



United States Department of Agriculture

2022 Snowpack Status and Streamflow Outlook for the Eastern Sierra & Humboldt Basin

New GOES telemetry

Old meteorburst telemetry

Nevada Division of Water Resources
March 16, 2022

Jeff Anderson
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Photo:
3/11/22 Marlette Lake SNOTEL
Telemetry Upgrade

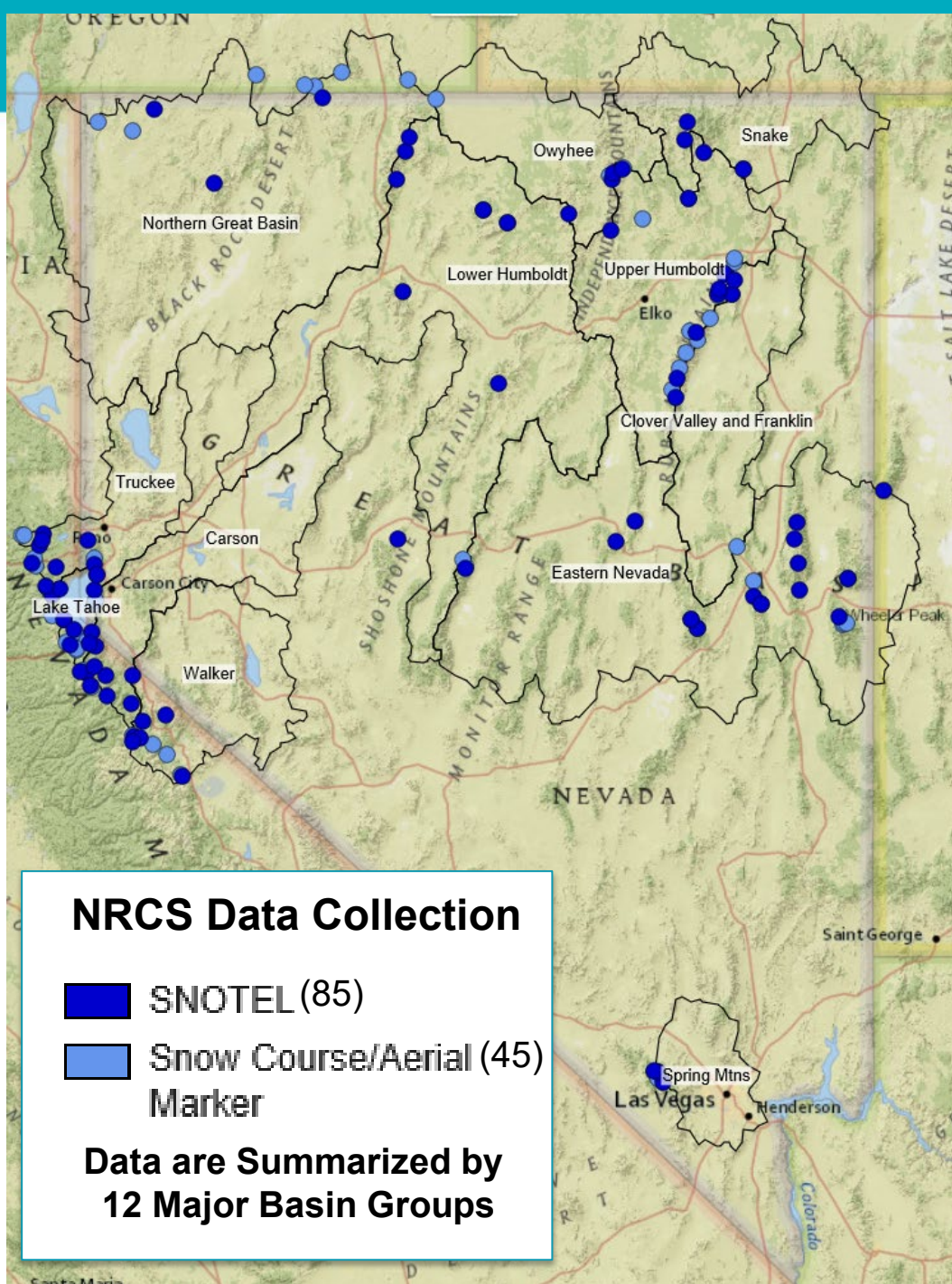


Natural Resources Conservation Service

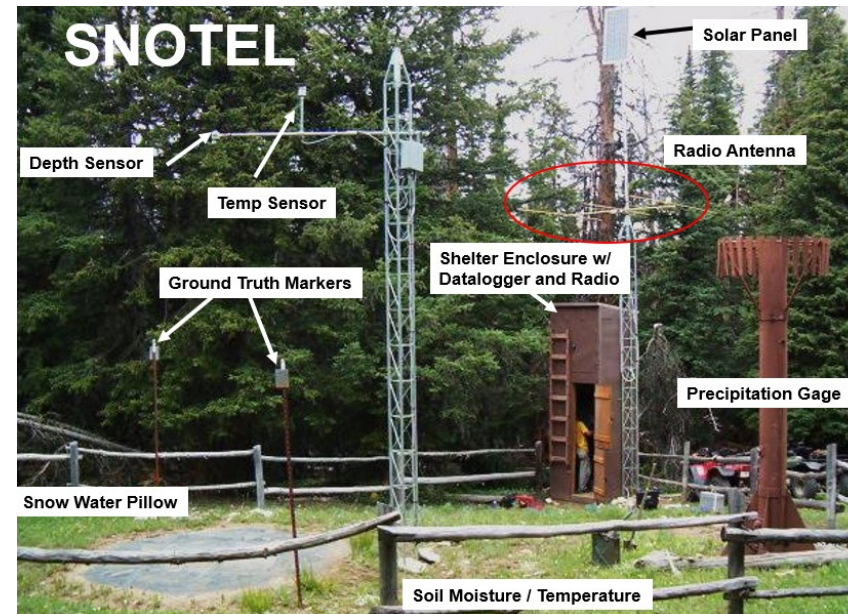
www.nrcs.usda.gov/wps/portal/nrcs/main/nv/snow/

Snow Survey Overview

Key Vocab: Snow Water Equivalent (SWE)



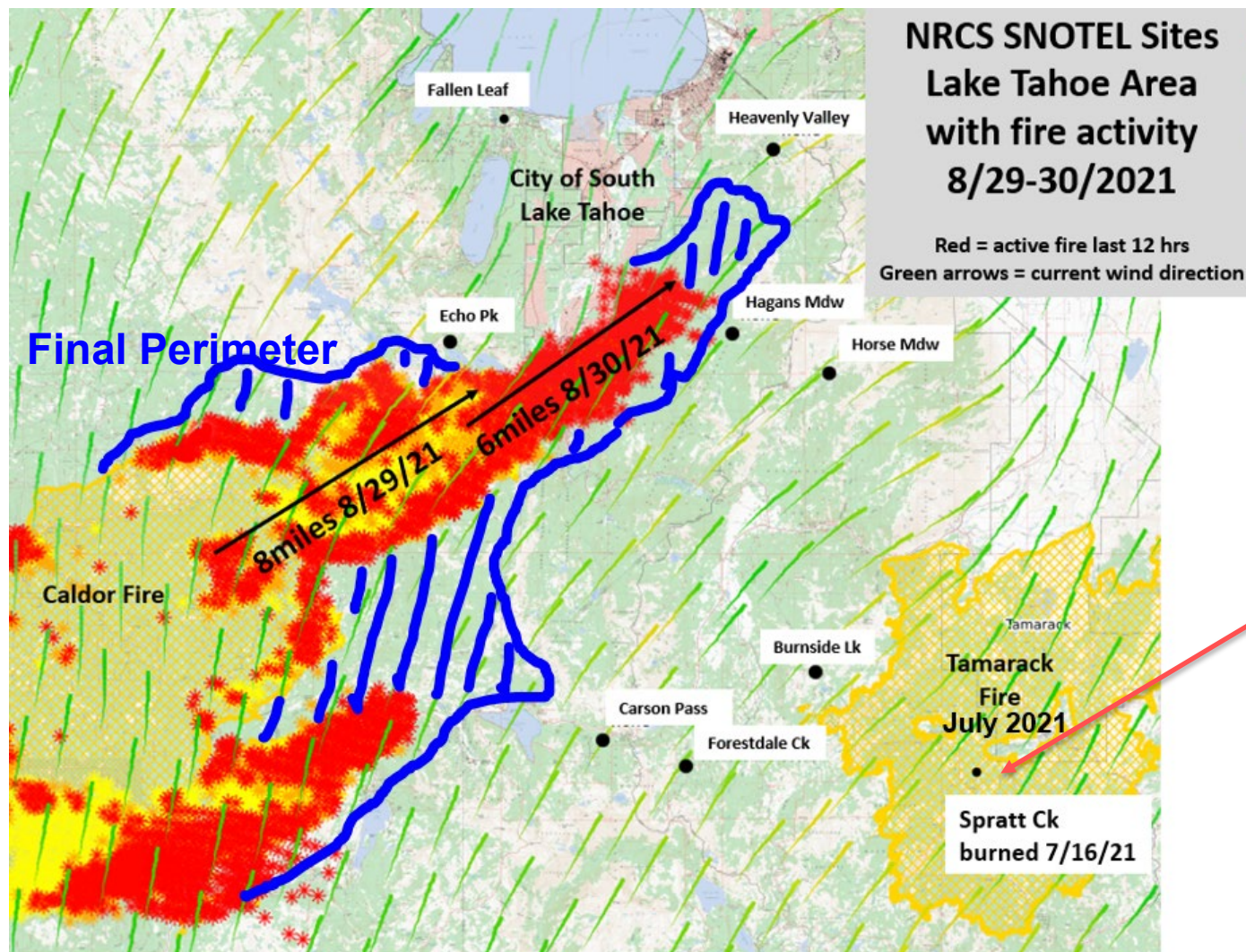
Snow Course



Natural Resources Conservation Service

nrcs.usda.gov/

2021 Fires – Dodging the Flames



Spratt Ck SNOTEL after rebuild

A big thanks to fire personnel who defended other SNOTEL sites from damage and for hazard tree removal at Spratt Creek.

New for 2022



Snow Survey - You Tube Video

An overview of the Snow Program in Nevada including information about the SNOTEL network, streamflow forecasting and services available.

[Click Here](#)



Palisade Tahoe Name Change

The names of the SNOTEL and snow course located at the ski resort formally known as Squaw Valley have been changed.

New names are:

[Palisades Tahoe SNOTEL](#)

[Palisades Tahoe #2 Snow Course](#)



1991-2020 Normals Dashboard

The NRCS updated its 30-year normals period from 1981-2010 to 1991-2020. Normals are used in a variety of products to represent data as a percent of normal. Changing normals impacts percentages and requires users to re-calibrate themselves. The dashboard provides tools to assess impacts in Nevada.

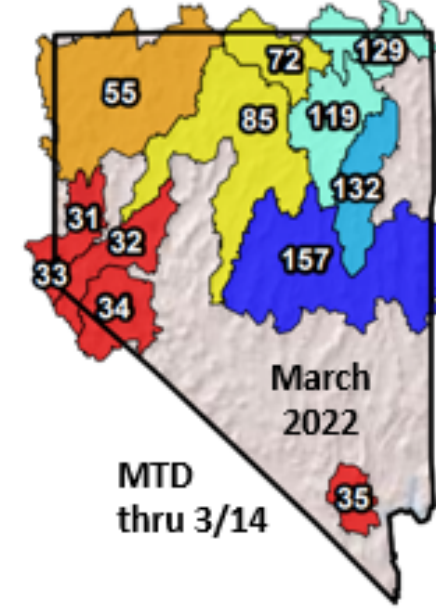
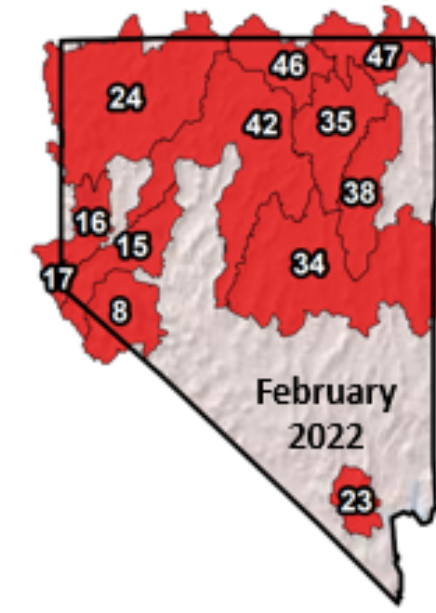
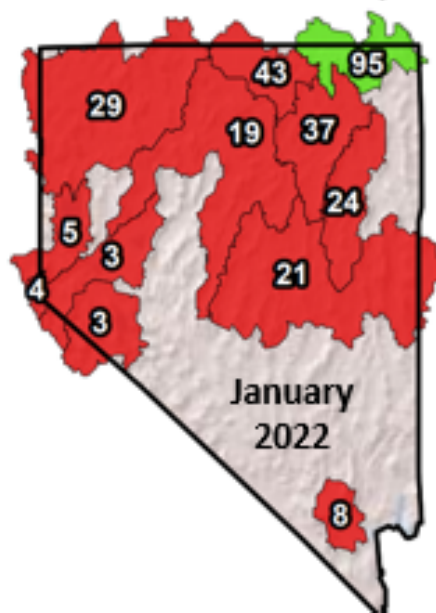
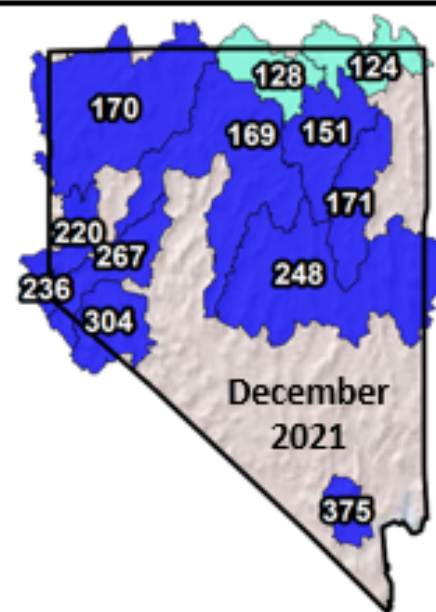
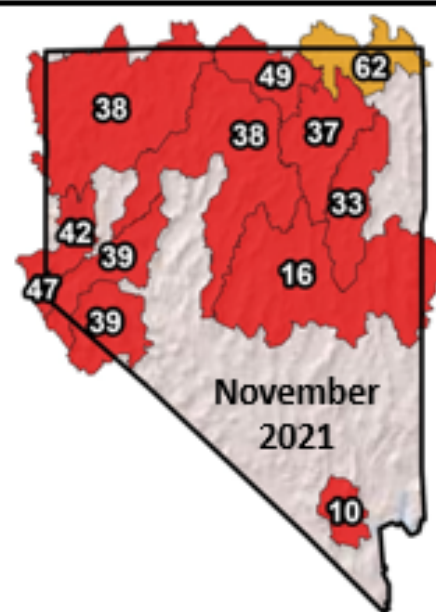
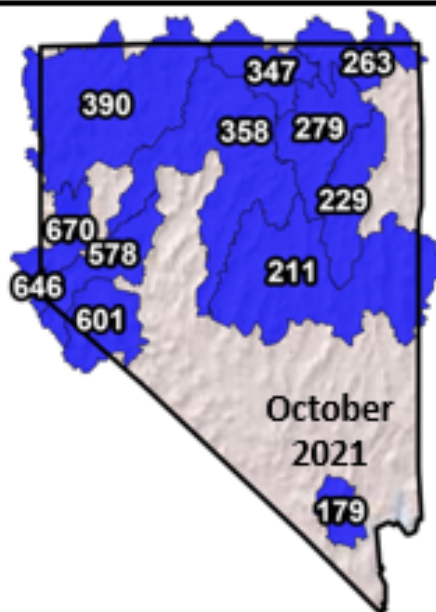
[Click Here](#)

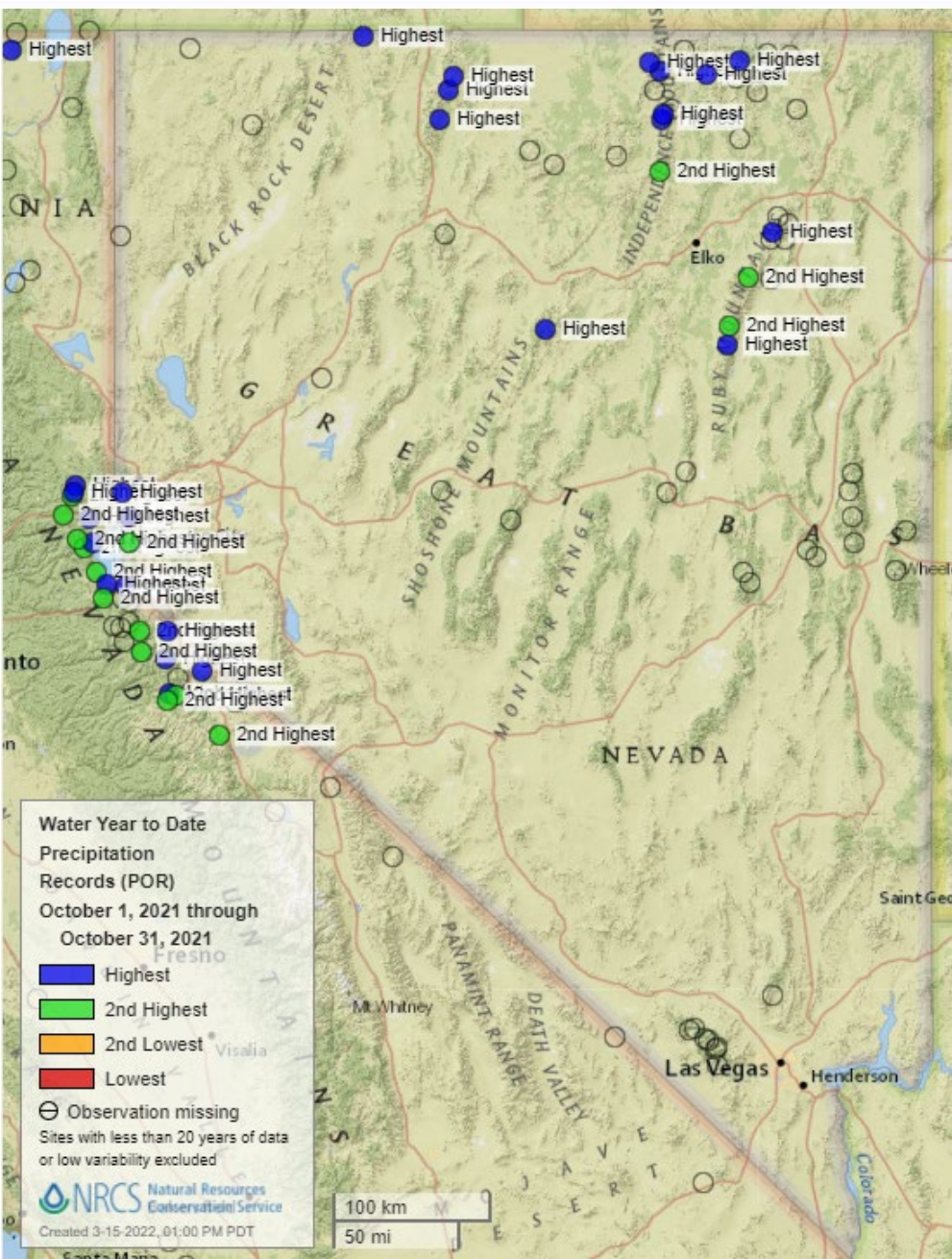


New Stream Forecasts for 2022

- **Bruneau River at Rowland Snake Basin (new)**
- **Jarbidge River below Jarbidge Snake Basin (new)**
- **SF Humboldt R ab Tenmile Ck Upper Humboldt Basin (new)**
Gage is above Southfork Res
- **L Humboldt nr Paradise Valley Lower Humboldt Basin**
Adjusted for Chimney Ck Res

Monthly Precipitation as Percent of Median – Water Year 2022





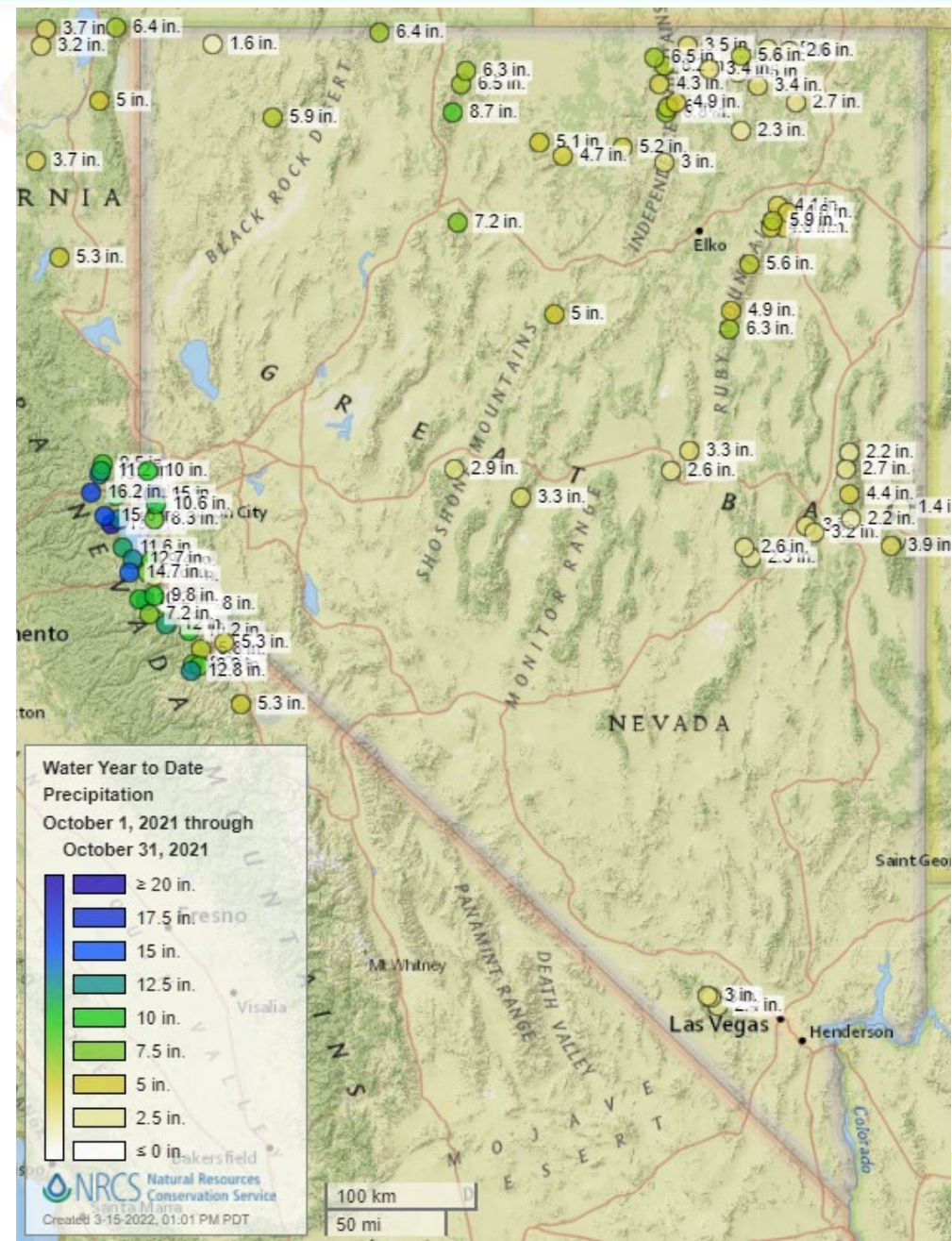
Record Breaking October Precipitation

Sierra SNOTELs ~5-20in

Humboldt Basin

Ruby Mtns ~4-6in

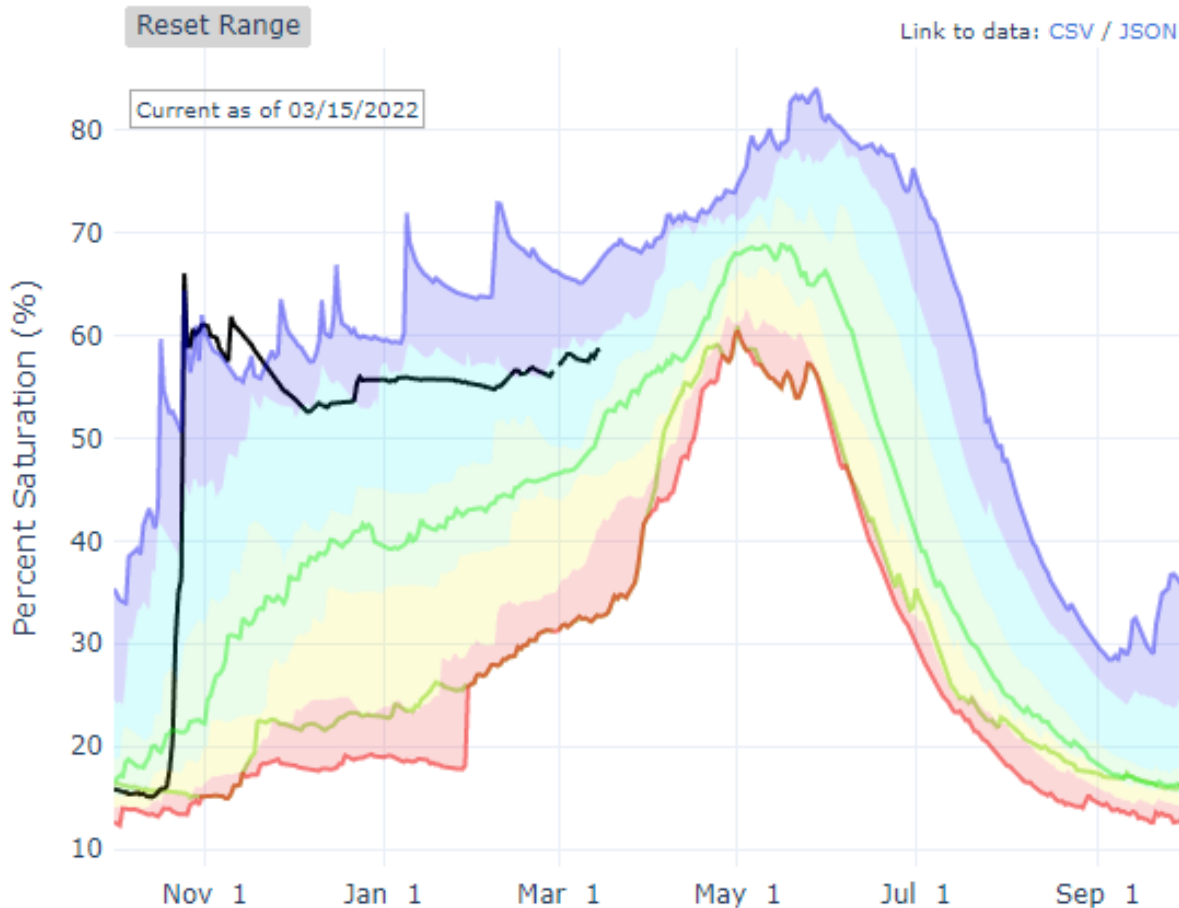
Santa Rosa Mtns ~6-9in



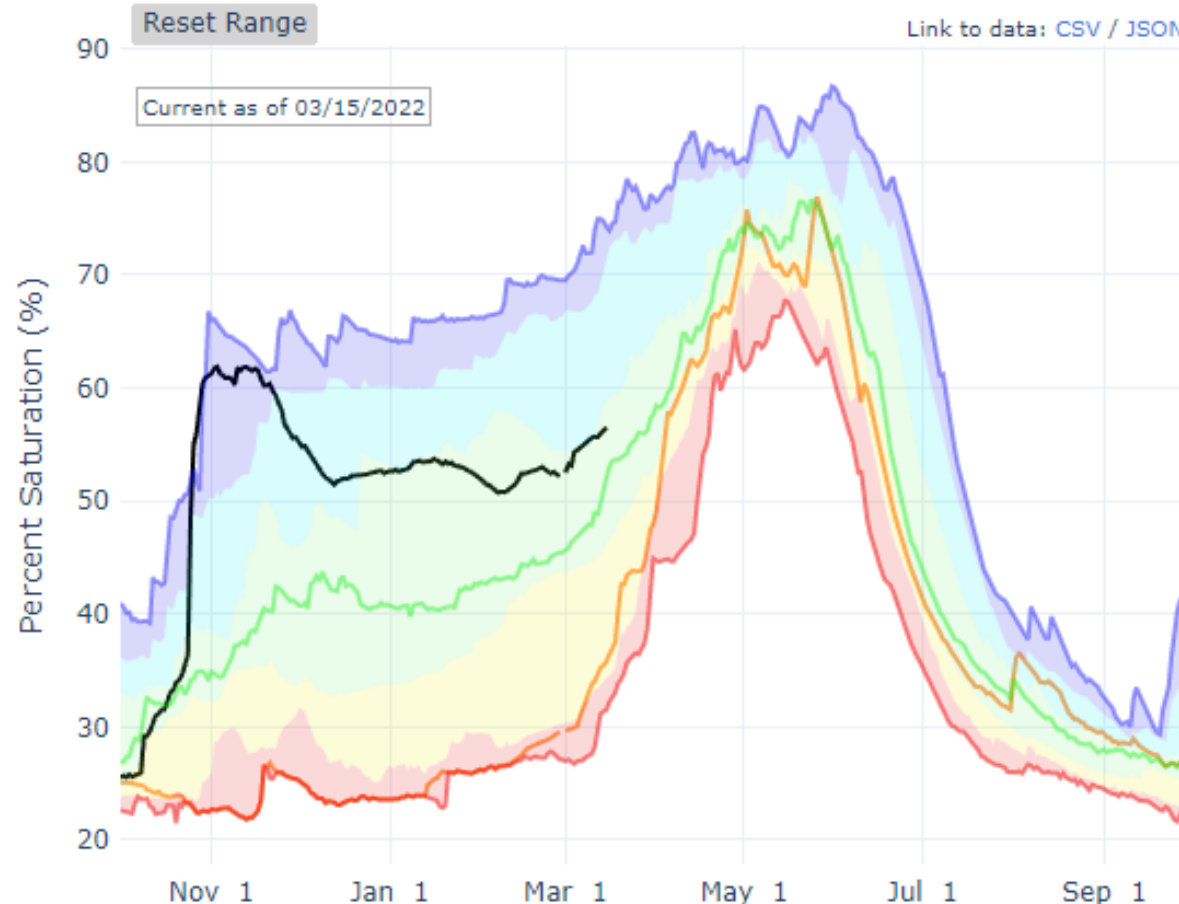
Soil Moisture much better than 2021



DEPTH AVERAGED SOIL SATURATION IN EASTERN SIERRA



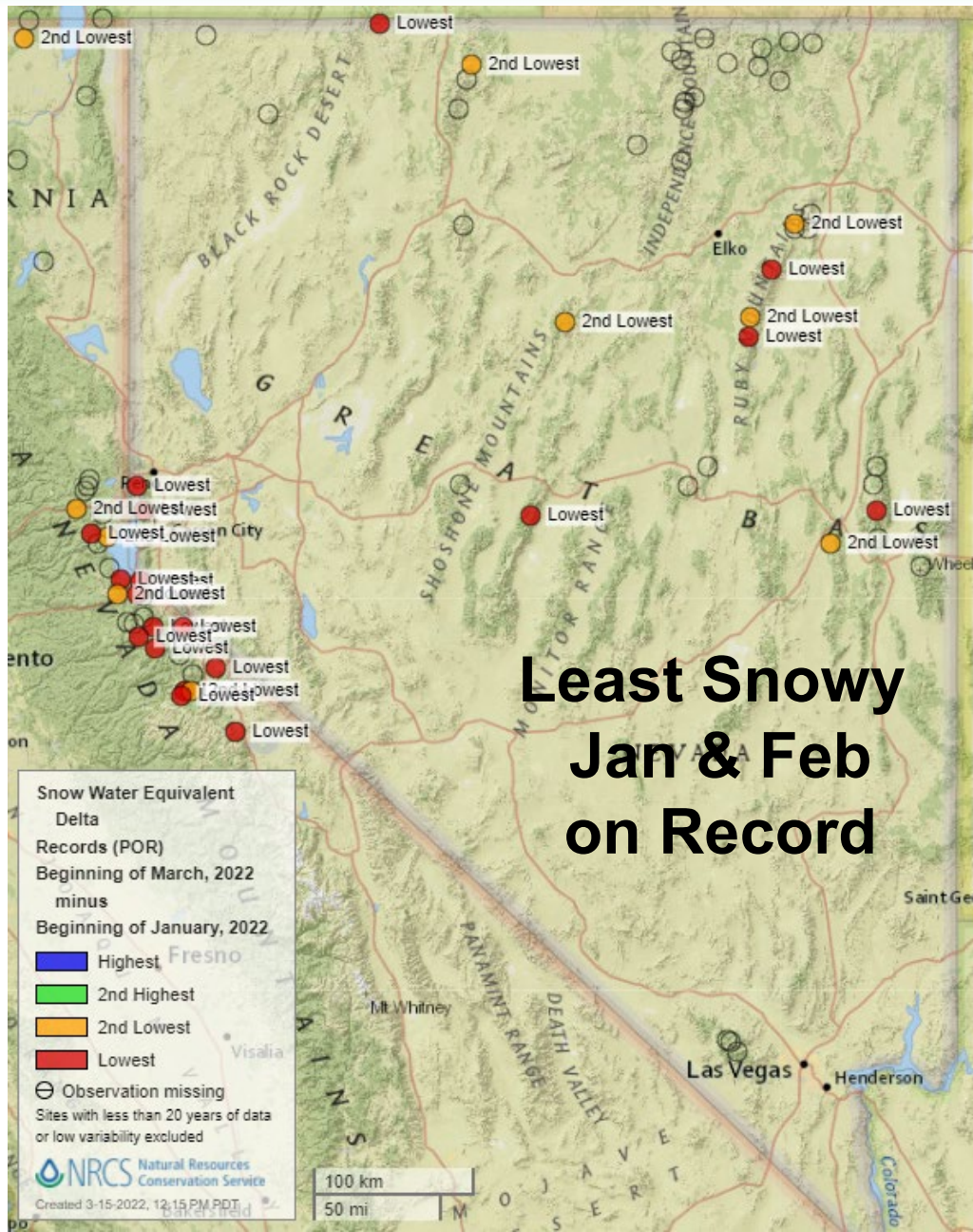
DEPTH AVERAGED SOIL SATURATION IN HUMBOLDT





Record High & Low Snowpack Accumulation

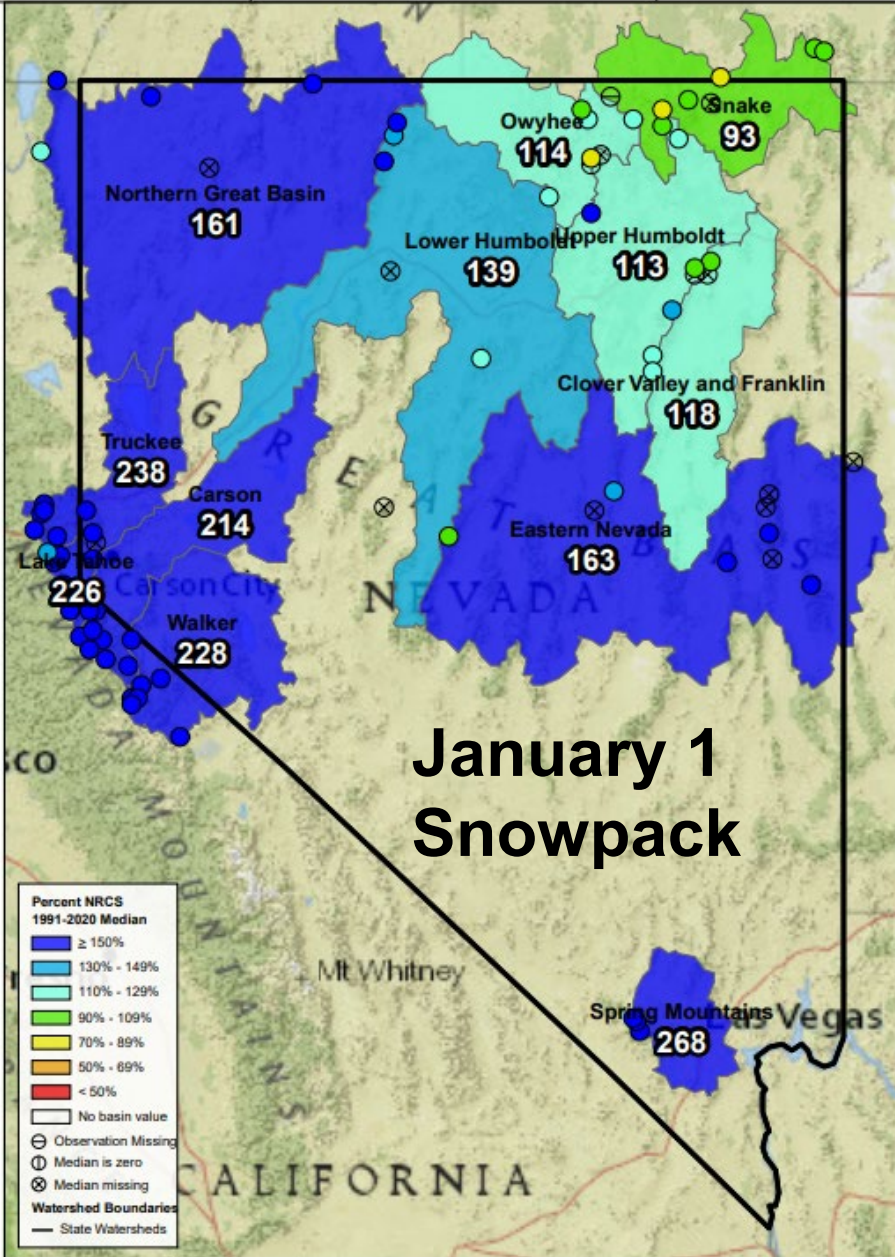
Boom & Bust In one year



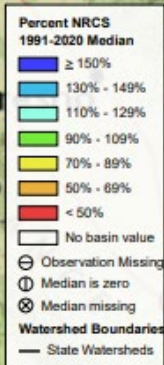
Snow Water Equivalent

Percent NRCS 1991-2020 Median

January 1, 2022, first of day



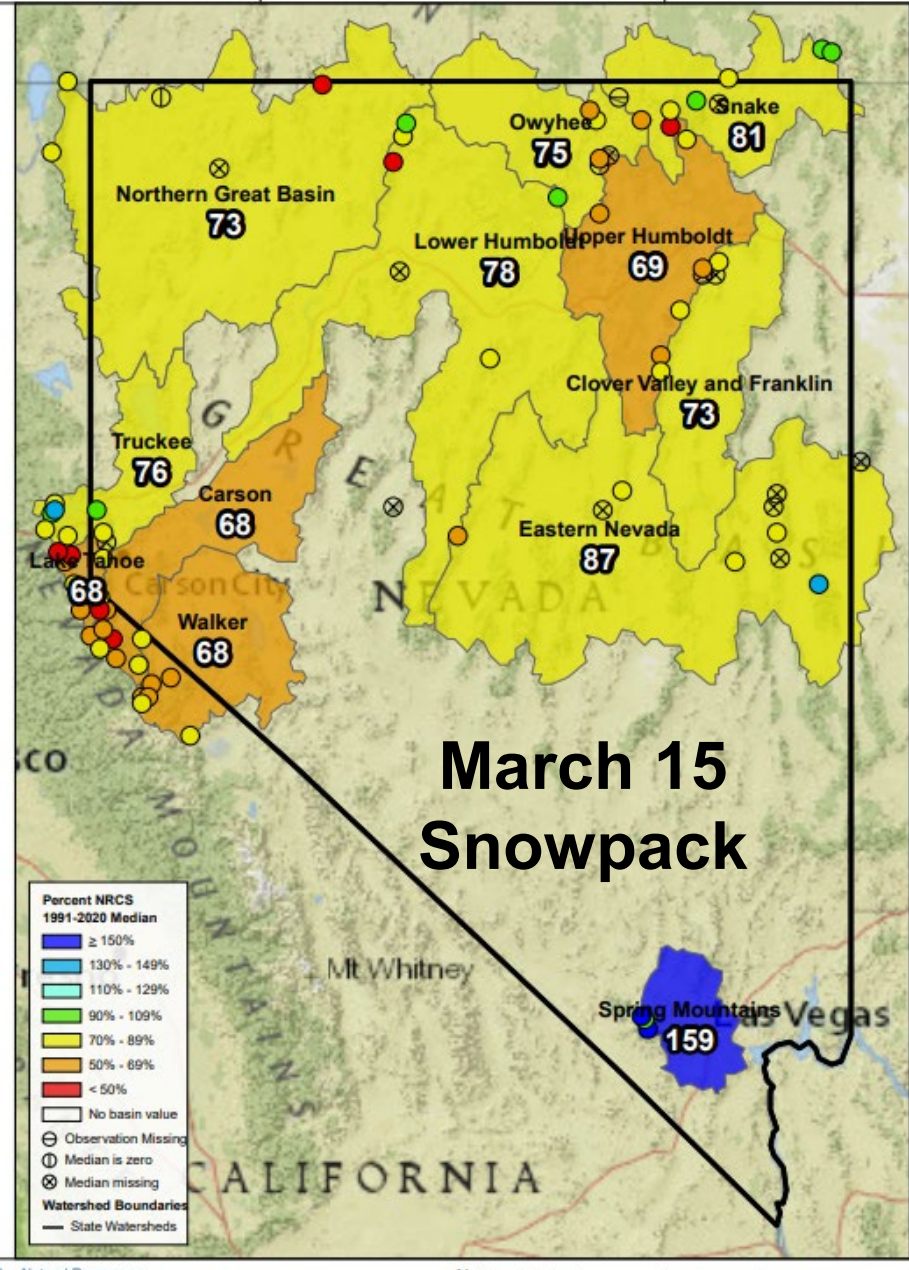
January 1 Snowpack



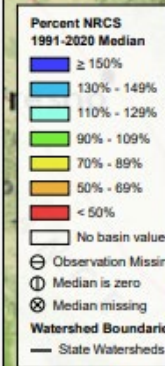
Snow Water Equivalent

Percent NRCS 1991-2020 Median

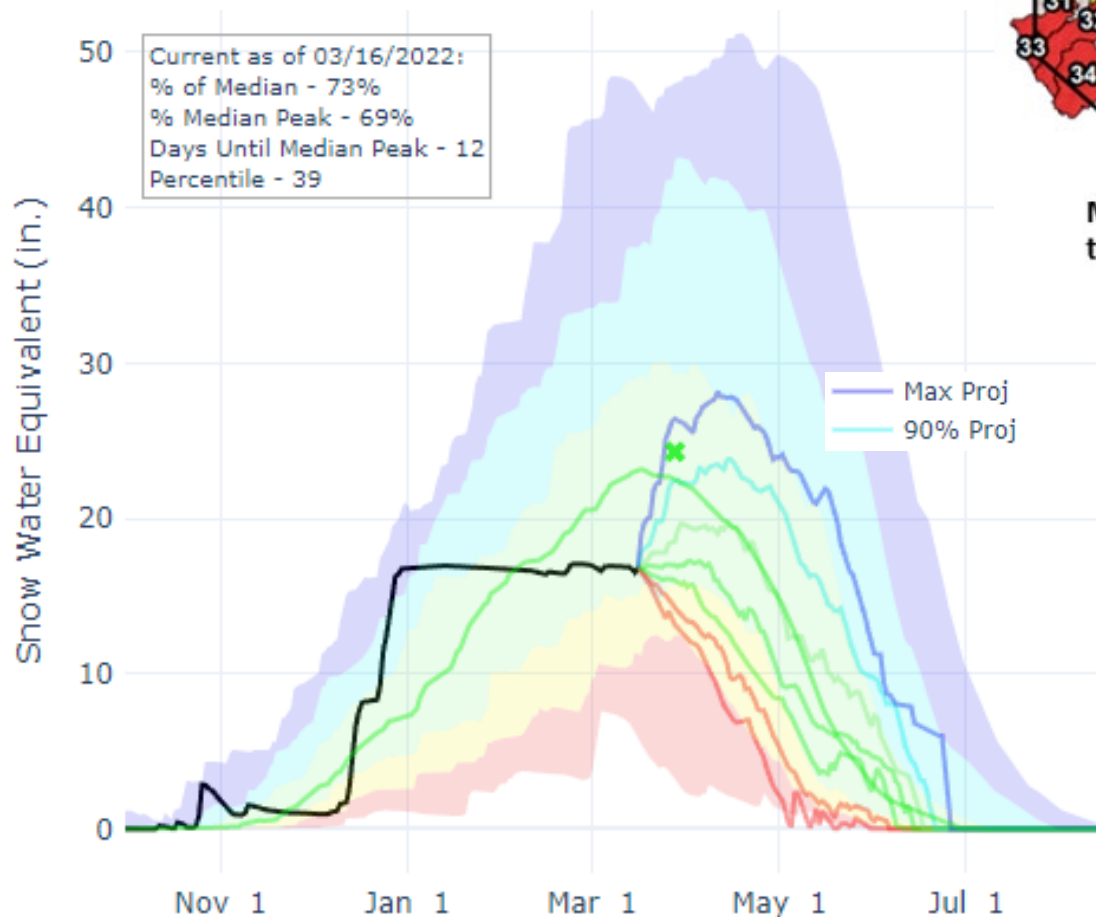
March 15, 2022, first of day



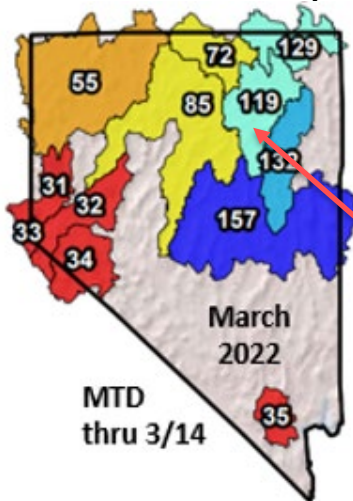
March 15 Snowpack



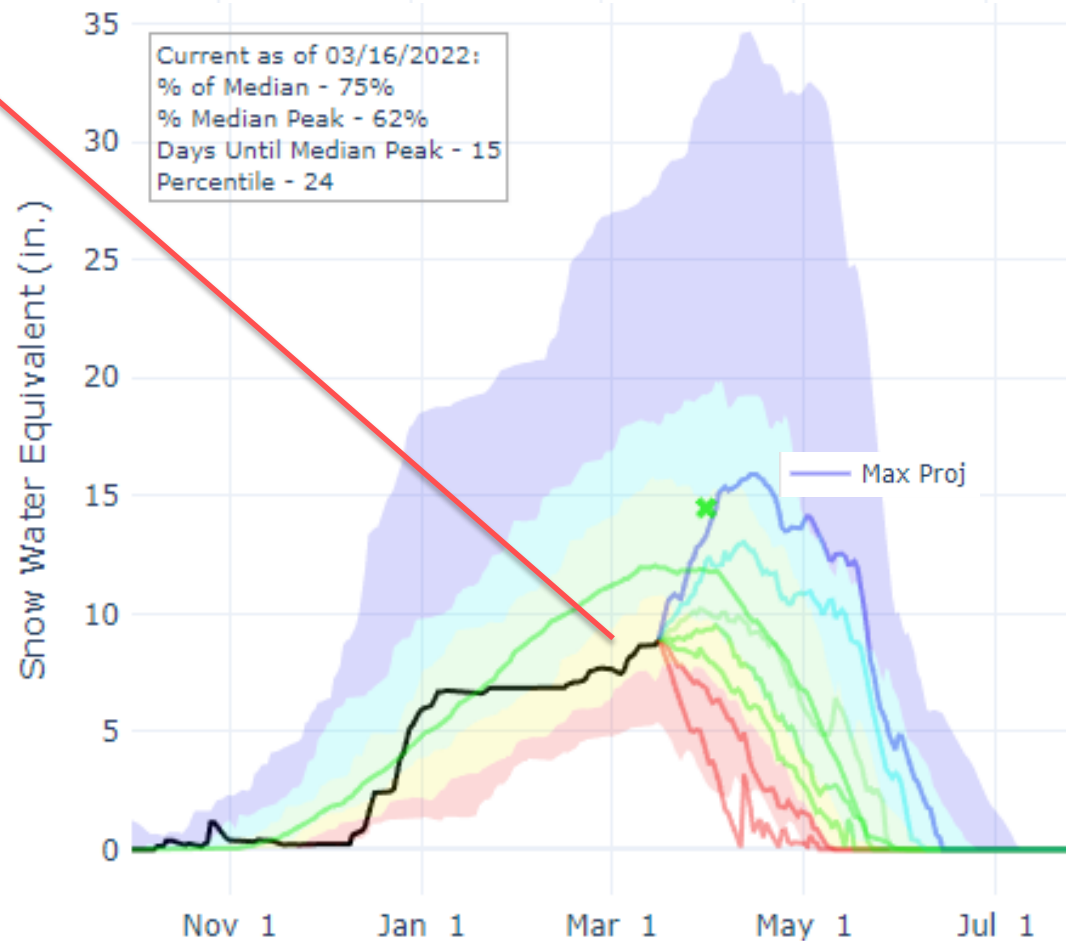
SNOW WATER EQUIVALENT IN EASTERN SIERRA



March Precip



SNOW WATER EQUIVALENT IN HUMBOLDT



Snow is thin to gone on south/west aspects



**Genoa Peak – Tahoe / Carson Basins
9000ft east side of Tahoe 3/13/22**



**Waterhouse Peak - Carson Basin
9400ft on near Lost Lakes 3/8/22**

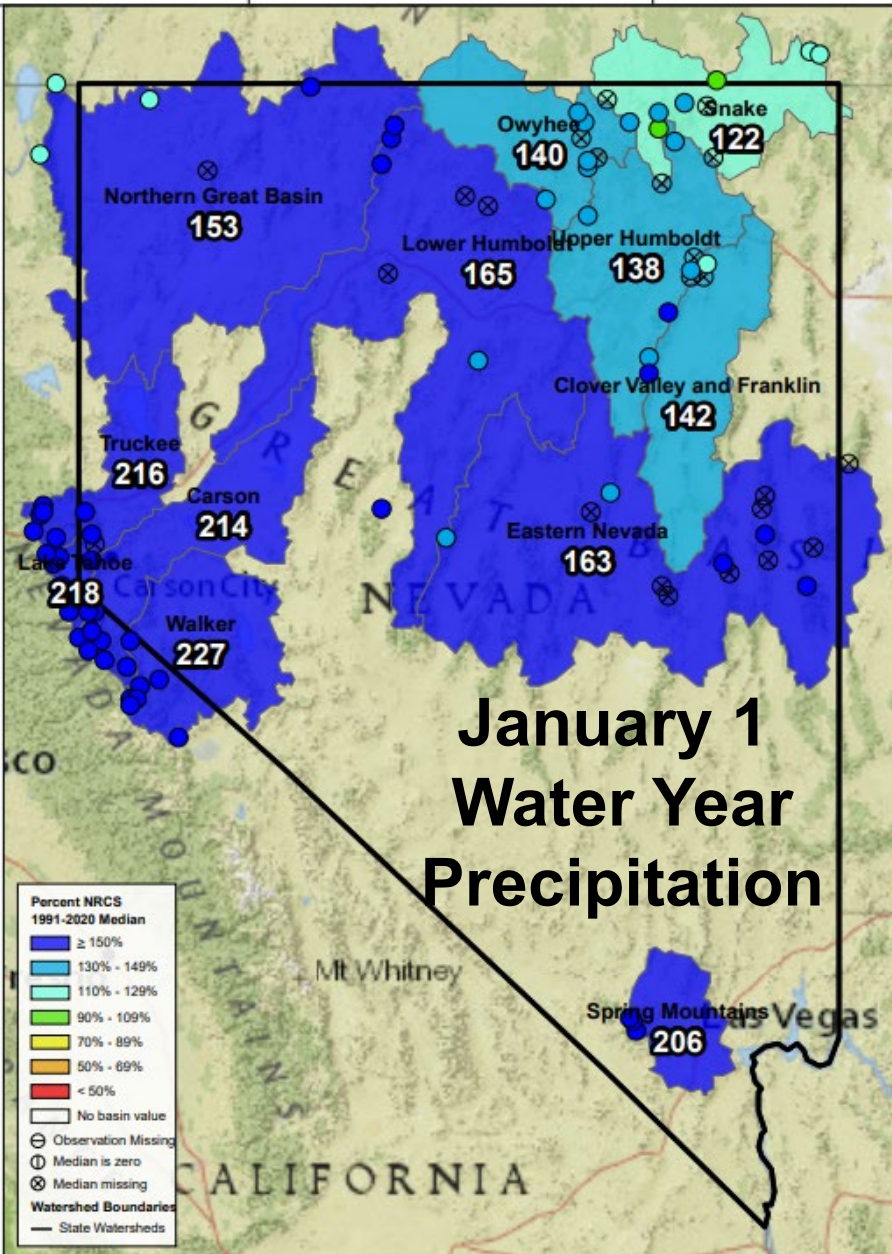


**Sonora Pass Rd - Walker Basin
Below 7800ft 3/8/22**

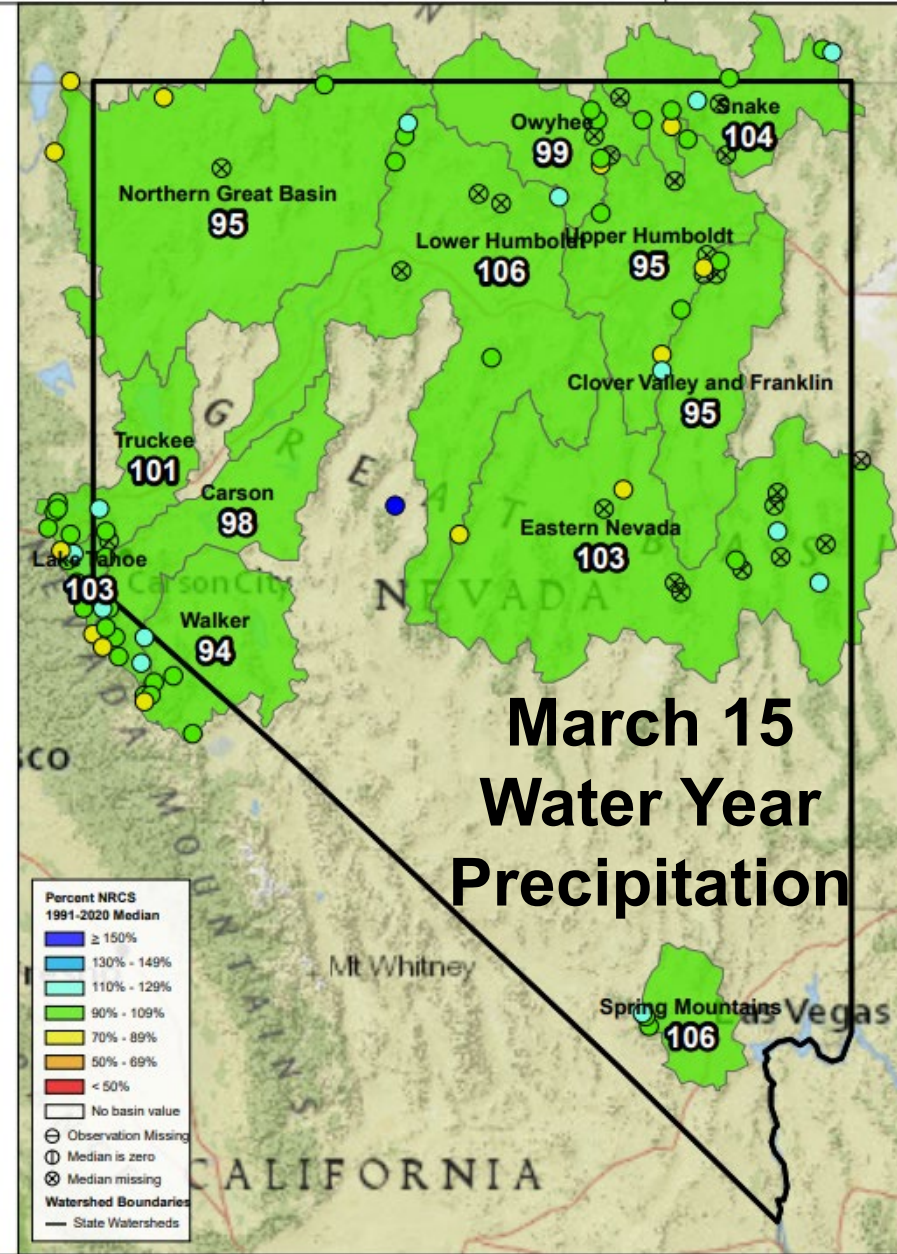
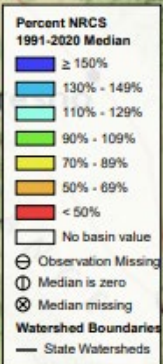


**Sunny side of Mt Houghton and Mt Rose
Truckee Basin
9000-10500ft
3/12/22**

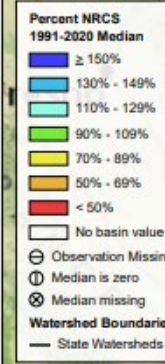
Photos courtesy Sierra and Bridgeport Avalanche Centers



January 1 Water Year Precipitation



March 15 Water Year Precipitation



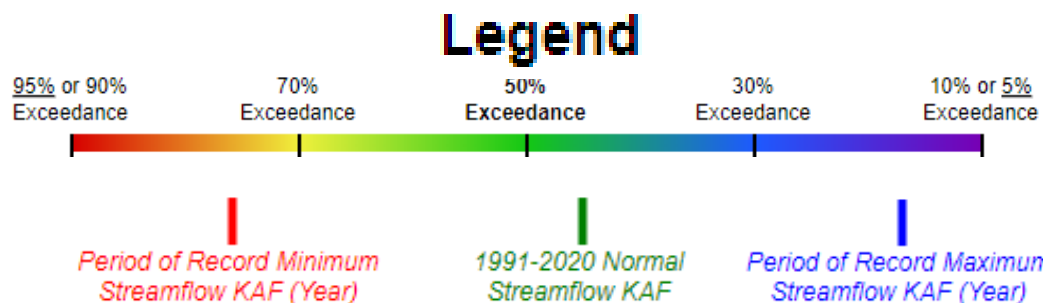
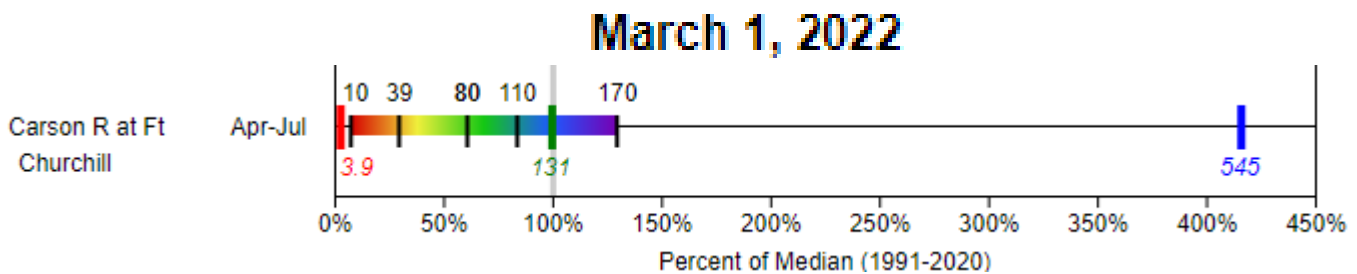
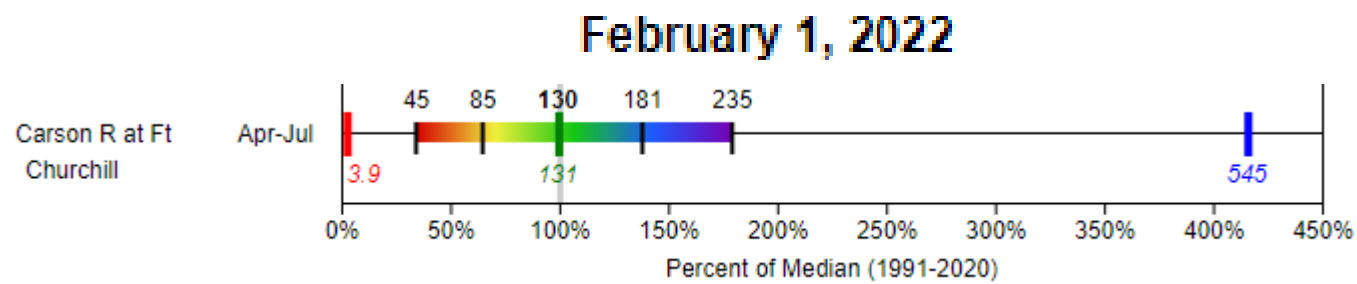
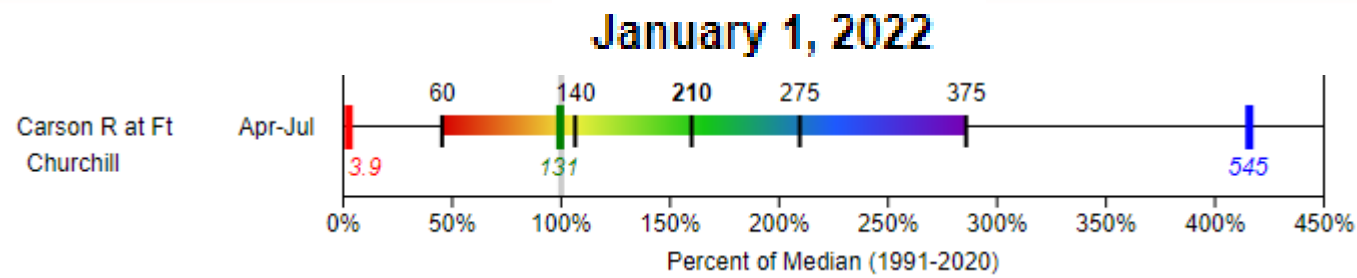
Jolyne Lea's comment on March 1, 2022 forecasts...

“Forecast decreases since January 1 are the largest declines I have seen in my career.”

Jolyne has been forecasting Nevada streamflow for the NRCS since 1991.



Forecast Exceedance Probabilities
 Forecast Point Forecast Period <----- Drier -----> Future Conditions -----> Wetter ----->
 Labels on chart represent volumes of water expressed in thousand acre-feet.



Exceedance Spread

315kaf

190kaf

160kaf

Forecast skill increases as winter passes

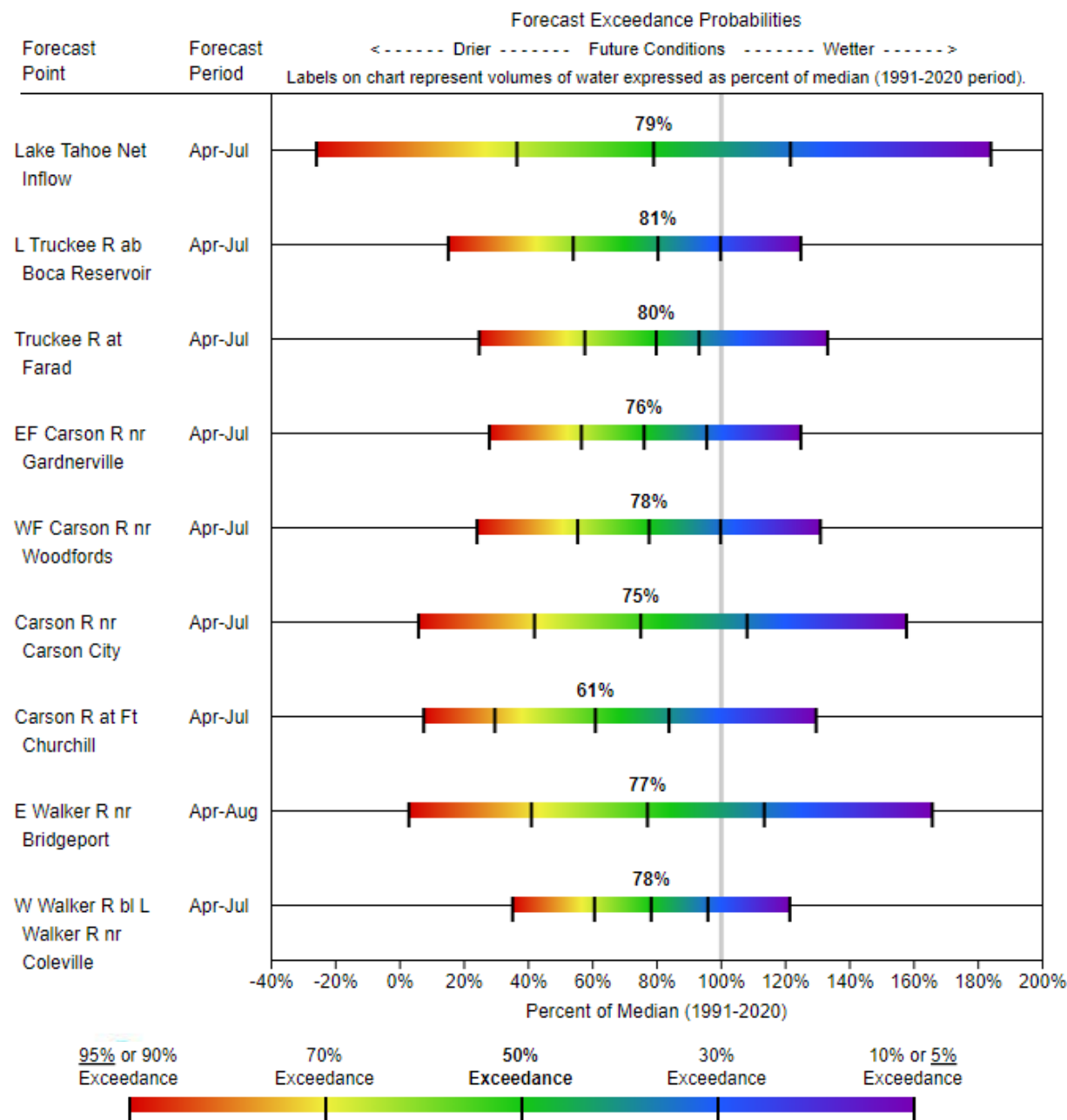
Spread between 10% and 90% exceedances shrink

- What is correct exceedance level
- #1 What's future weather – wet or dry?
 - #2 What other factors are special in 2022
 - soil moisture / base flows
 - lack of snow on sunny aspects



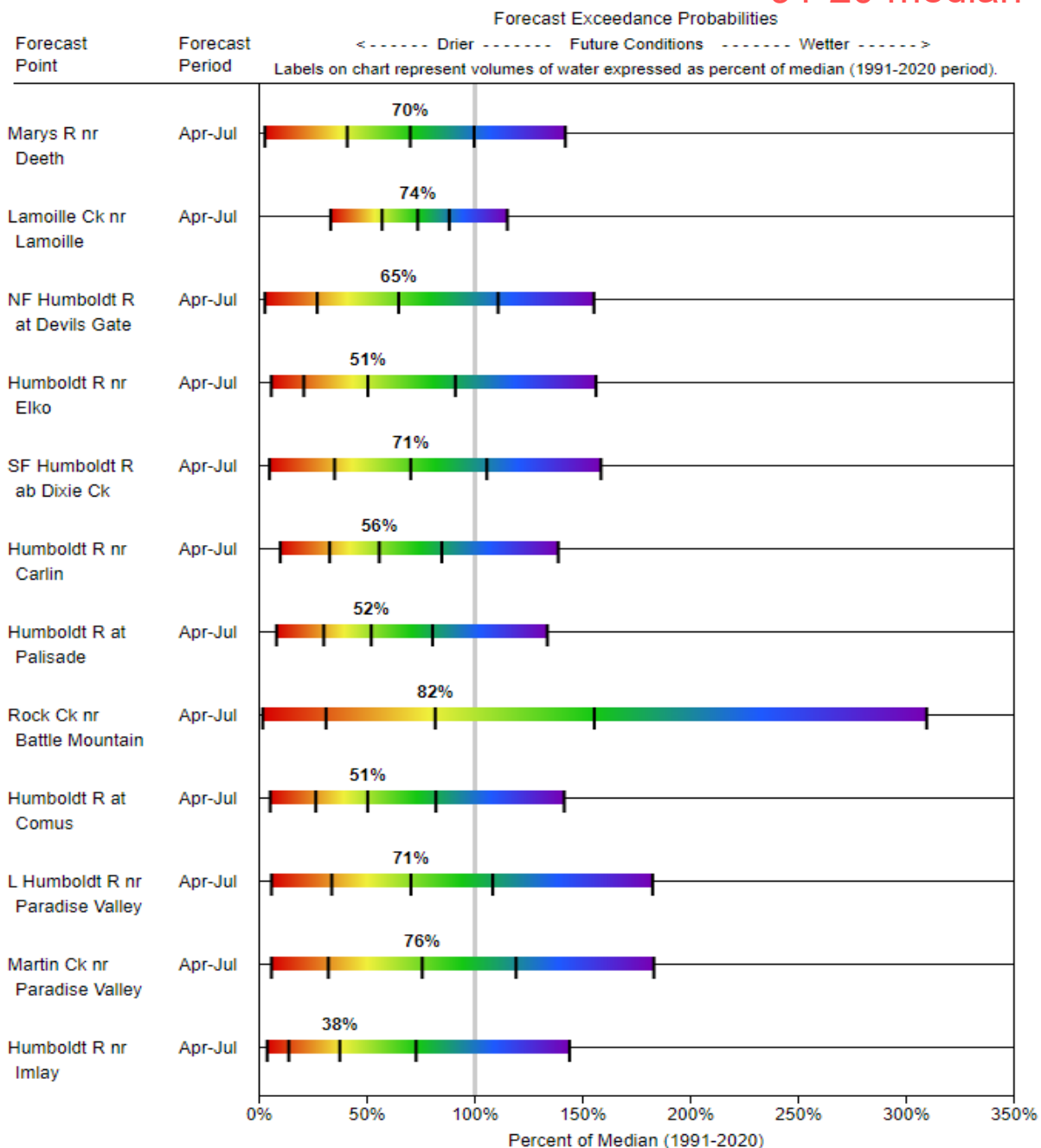
Eastern Sierra Basin Summary
Water Supply Forecasts
 March 1, 2022

61-81%
 '91-20 median



Humboldt River Summary
Water Supply Forecasts
 March 1, 2022

38-82%
 '91-20 median



Eastern Sierra Basin Summary

Water Supply Forecasts

March 1, 2022

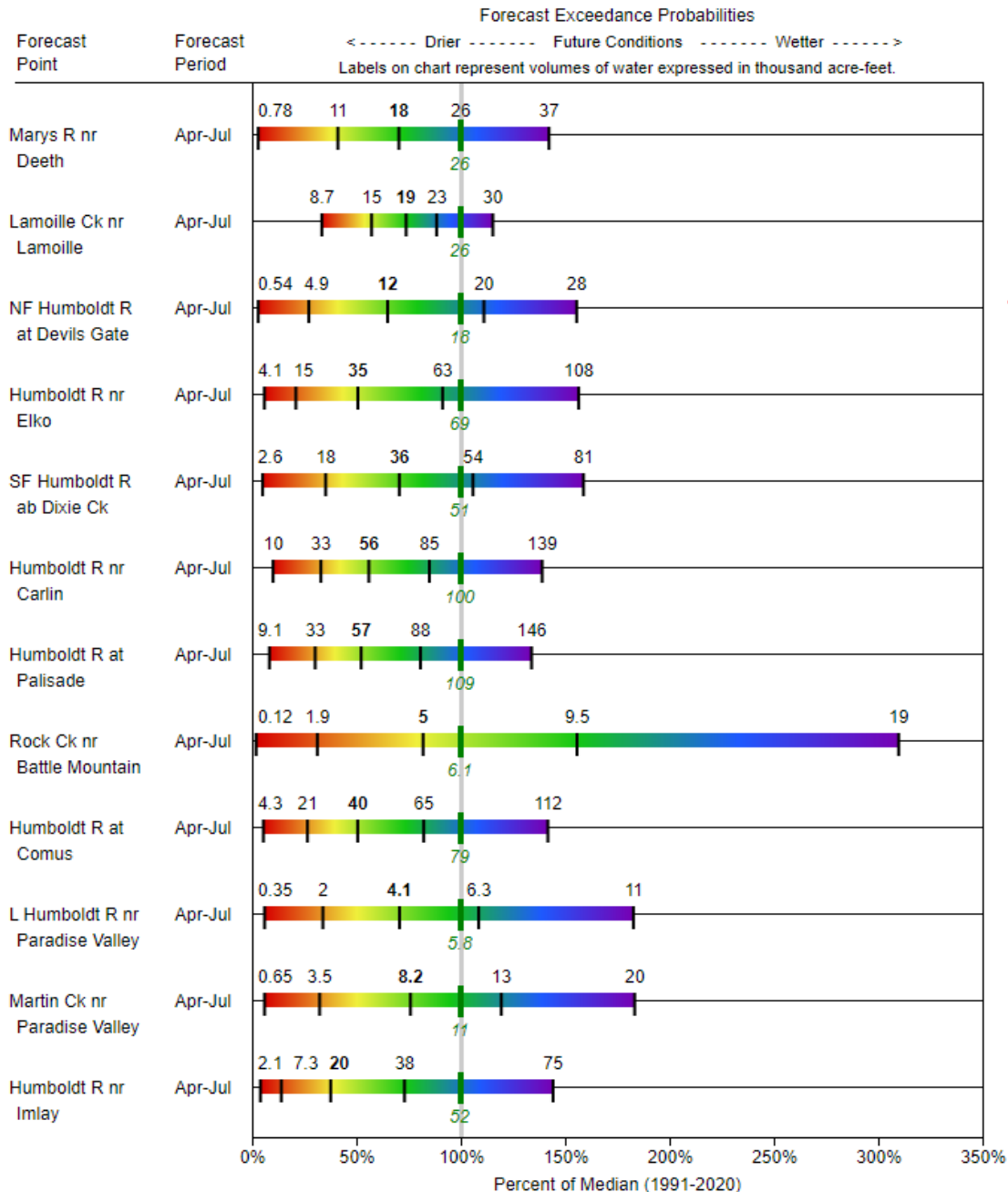
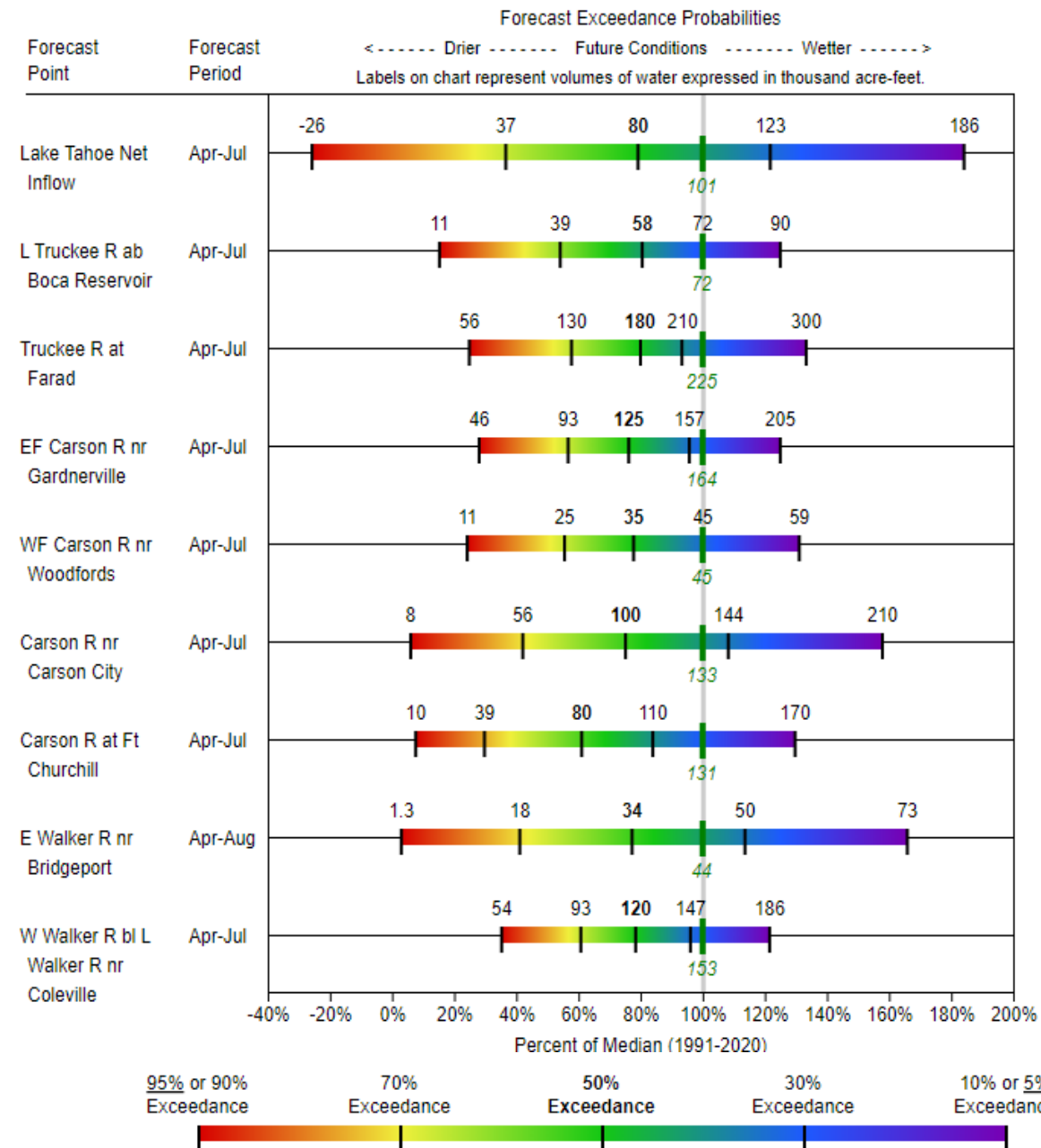
2021
Obs

Humboldt River Summary

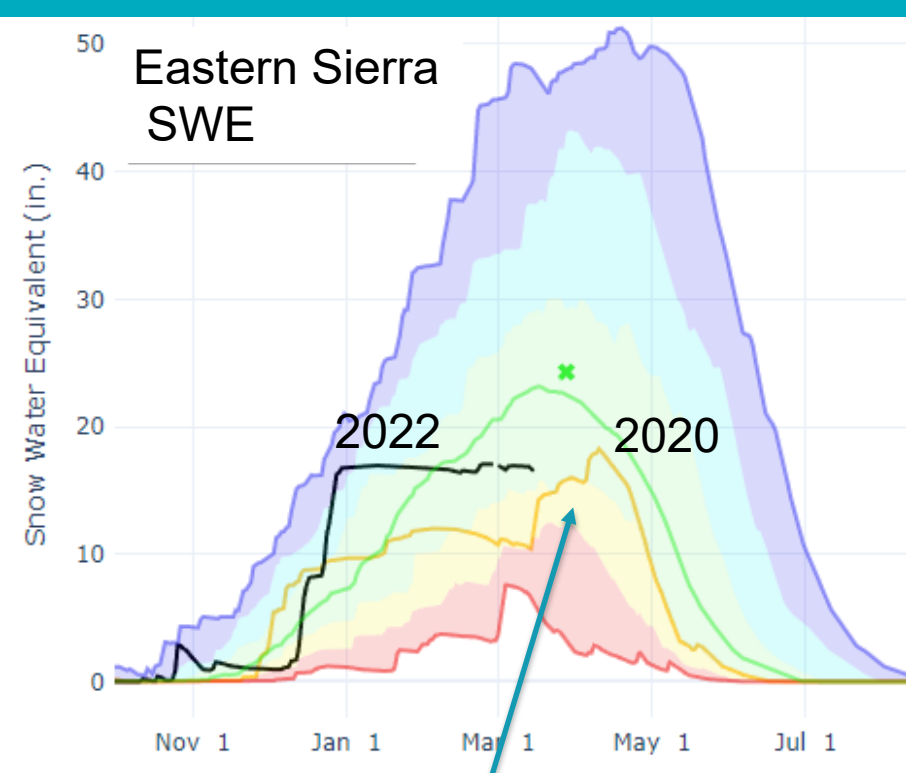
Water Supply Forecasts

March 1, 2022

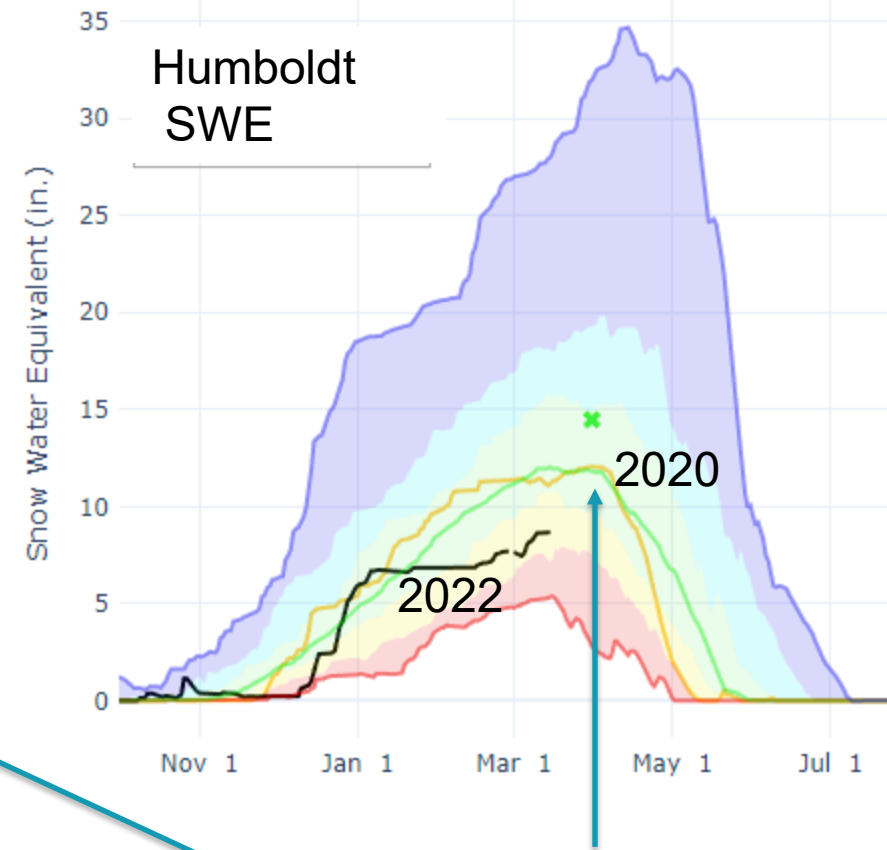
2021
Obs



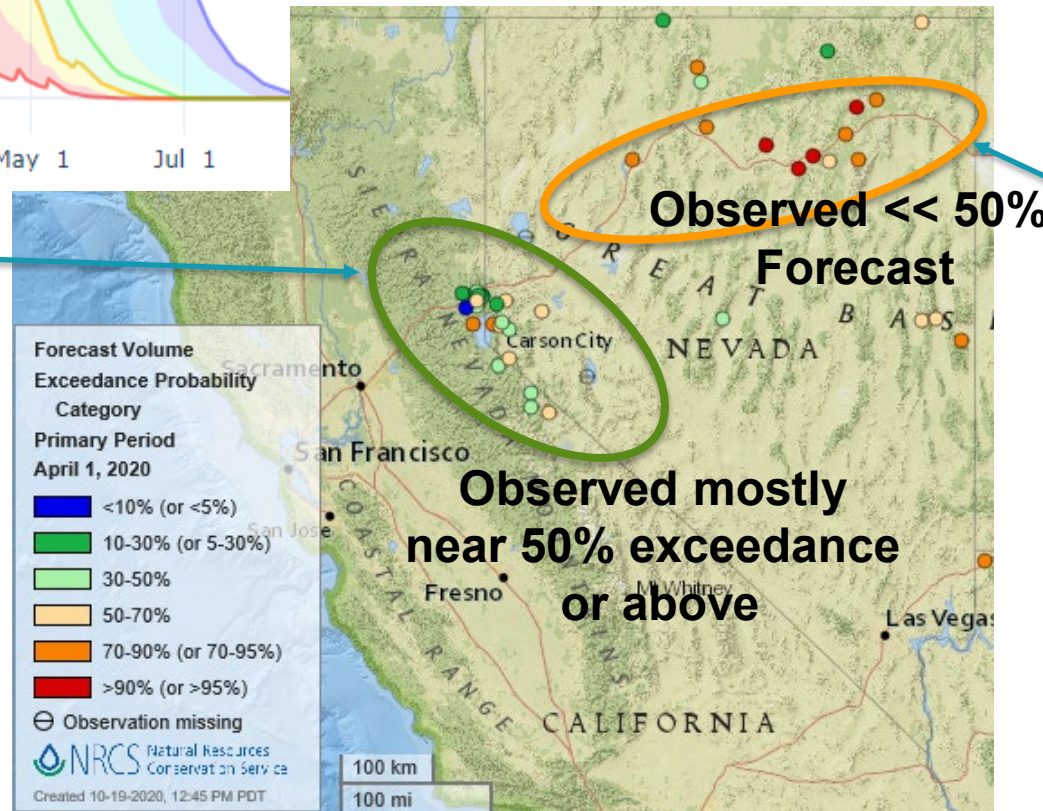
Lessons from 2020 Runoff Observed vs Exceedances



Late snow
Observed runoff in
normal and wetter
exceedances



Little spring snow
observed runoff in
drier exceedances



1991-2020 Normals Summary

New 1991-2020 medians & averages for:

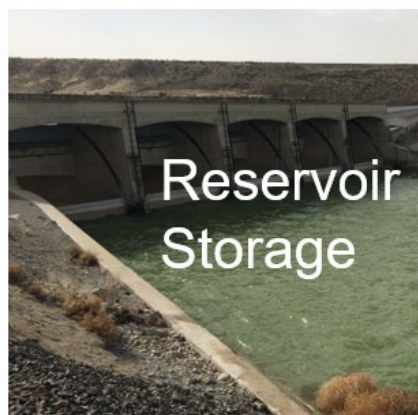
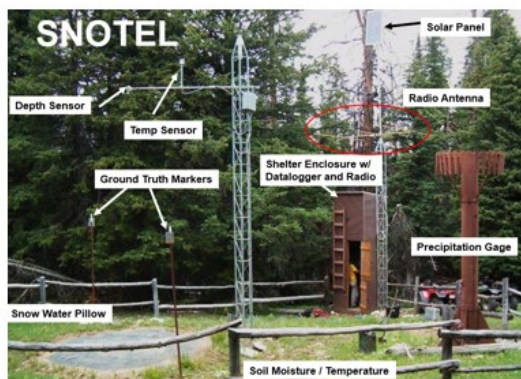
- **Snow Course** – Monthly Snow-water
- **Reservoir Storage** – monthly volumes
- **Streamflow Volumes** – monthly & seasonal (April-July)
- **SNOTEL** – Daily Snow Water & Precipitation
 - Annual Stats: snow onset, peak & melt-out

Key Points:

- Sites with ≥ 10 years of data get official normals

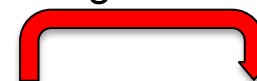
Newer sites
with enough years

SNOTEL	Years	Basin
Rainbow Cyn	12	Spring Mtns
Bristlecone Trail	12	Spring Mtns
Lee Canyon	12	Spring Mtns
Toe Jam	11	Lower Humboldt
Wheeler Peak	10	Eastern NV



- Streamflow forecasts are re-calibrated with '91-20 data
- Update **doesn't change**: SNOTEL data or forecasting methods
- **Median is the new default for all NRCS products**

Change in Years



	1981-2010	1991-2020
Snow Water	median	median
Precipitation	average	median
Streamflow	average	median
Reservoir	average	median



Change in Stats

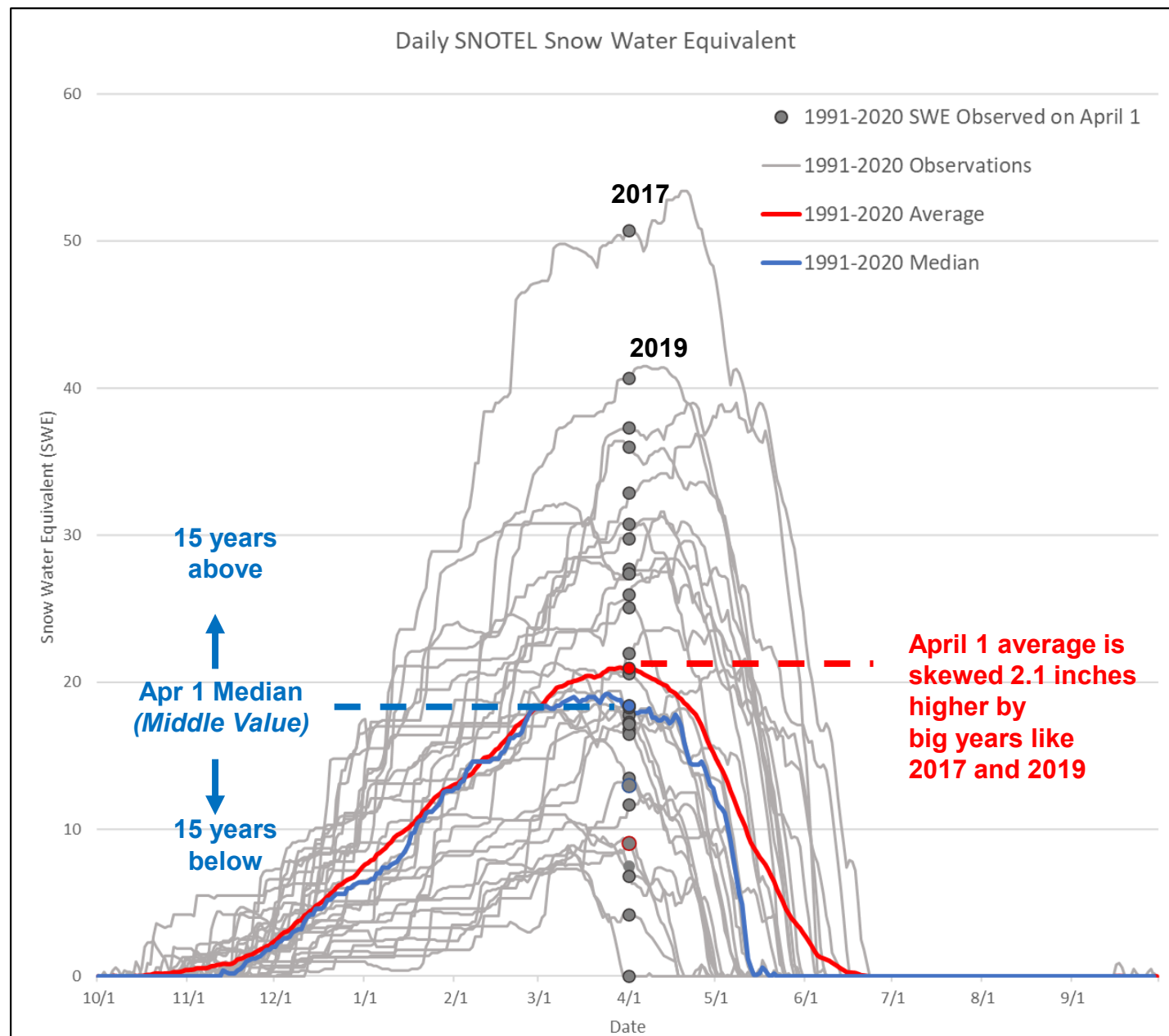


Why Median?

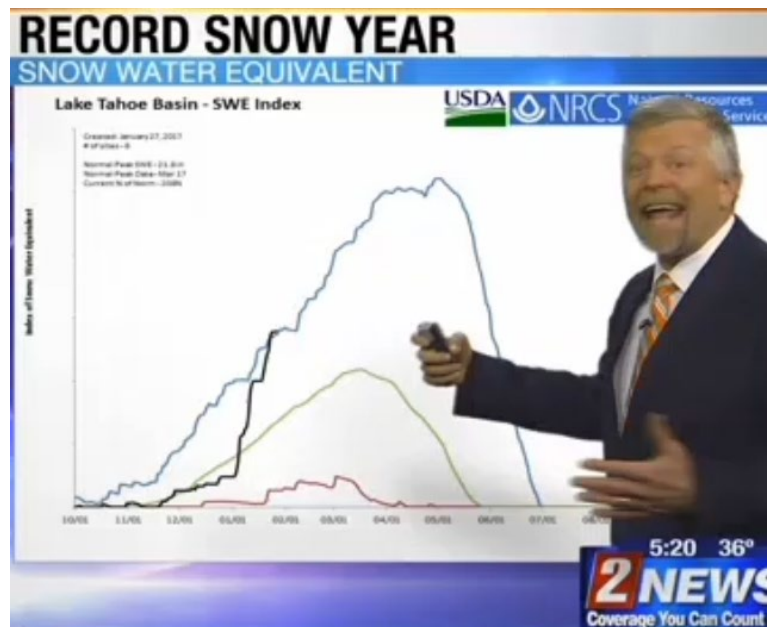
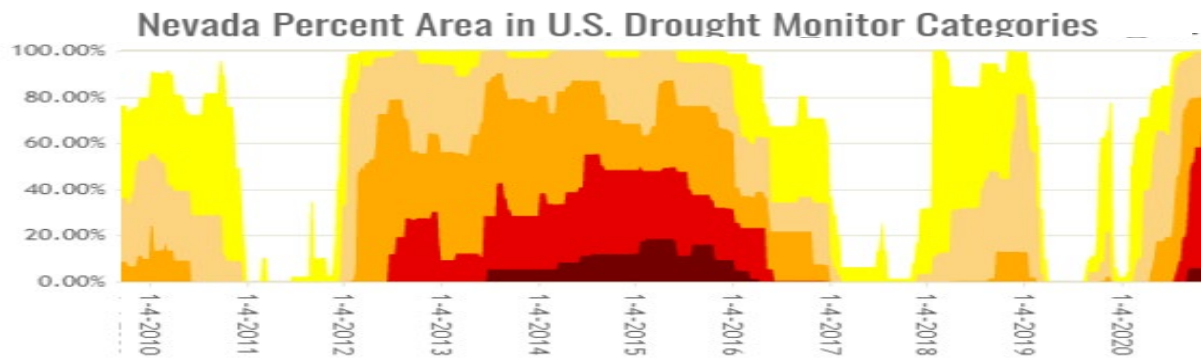
Hydro-climatic datasets (snow, precip, streamflow) are often non-symmetrical.

For non-symmetric data the median better represents the central tendency since half the values are above and half are below.

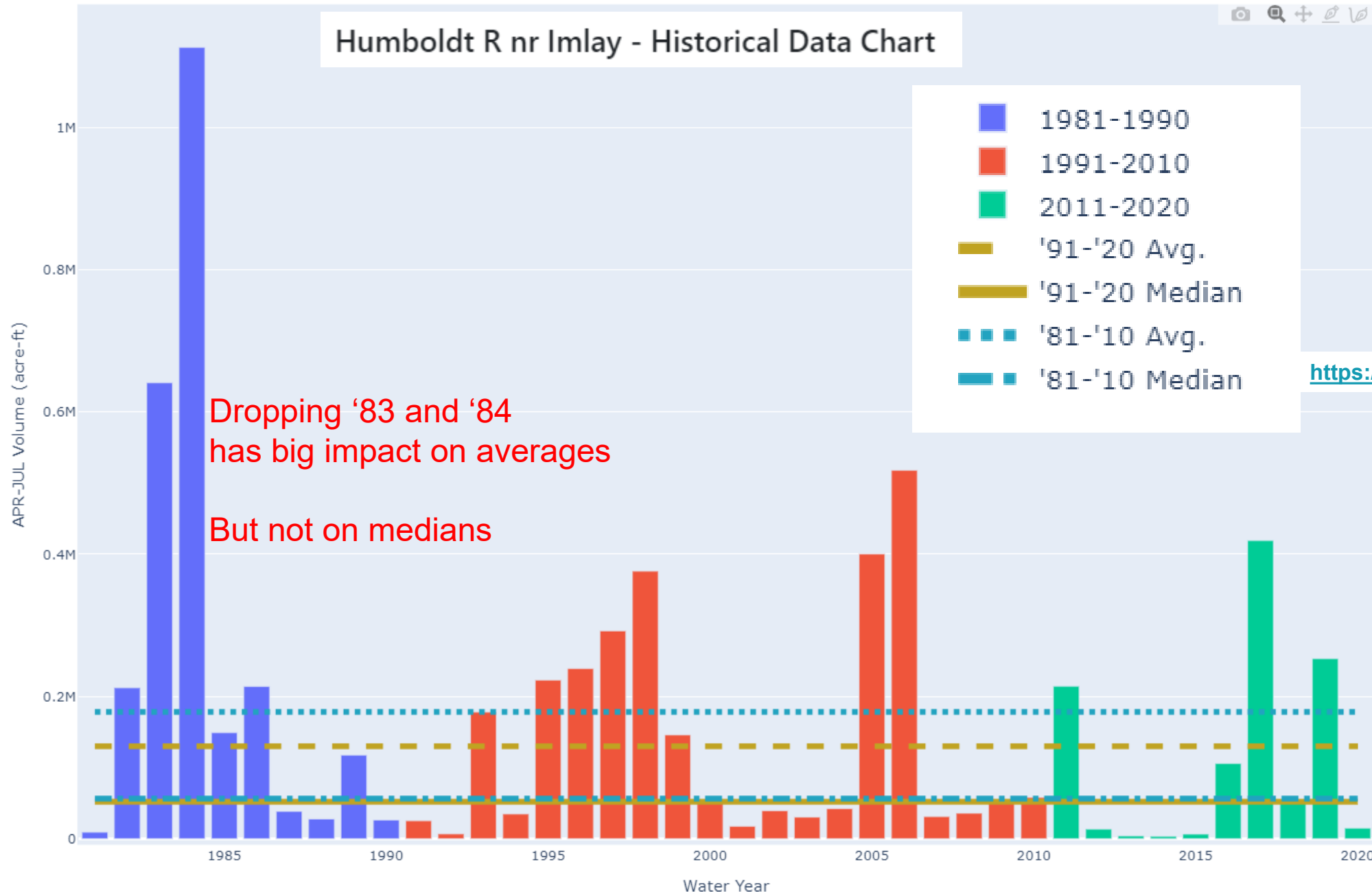
The median is less skewed than the average by extremes



1991-2020 Normals - What's happened since 2010?



1991-2020 Normals – What's missing from the 1980s?



Similar charts for all forecast points on **Nevada Normals Dashboard**

<https://tinyurl.com/2p8ntrrx>

81-10 Average
91-20 Average
81-10 and 91-20 Medians

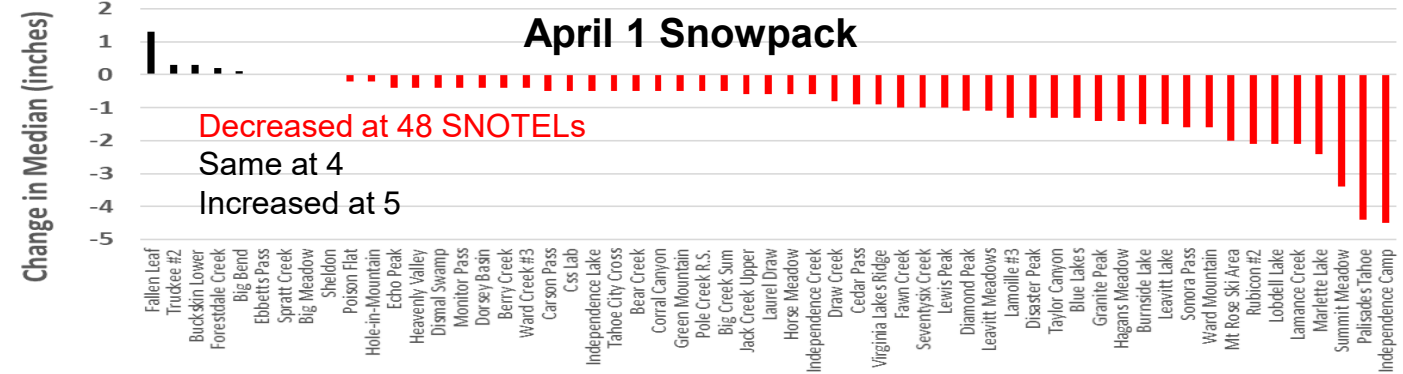


How has changing years changed medians?

In general, new medians < old medians
less water = more red than black

Snowpack: April 1 '91-20 medians < '81-'10

Change in Median (1991-2020 vs 1981-2010) SNOTEL / Streamflow Points in Northern Nevada & Eastern Sierra Basins

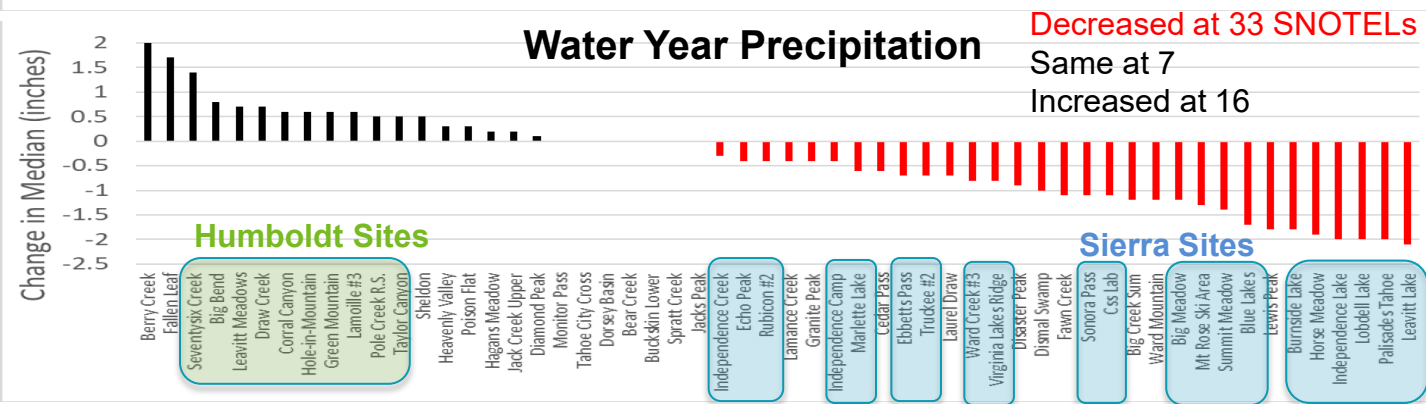


Water Year Precip: Mixed results

New Medians ↑ 1/3 sites ↓ 2/3 sites

Increases more common in **Humboldt Basin**

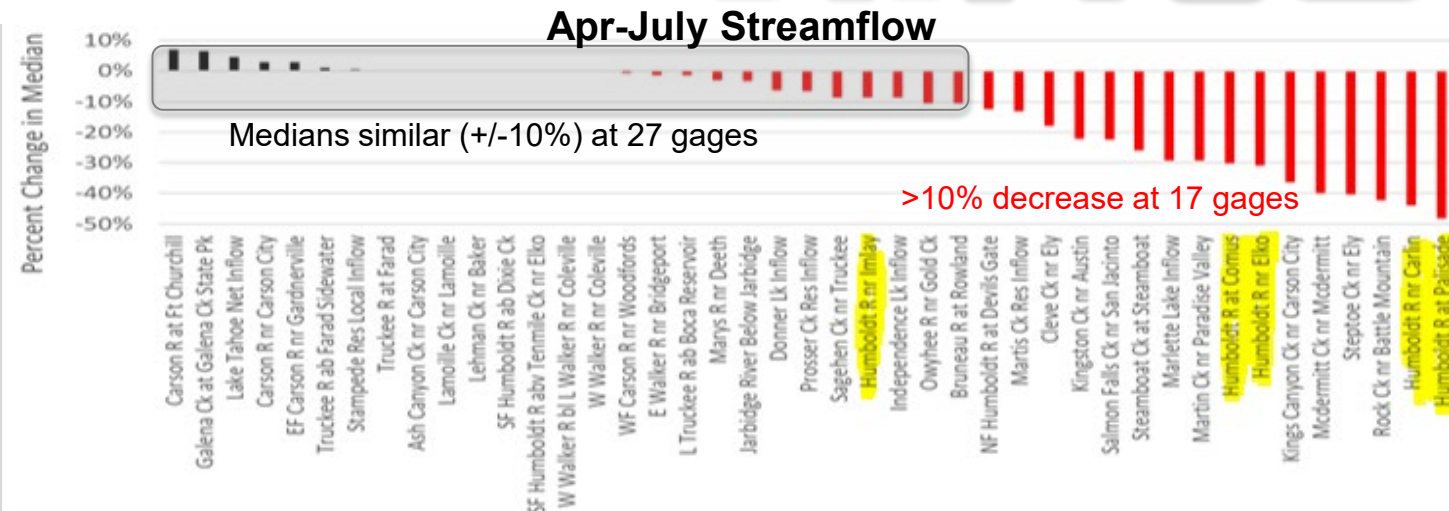
Decreases more common in **Sierra Basins**



Seasonal Streamflow (April-July):

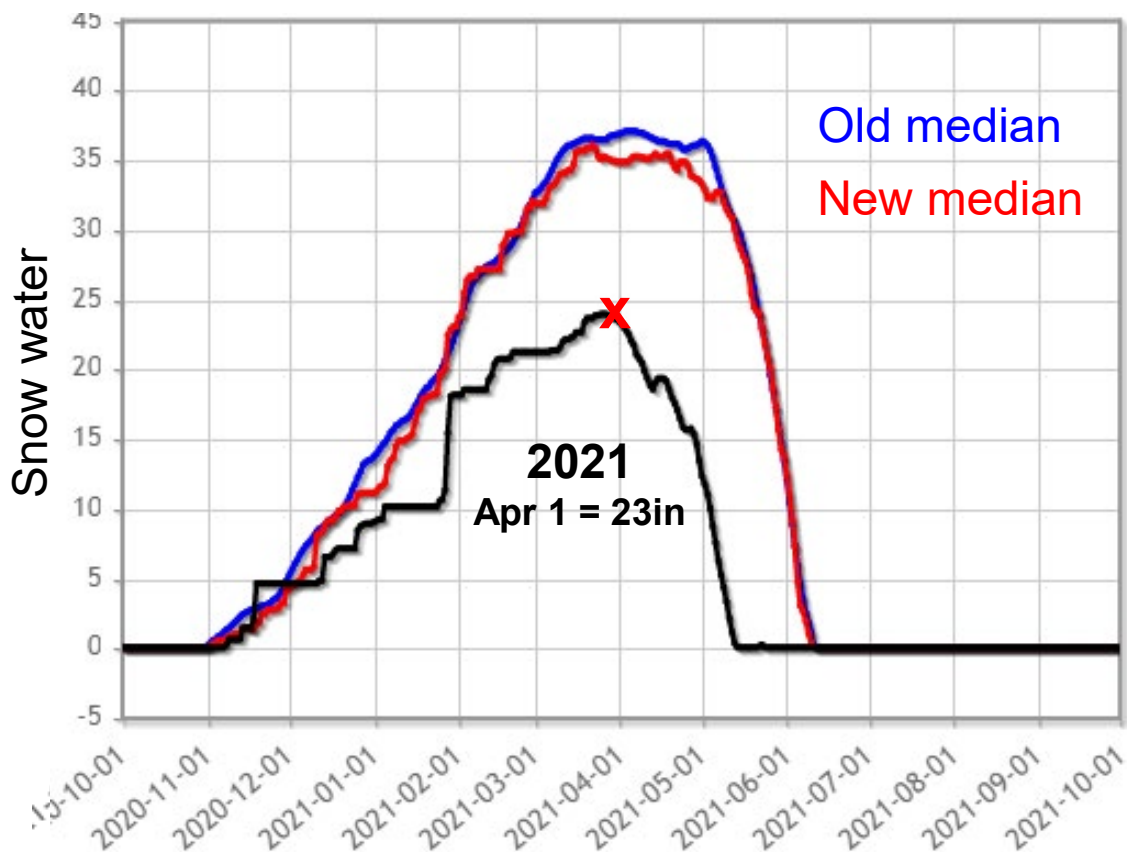
Most new / old medians +/-10% of each other
17 gages >10% decrease in median

Humboldt River has significant decrease



What is the impact of a lower normals?

Mt Rose Ski Area (652) Nevada SNOTEL Site - 8801 ft



■ Median Snow Water Equivalent (1981-2010)

■ Median Snow Water Equivalent (1991-2020)

Changing the normal, changes the percent

A smaller normal results in a higher percentage

Using 1981-2010 Apr 1 Median = 37"

$$23 / 37 = 63\%$$

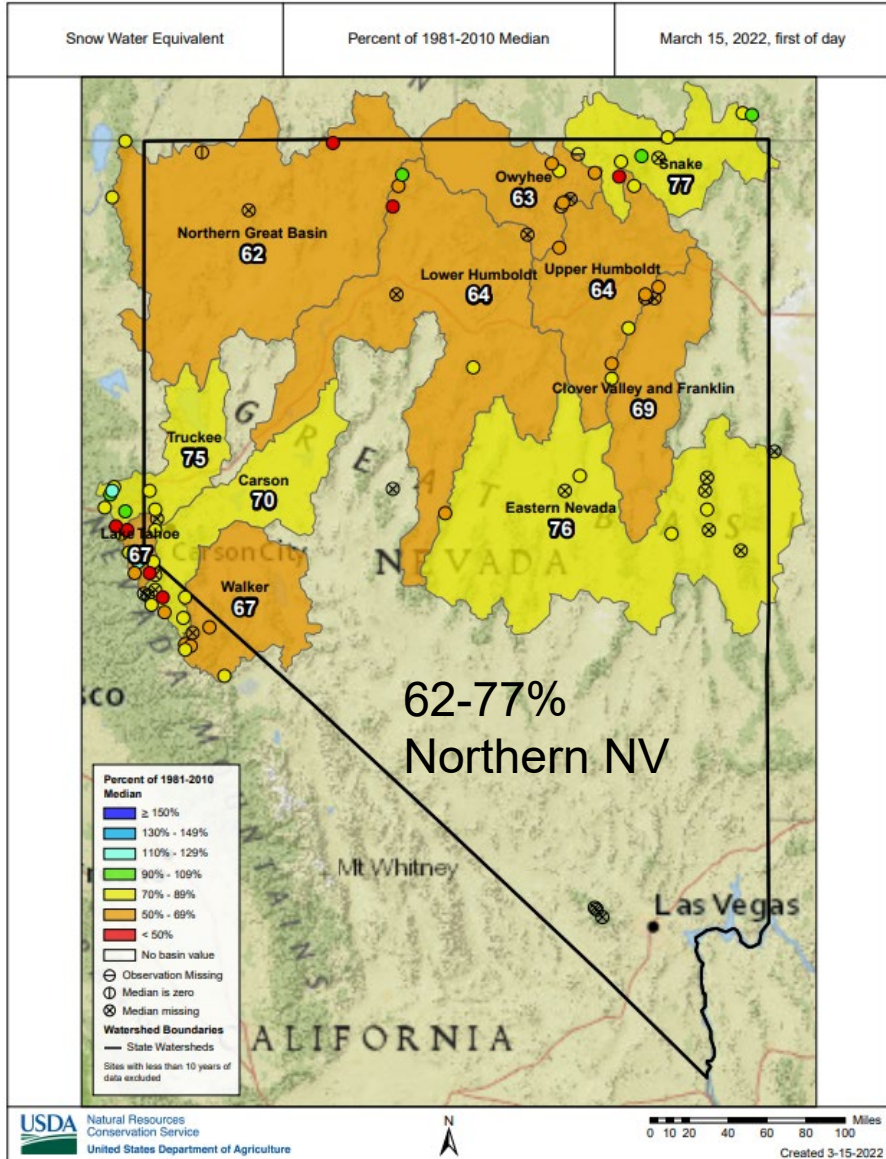
1991-2020 Apr 1 Median = 35"

$$23 / 35 = 67\%$$

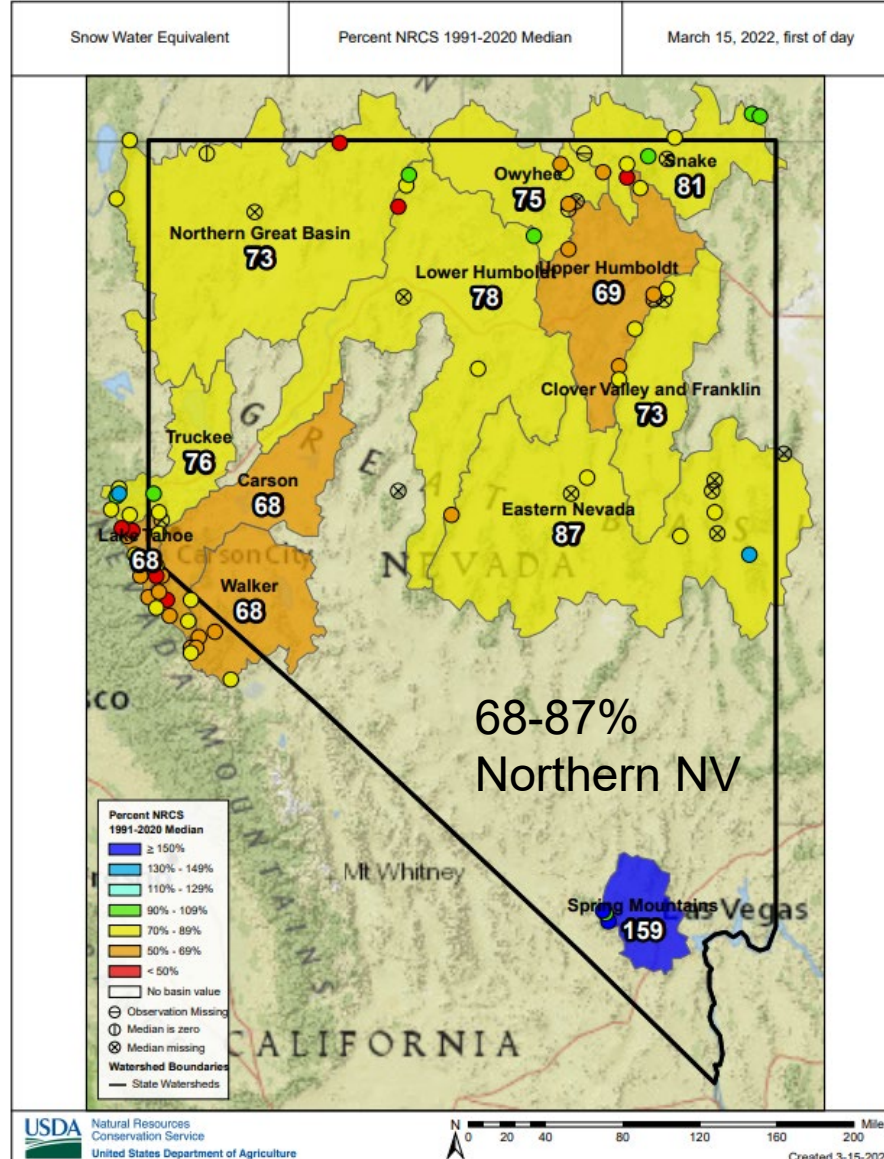
Change in snow percentages old median vs new median?

Snowpack on March 15, 2022

% of 1981-2010 Median



% 1991-2020 Median



Basin Change %

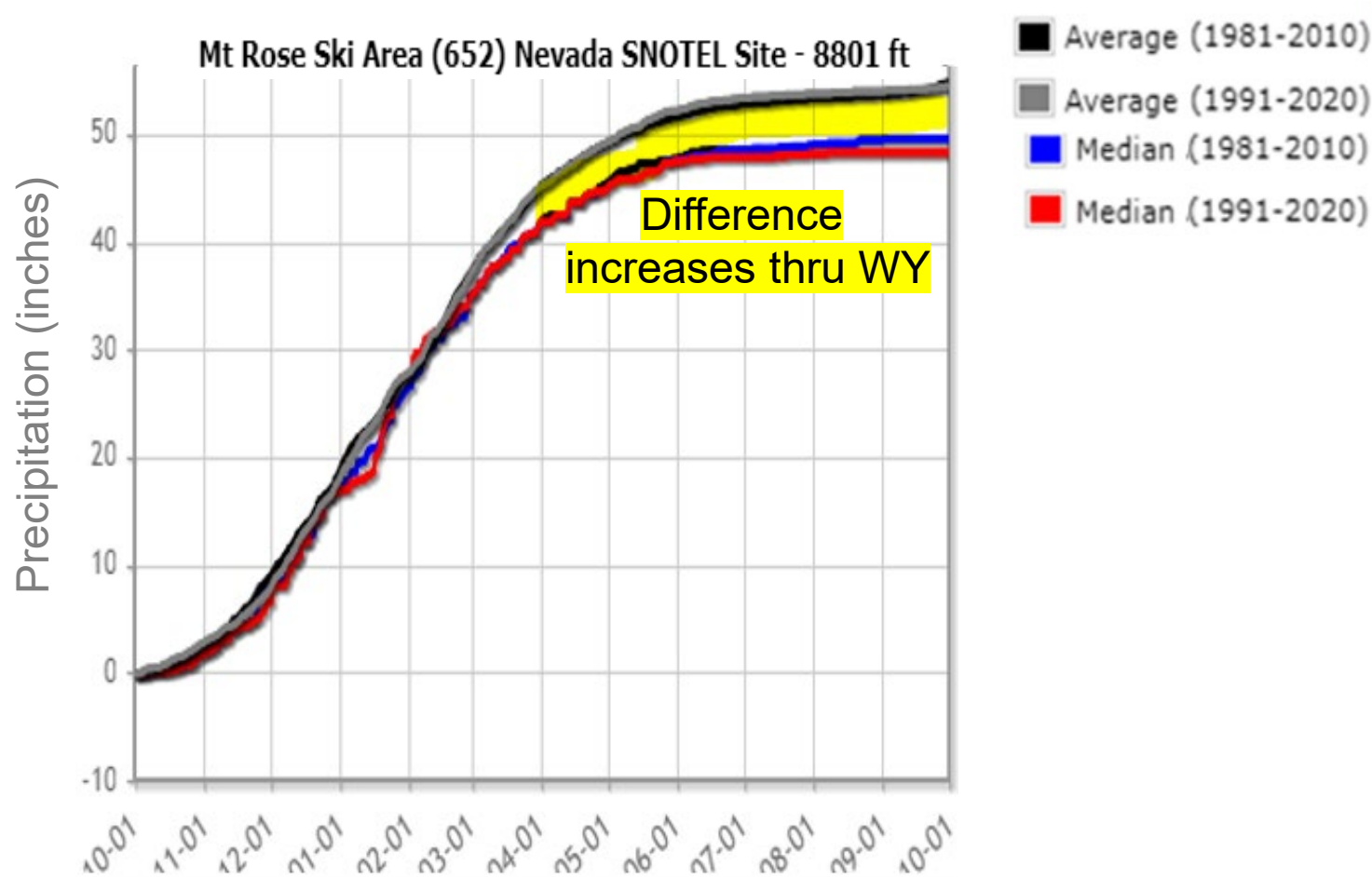
Tahoe	+1%
Truckee	+1%
Carson	- 2%*
Walker	+1%
Upper Humboldt	+5%
Lower Humboldt	+14%*

*Differences due to short record for newer sites

- **Carson:** '81-10 included 4 sites with 7-8 years of data
- **L Humboldt:** '91-20 includes Toe Jam with 11 years of data

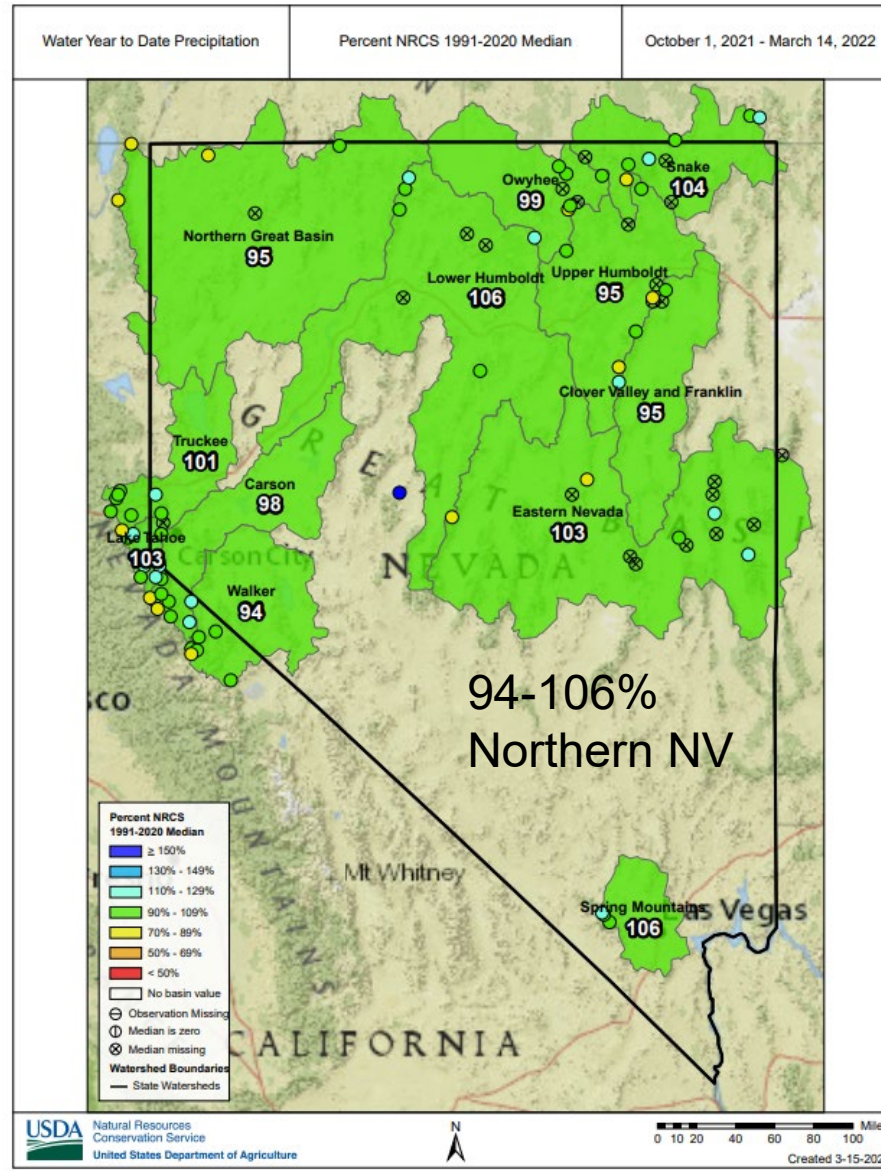
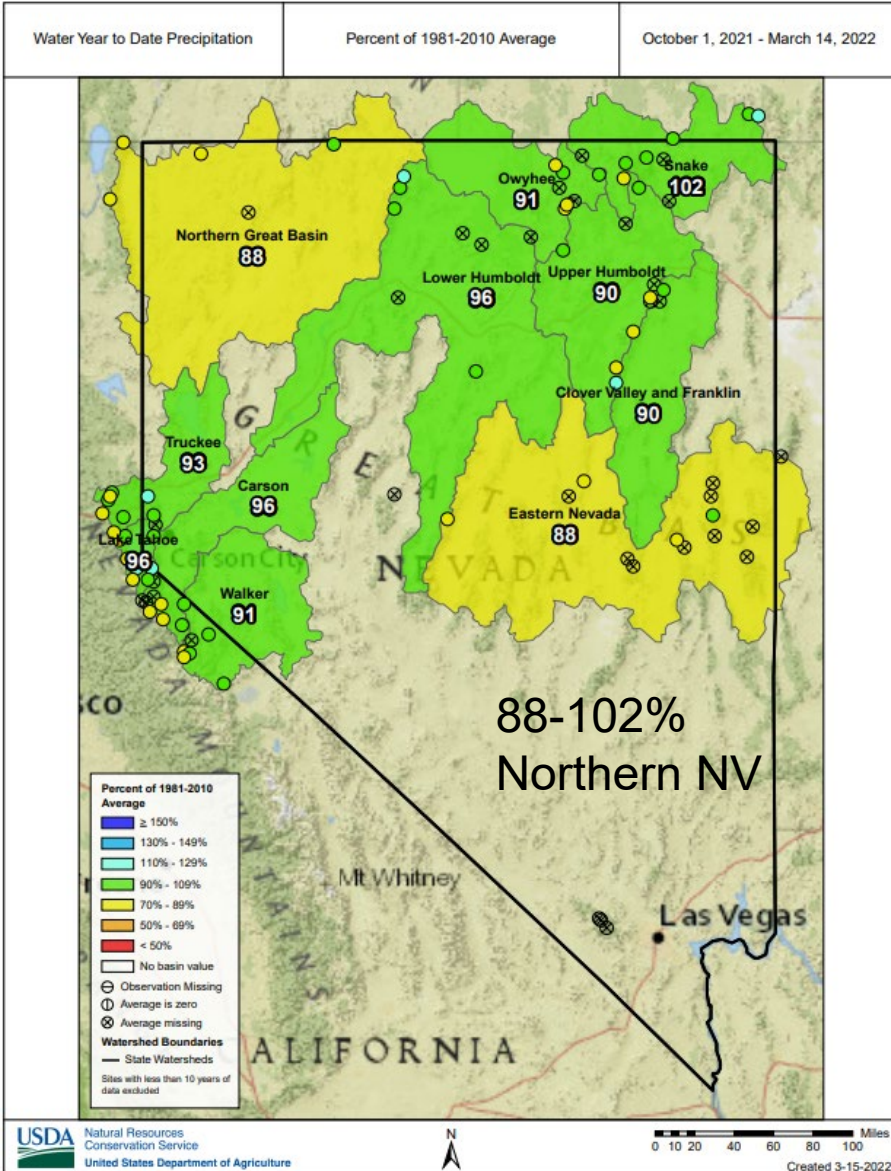
What is impact of changing from average to median for precipitation?

Water Year Precipitation
Medians << Averages
due to non-symmetric data



Change in precipitation percentages old average vs new median?

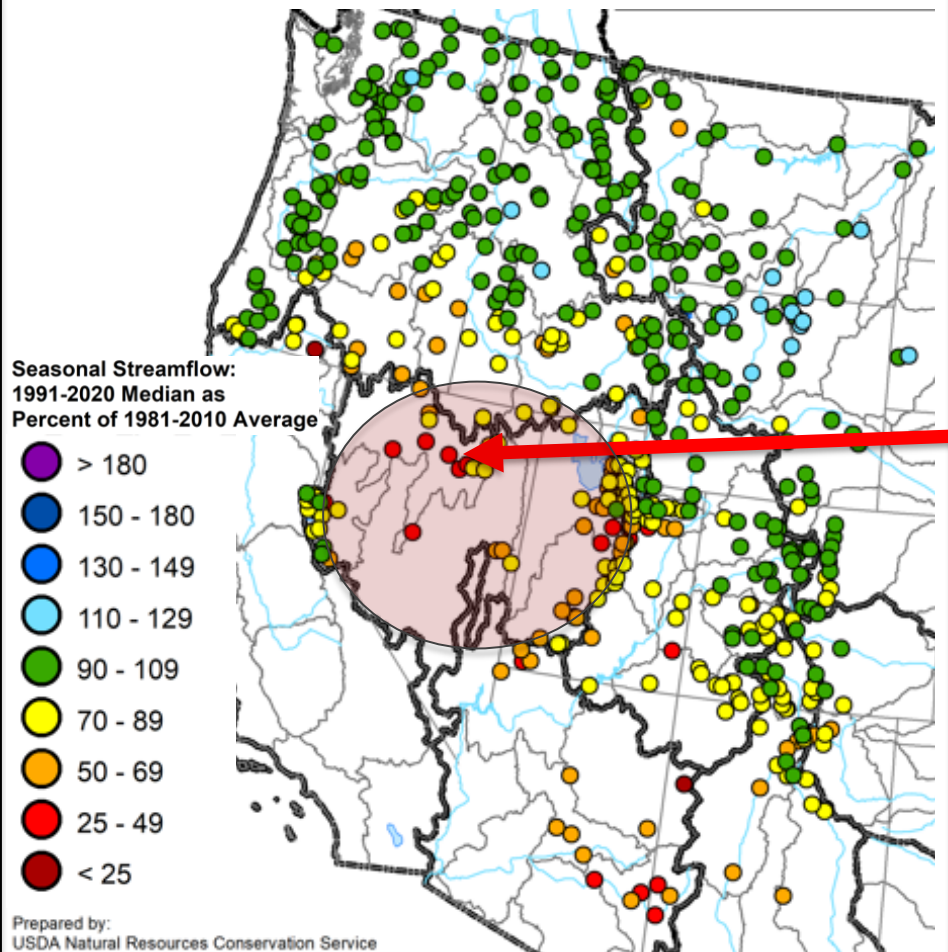
Water Year Precipitation on March 15, 2022
% of 1981-2010 Average **% 1991-2020 Median**



Basin	% Change
Tahoe	+7%
Truckee	+8%
Carson	+2%
Walker	+3%
Upper Humboldt	+5%
Lower Humboldt	+10%

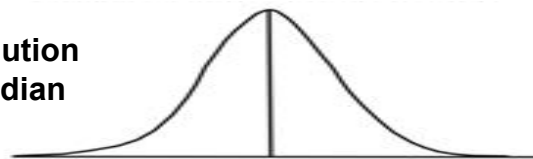
What is impact of changing from average to median on April-July streamflow?

Seasonal Streamflow 1991-2020 Median As Percent of 1981-2010 Average



- Most gages in Western US have new medians within 10% of old average
These datasets may have a more normal distribution in data

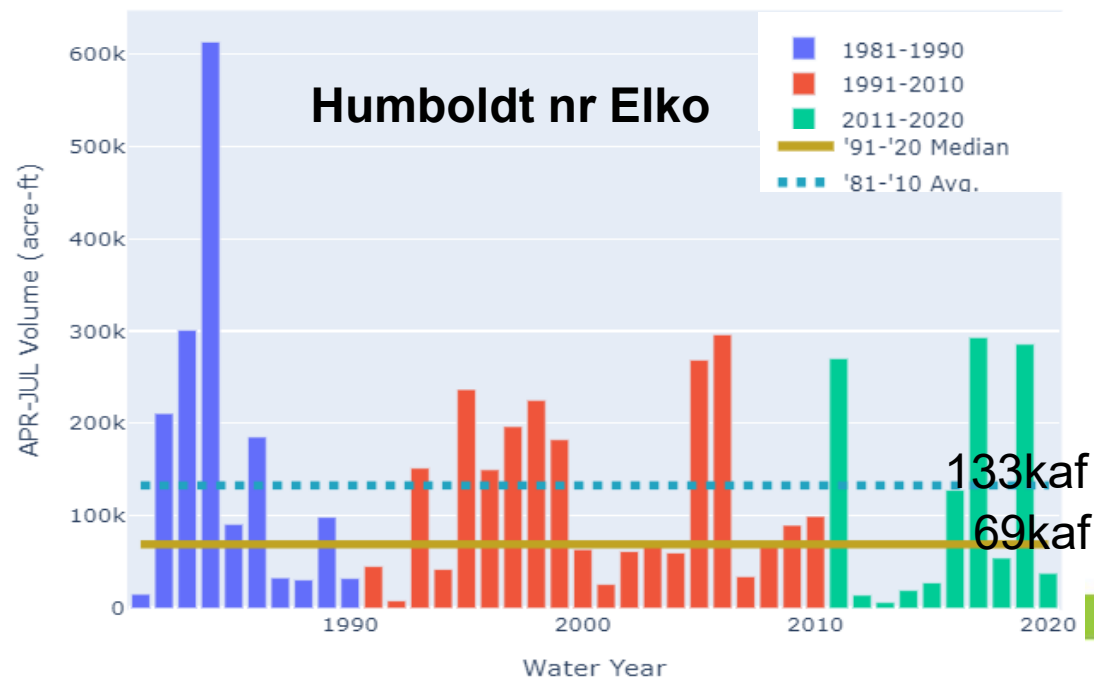
Normal Distribution
Average = Median



- Great Basin streamflow data are highly non-symmetrical
- Extreme years skews averages much higher than medians

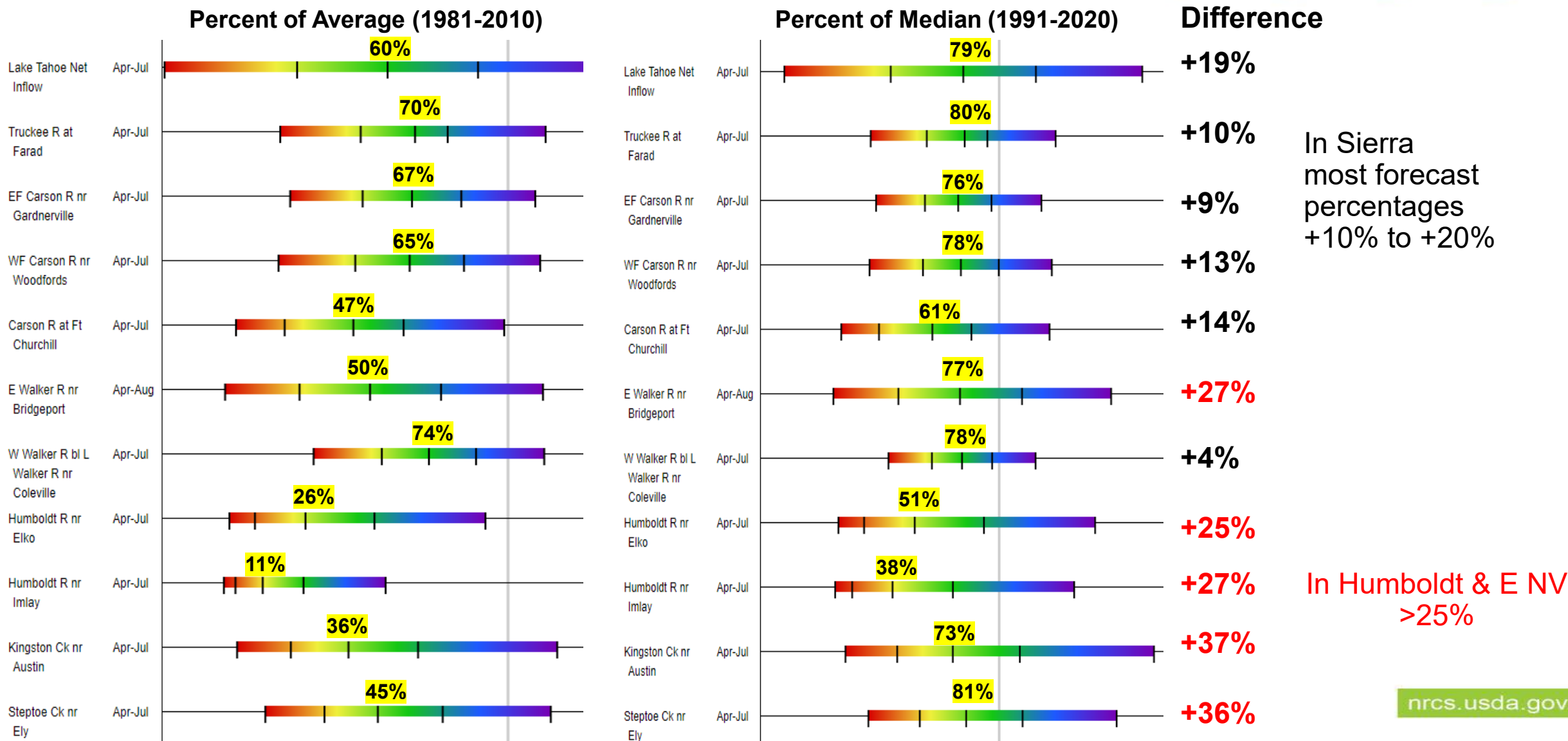
- Humboldt River '91-20 medians are less than half of '81-10 averages

- Expect a big impact on percentages



How much do forecast percentages change from old normal to new normal?

Streamflow Forecasts March 1, 2022 (50% Exceedance)



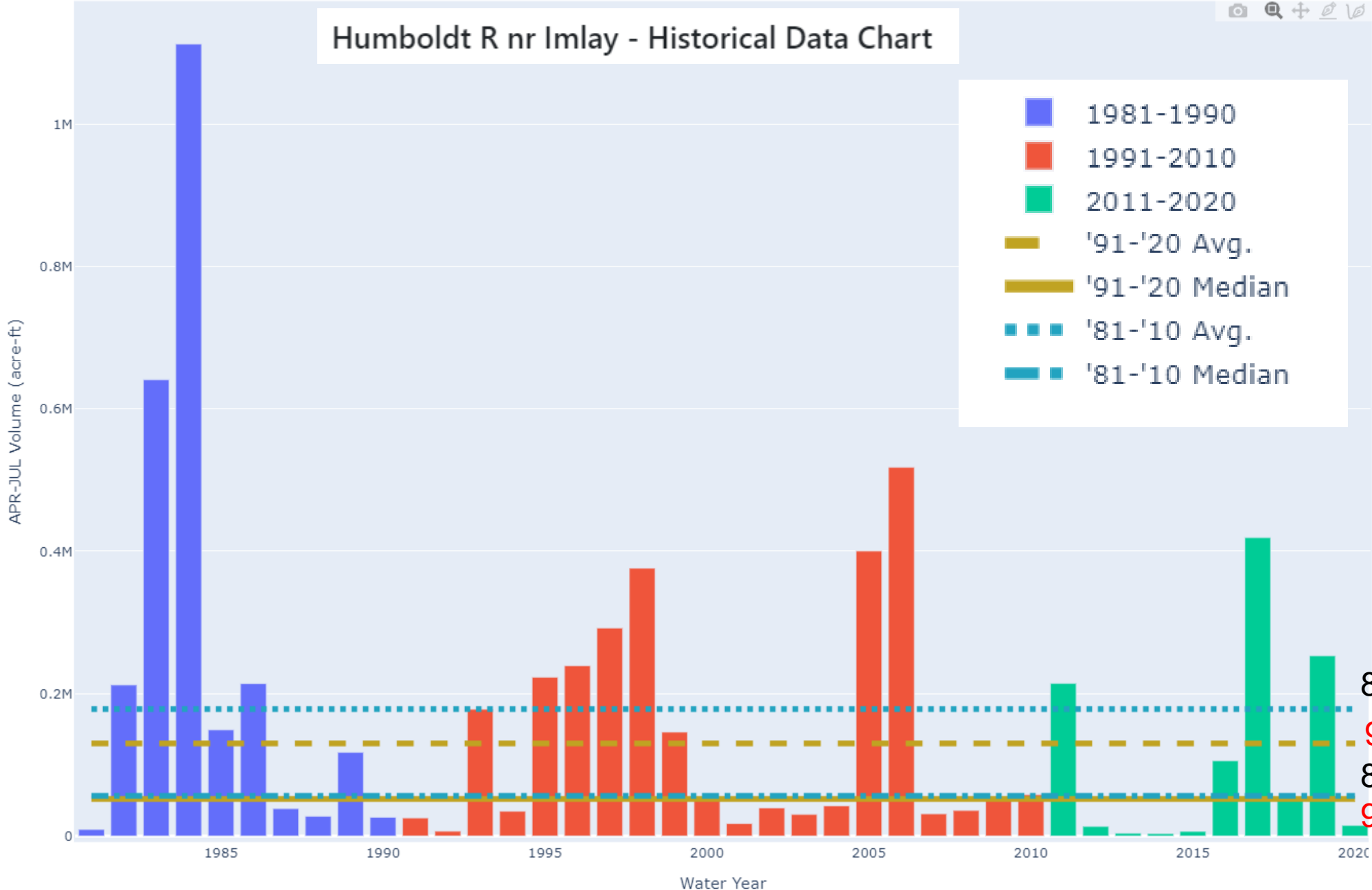
Humboldt R nr Imlay - Historical Data Chart

- 1981-1990
- 1991-2010
- 2011-2020
- '91-'20 Avg.
- '91-'20 Median
- - - '81-'10 Avg.
- - - '81-'10 Median



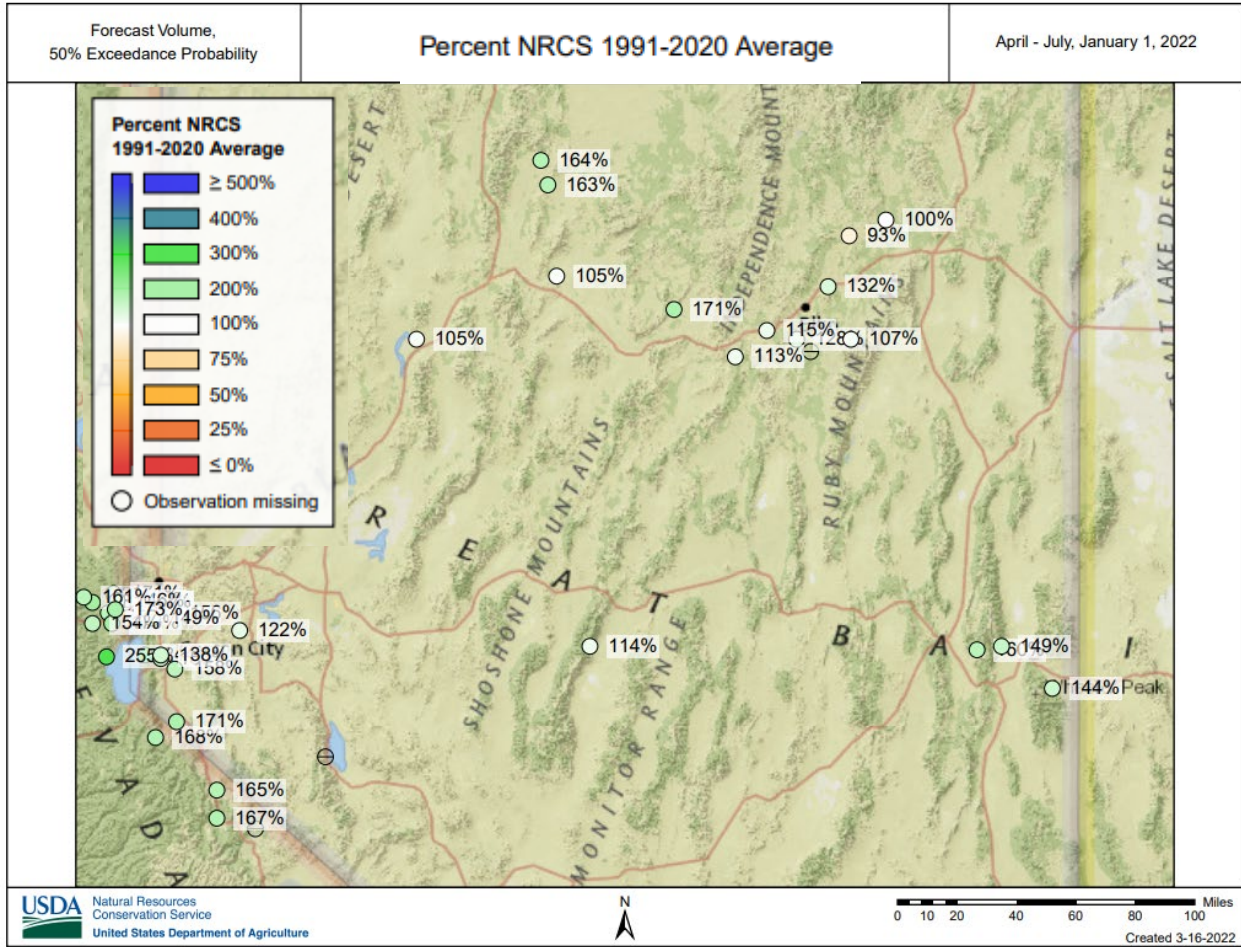
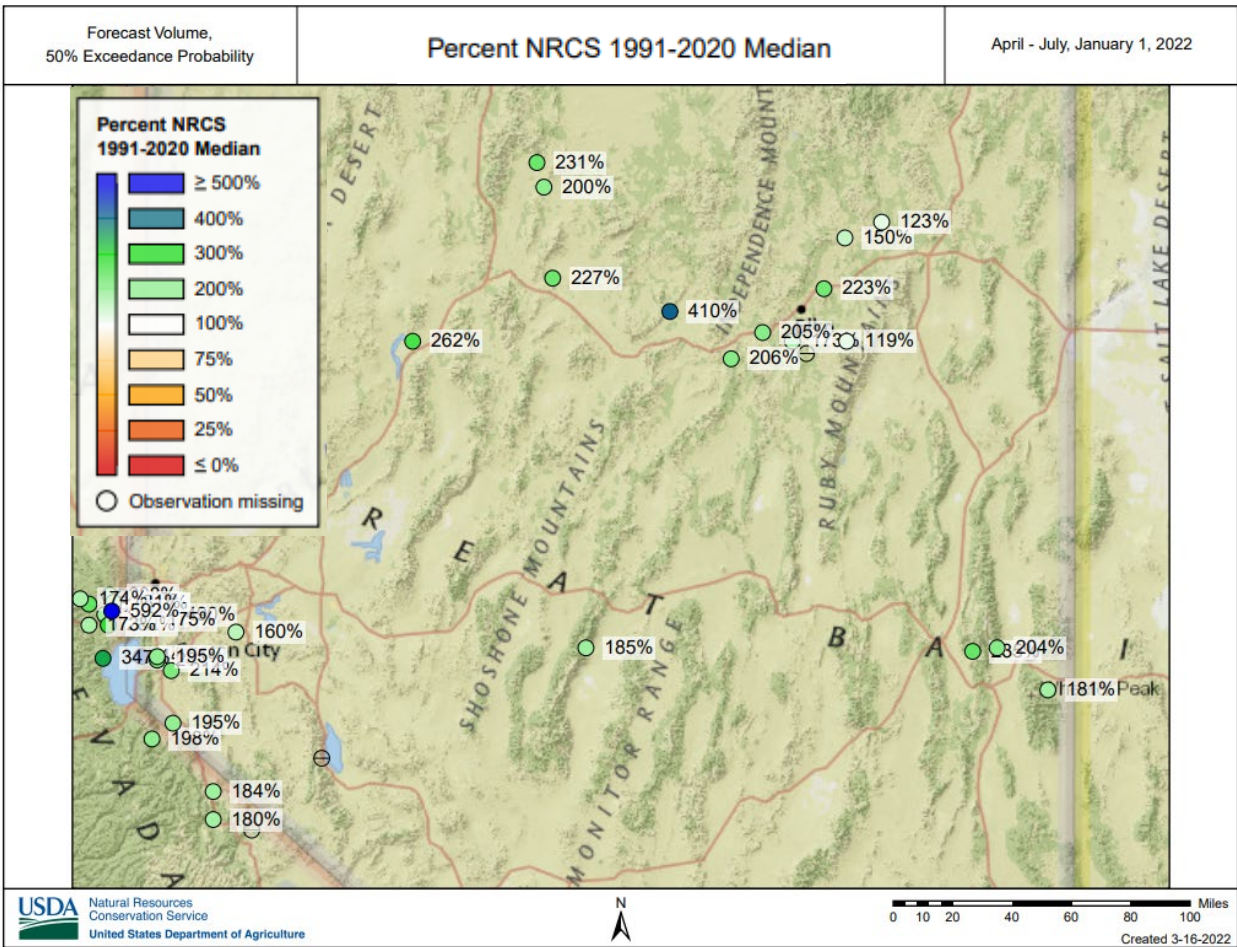
Difference 91-20 median and average less than Between 81-10 median and average

81-10 Average
 91-20 Average
 81-10 Median
 91-20 Median



When volumes are large, % median values >> % average

Example Jan 1, 2022 50% exceedance forecasts



Some forecasts >400% of median

vs

Same volumes <200% average

Service

nrcs.usda.gov/

Natural Resources Conservation Service

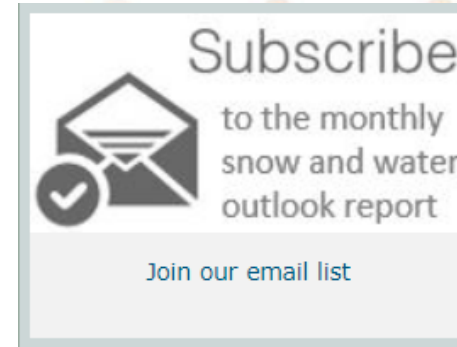
Nevada Water Supply Outlook Report March 1, 2022



The view from Lamoille Canyon #5 snow course on February 25, 2022

This snow course is in the Ruby Mountains near the top of the Lamoille Canyon road. Snow surveyors measured 41 inches of snow depth with 14.6 inches of water content which is 65% of median. Averaging together data from all 25 SNOTEL and snow course locations in the Upper Humboldt Basin the March 1 snowpack is 63% of median. Based on SNOTEL data this is the lowest March 1st snowpack since 2012. Overall, it's the sixth lowest snowpack since 1981 when SNOTEL data begins. Snowpack percentages across Nevada have steadily decreased as the state has seen too many blue bird days and not enough storm days since the start of January. Hopefully late season storms will arrive to improve conditions before the snow starts melting.

Photo Credit: Kent Sutcliffe



<https://www.nrcs.usda.gov/wps/portal/nrcs/main/nv/snow/>

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Natural
Resources
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Service

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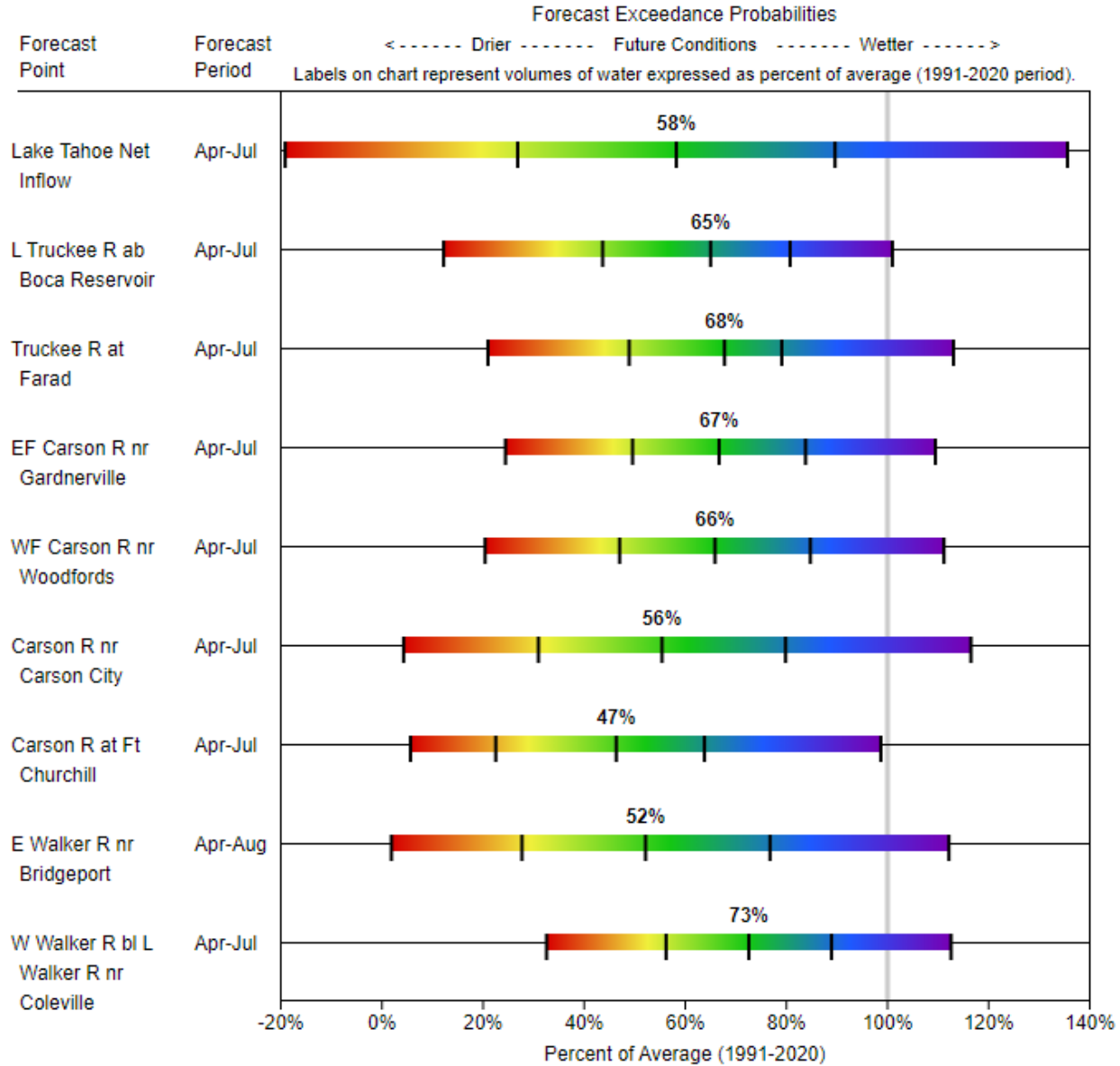


Bonus Slides



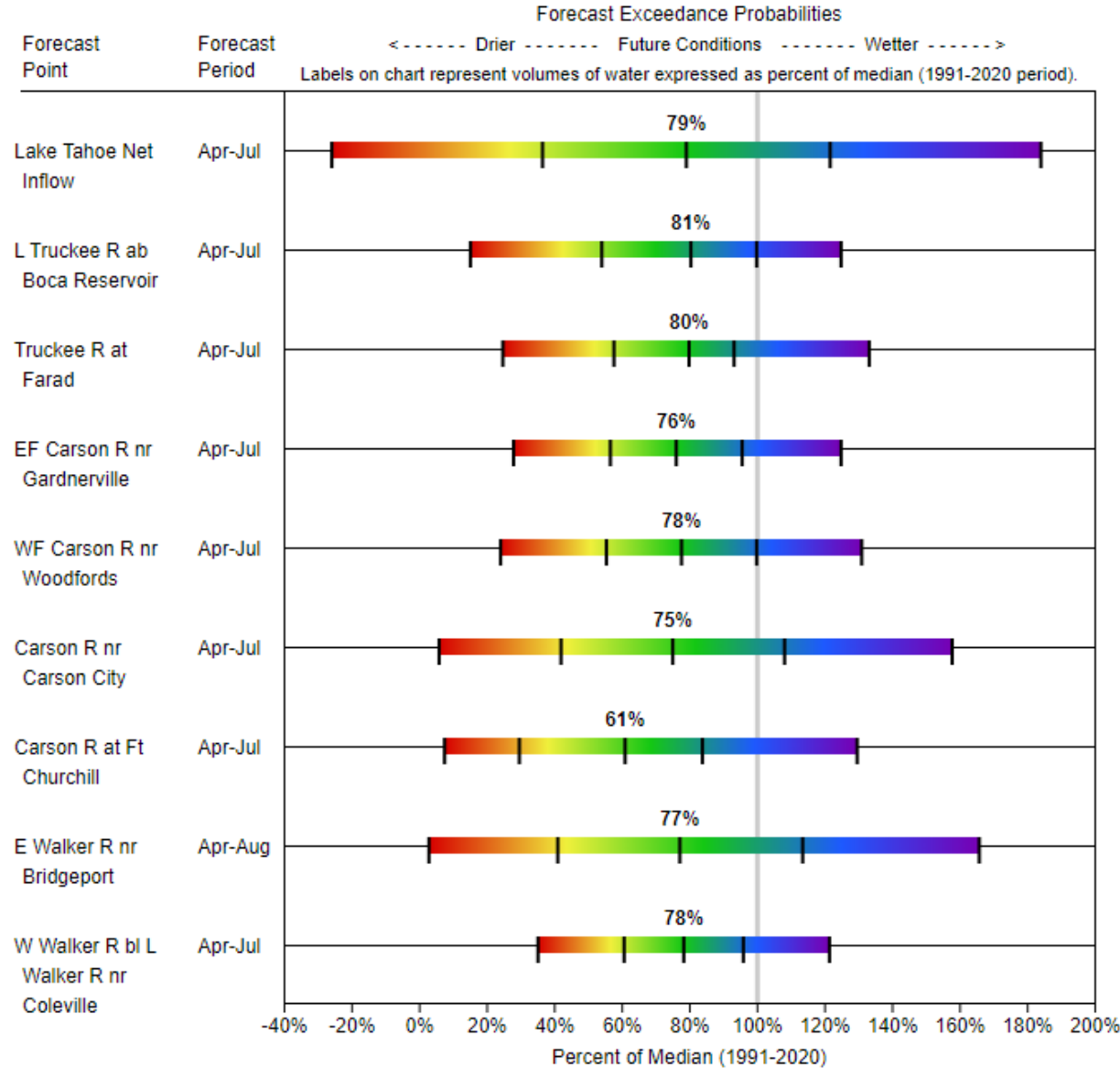
Eastern Sierra Basin Summary
Water Supply Forecasts
 March 1, 2022

47-73%
 '91-20 average



Eastern Sierra Basin Summary
Water Supply Forecasts
 March 1, 2022

61-81%
 '91-20 median



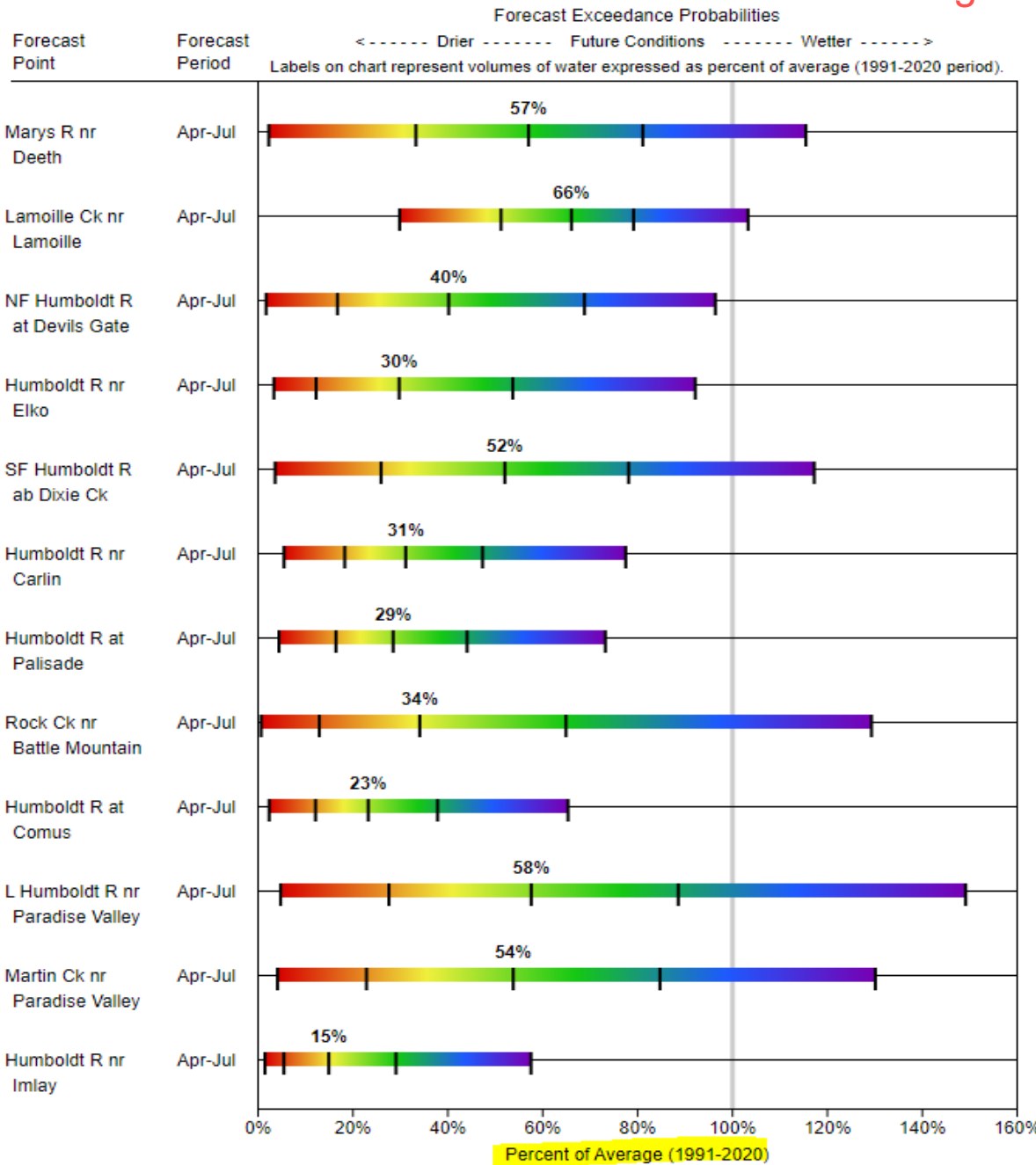
95% or 90% Exceedance 70% Exceedance 50% Exceedance 30% Exceedance 10% or 5% Exceedance

Service

nrcs.usda.gov/

Humboldt River Summary
Water Supply Forecasts
March 1, 2022

15-66%
'91-20 average



Humboldt River Summary
Water Supply Forecasts
March 1, 2022

38-82%
'91-20 median

