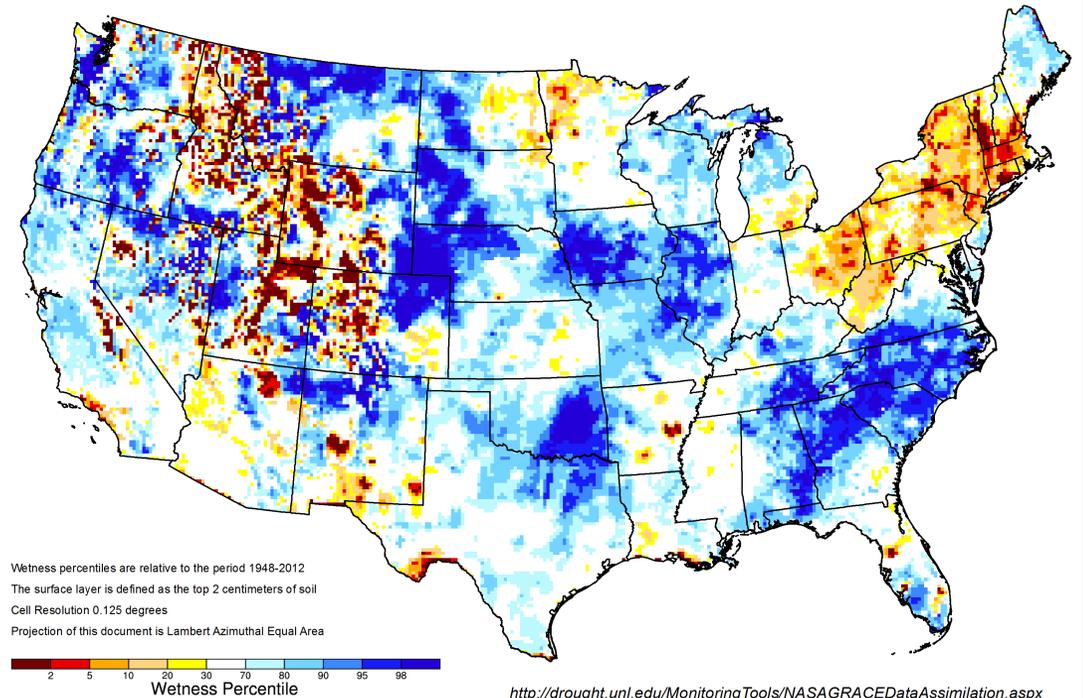
# Current Soil Moisture

Ensemble-Mean - Current Total Column Soil Moisture Percentile  
NCEP NLDAS Products Valid: JAN 28, 2016



GRACE-Based Surface Soil Moisture Drought Indicator

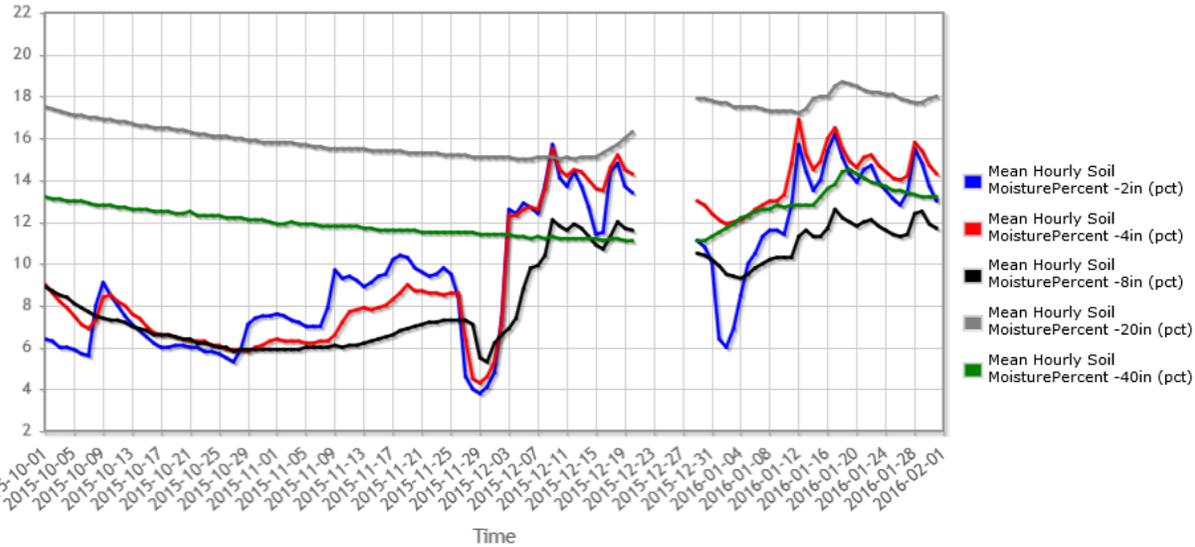
January 25, 2016



# Soil Moisture – cont.

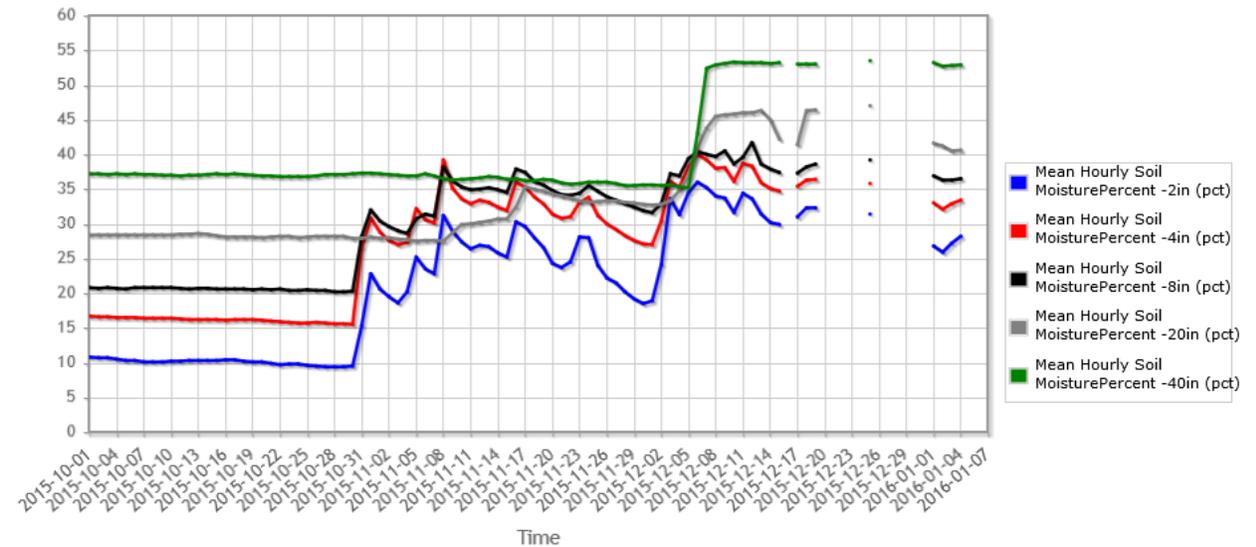
## Klamath River Basin

Lynhart Ranch (2074) Oregon SCAN Site - 4092 ft



## Lower Snake River Basin

Cook Farm Field D (2198) Washington SCAN Site - 2727 ft



# USDM Author's Perspective “Areas of Opportunity”

## Coordination

- \* Improve coordination with various sectors beyond weather-climate and hydro sectors; such as, agriculture, fisheries, recreation-tourism, and wildlife.
- \* Improve coordination with the USDA, state-level agriculture agencies, ag extension, and producers.
- \* USDM author participation on weekly/bi-weekly coordination calls.
- \* Access to a weekly or bi-weekly regional (or by river basin) drought synopsis similar to that produced by the NIDIS UCRB group. A write-up with a discussion, supporting data, issues, and recommendations is very helpful.

## Assessment & Monitoring

- \* Difficult to obtain regional drought impacts information, particularly in the agricultural sector.
- \* Low spatial density of weather-climate observing stations in southwestern Idaho and southeastern Oregon.
- \* Need for more soil moisture measurements across the region (only 5 NRCS SCAN and 9 NOAA CRN stations across the region). Need for these type of measurements to ground truth satellite-based and modelled products; such as, NASA Grace-Based and NLDAS.
- \* Agrimet stations augmented with soil moisture sensors (most only have soil temperature measurements).

Sometimes you need a secret decoder ring to figure out what and where they're talking about.



Was in Newman Grove (30 miles SW of Norfolk) on Saturday. Grass growth in pastures and ditches are just now starting to shoot the first green leaves of the season. Essentially, no significant water use has occurred in this young season. In fact, the only areas of the state that are exhibiting grass growth of any magnitude are south central and southwest Nebraska. I know everyone fixates on SPI values, but what everyone is missing is the impacts of the December, late January, and early February moisture events. December's was in the form of rain, as was most of the late January storm. The early February storm fell as snow on unfrozen ground (southern half of the state). Out of these storms we gained an average of 2 inches of soil moisture statewide, with west central Nebraska pushing 3 inches. In a normal winter there is very little change in soil moisture from December 1 to February 28. These moisture events helped to offset the dry period from mid-October through mid-December. The brunt of the dryness currently depicted on the DM is the result of the poor moisture conditions since the early part of February.

I just looked at all soil moisture sites (over grass vegetation) across the state and I would like to acknowledge a couple of observations. First, even in the worst areas of the state (SW and SC), average soil moisture values are a full 2 inches above this time last year. Second, soil moisture values haven't decreased more than 0.5 inches across SW and SC Nebraska since green up began. It is hard for me to digest that drought conditions have/are being felt much further north of I-80. Unless substantial soil moisture deficits have accumulated that could impact grass growth, I am hesitant about putting a D1 label for areas that are just showing early signs of dormancy break (north central and northeast Nebraska).

You currently have Imperial on the western fringe of D1. Soil moisture values for Imperial are running 1.5 inches above historical trend for this time of year. North Platte and Gothenburg are normal. However, Dickens and Curtis (20-30 miles south of this area) have deficits of 1.5 to 2.5 inches. Therefore, I propose to take your D1 line and shift it south so that the northern fringe covers the southern 10 miles of Lincoln county. At the eastern edge of Lincoln county, bend your line northeast to pass half way between Gothenburg and Cozad. Cozad has a soil moisture value 2.0 inches below normal. Then move your line northeast to the southeast corner of Rock county. All stations to the northwest of this line have surplus moisture balances of 0.50 to 1.50 inches. This will essentially shave off a thin sliver of the west edge depiction of the D1.

Now to the more difficult D1 depiction. Pull the D1 eastward in central Nebraska such that Hastings and Grand Island are in D1. Minden, Grand Island, and Shelton have 1.5 to 3.0 inch moisture deficits. Take the D1 line up the Platte river to half way between Central City(northern Hamilton county) and Monroe (SW Platte county). Central City is down 1.5 inches, while Monroe is right at it seasonal average. Then take the D1 line and bend it toward the northwest to 20 miles east of O'Neill. Elgin, Norfolk, and Concord (Dixon, UNL research center) all have surplus moisture values ranging from 1.0 to 2.5 inches above seasonal normals. From O'Neill, draw the D1 line

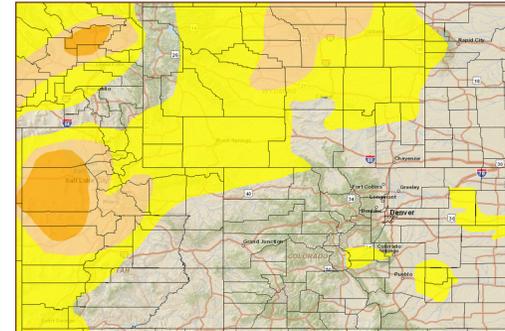
# NIDIS Upper Colorado River Basin Example

## SNOTEL Precipitation Percentiles:

- SNOTEL Water Year precipitation percentiles in the Upper Green Basin are mostly below the median. Percentiles in the northern portions of Sublette County are mostly in the 20-40th percentile range. Percentiles in Lincoln and southern Sublette counties are below the 20th percentile.
- The Uintah Range is in the average range, but there is a lot of spread. SNOTEL water year to date percentiles are between 21st and 85th.
- In the Wasatch Range there is a gradient from north to south with the northernmost percentiles being the lowest. The southern Wasatch Range and all SNOTEL precipitation percentiles in southeast Utah are well above average with one exception in Plute County.
- The northern Rockies in Colorado extending into Wyoming percentiles are in the normal range. A few percentiles in Routt, Larimer and along the Divide in Grand counties, are above the 60th percentile. There is one lingering anomaly at the 4th percentile that may be an error.
- The Rockies of central Colorado have fallen a little in percentile ranking, but are still in pretty good shape. There is an anomaly in Eagle County at the 9th percentile, but the rest range from the 19th to 63rd percentile.
- The San Juans are well above average for the water year to date. Percentiles are above the median, with most above the 70th percentile. Percentiles in Mineral and Hinsdale Counties are lagging behind a little bit.
- The Sangre de Cristos are slightly above average, and range from 43-76.

## SWE Timeseries Graphs:

- Most river basins stayed right about on track with median snowfall numbers through the week. The biggest rise with respect to the median was the Yampa River Basin (+4%), and the biggest fall was in the San Juan River Basin (-4%).
- The Upper Green Basin is slightly below normal, at 91% of median snowpack for the season to date.
- The Duchesne basin is at 93% of median snowpack.
- The Yampa River Basin is at 97% of median snowpack to date.
- The Upper Colorado River Mainstem is now at 101% of median snowpack.
- The Gunnison Basin is at 111% of median snowpack for the season to date.
- The San Juan Basin is at 101% of median snowpack to date.



## Summary: January 26, 2016

Temperatures over the past week were slightly above average for the UCRB with some good precipitation for the Uintah Mountain Range, and for the northern Rockies in Colorado and Wyoming. With the coming weekend's storm expected to once again favor the Upper Green River Basin and the Yampa and White Basin the most favorable snowpack with respect to average seems to be shifting from south to north. East of the divide conditions were warm and dry. This is expected to continue through the week. Some light precipitation is possible for northeast Colorado this coming weekend, but southeast Colorado is forecast to stay warm and dry again.

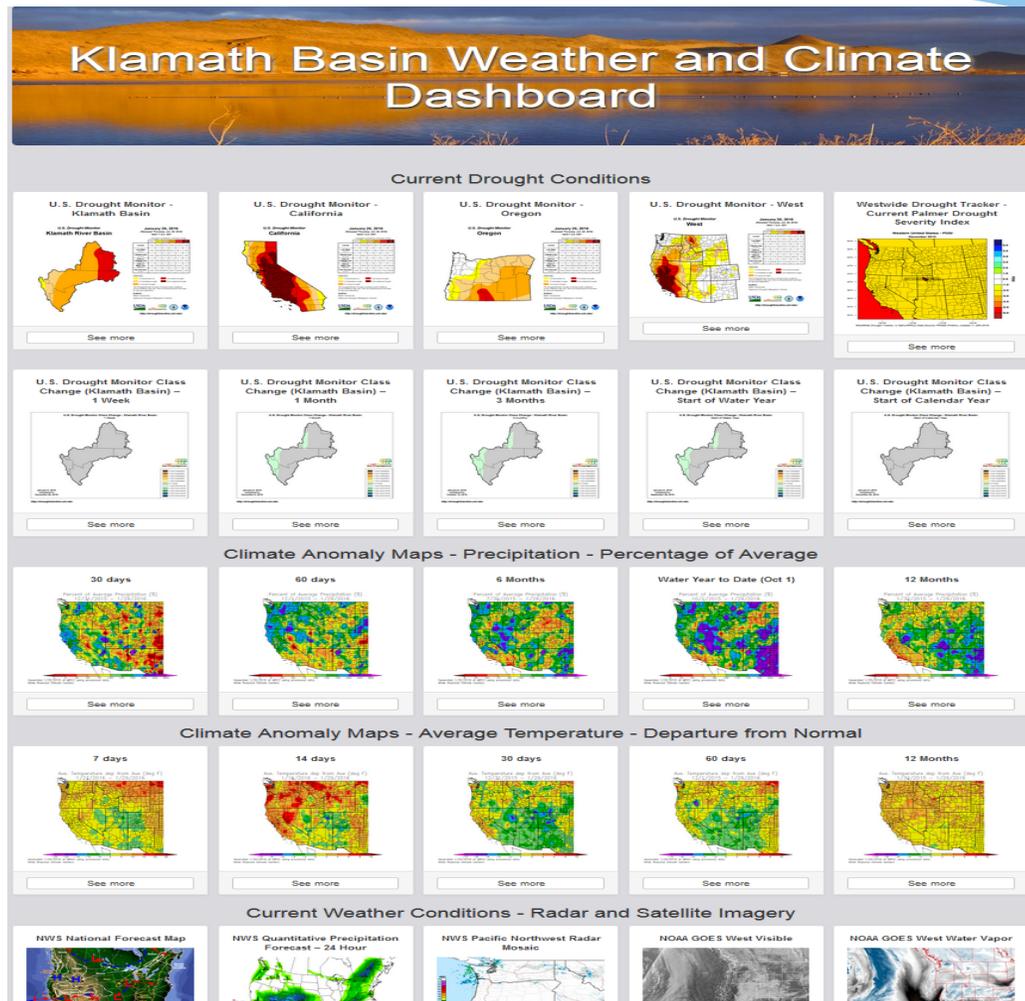
SPIs are low at both one and six month timescales now for Washington County in northeast Colorado, and for Summit, Park, and Clear Creek Counties in central Colorado. For the time, this appears less problematic in central Colorado as Colorado Mainstem and South Platte snowpack for the year to date are still in good shape and SNOTEL water year to date precipitation percentiles are still in the normal range. The VIC model shows drier soils in Washington County that corroborate the lower SPIs, and even though potential evapotranspiration is very low in the winter with respect to other times of year, 12-week EDDI is showing some drying at the southern end of Washington County.

## Recommendations:

**UCRB:** Status quo. Southern Carbon County is looking like it could be improved to Dnada in the near future if the forecast pans out, but a couple low SNOTEL precipitation percentiles are keeping me cautious.

**Eastern Colorado:** Status quo. D0 looks like it could be extended slightly in southeast and northeast Colorado, but any changes made would be very fine scale.

# Klamath Basin Weather & Climate Dashboard



- \* <http://wrcc.dri.edu/klamathbasin/>
- \* Developed through support from NIDIS.
- \* Developed and administered by the Western Regional Climate Center.
- \* Intended to serve as a “one-stop shopping” for weather, climate, and drought-related information and products for the Klamath River Basin and western U.S. as well as a bridge between the CA/NV Drought coordination group and PNW coordination activities.
- \* Development of the website and associated data products build upon user data needs identified through the NOAA SARP Project: ***From Fisheries to Family Farmer: Improved Products for Communicating Water Supply, Drought, and Climate Change Risk for Daily Decision-Making Within the Klamath Basin*** (PI’s – Dr. Mark Deutschman, Houston Engineering; Rob Hartman, NWS CA-NV River Forecast Center; and Dr. David Garen, NRCS National Water & Climate Center)

# Klamath Basin Data Needs

[http://www.klamathdss.org/5.14.14\\_UserRequirementsReport.pdf](http://www.klamathdss.org/5.14.14_UserRequirementsReport.pdf)

## User Needs Report

Final • April, 2014

The Role of Climate and Water Resources Data in Societal Decisions  
within the Klamath Basin of Oregon and California

A User Requirements Framework for the Western United States



## Climate and Water Data

### Data Type

- Surface air temperature;
- Precipitation;
- Snowfall (depth);
- Growing degree days;
- Snow water equivalent;
- Streamflow;
- Groundwater elevation;
- Lake/reservoir surface water elevation ;
- Soil Moisture; and
- Evapotranspiration.

### Temporal Scale

- Instantaneous (near real-time, generally 15-minute);
- 1-hour;
- Last 1-day;
- Last 7 days;
- Last 14 days;
- Last 1, 2, 3, 4, 5, 6, 7, 8, 9, 10, 11, 12, 15, 18, 24, 30, 36, 48, 60, and 72 months, ending on the last day of the latest month;
- Water Year To Date (WYTD); and
- Calendar Year to Date (CYTD).

Thank You!  
Questions or Comments?

