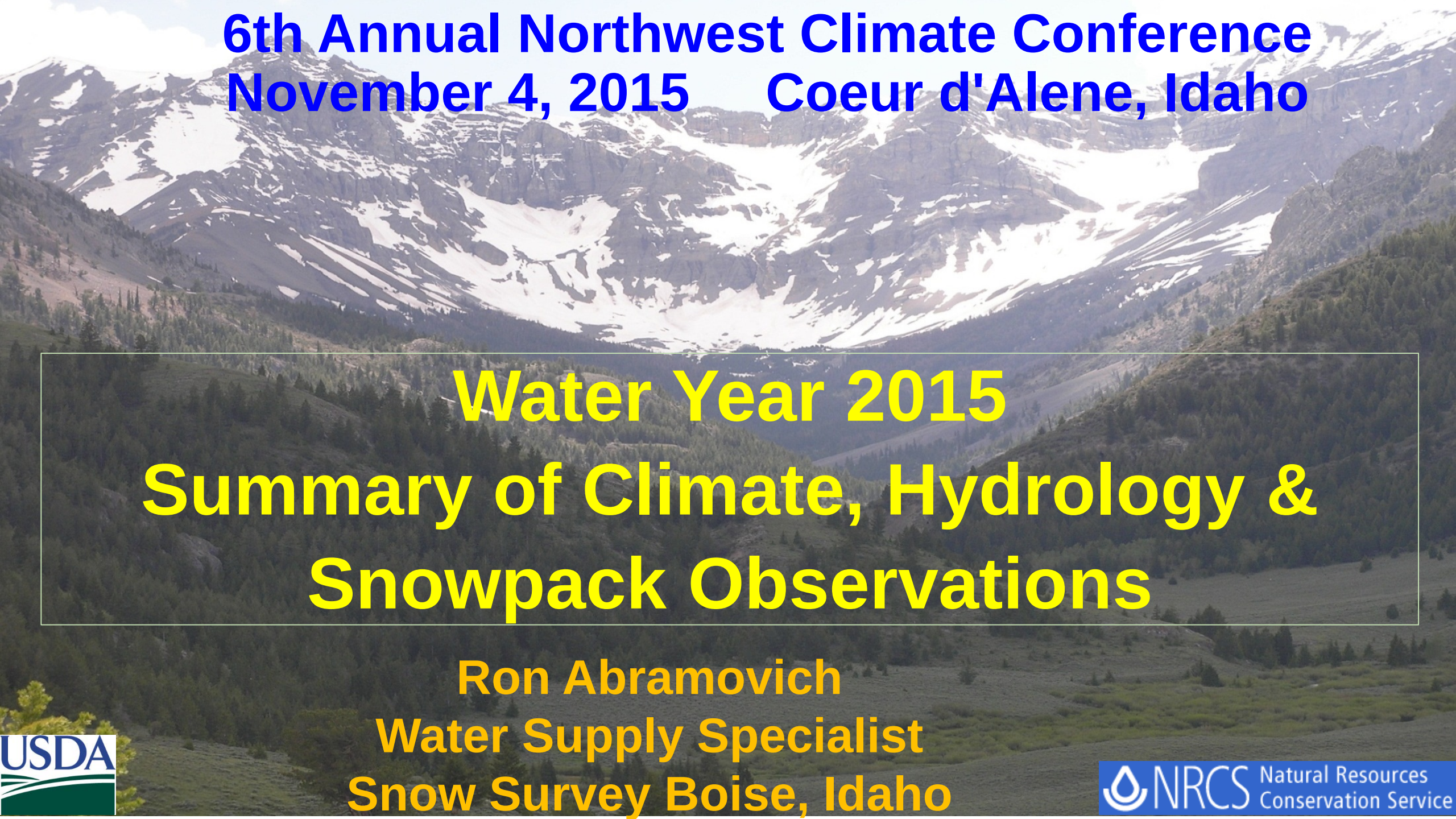


6th Annual Northwest Climate Conference
November 4, 2015 Coeur d'Alene, Idaho

Water Year 2015
Summary of Climate, Hydrology & Snowpack Observations

Ron Abramovich
Water Supply Specialist
Snow Survey Boise, Idaho

USDA

NRCS Natural Resources Conservation Service

Water Year 2015 Summary of Climate, Hydrology & Snowpack Observations

Abstract

Water year 2015 was very unique in terms of climate variability in Idaho and the Pacific Northwest.

We'll discuss fall precipitation, the November arctic cold spell and how Christmas brought the best powder skiing conditions for the year.

Development of the 'Snow Drought' and impacts from two Atmospheric River events that produced early runoff before the typical snowmelt runoff forecast period even started.

A dry and warm March and April closed ski areas early and produced record high early irrigation demand.

May's rains provided some relief for southern Idaho irrigators.

Record high June temperatures gave way to more reasonable July temperatures as the summer fire season grew in intensity.

After the past unique year and several since 2011, everyone is looking and wondering what the winter of 2016 will bring to the Pacific Northwest.

USDA

Water Year 2015 Summary of Climate, Hydrology & Snowpack Observations

Abstract

Water year 2015 unique

November arctic cold spell

best powder skiing

‘Snow Drought’ two Atmospheric River events

dry and warm March and April record high early irrigation demand.

May’s rains

Record high June temperatures reasonable July temperatures

past unique year and several since 2011

winter of 2016

USDA

Rain is good but snow is better. **Summary Slide**

Good mountain snowpacks allows for better planning by farmers & water managers, but that doesn't always happen…

With increase in climate variability –

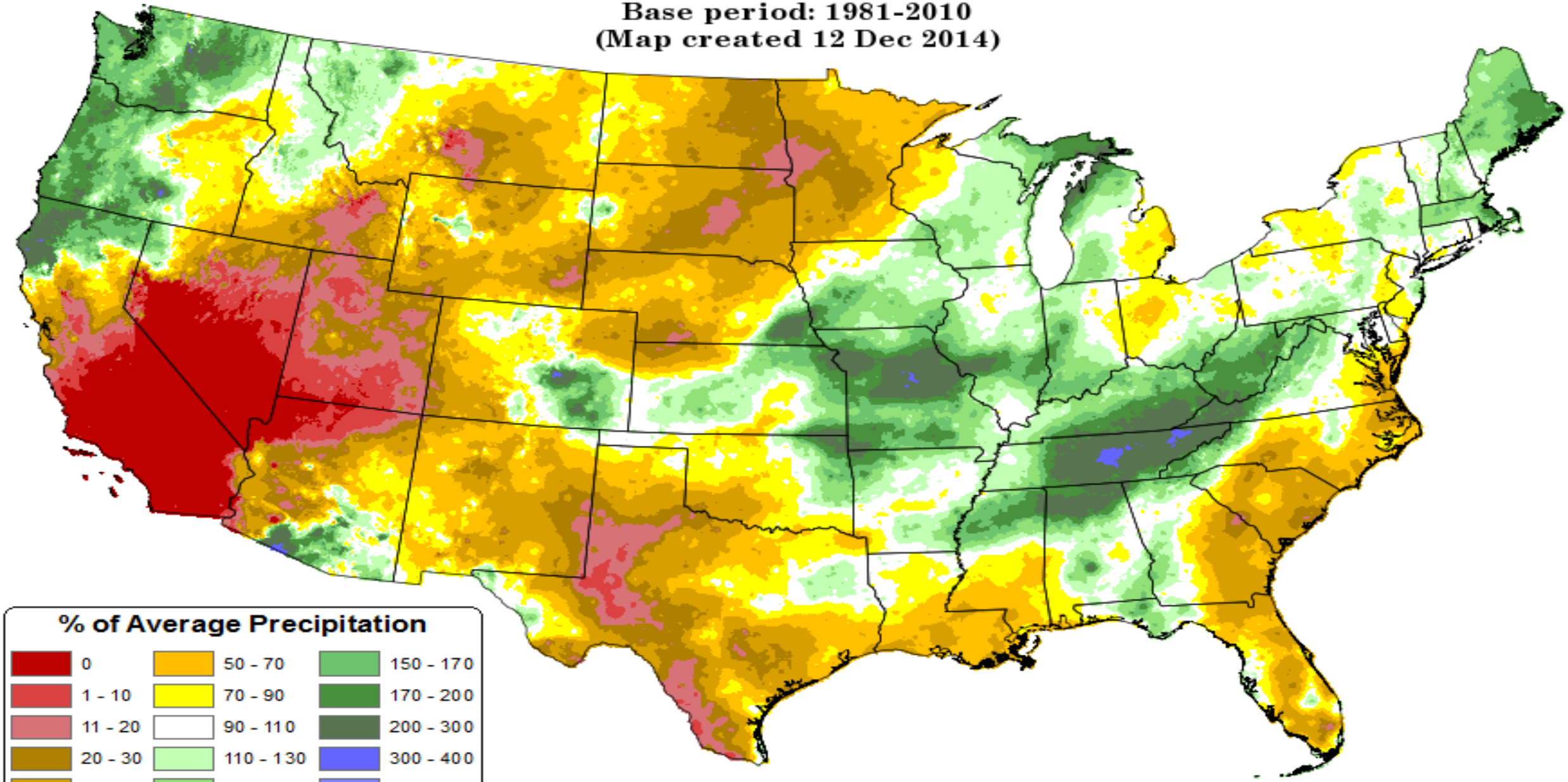
Key is understanding the storm track that brings moisture to your basin and what makes it flow (snow cover area & rain intensities)

USDA

Questions/Comments

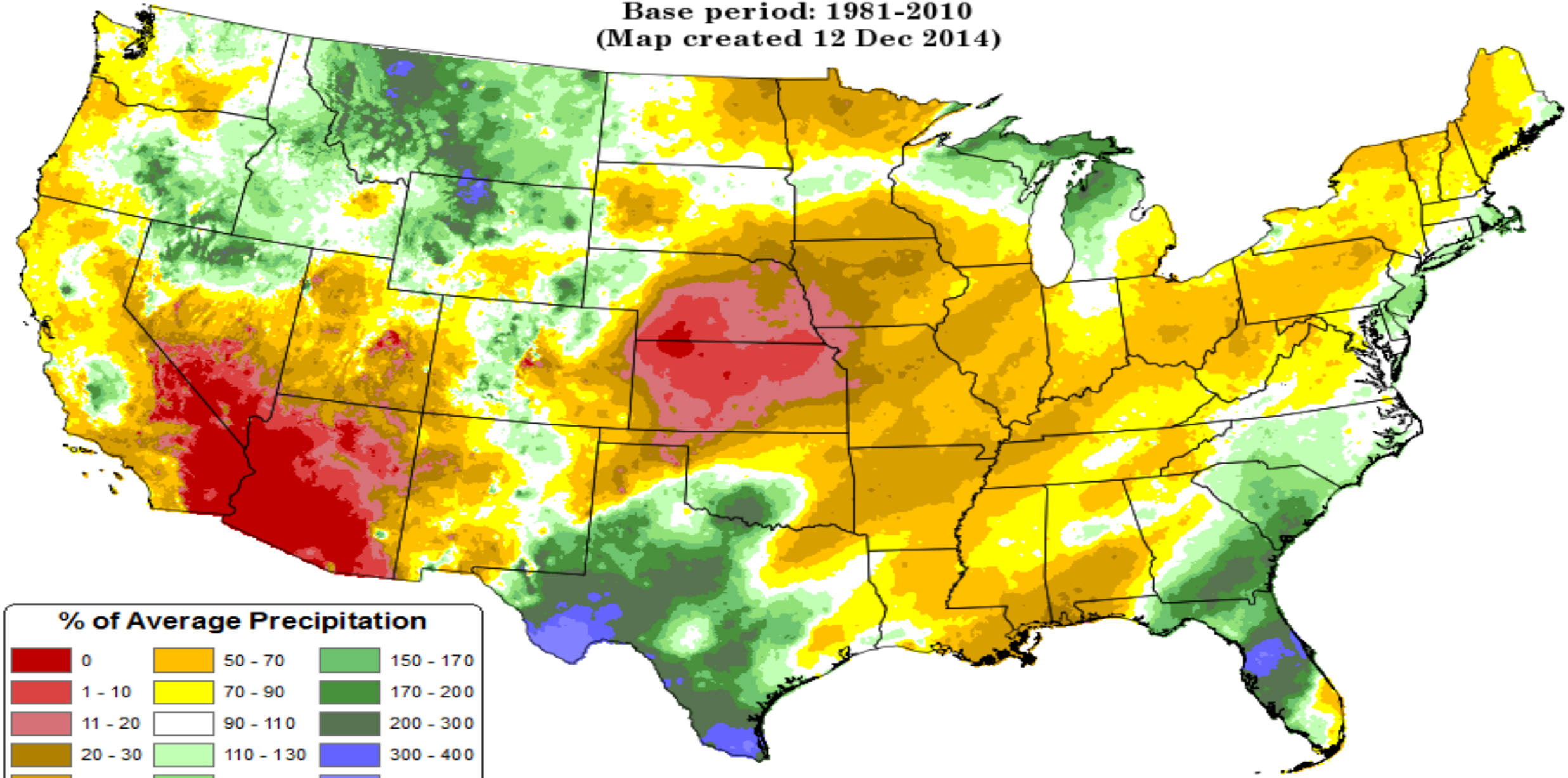
Total Precipitation Anomaly: October 2014

Period ending 31 Oct 2014
Base period: 1981-2010
(Map created 12 Dec 2014)



Total Precipitation Anomaly: November 2014

Period ending 30 Nov 2014
Base period: 1981-2010
(Map created 12 Dec 2014)



- Nov 2014 Arctic Cold Spell suddenly spilled into Idaho from Montana
- Went from 50s F to single digits in a few days

- MF Salmon River basically froze overnight

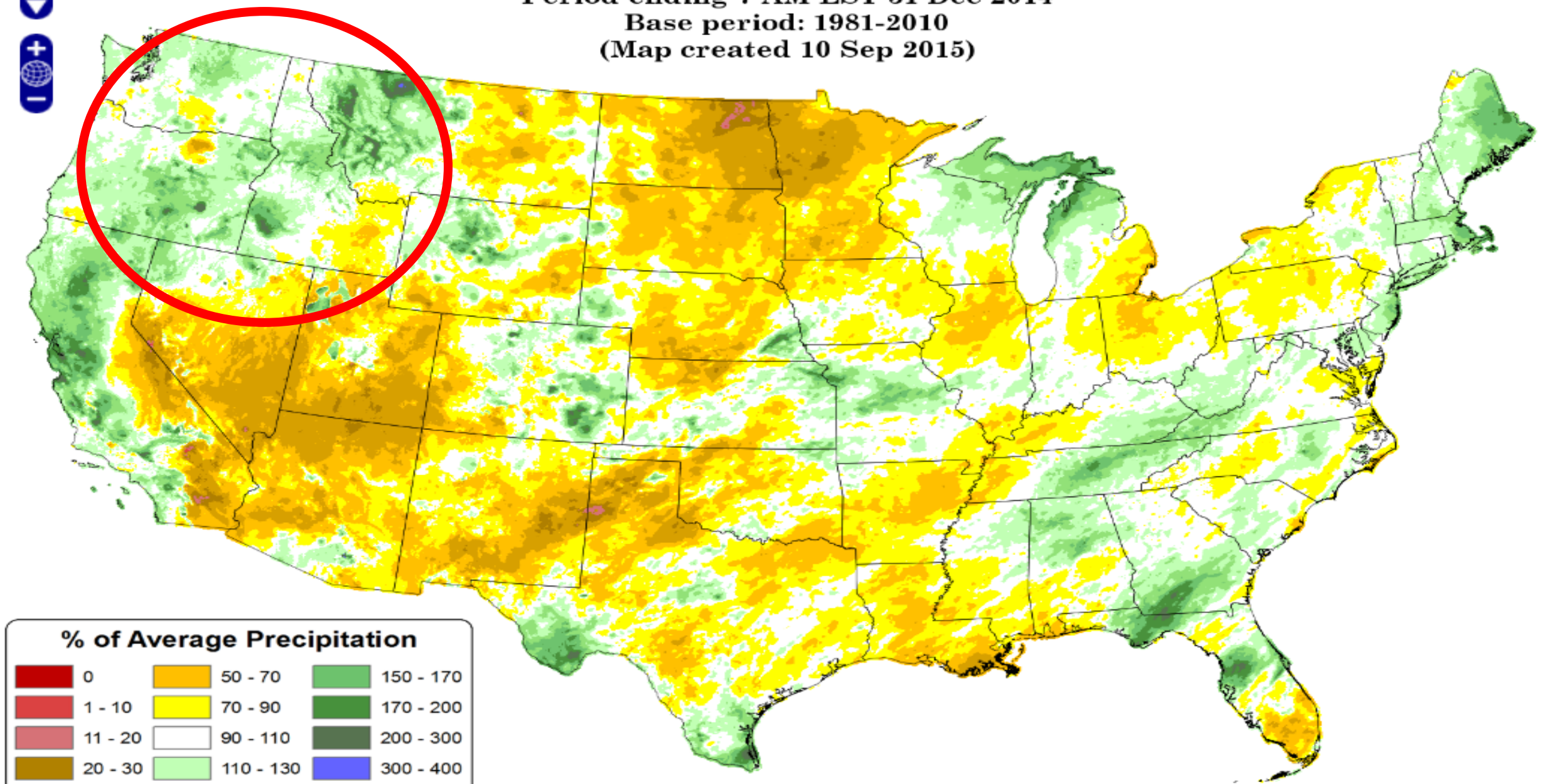
USDA

Total Precipitation Anomaly: October 2014 - December 2014

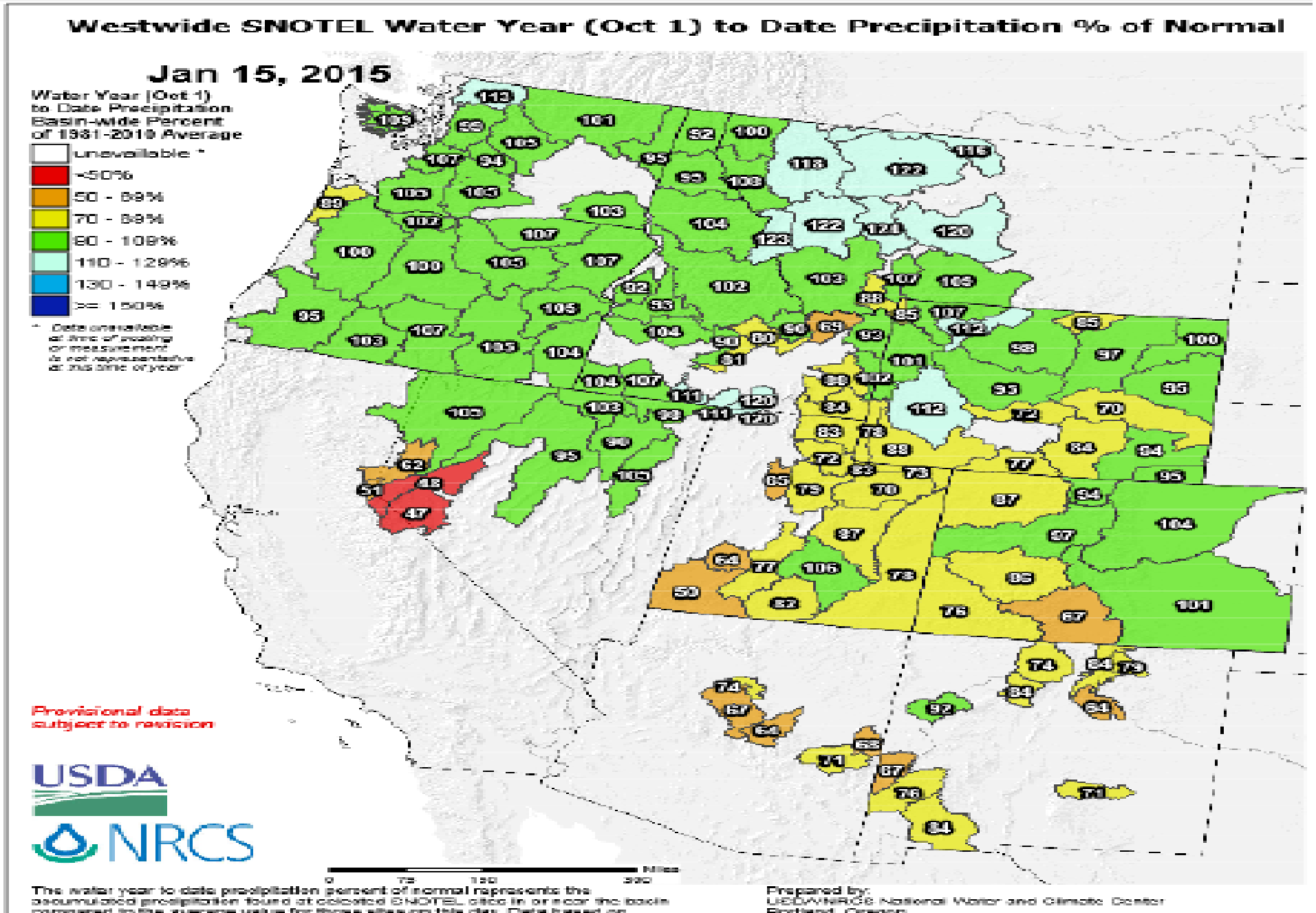
Period ending 7 AM EST 31 Dec 2014

Base period: 1981-2010

(Map created 10 Sep 2015)



SNOTEL Mountain Precipitation Water Year to Date: Jan 15, 2015

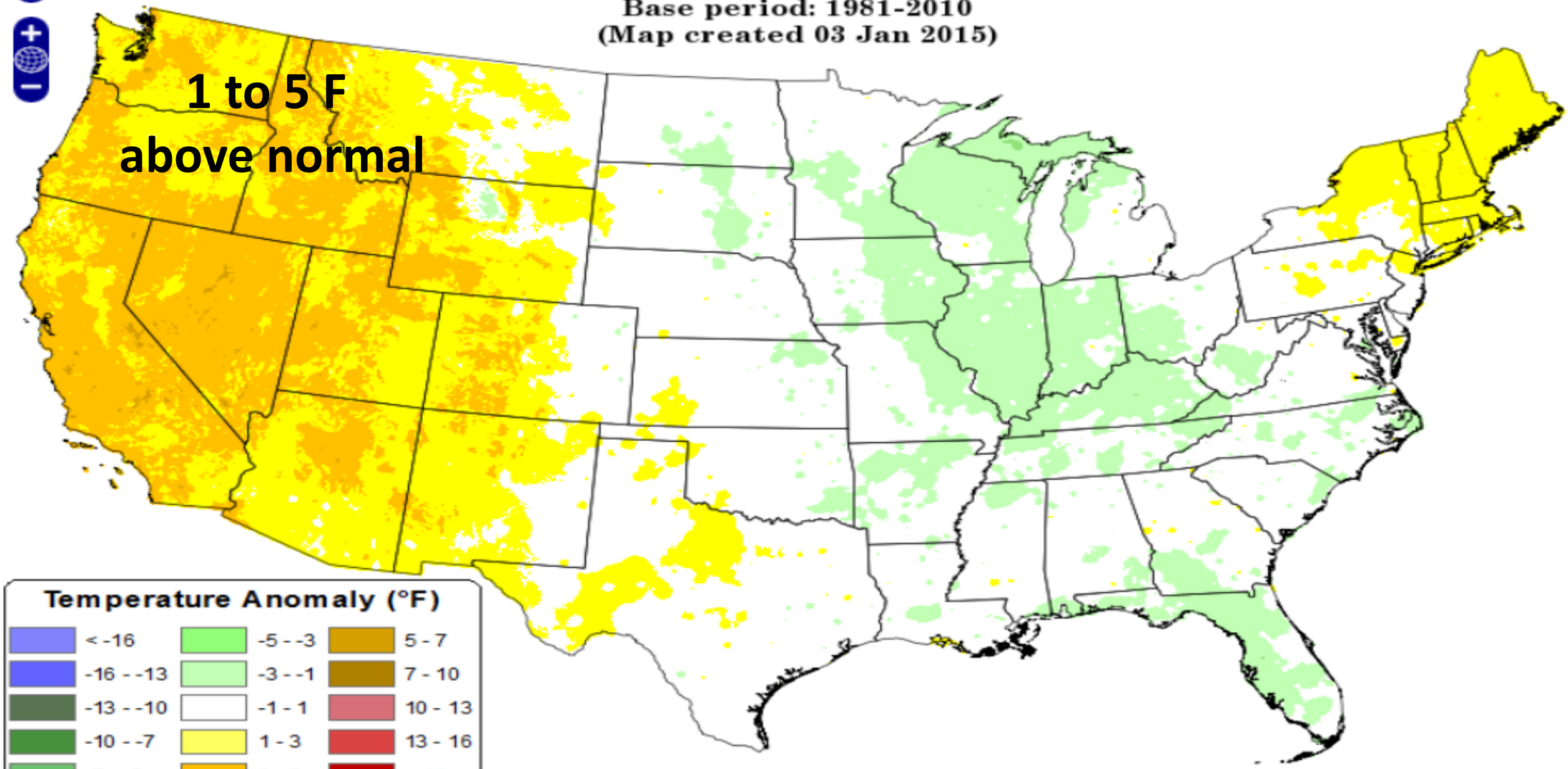


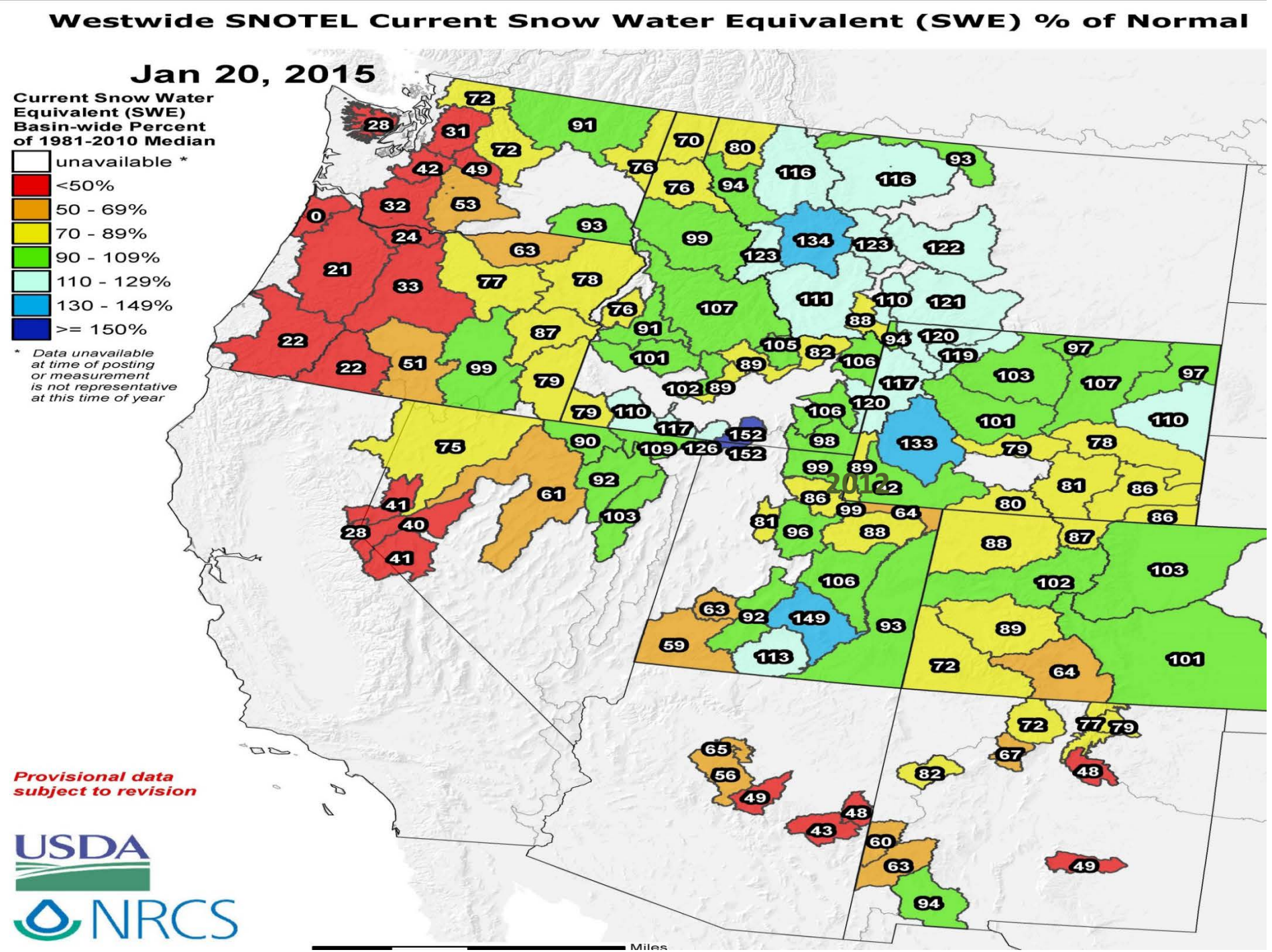
Normal or better across PNW

NOT a Precipitation Drought

Daily Mean Temperature Anomaly: October 2014 - December 2014

Period ending 7 AM EST 31 Dec 2014
Base period: 1981-2010
(Map created 03 Jan 2015)





Snow Drought!

Cold Christmas temperatures brought best powder ski days of the year to ID MT WY

March 11, 2015 Lost-Wood Divide SNOTEL Site

We hide 'em on north facing slopes that tend to hold on to the snow

Photo by Ray Gadd

Skiing Impacts

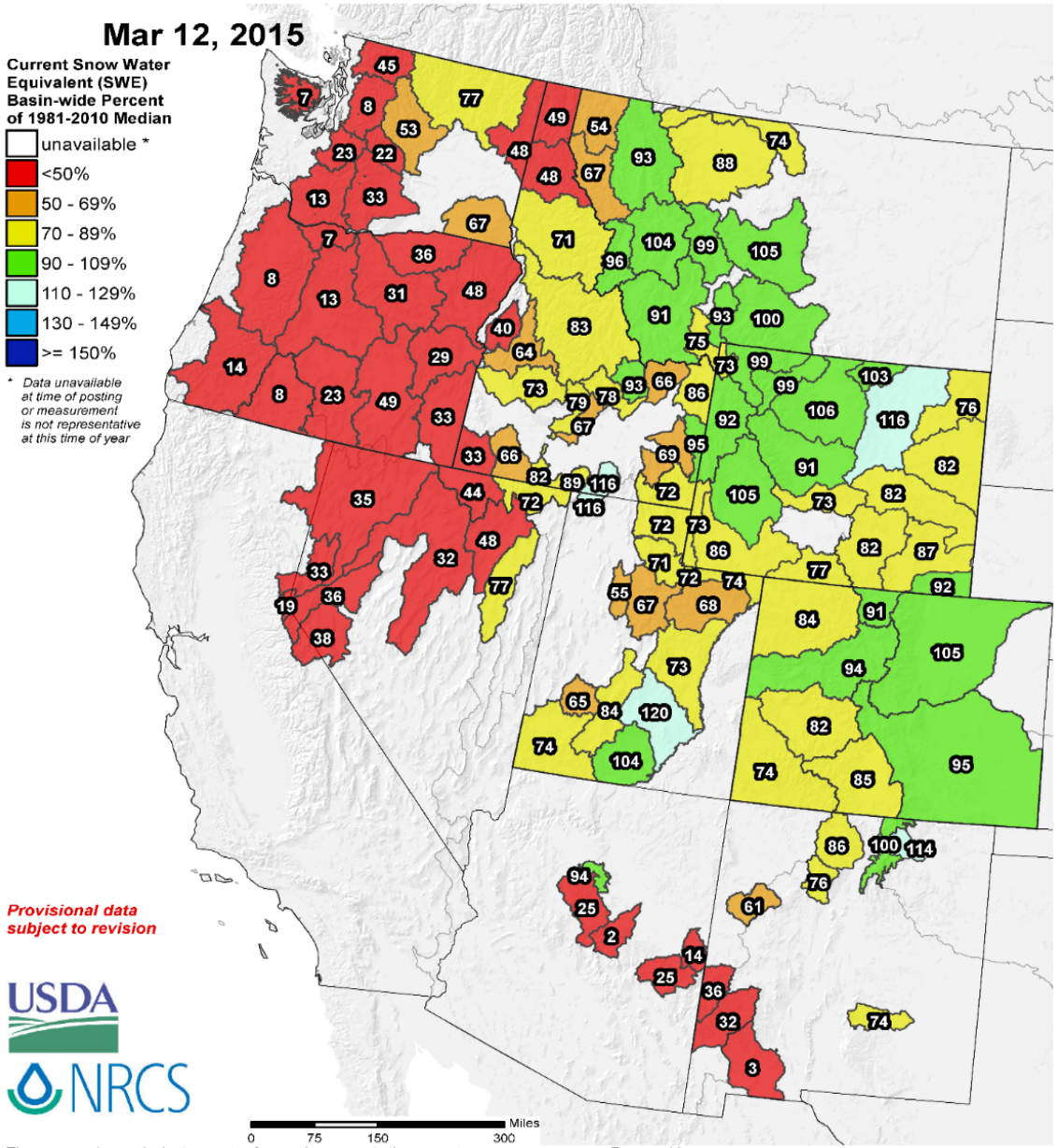
- Ski Races Moved
- Skier Days Down
- Season Pass Sale Down

Photo taken by Ray Gadd March 11, 2015 looking east over Ketchum in Big Wood River valley illustrating lack of snow on south facing slopes.

USDA

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

Mar 12, 2015

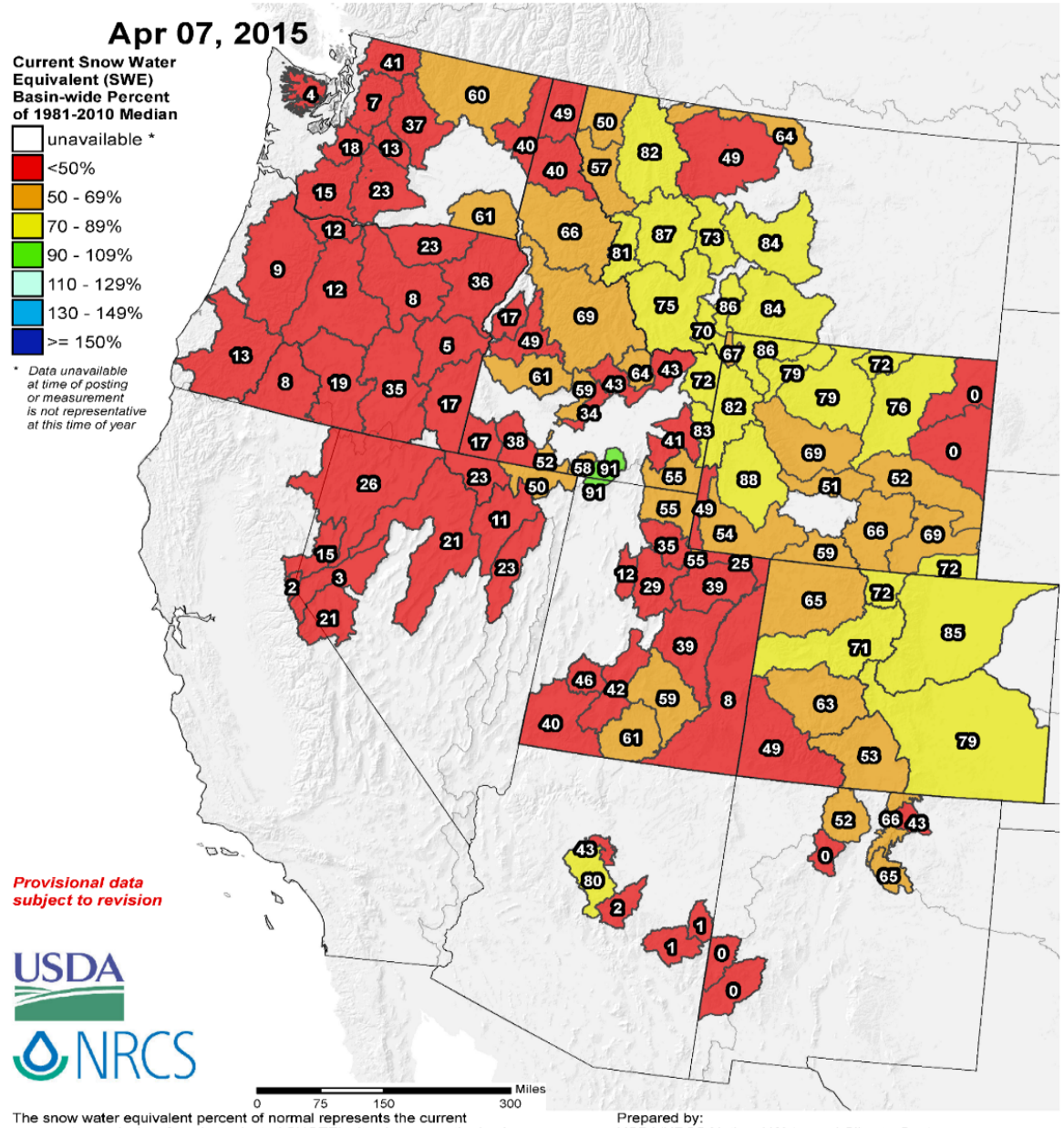


The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

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

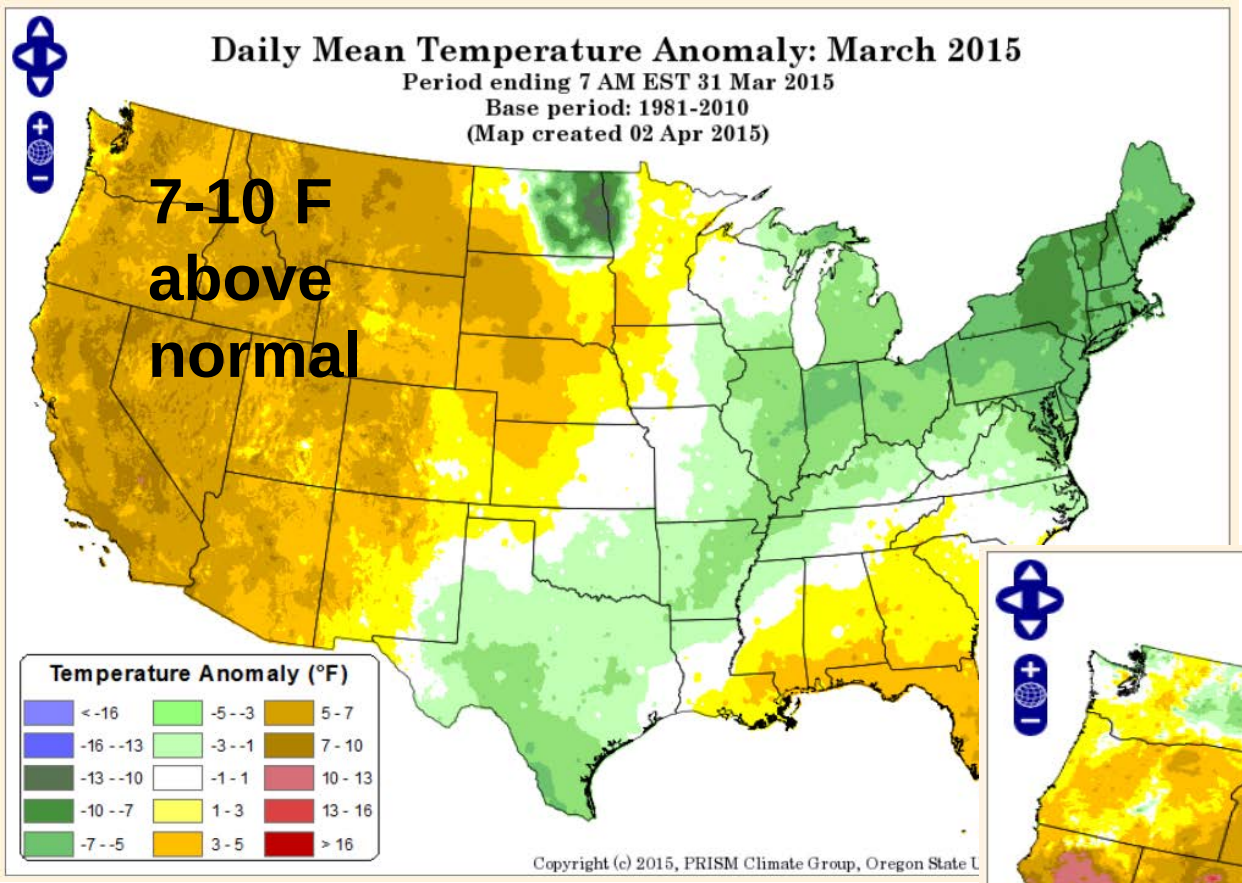
Apr 07, 2015

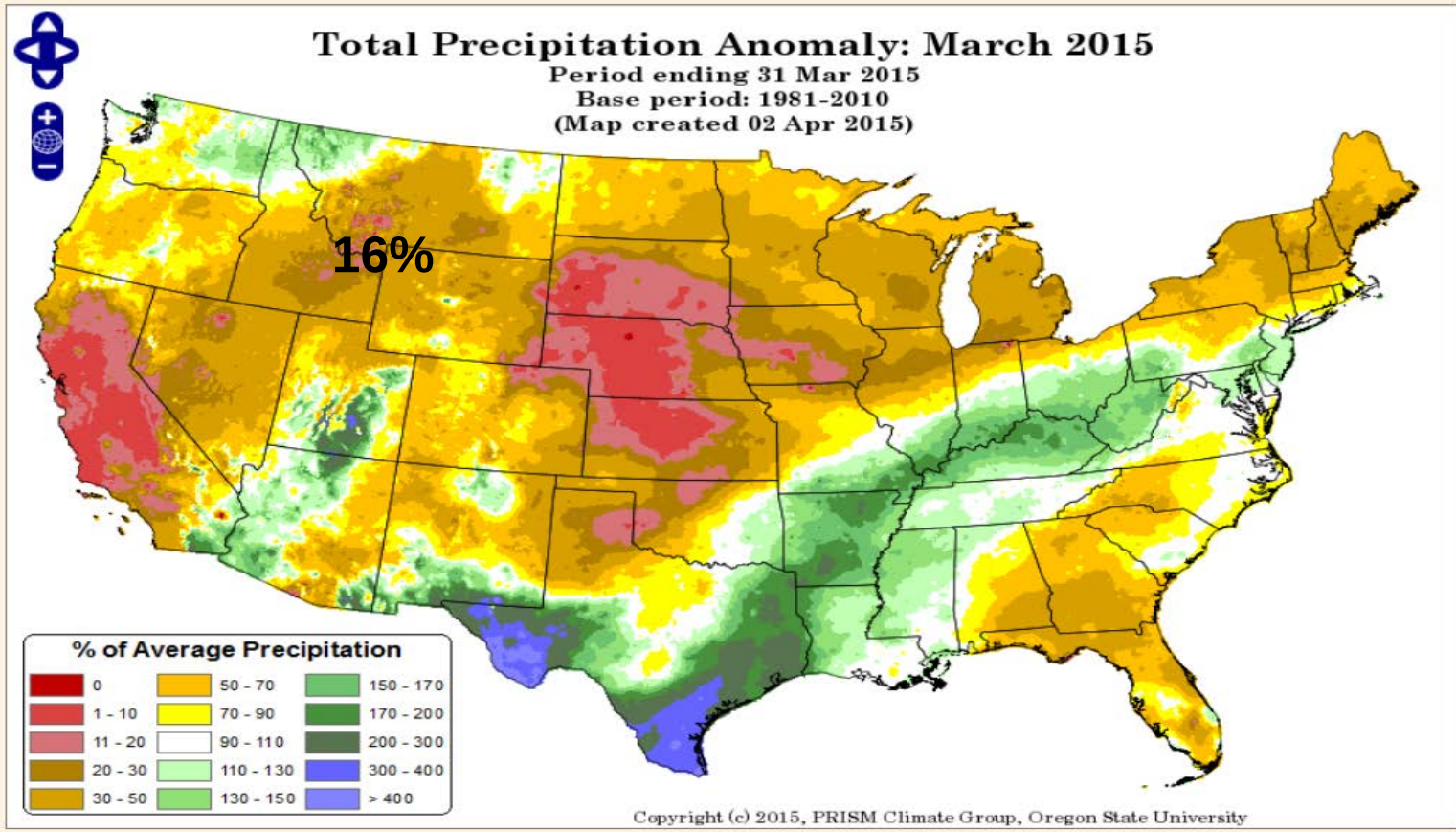


The snow water equivalent percent of normal represents the current snow water equivalent found at selected SNOTEL sites in or near the basin compared to the average value for those sites on this day. Data based on the first reading of the day (typically 00:00).

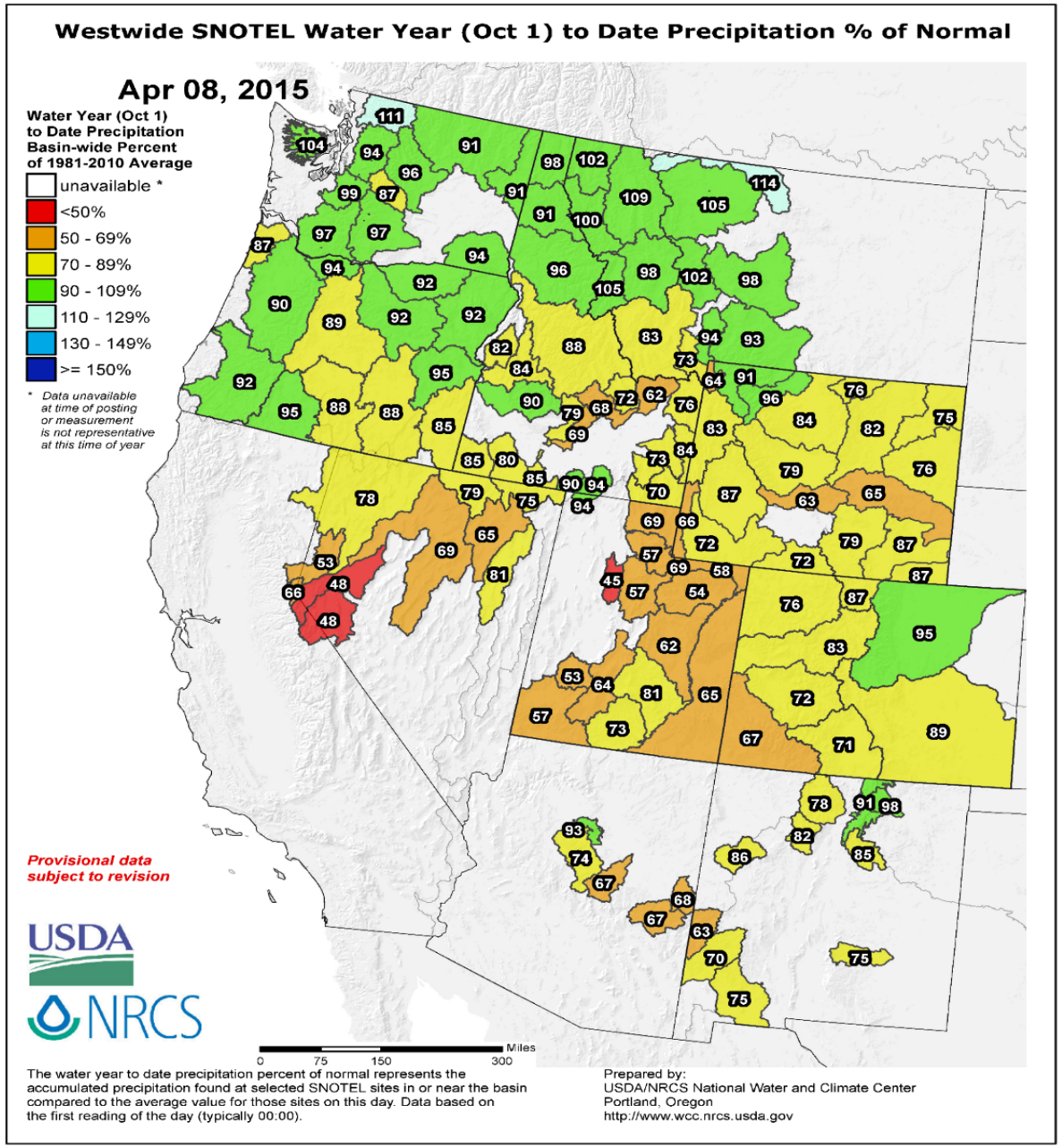
Prepared by:
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov

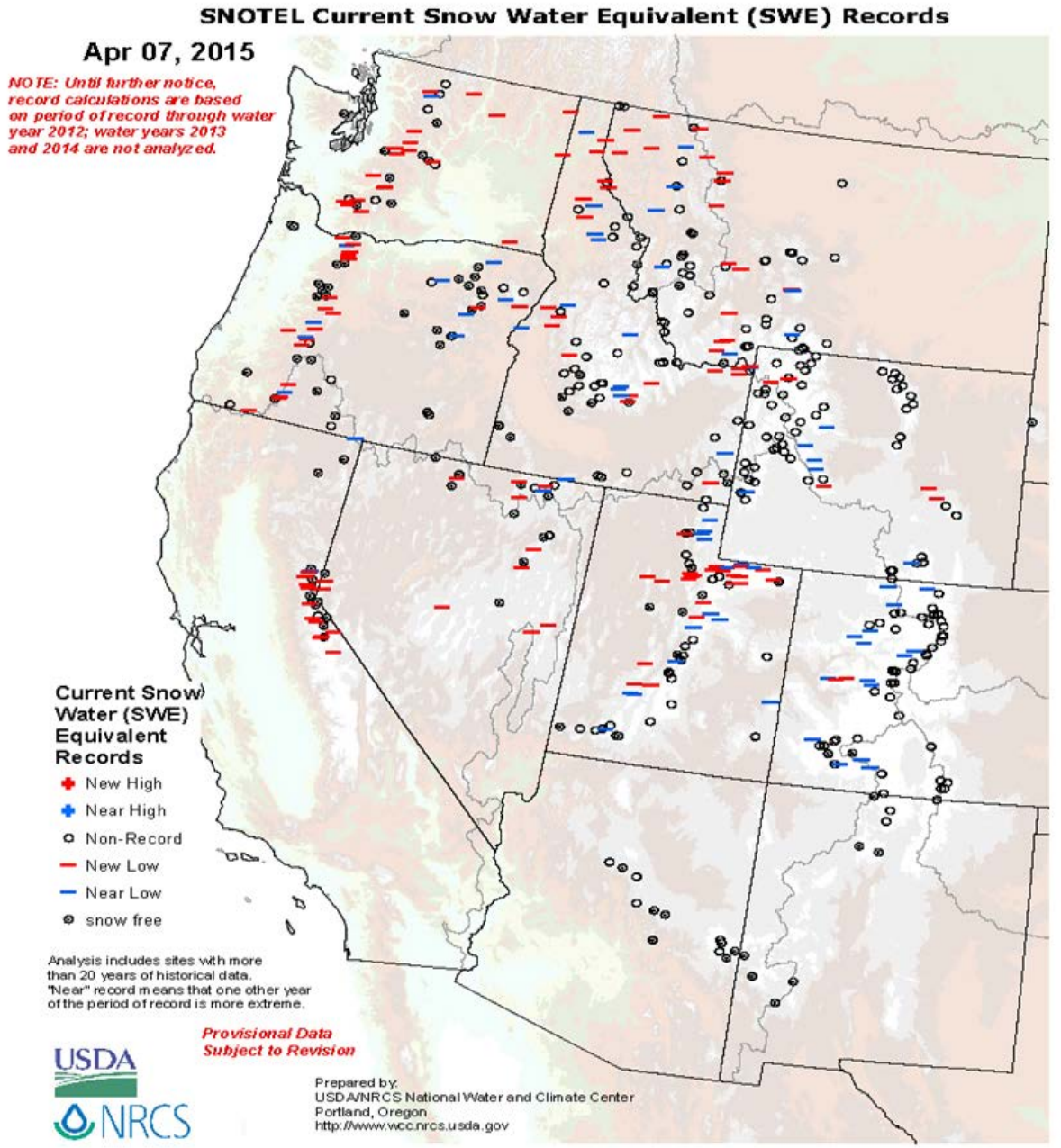
Combined Above Normal March Temperatures & Below Normal Precipitation Deteriorated Idaho's Snowpack and much in PNW





Water Year to Date Precipitation April 7, 2015 Record Low Snow





Montana --- Mean temperature departure & precipitation falling normal Nov 1 – Mar 31:

Twelve Mile: 3.8F 5600 ft

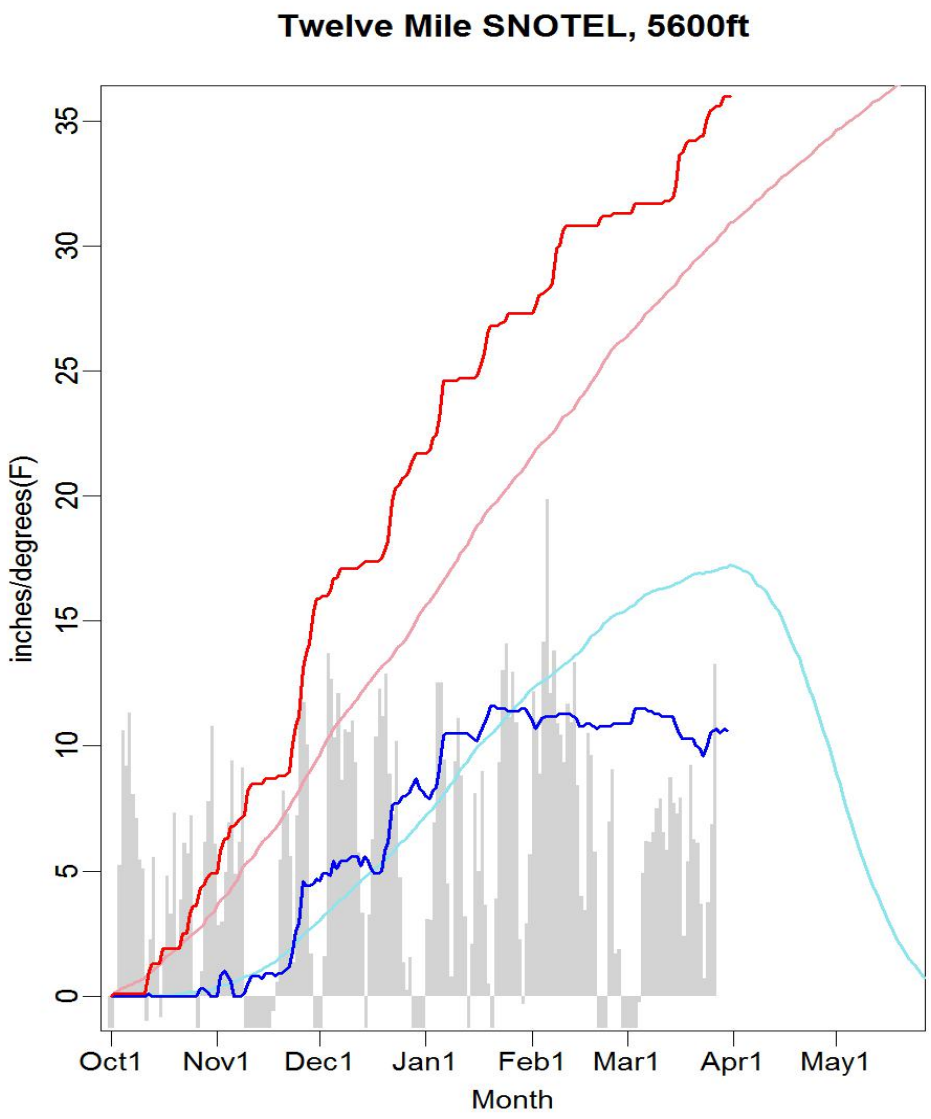
Normally 70% precip falls as snow

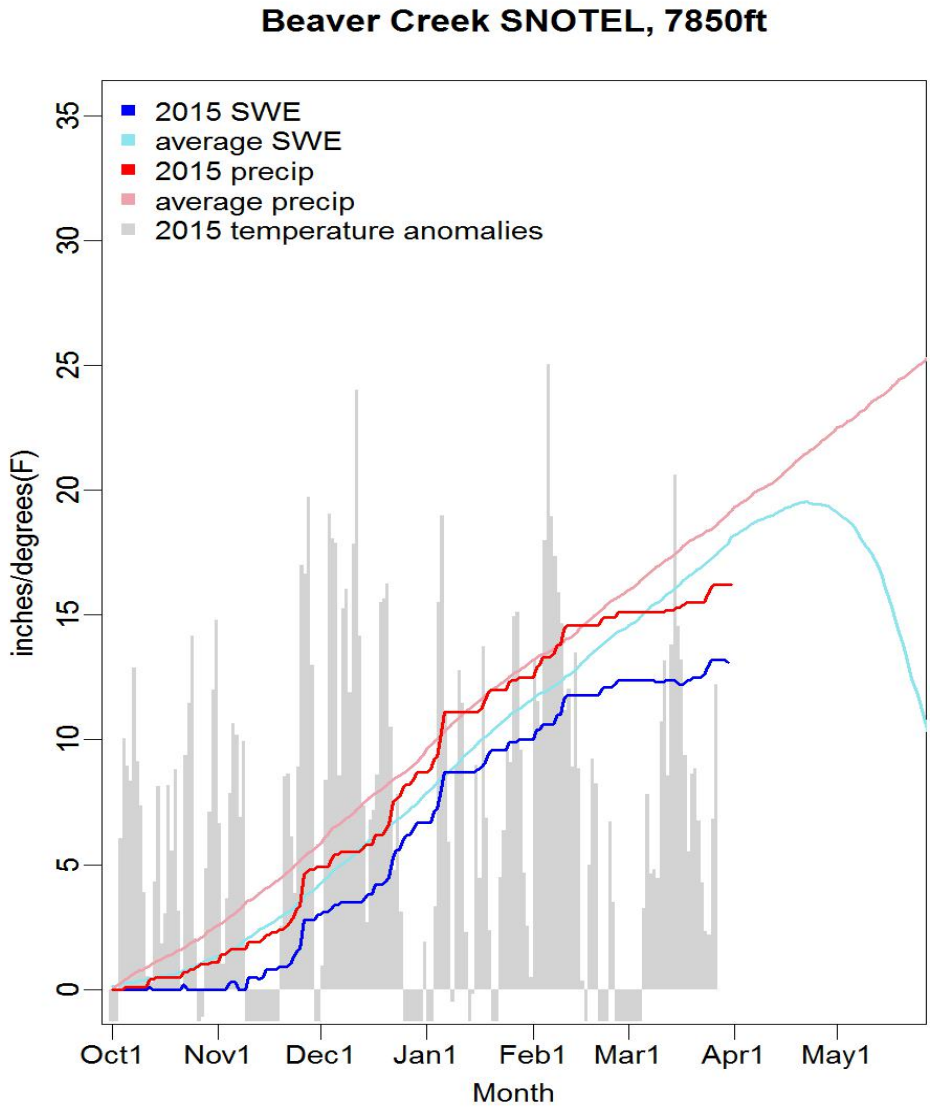
2015 60% fell as snow

Beaver Creek: 5.1F 7885 ft

Normally 97% precip falls as snow

2015 92% fell as snow





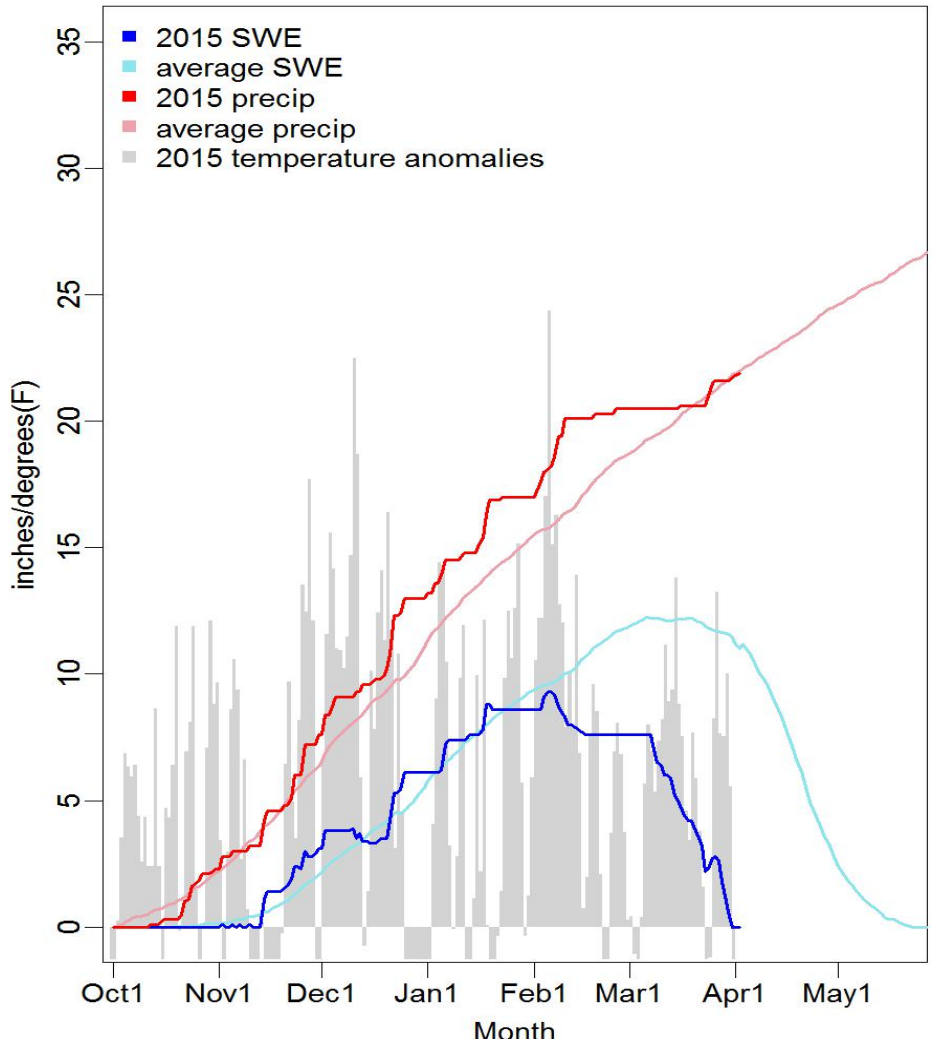
USDA

Idaho --- Mean temperature departure & precipitation falling normal Nov 1 – Mar 31:

Graham Guard: 4.9 F

Normally 75% precip falls as snow

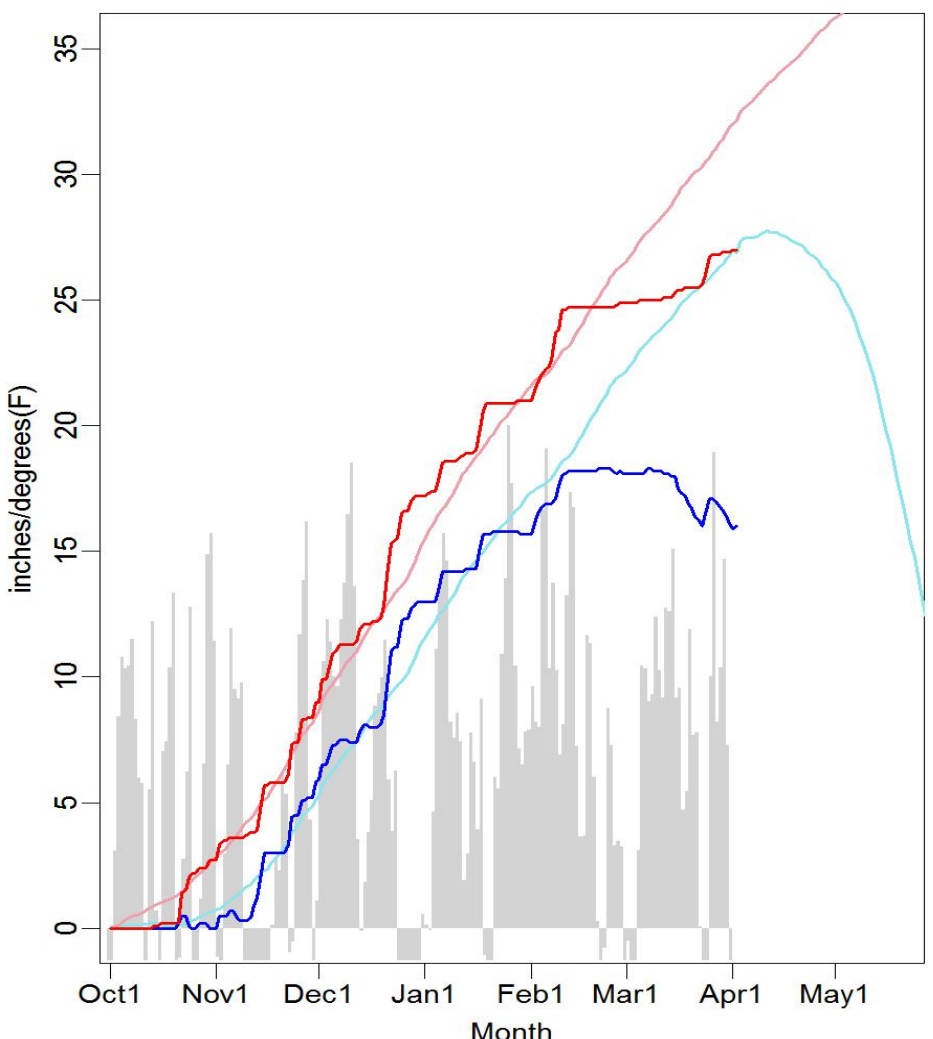
2015 60% fell as snow



Jackson Peak: 5.1 F

Normally 92% precip falls as snow

2015 84% fell as snow



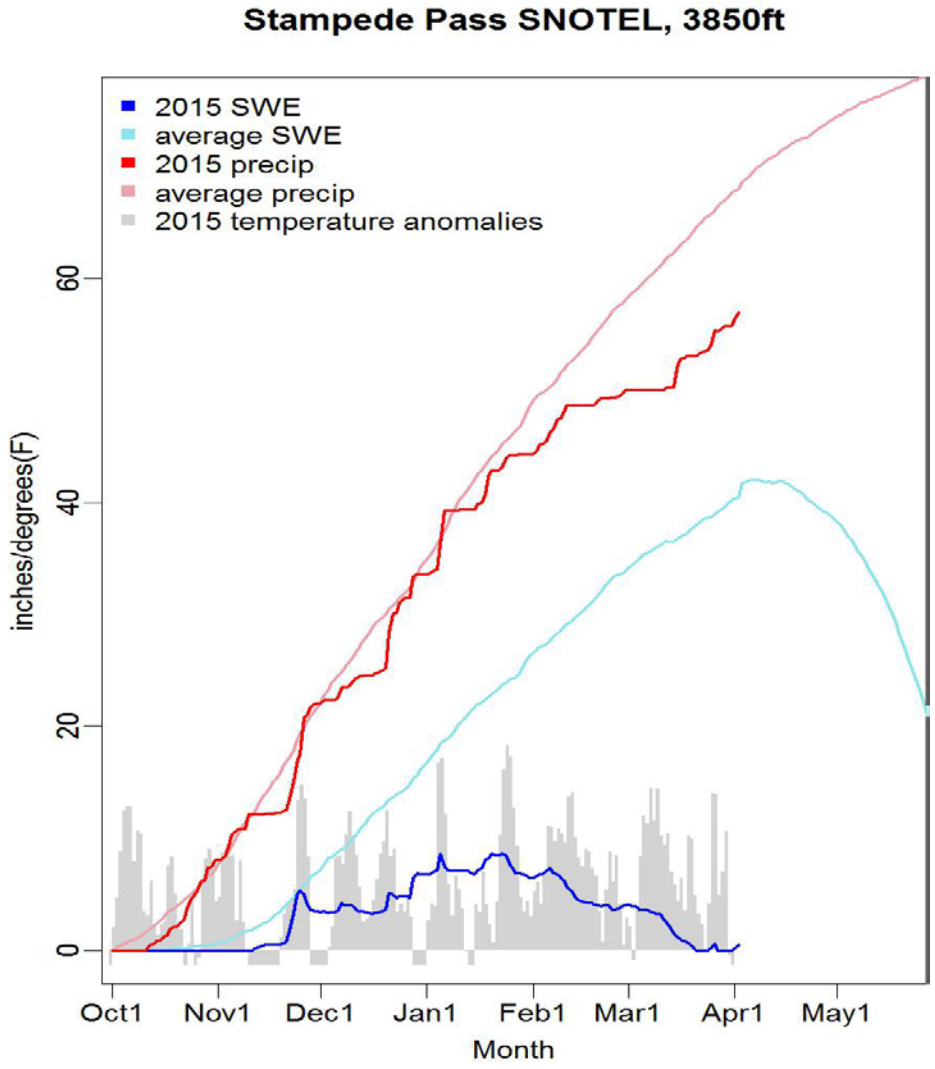
USDA

Washington --- Mean temperature departure & precipitation falling normal Nov 1 – Mar 31:

Stampede Pass: 5.0 F 3850 ft

Normally 80% precip falls as snow

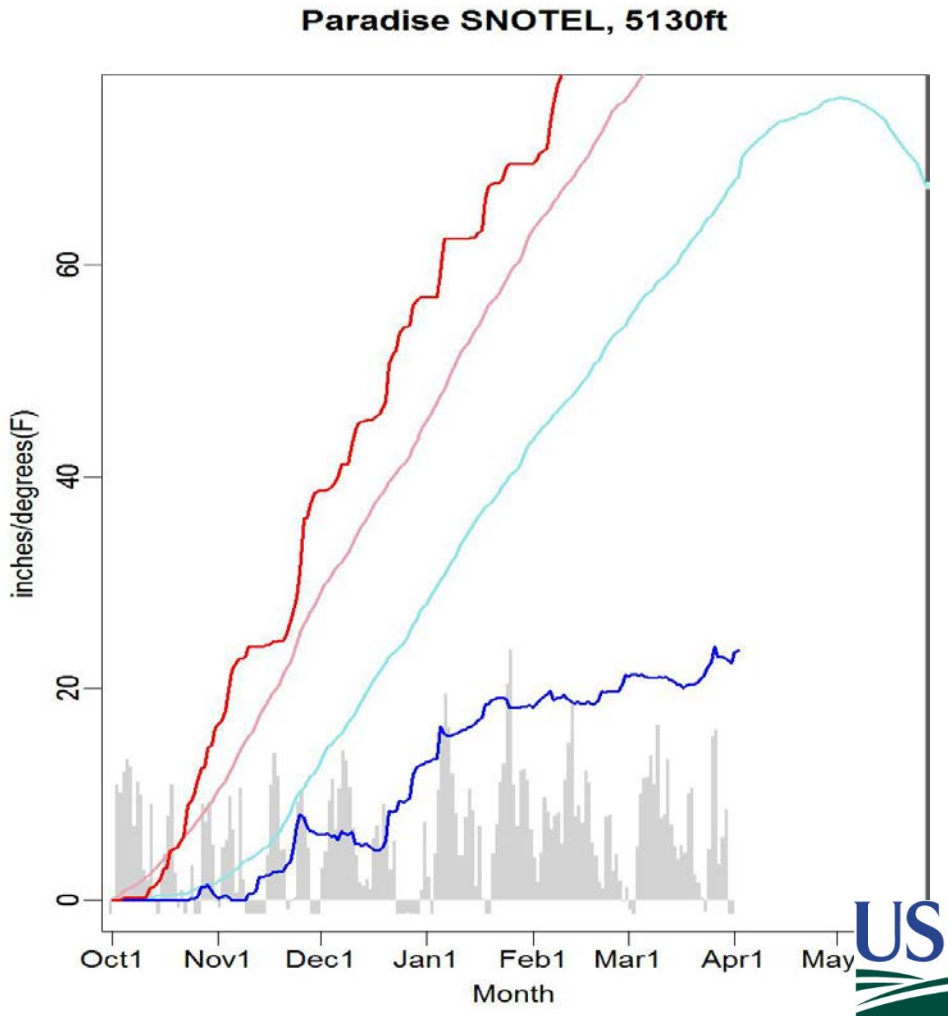
2015 34% fell as snow



Paradise: 5.3 F 5130 ft

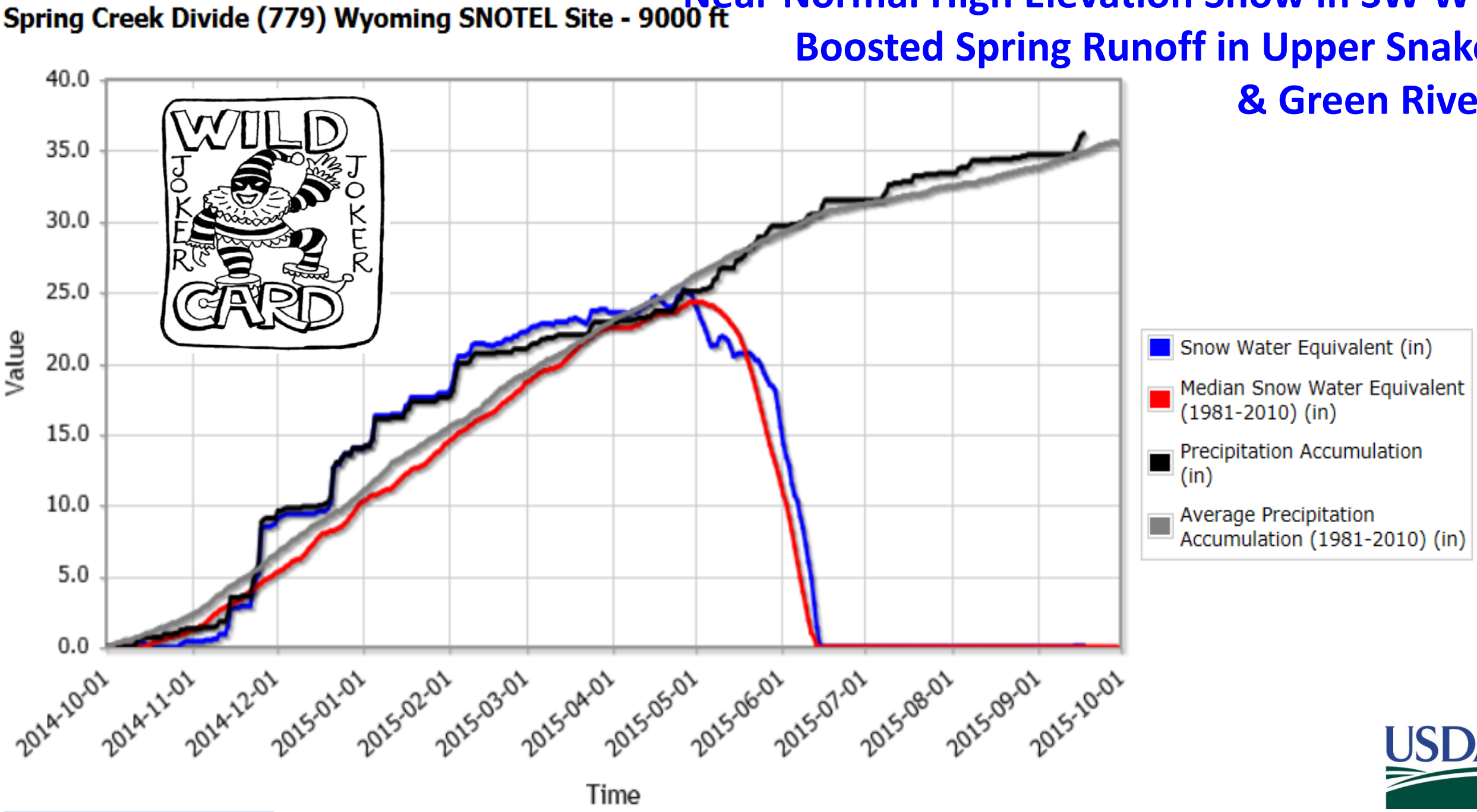
Normally 92% precip falls as snow

2015 46% fell as snow

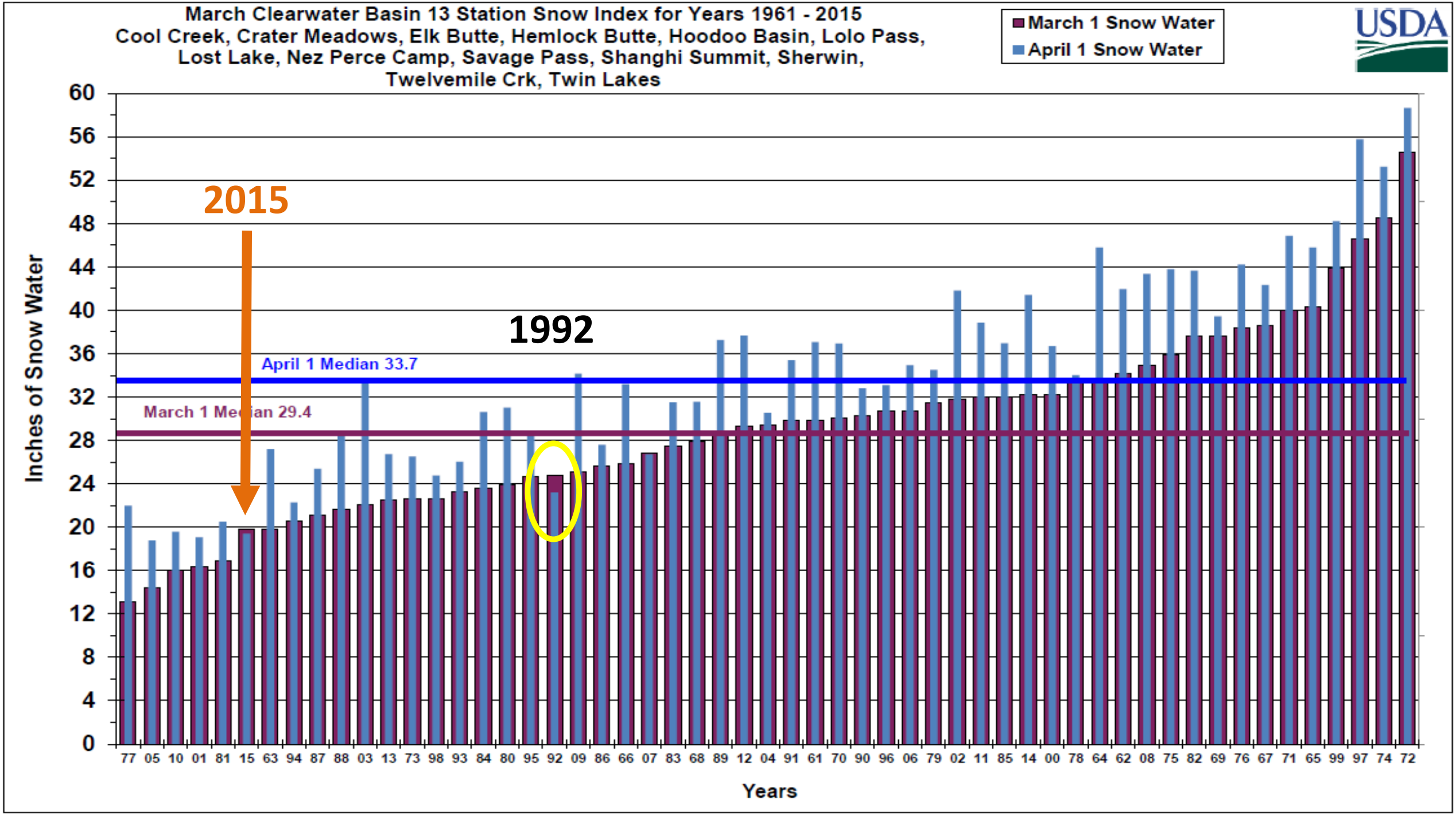


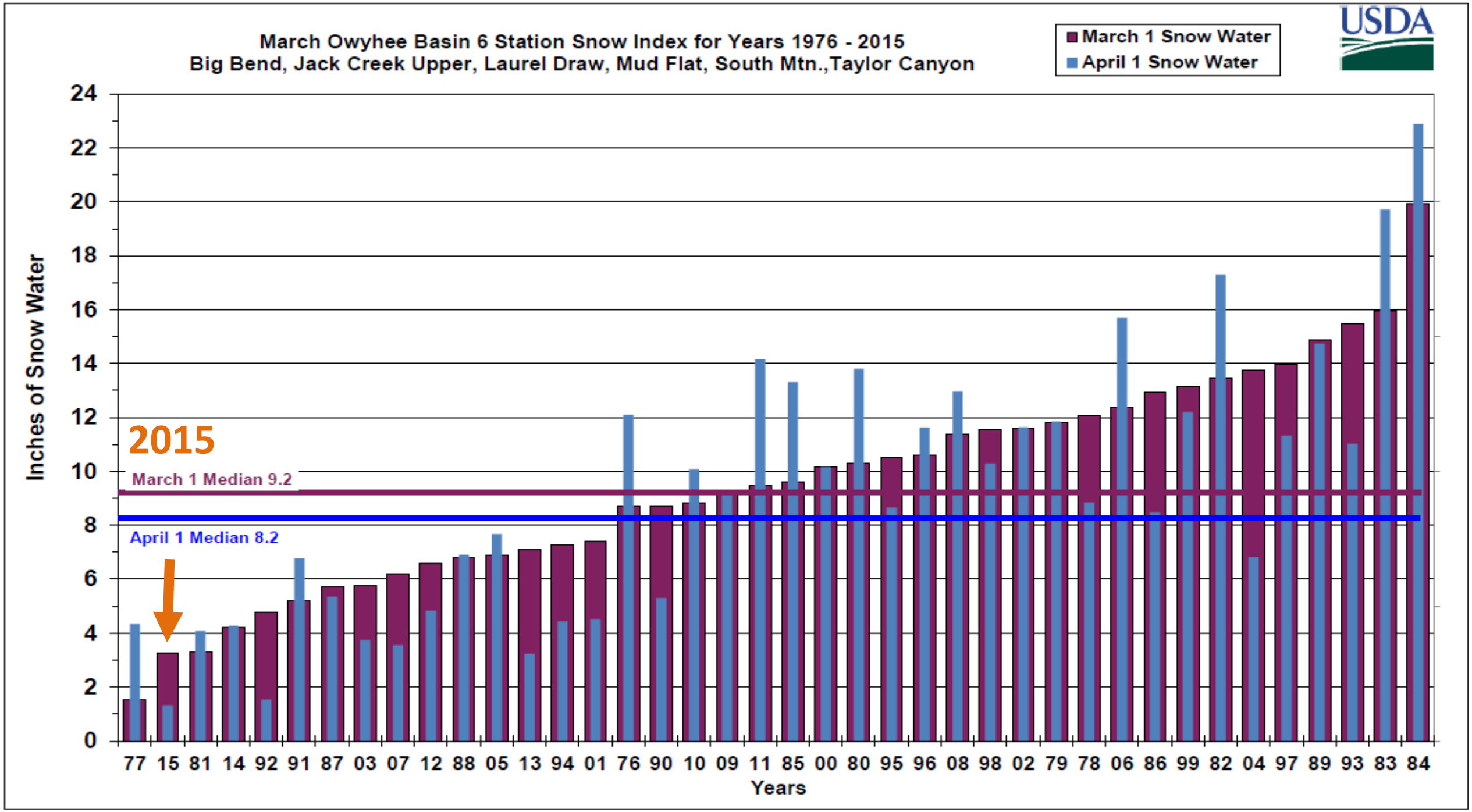
USDA

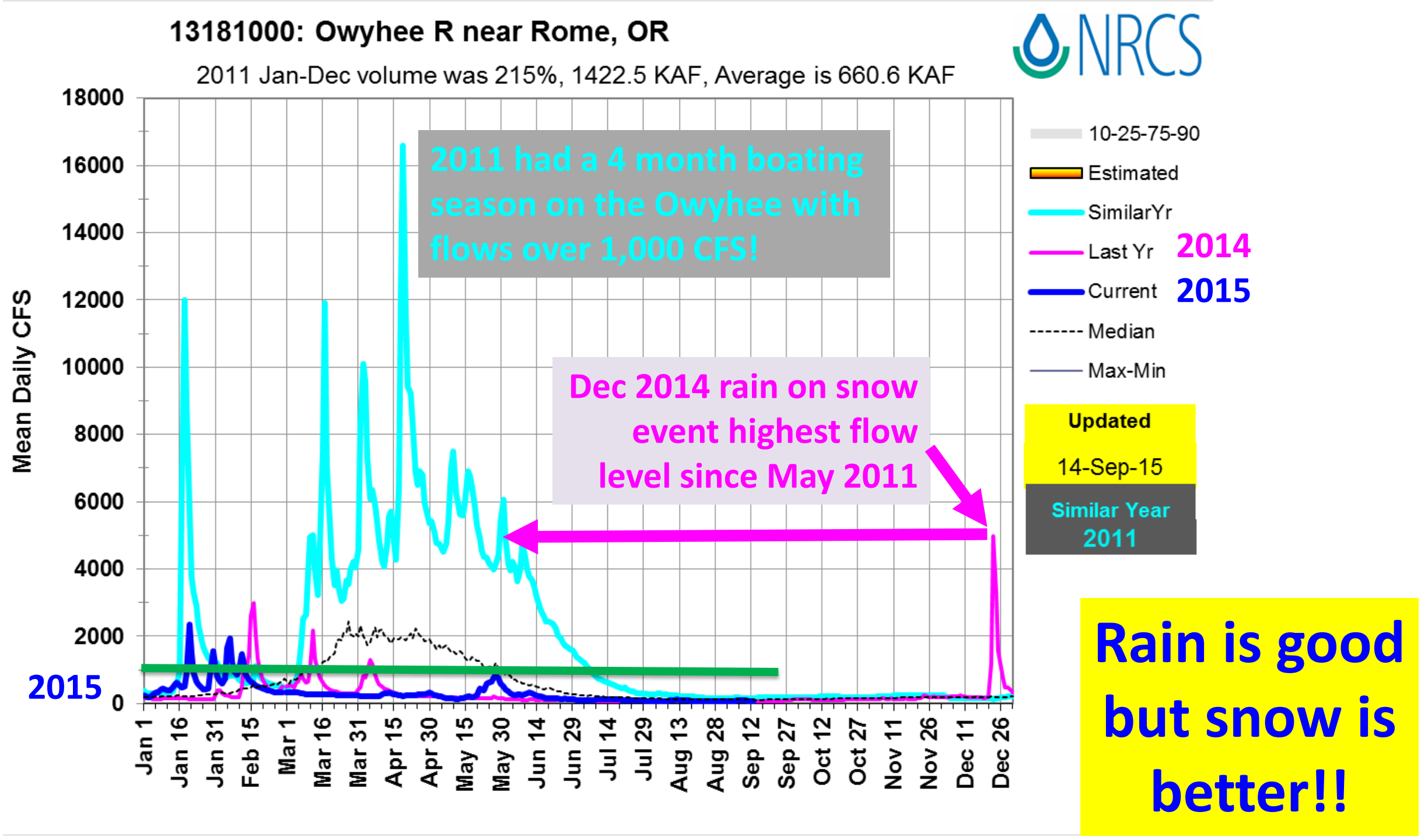
Near Normal High Elevation Snow in SW WY Boosted Spring Runoff in Upper Snake & Green River

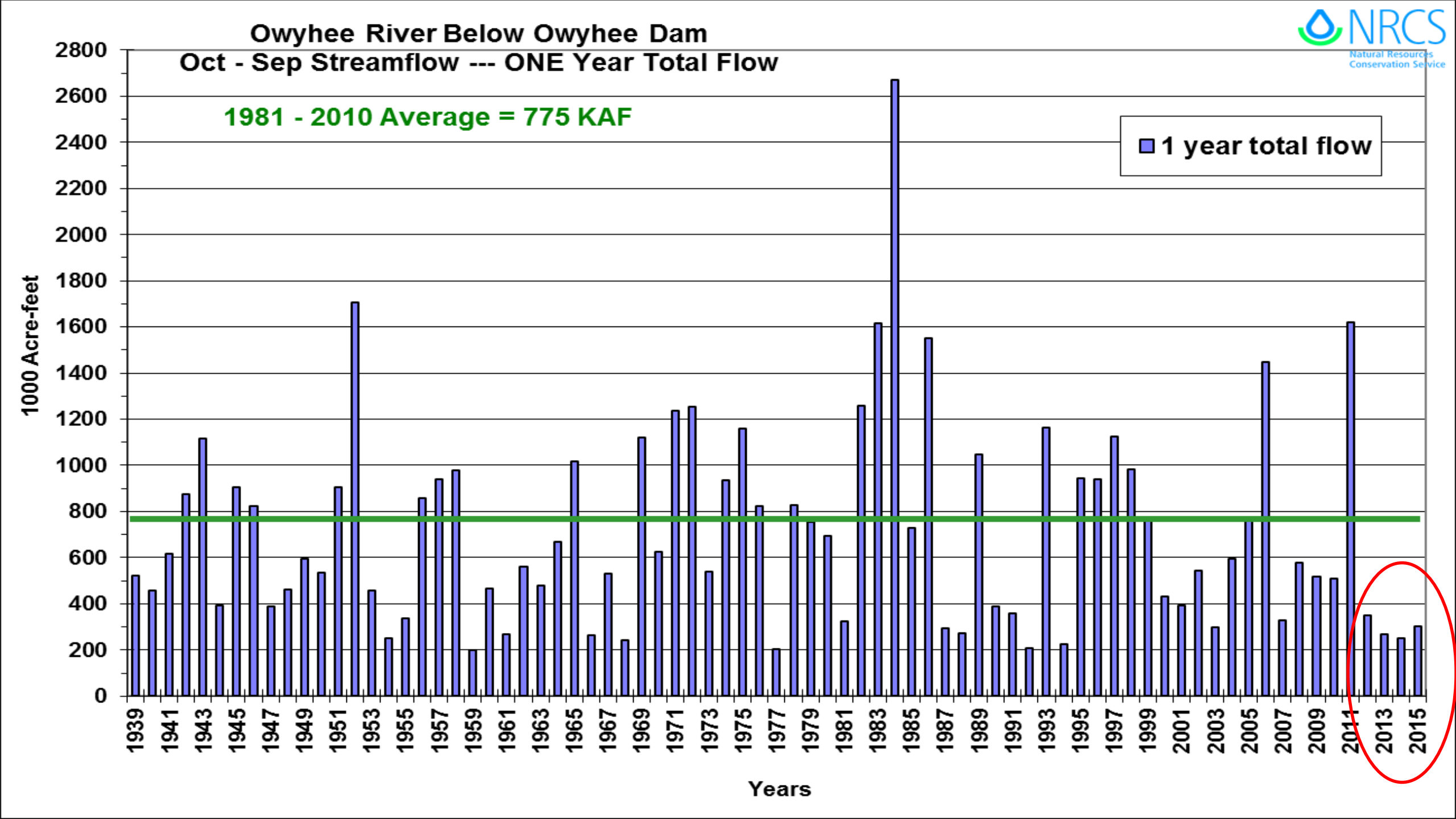


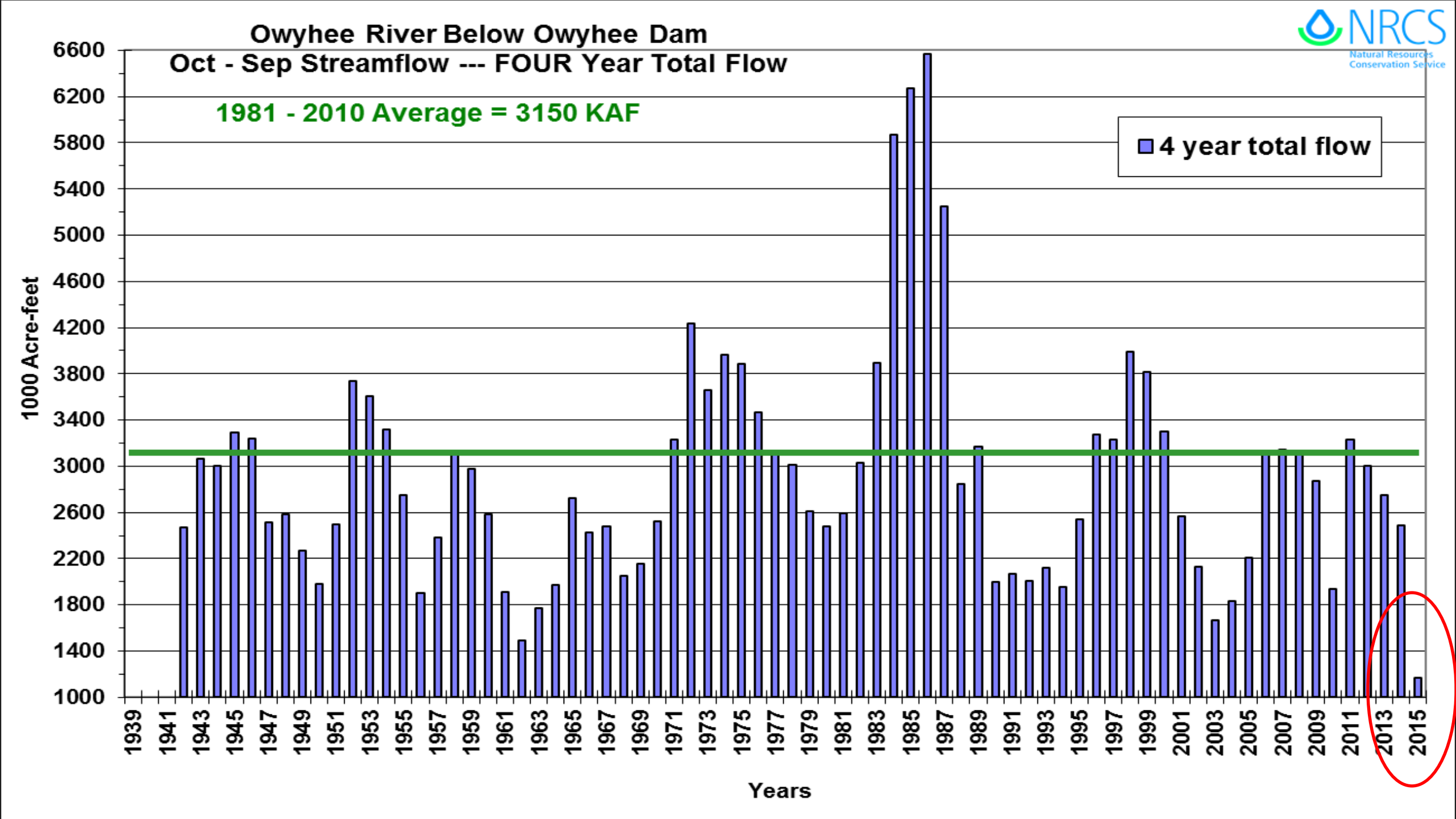
USDA

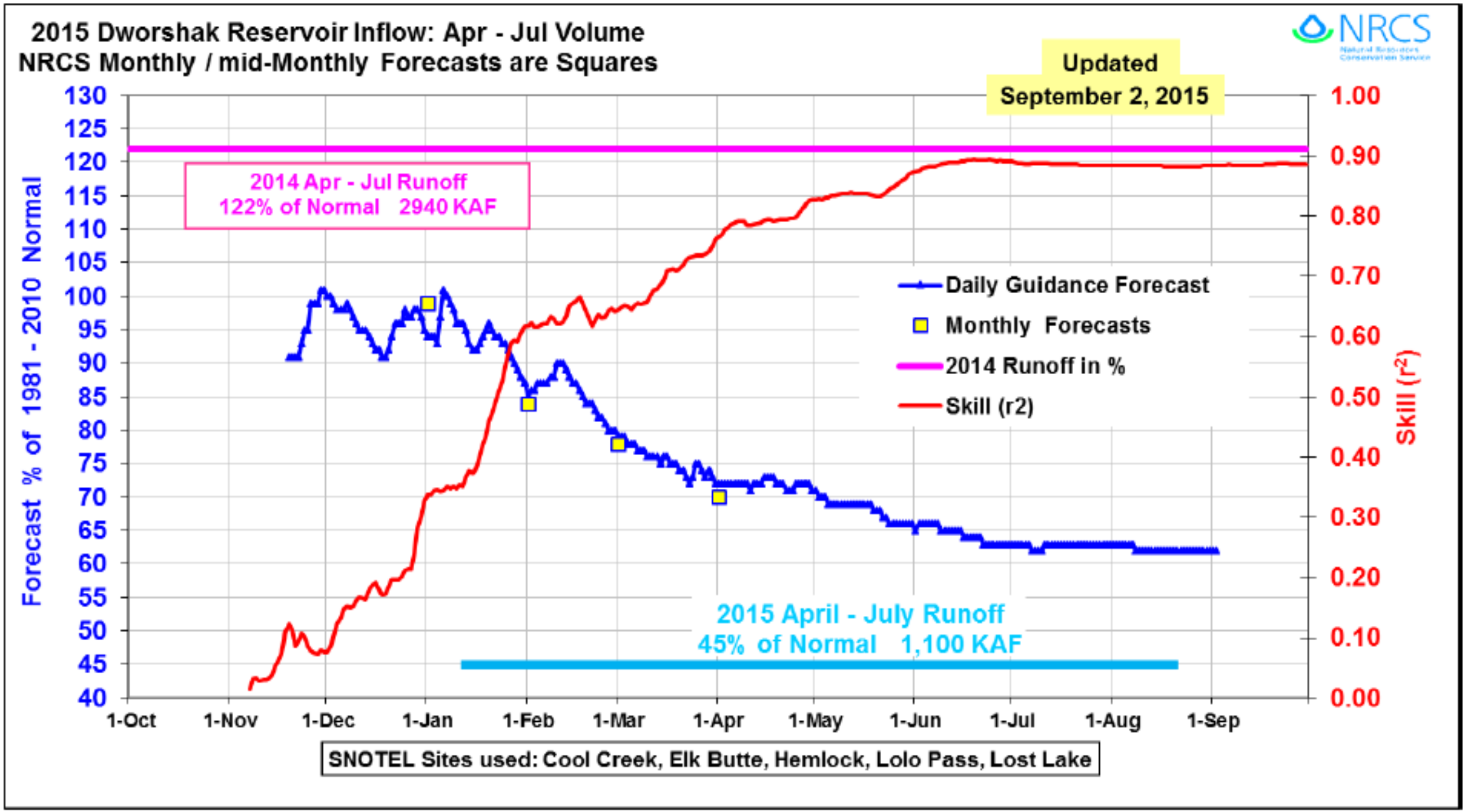

March Clearwater Basin 13 Station Snow Index for Years 1961 - 2015
Cool Creek, Crater Meadows, Elk Butte, Hemlock Butte, Hoodoo Basin, Lolo Pass,
Lost Lake, Nez Perce Camp, Savage Pass, Shanghi Summit, Sherwin,
Twelvemile Crk, Twin Lakes
March 1 Snow Water
April 1 Snow Water
USDA
2015
1992
April 1 Median 33.7
March 1 Median 29.4
Inches of Snow Water
0
4
8
12
16
20
24
28
32
36
40
44
48
52
56
60
77 05 10 01 81 15 63 94 87 88 03 13 73 98 93 84 80 95 92 09 86 66 07 83 68 89 12 04 91 61 70 90 96 06 79 02 11 85 14 00 78 64 62 08 75 82 69 76 67 71 65 99 97 74 72
Years

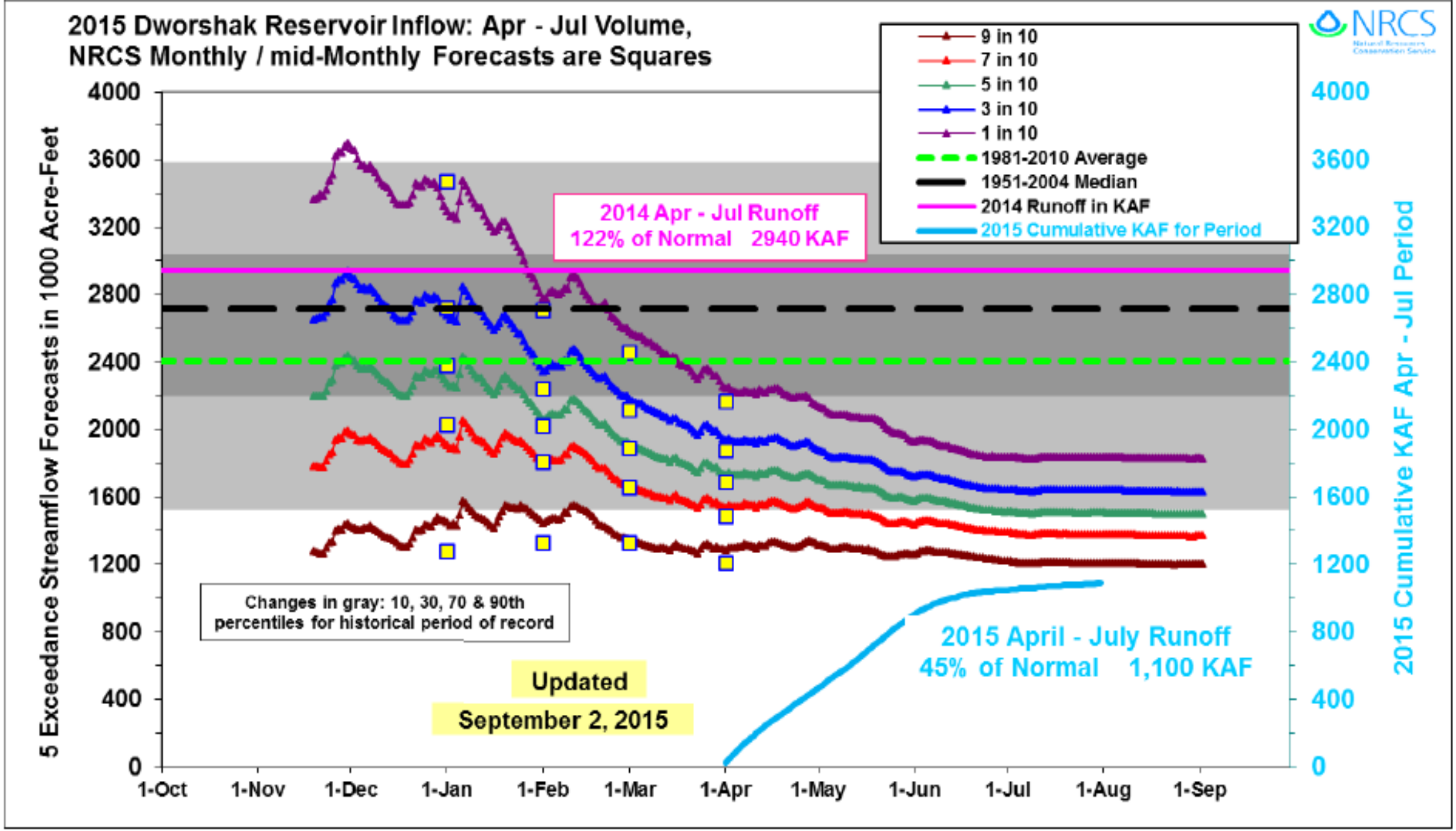

March Owyhee Basin 6 Station Snow Index for Years 1976 - 2015
Big Bend, Jack Creek Upper, Laurel Draw, Mud Flat, South Mtn.,Taylor Canyon
March 1 Snow Water
April 1 Snow Water
USDA
Inches of Snow Water
0
2
4
6
8
10
12
14
16
18
20
22
24
2015
March 1 Median 9.2
April 1 Median 8.2
77 15 81 14 92 91 87 03 07 12 88 05 13 94 01 76 90 10 09 11 85 00 80 95 96 08 98 02 79 78 06 86 99 82 04 97 89 93 83 84
Years

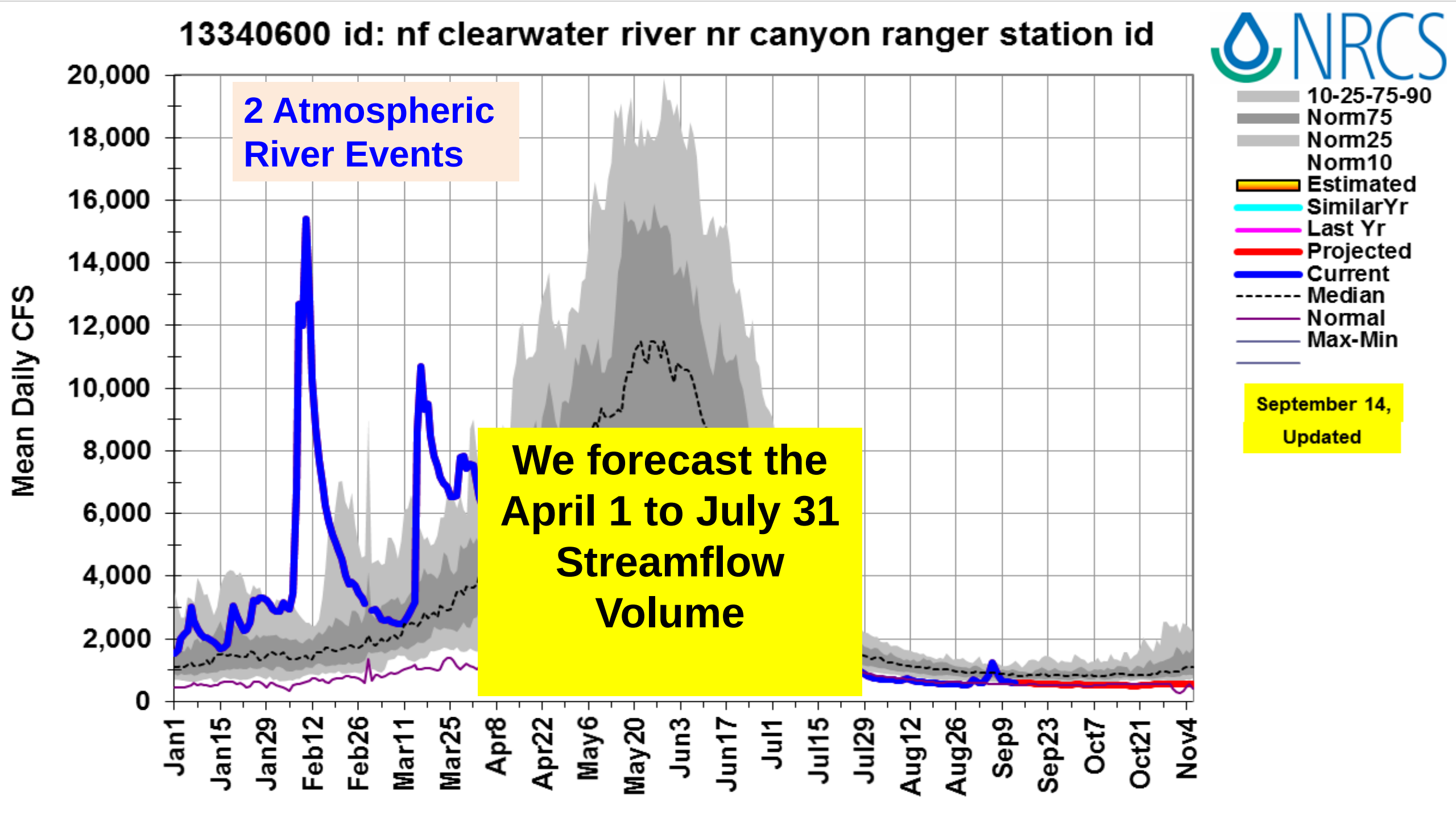

13181000: Owyhee R near Rome, OR
2011 Jan-Dec volume was 215%, 1422.5 KAF, Average is 660.6 KAF
NRCS
Mean Daily CFS
18000
16000
14000
12000
10000
8000
6000
4000
2000
0
2015
Jan 1
Jan 16
Jan 31
Feb 15
Mar 1
Mar 16
Mar 31
Apr 15
Apr 30
May 15
May 30
Jun 14
Jun 29
Jul 14
Jul 29
Aug 13
Aug 28
Sep 12
Sep 27
Oct 12
Oct 27
Nov 11
Nov 26
Dec 11
Dec 26
2011 had a 4 month boating season on the Owyhee with flows over 1,000 CFS!
Dec 2014 rain on snow event highest flow level since May 2011
10-25-75-90
Estimated
SimilarYr
Last Yr 2014
Current 2015
Median
Max-Min
Updated
14-Sep-15
Similar Year
2011
Rain is good but snow is better!!

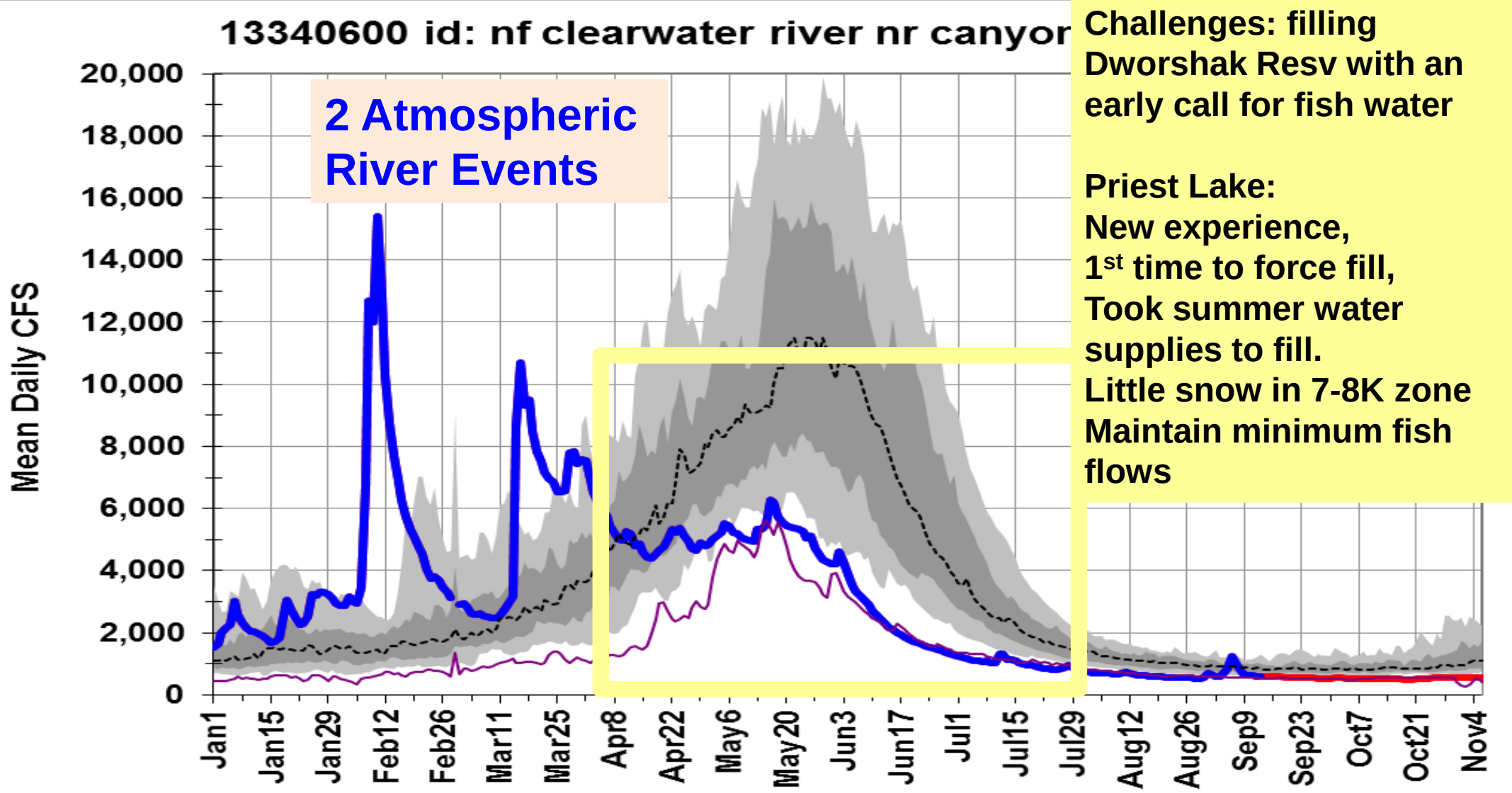

Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- ONE Year Total Flow
1981 - 2010 Average = 775 KAF
1 year total flow
1000 Acre-feet
Years
NRCS
Natural Resources Conservation Service


Owyhee River Below Owyhee Dam
Oct - Sep Streamflow --- FOUR Year Total Flow
1981 - 2010 Average = 3150 KAF
4 year total flow
1000 Acre-feet
Years
6600
6200
5800
5400
5000
4600
4200
3800
3400
3000
2600
2200
1800
1400
1000
1939
1941
1943
1945
1947
1949
1951
1953
1955
1957
1959
1961
1963
1965
1967
1969
1971
1973
1975
1977
1979
1981
1983
1985
1987
1989
1991
1993
1995
1997
1999
2001
2003
2005
2007
2009
2011
2013
2015
NRCS
Natural Resources Conservation Service


2015 Dworshak Reservoir Inflow: Apr - Jul Volume
NRCS Monthly / mid-Monthly Forecasts are Squares
NRCS
Natural Resources Conservation Service
Updated
September 2, 2015
2014 Apr - Jul Runoff
122% of Normal 2940 KAF
Daily Guidance Forecast
Monthly Forecasts
2014 Runoff in %
Skill (r2)
2015 April - July Runoff
45% of Normal 1,100 KAF
Forecast % of 1981 - 2010 Normal
Skill (r^2)
130
125
120
115
110
105
100
95
90
85
80
75
70
65
60
55
50
45
40
1.00
0.90
0.80
0.70
0.60
0.50
0.40
0.30
0.20
0.10
0.00
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
SNOTEL Sites used: Cool Creek, Elk Butte, Hemlock, Lolo Pass, Lost Lake


2015 Dworshak Reservoir Inflow: Apr - Jul Volume,
NRCS Monthly / mid-Monthly Forecasts are Squares
NRCS
9 in 10
7 in 10
5 in 10
3 in 10
1 in 10
1981-2010 Average
1951-2004 Median
2014 Runoff in KAF
2015 Cumulative KAF for Period
2014 Apr - Jul Runoff
122% of Normal 2940 KAF
5 Exceedance Streamflow Forecasts in 1000 Acre-Feet
2015 Cumulative KAF Apr - Jul Period
4000
3600
3200
2800
2400
2000
1600
1200
800
400
0
1-Oct
1-Nov
1-Dec
1-Jan
1-Feb
1-Mar
1-Apr
1-May
1-Jun
1-Jul
1-Aug
1-Sep
Changes in gray: 10, 30, 70 & 90th
percentiles for historical period of record
Updated
September 2, 2015
2015 April - July Runoff
45% of Normal 1,100 KAF


13340600 id: nf clearwater river nr canyon ranger station id
NRCS
2 Atmospheric River Events
We forecast the April 1 to July 31 Streamflow Volume
Mean Daily CFS
20,000
18,000
16,000
14,000
12,000
10,000
8,000
6,000
4,000
2,000
0
Jan1
Jan15
Jan29
Feb12
Feb26
Mar11
Mar25
Apr8
Apr22
May6
May20
Jun3
Jun17
Jul1
Jul15
Jul29
Aug12
Aug26
Sep9
Sep23
Oct7
Oct21
Nov4
10-25-75-90
Norm75
Norm25
Norm10
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Normal
Max-Min
September 14,
Updated



Challenges: filling Dworshak Resv with an early call for fish water

Priest Lake:
New experience,
1st time to force fill,
Took summer water supplies to fill.
Little snow in 7-8K zone
Maintain minimum fish flows

NRCS

10-25-75-90
Norm75
Norm25
Norm10
Estimated
SimilarYr
Last Yr
Projected
Current
Median
Normal
Max-Min

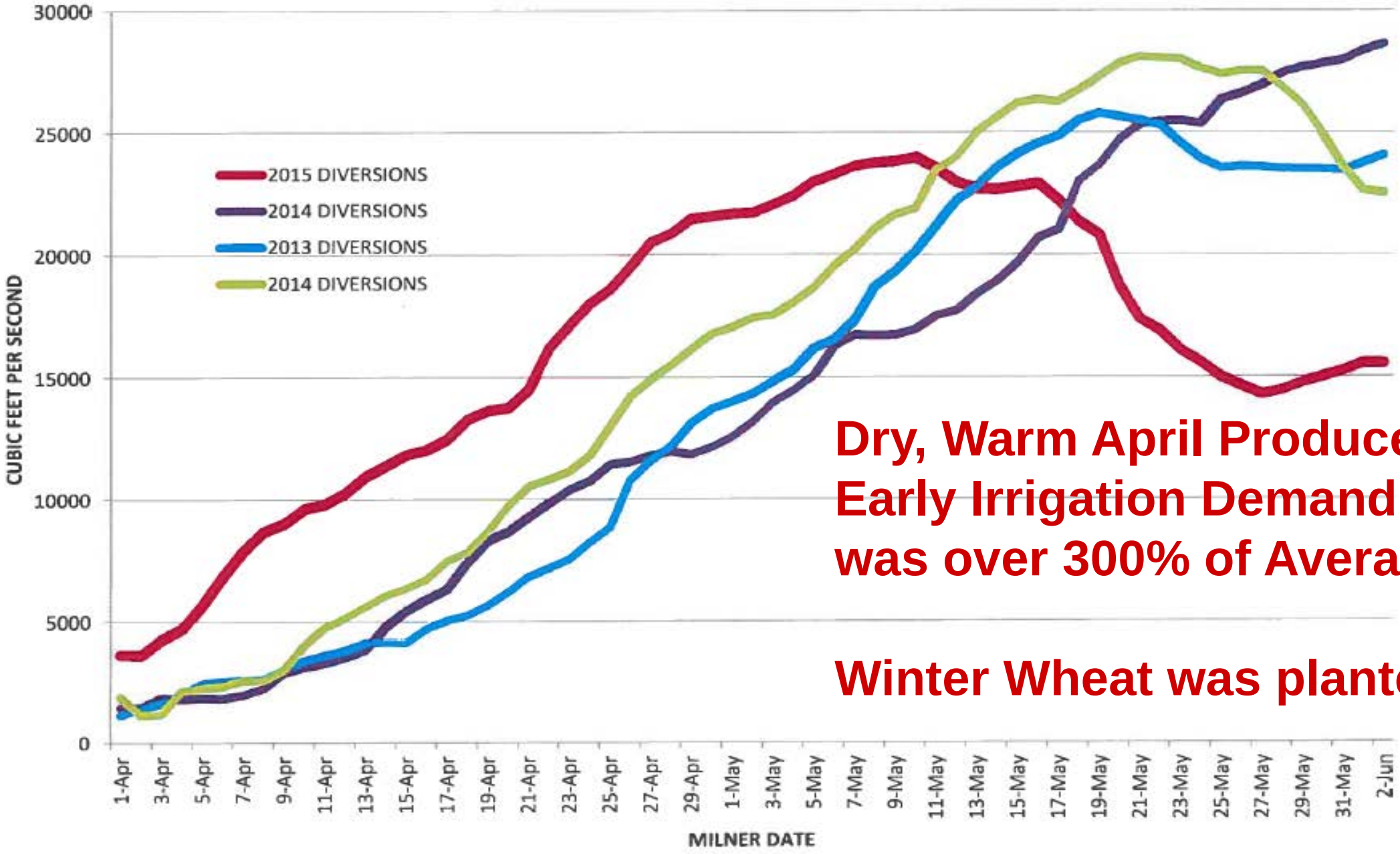
September 14, Updated

Dworshak Inflow in Thousands of Acre-Feet for Water Year 2015

Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep
76	169	256	266	586	569	455	429	162	41	30	17

2015 monthly volumes peaked in Feb & Mar

2012, 2013, 2014, & 2015 TOTAL DIVERSION COMPARISON



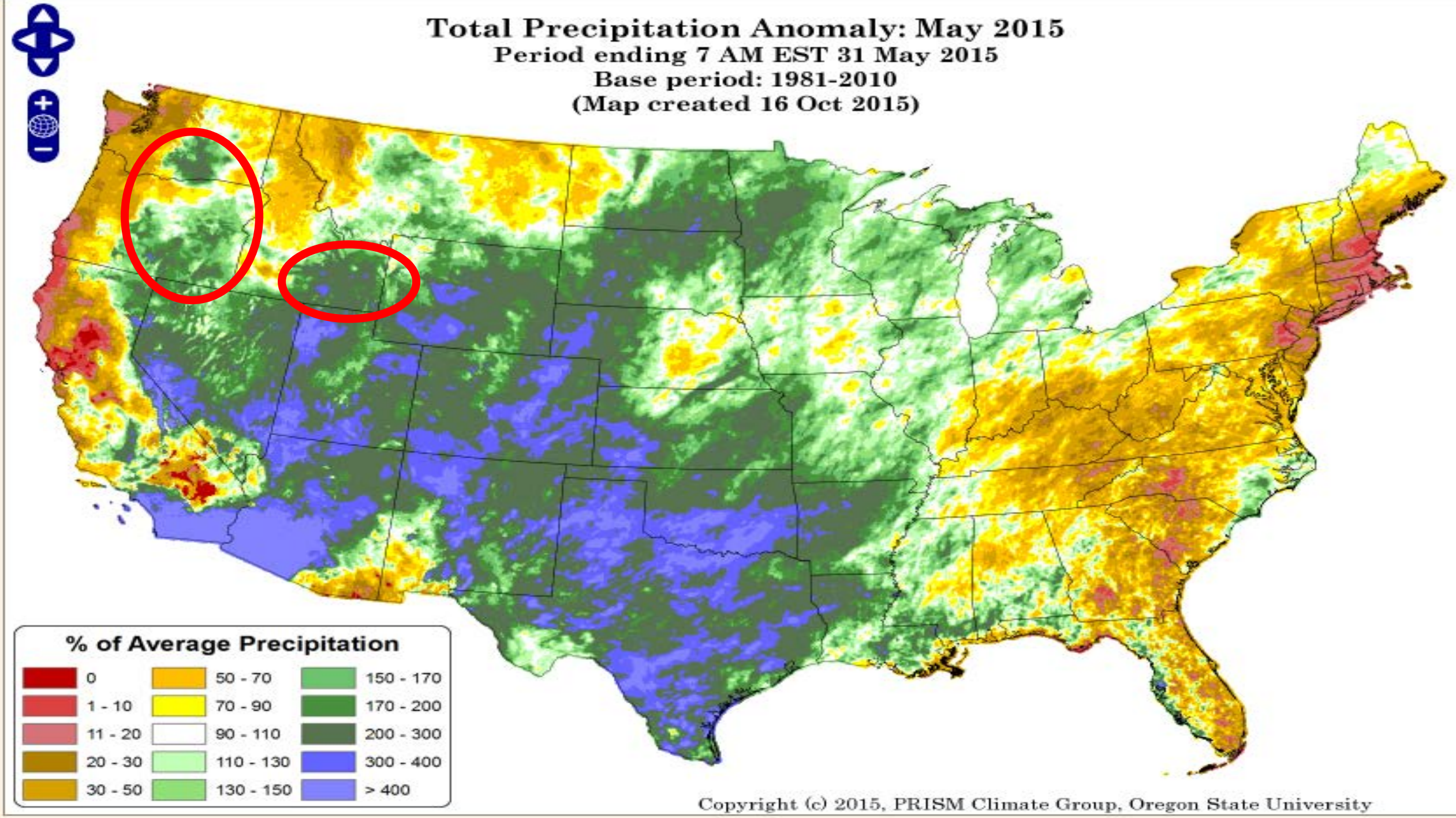
Dry, Warm April Produced Early Irrigation Demand that was over 300% of Average

Winter Wheat was planted

USDA

Total Precipitation Anomaly: May 2015

Period ending 7 AM EST 31 May 2015
Base period: 1981-2010
(Map created 16 Oct 2015)



Benefits of May Rain for One Farmer in South Central Idaho

Fish Creek – Small Reservoir – Water Allotment was 12% of normal

May rains provided for additional growing and cuttings of Organic Feed

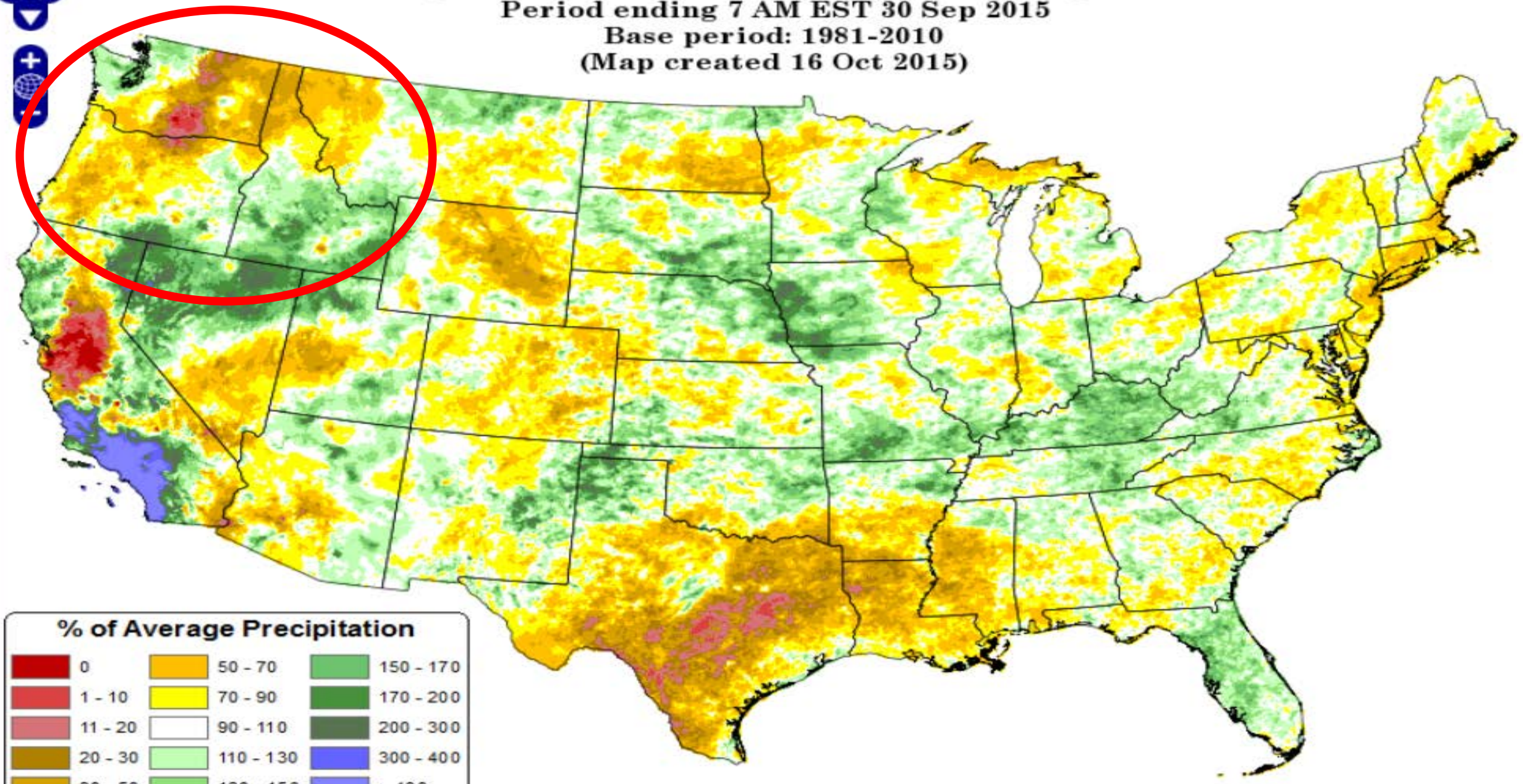
Brought in $100K for One Producer

Kept Water Allotment at 12%

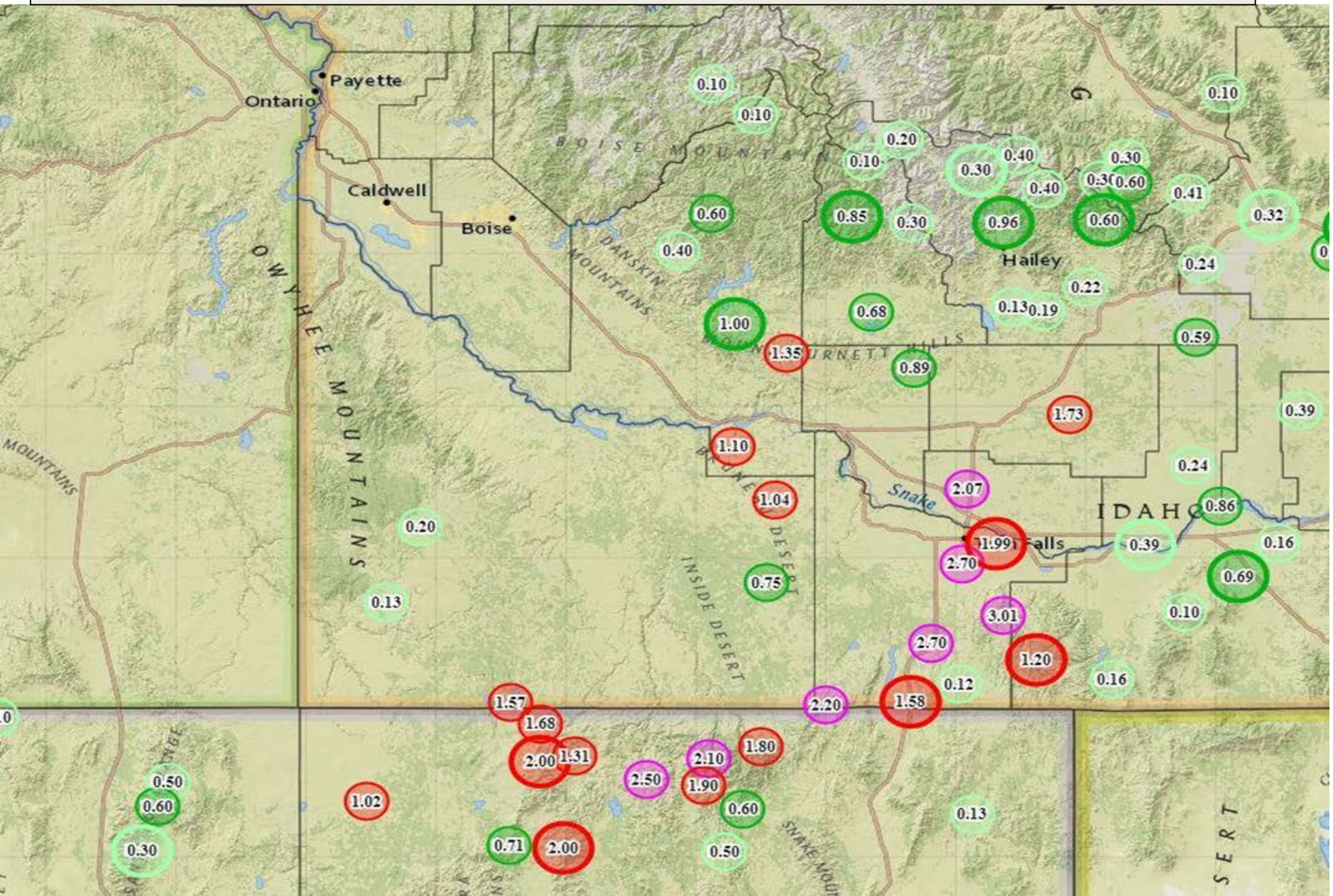
USDA

Total Precipitation Anomaly: July 2015 - September 2015

Period ending 7 AM EST 30 Sep 2015
Base period: 1981-2010
(Map created 16 Oct 2015)



From Boise NWS: Southern Idaho August 5-6, 2014
24 Hour rainfall totals from 3 PM to 3 PM on



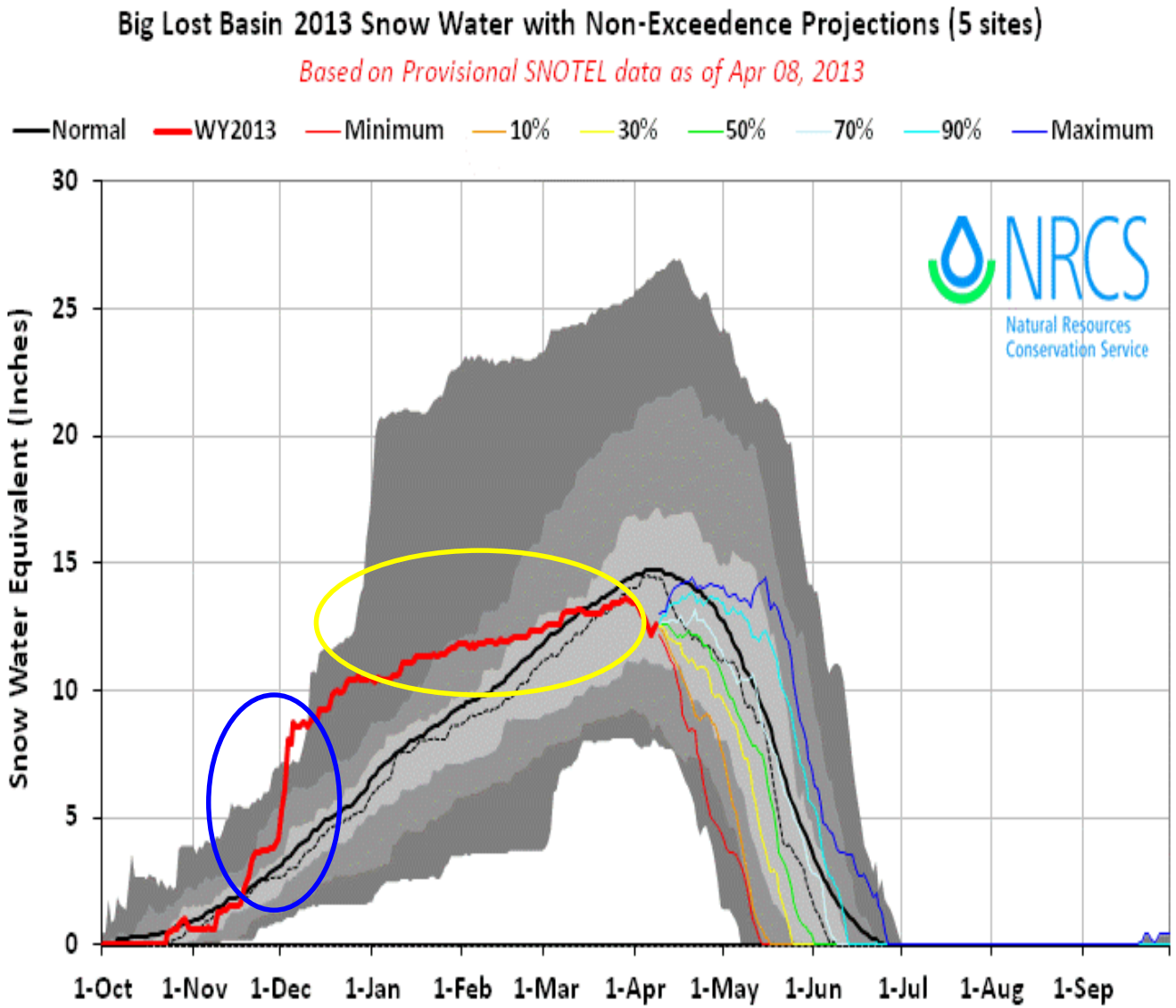
Example of Recent Climatic Variability 2014 - 2011

USDA

2013 WOOD and LOST RIVER BASINS

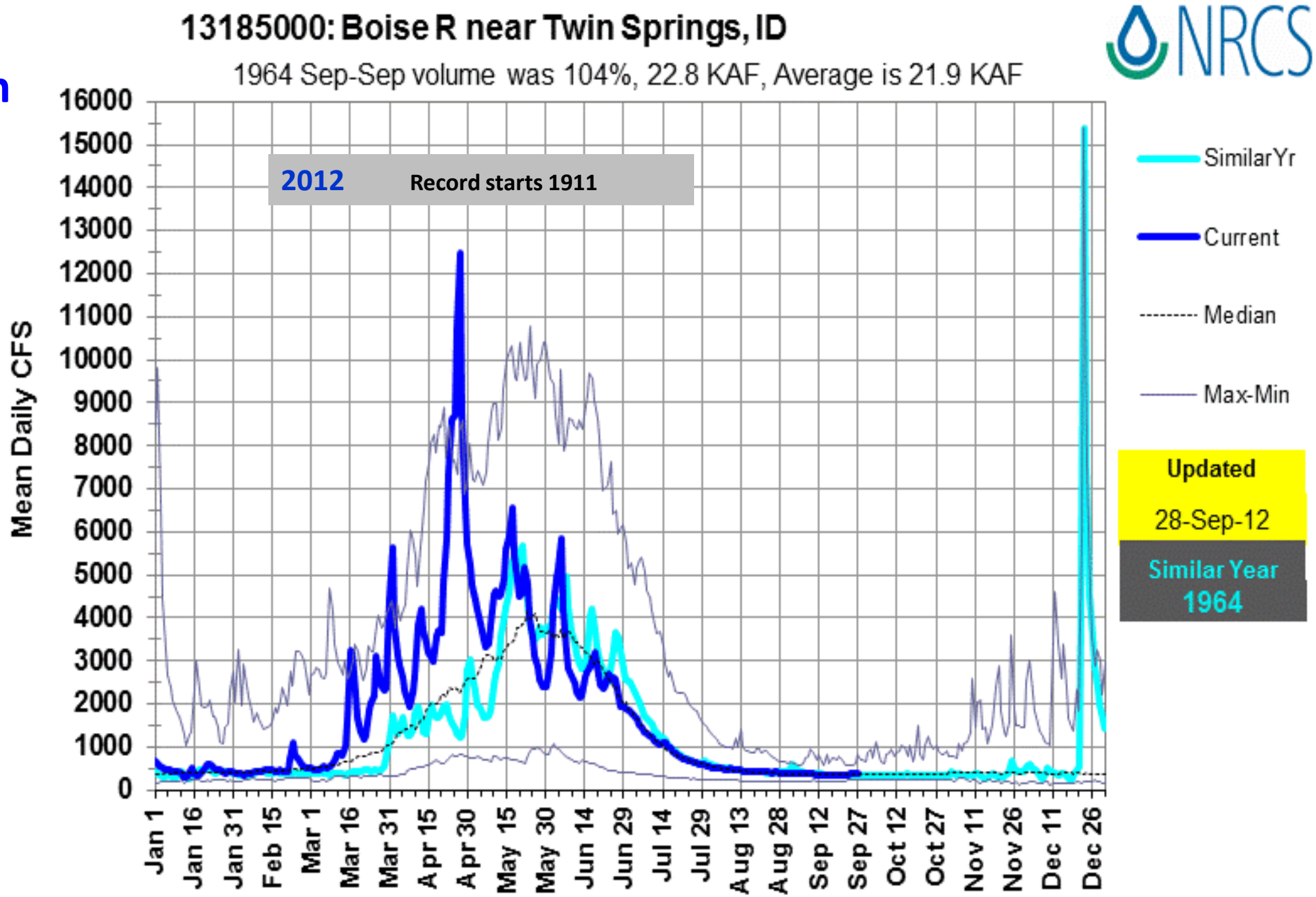
- Oct-Dec 2012 precipitation was 2nd wettest in the last 30 years at three SNOTEL sites
- Making it one of the best starts on record.
- January 1 snowpacks were 130-160%.

Thanksgiving at Galena Summit

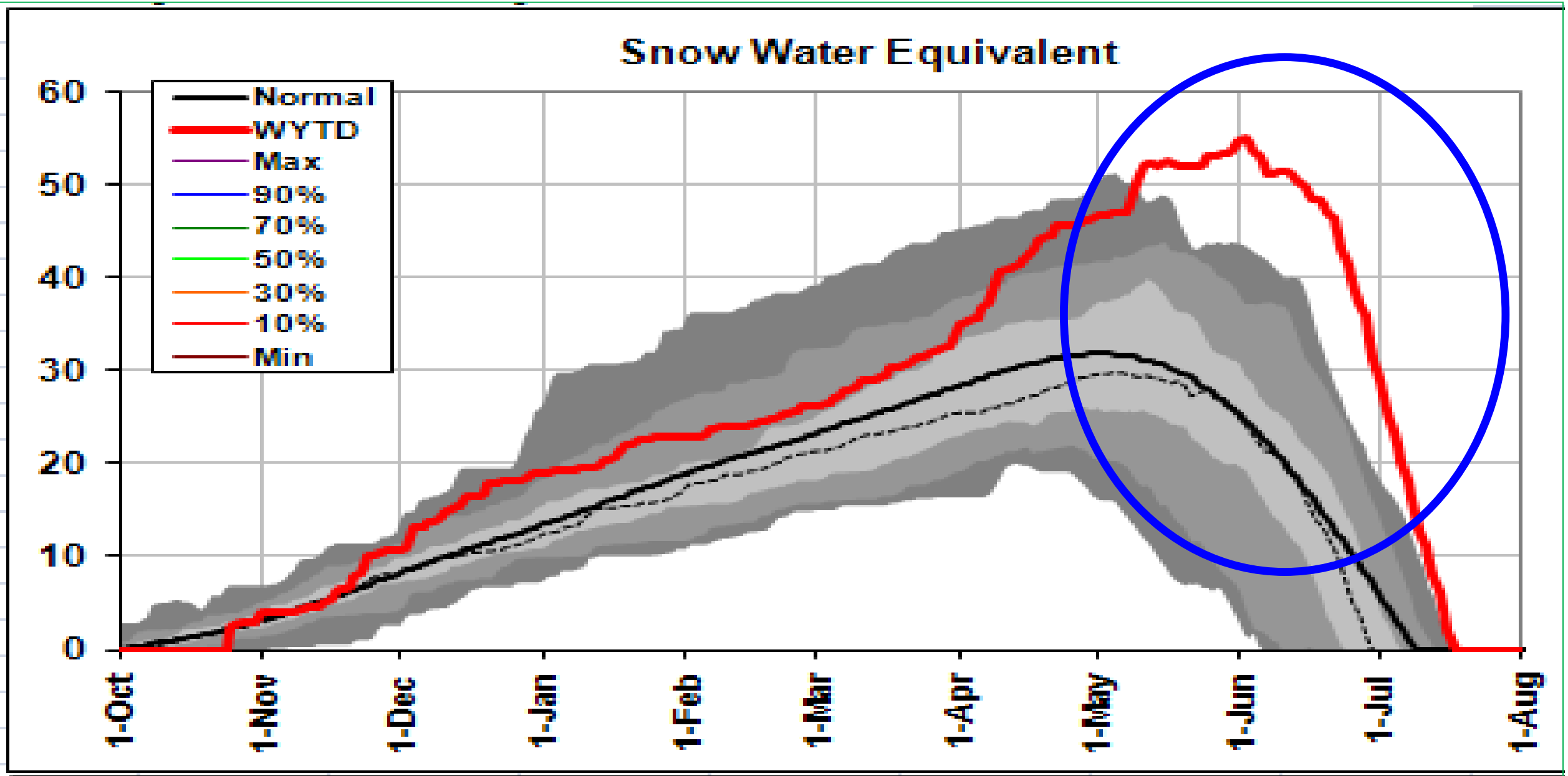


2012

April Record High Temperatures Followed by 1-2 Inches of Rain



2011: Snow Water Equivalent at Two Ocean Plateau SNOTEL Site Yellowstone NP, Elev. 9,240 feet



Rain is good but snow is better.

Good mountain snowpacks allows for better planning by farmers & water managers, but that doesn't always happen…

With increase in climate variability –

Key is understanding the storm track that brings moisture to your basin and what makes it flow (snow cover area & rain intensities)

Questions/Comments