Utah Water Supply Briefing

March 5th, 2021

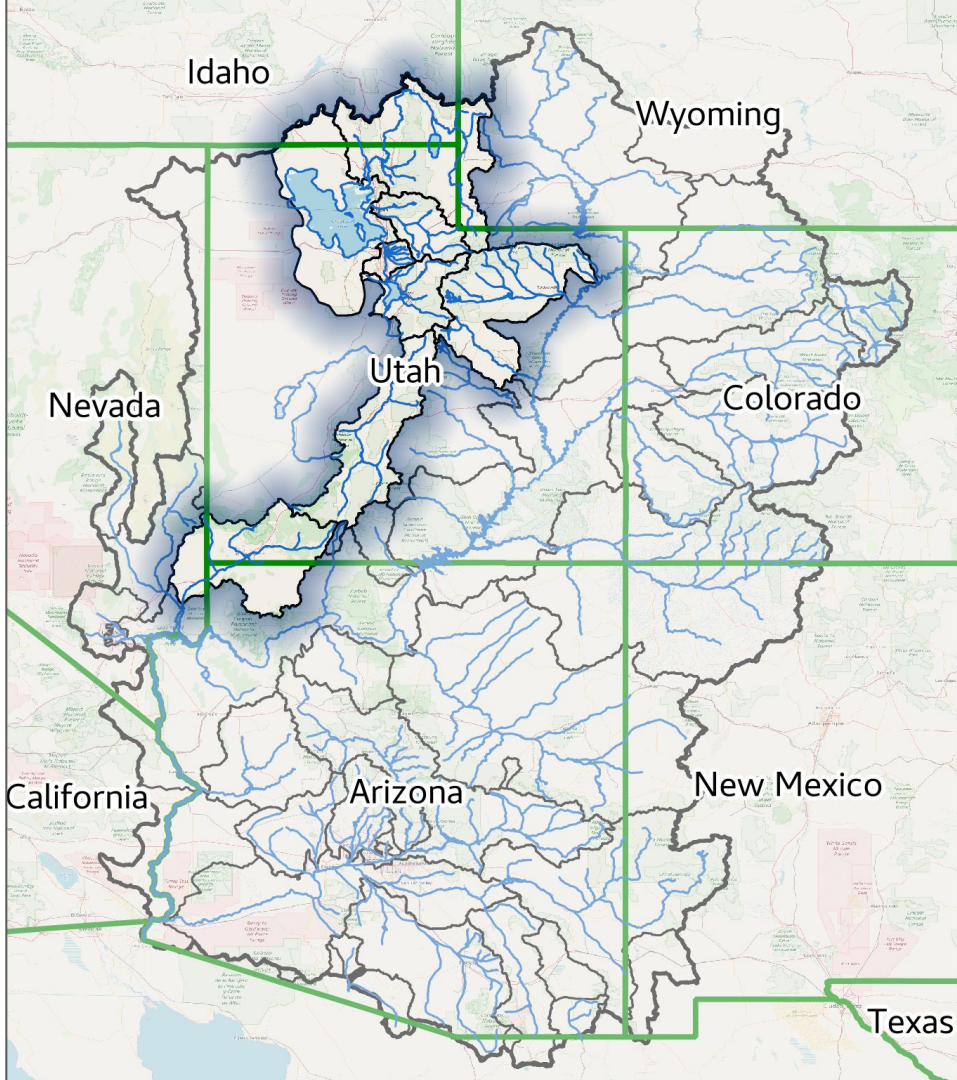
Colorado Basin River Forecast Center

Presenter: Brenda Alcorn - Hydrologist

Utah Forecasters: Brent Bernard, Zach Finch, Patrick Kormos

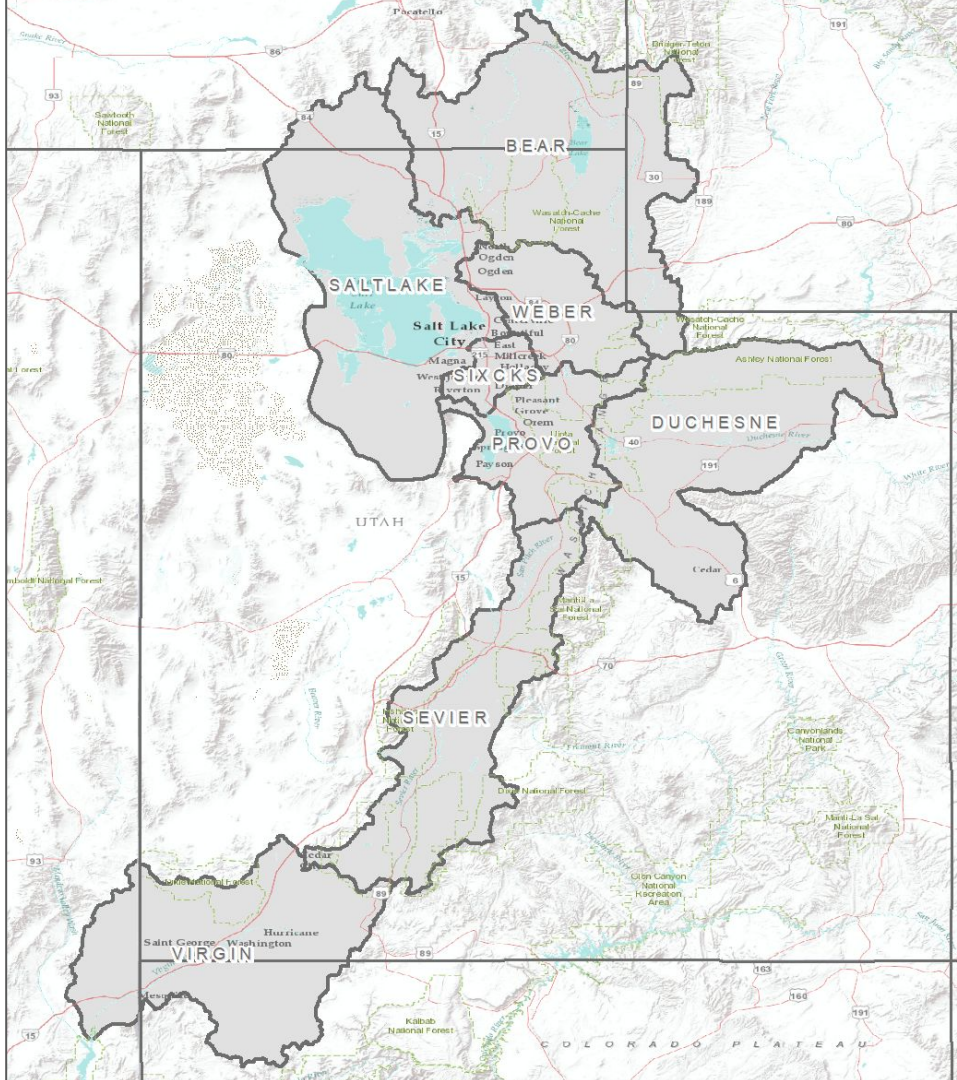
Questions: Type questions into the ‘Questions’ Box or Raise Hand

Webinar recording & slides will be made available on CBRFC webpage

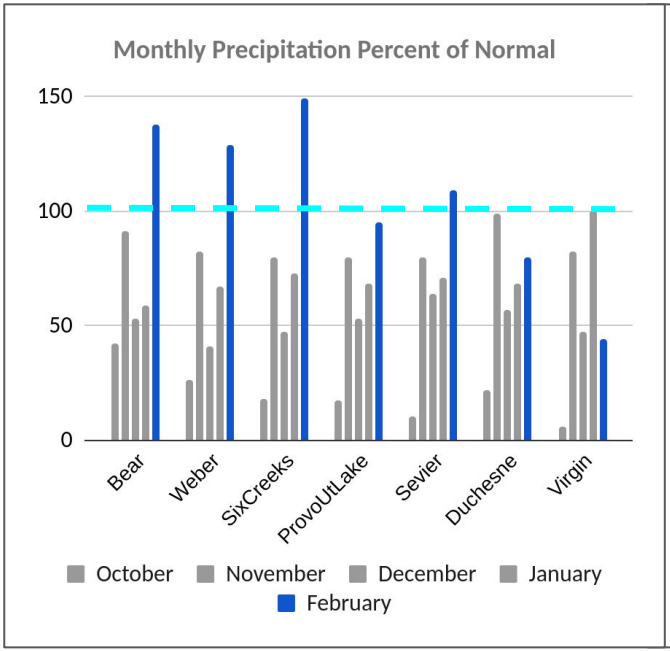


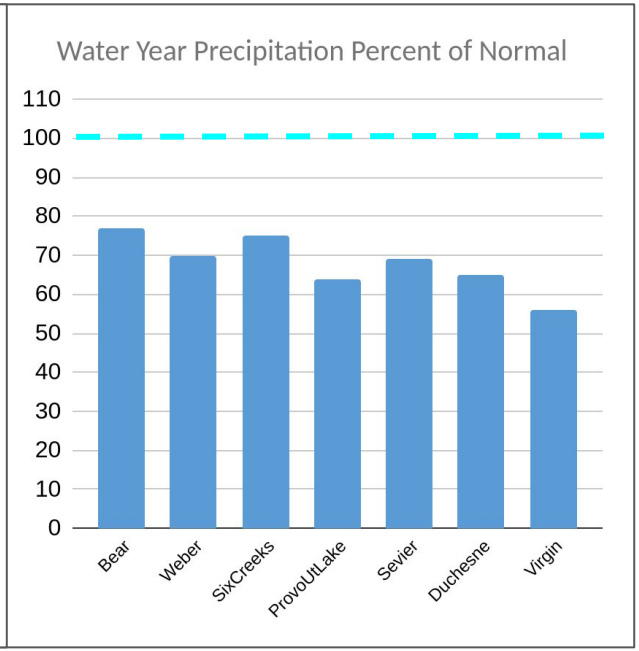
Utah Water Supply Briefing

1. Weather Review (Precipitation)
2. Current Snowpack
3. 2021 Water Supply Forecasts
4. Forecast Error
5. Upcoming Weather
6. CBRFC Hydro Science Update
7. Contacts & Questions



Utah Weather Review - Precipitation up to March 1, 2021

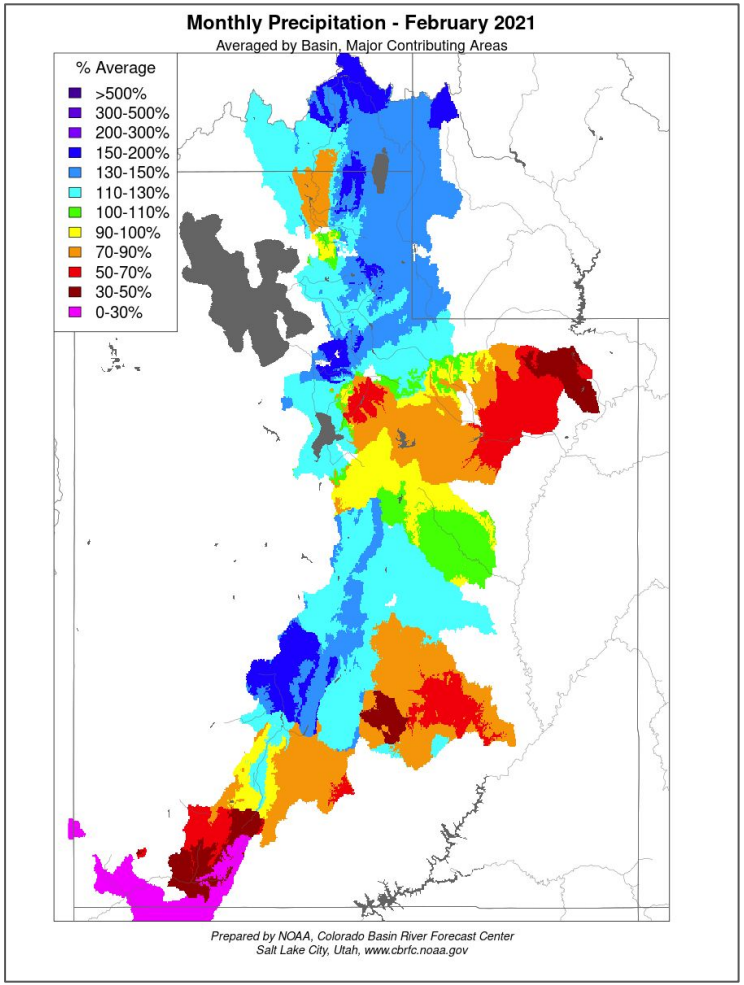


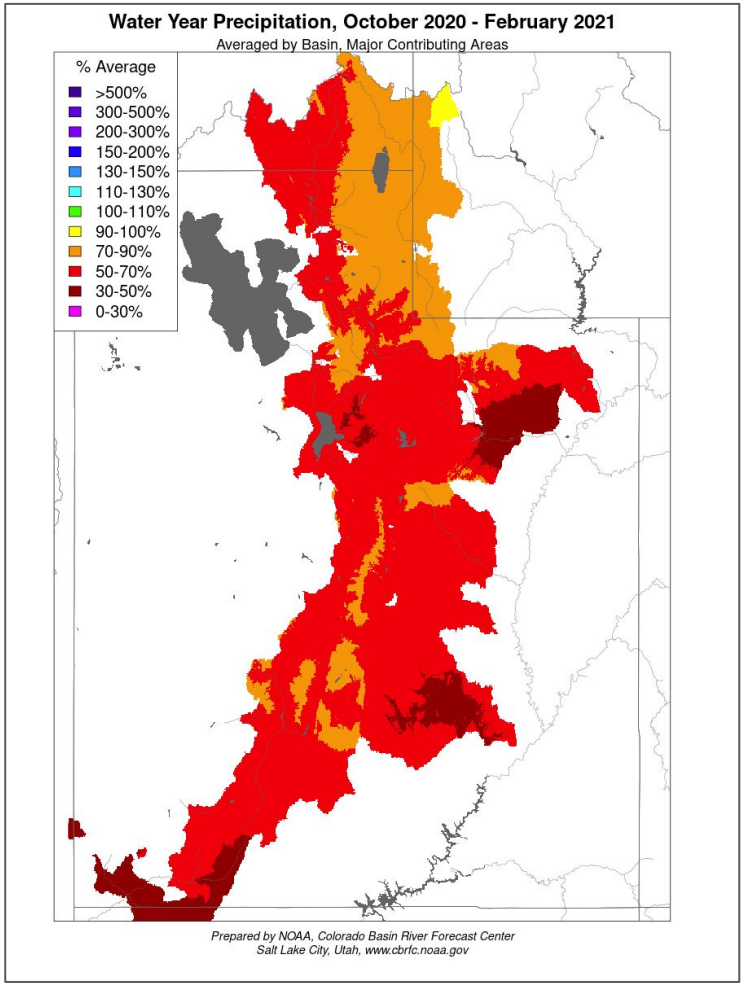


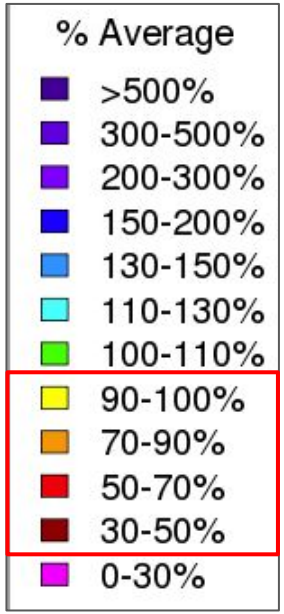
Forecast Group	Percent of WY normal
Bear	80
Weber	70
Six Creeks	75
Provo	65
Duchesne	65
Sevier	70
Virgin	55

- Below normal seasonal precipitation - All Basins
- Above normal February precipitation - Bear, Weber, Six Creeks, Sevier
- Near normal February precipitation - Provo / Utah Lake
- Below normal February precipitation - Duchesne, Virgin

Utah Weather Review - Monthly and Water Year Precipitation

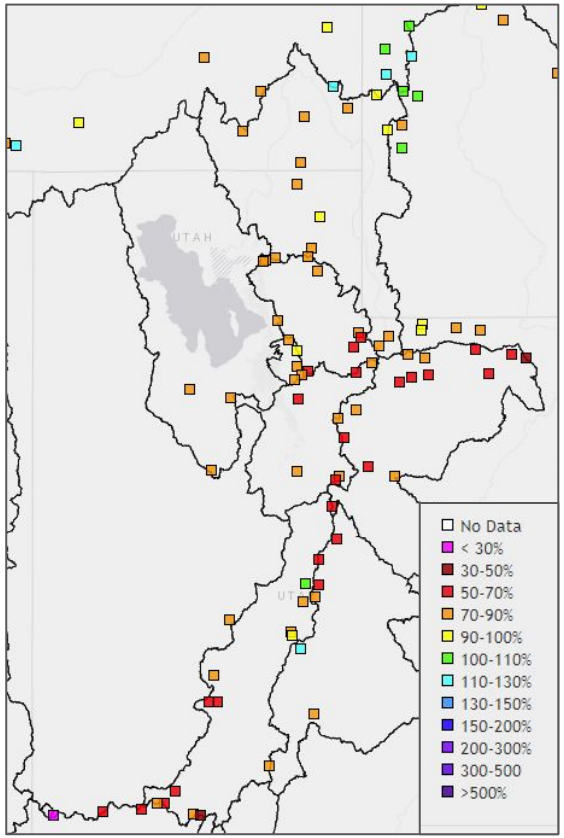


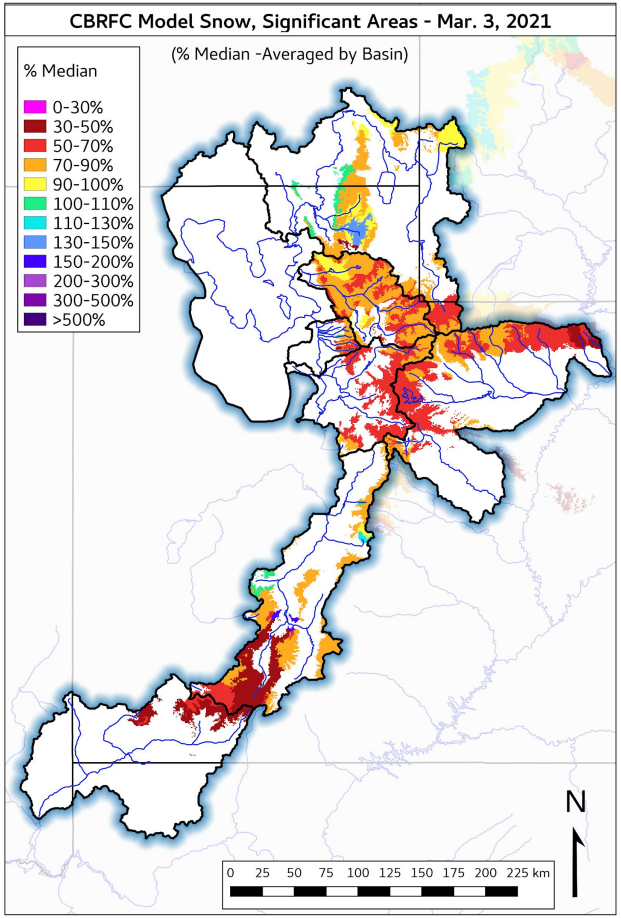




Utah Current Snowpack - March 2021

SNOTEL (Observed)



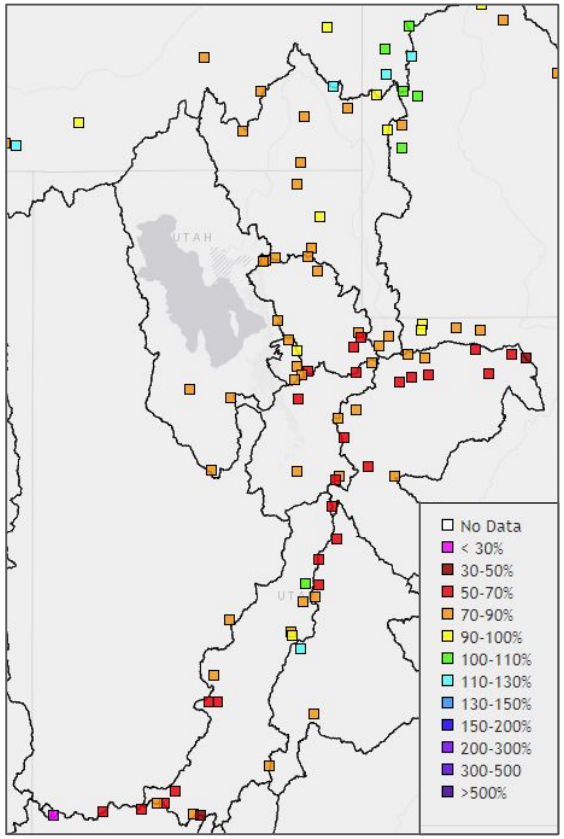


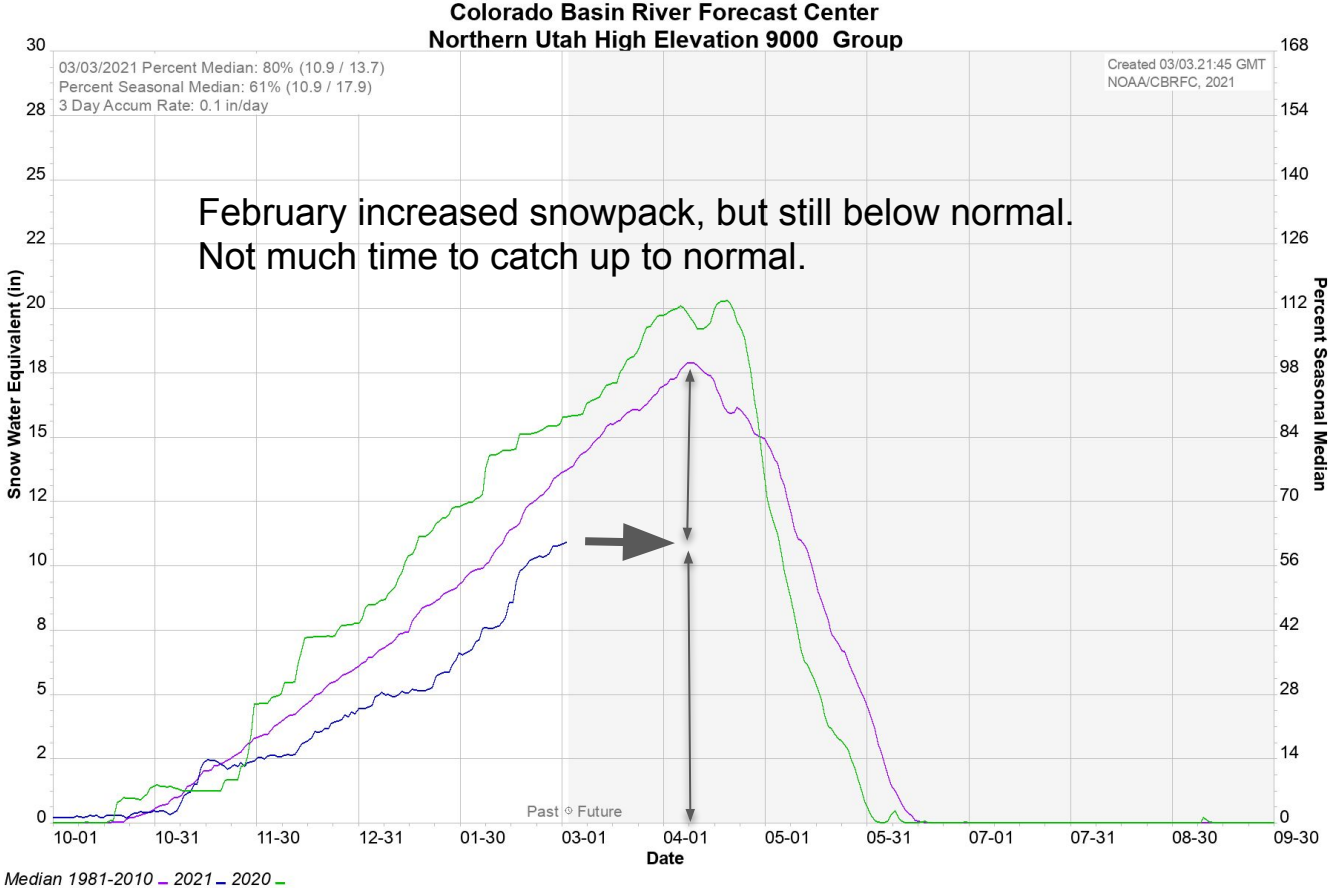
As of March 1, 2021
CBRFC Snow Groups (SNOTEL Stations)

- Bear: 85% of WY normal
- Weber: 75% of WY normal
- Six Cr: 85% of WY normal
- Provo: 65% of WY normal
- Duchesne: 70% of WY normal
- Sevier: 65% of WY normal
- Virgin: 65% of WY normal

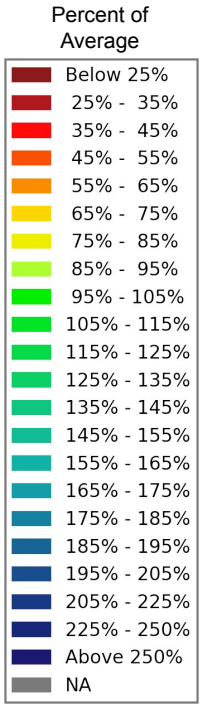
Utah Current Snowpack

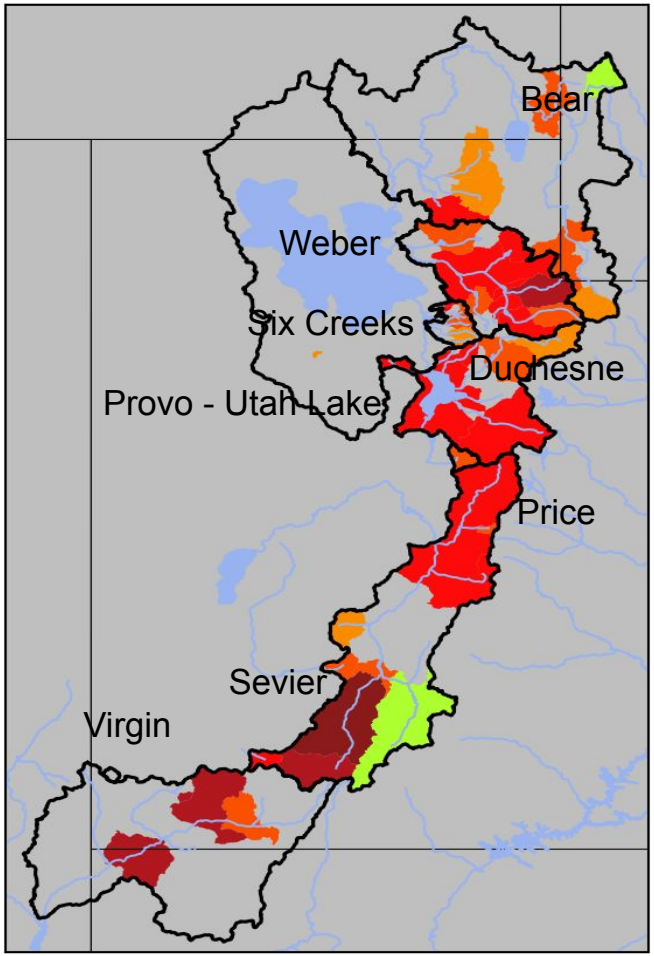
SNOTEL (Observed)





March 1, 2021 - Utah Water Supply Forecasts - Overview



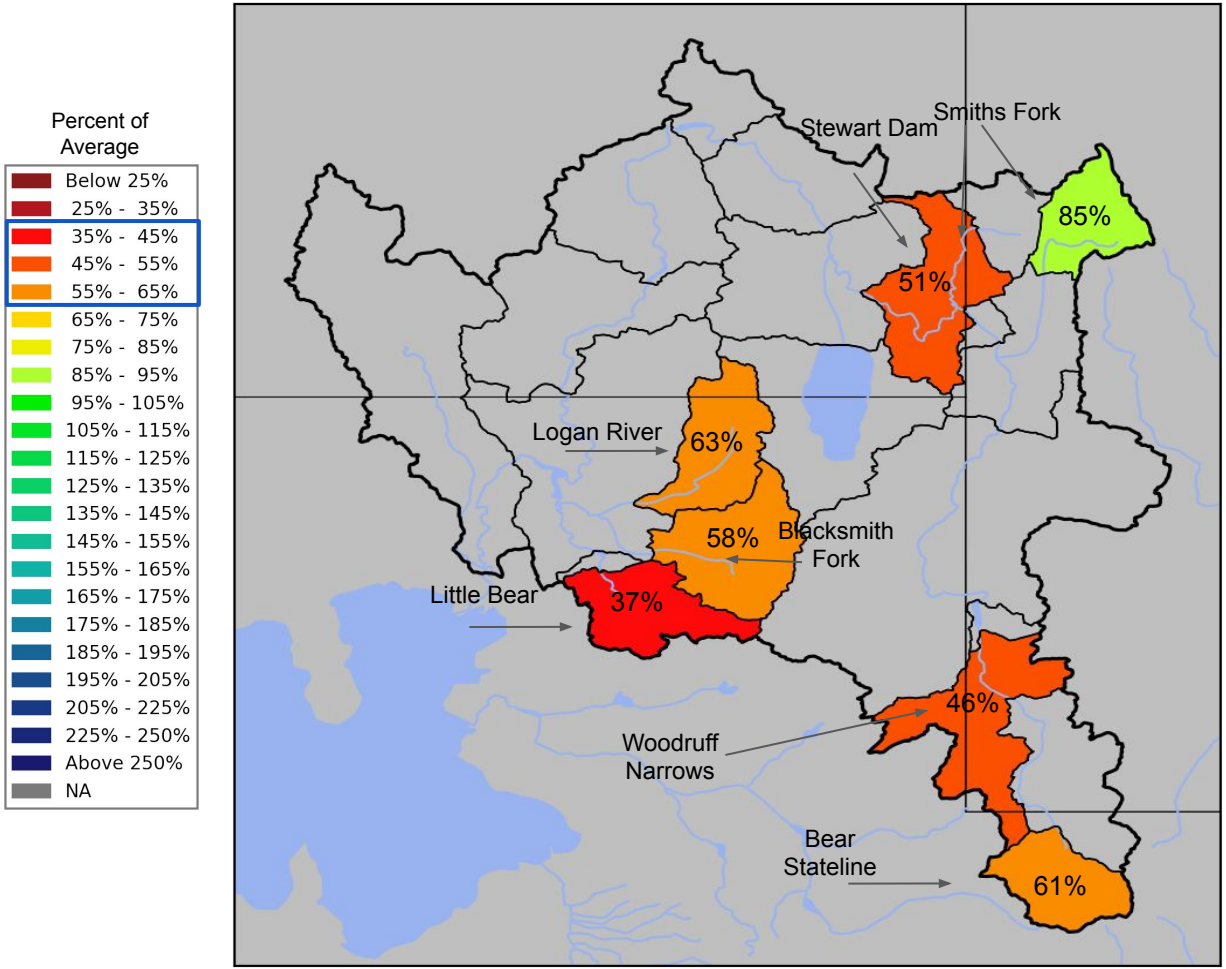


- March 1 Forecast for April-July Volume in 1000's acre feet (KAF)
- April-July Forecast Streamflow Volumes are in percent of 1981-2010 average

Median value of individual forecasts (in % of average) ...by Forecast Group.

Bear	60
Weber	45
Six Creeks	50
Provo / Utah Lake	45
Sevier	45
Duchesne	50
Virgin	35

March 1, 2021 - Utah Water Supply Forecasts - Bear



Bear River Basin Forecasts

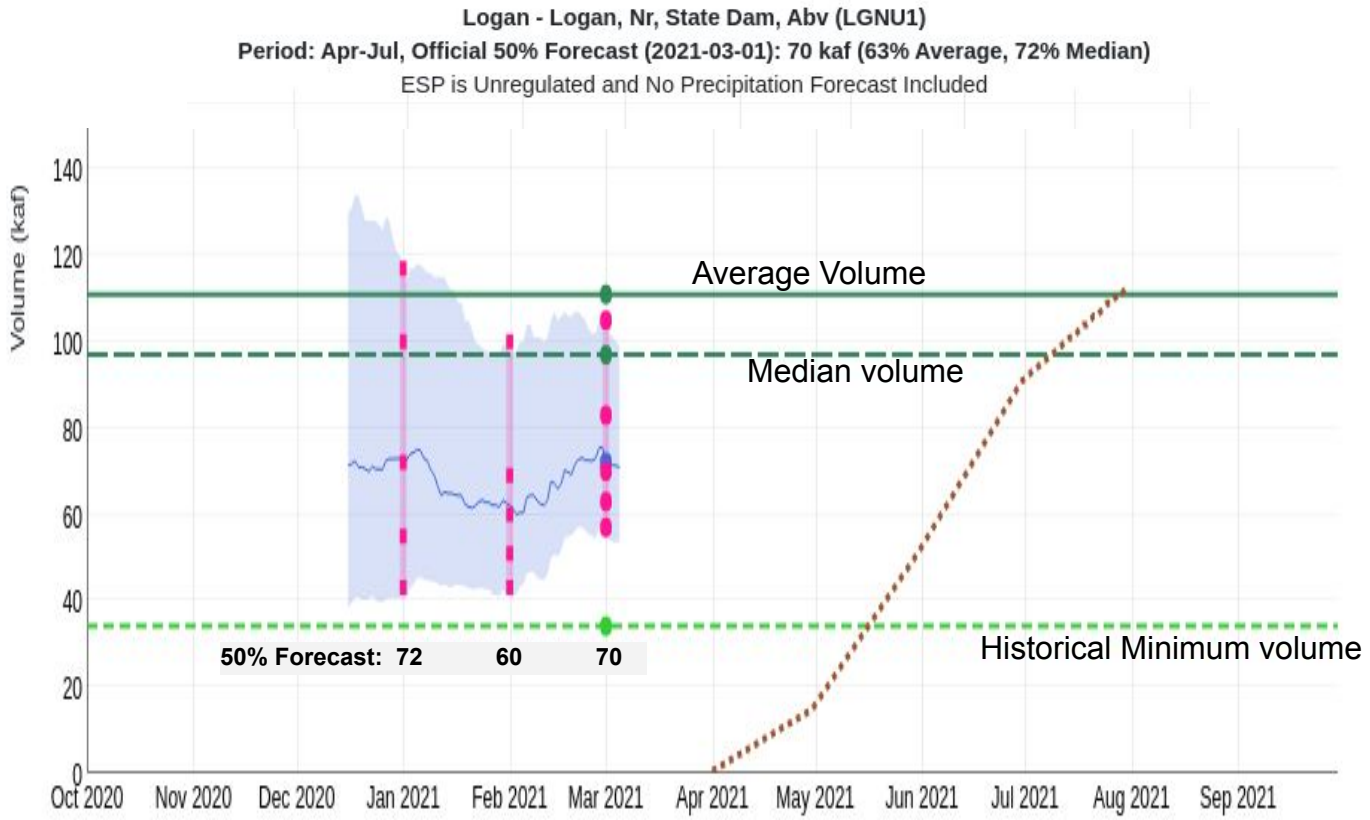
January: **55**% of Normal
February: **50**% of Normal

March: **60**% of Normal

- Forecasts range from 35-85% of normal

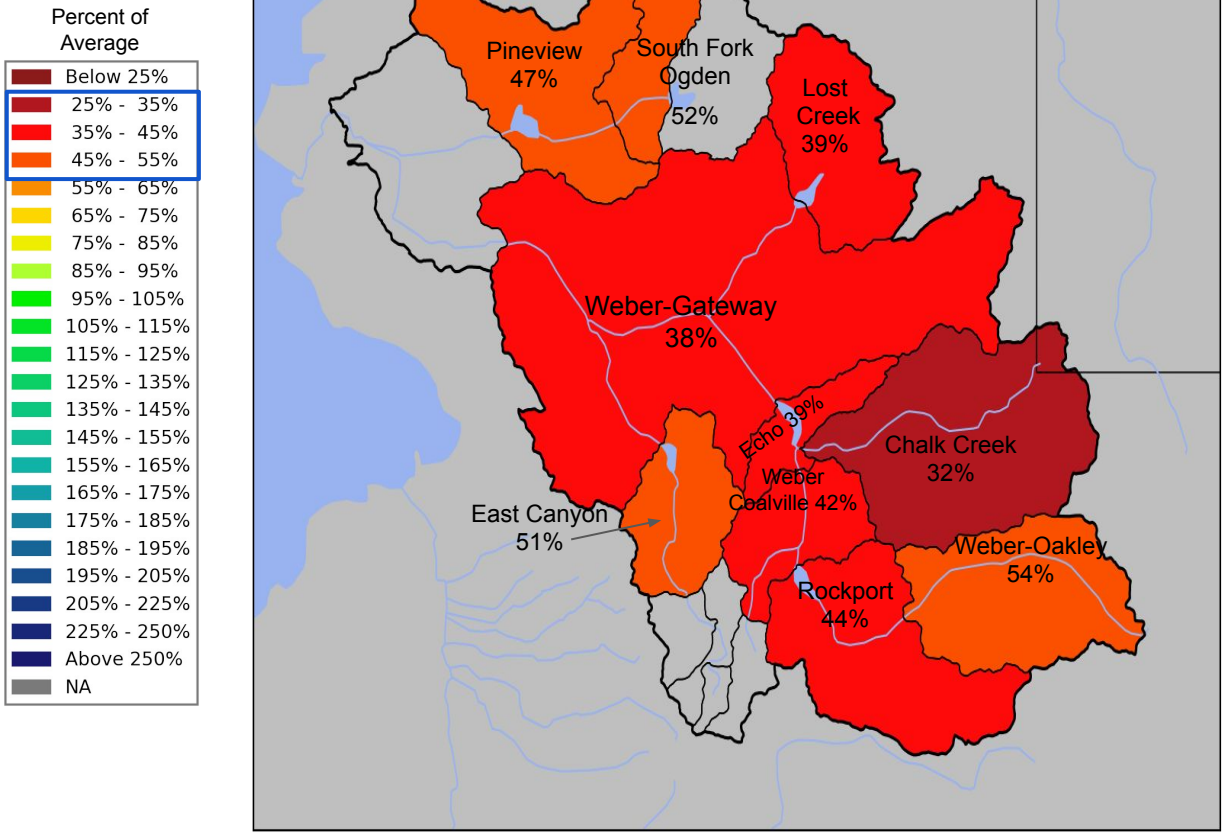
March 2021 - Utah Water Supply Forecasts - Bear

Logan River



2021/03/01:
Max 1986: 222.92
Min 1977: 34.12
Average: 111
Median: 97
ESP: 72.1
Official 10: 105
Official 30: 83
Official 50: 70
Official 70: 63
Official 90: 57

March 1, 2021 - Utah Water Supply Forecasts - Weber River Basin



Weber River Basin Forecasts

January: **45**% of Normal

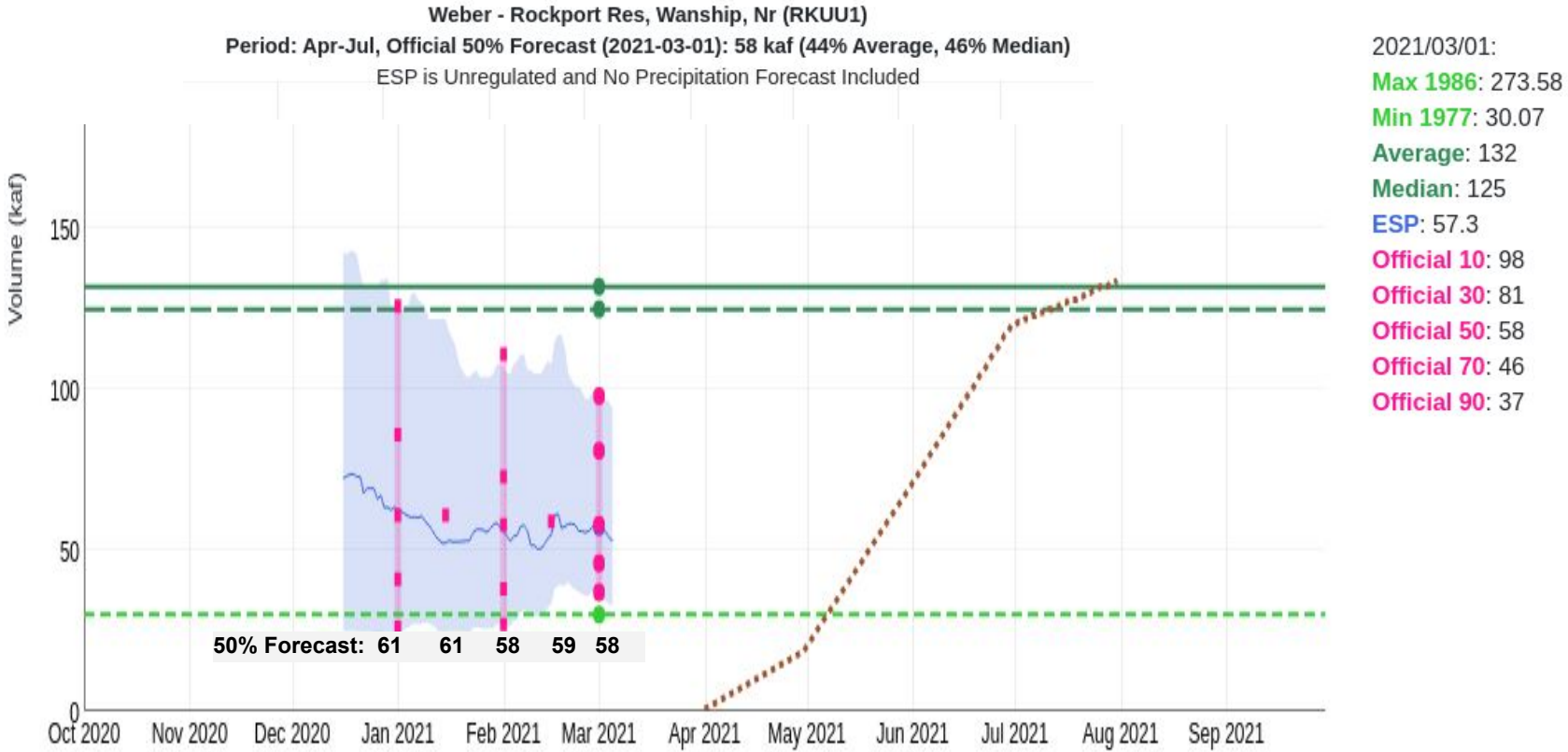
February: **45**% of Normal

March: **45**% of Normal

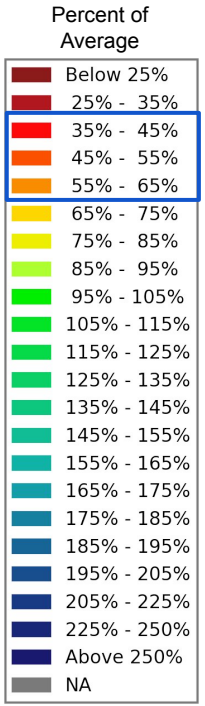
- Forecasts range from 30-55% of normal

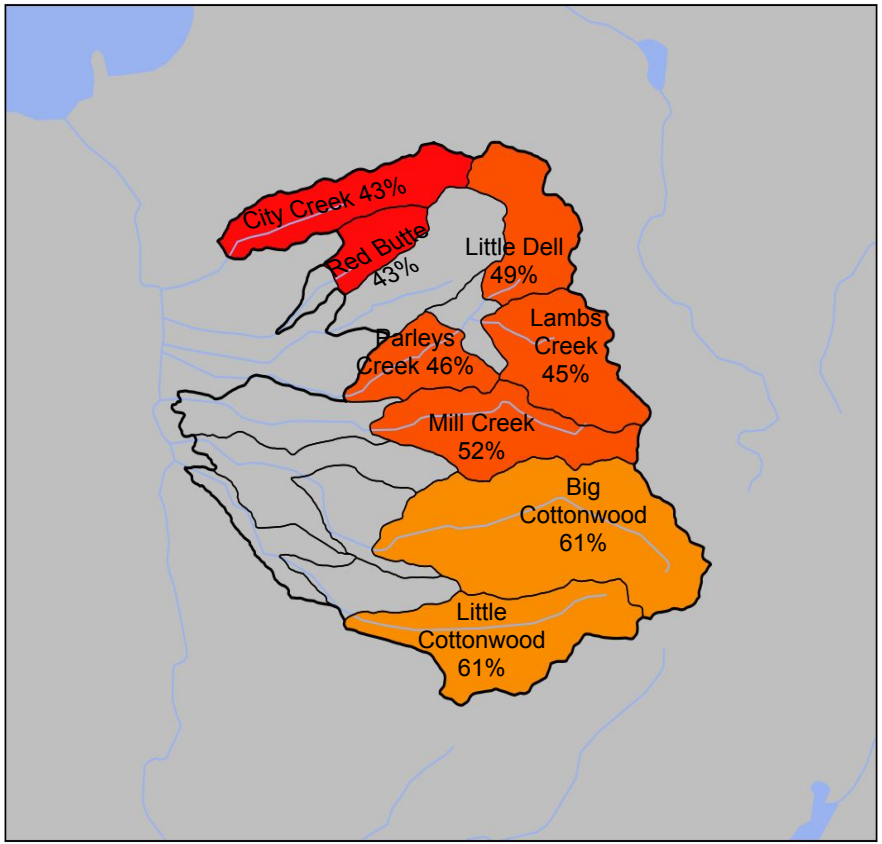
Utah Water Supply Forecasts - Weber

Rockport Reservoir



March 2021 - Utah Water Supply Forecasts - Six Creeks





Six Creeks Basin Forecasts

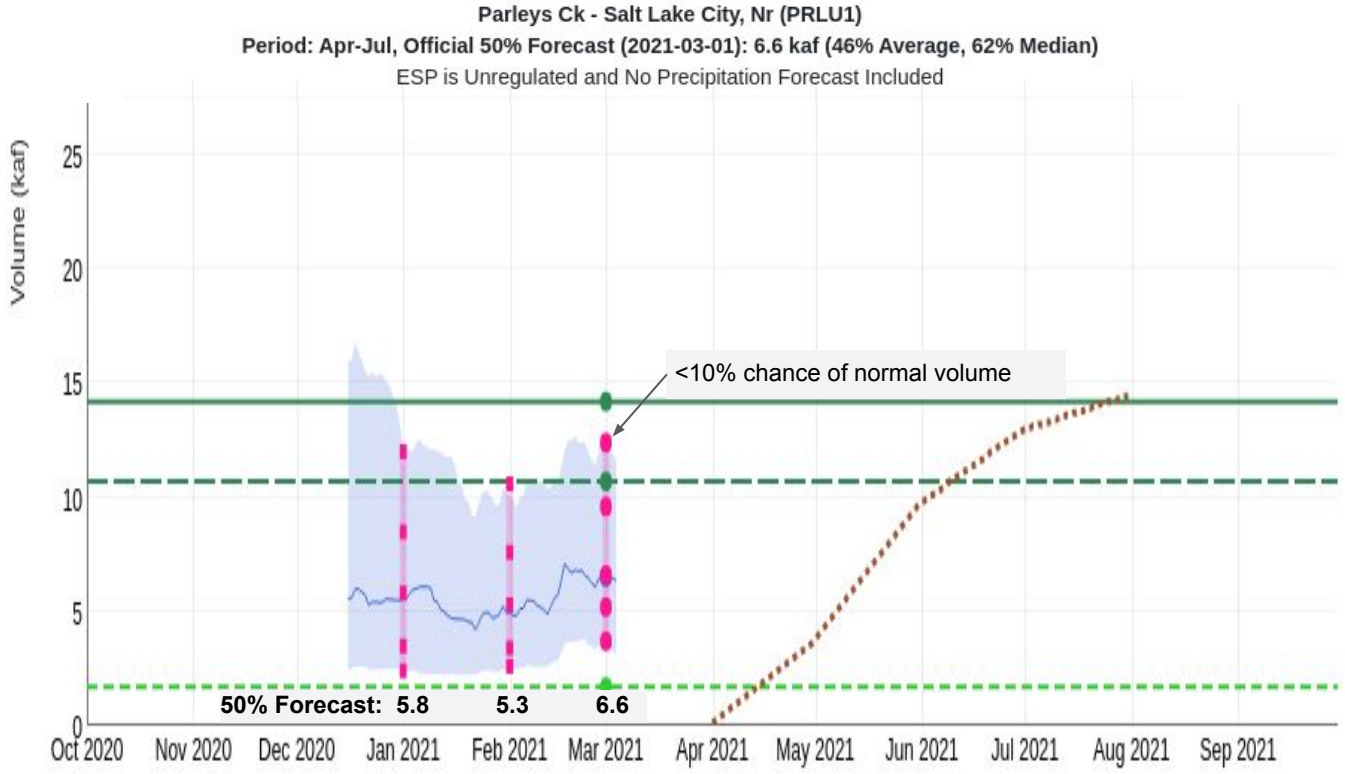
January: **40**% of Normal
February: **40**% of Normal

March: **50**% of Normal

- Forecasts range from 45-60% of average
- Improvement in lower elevation basins

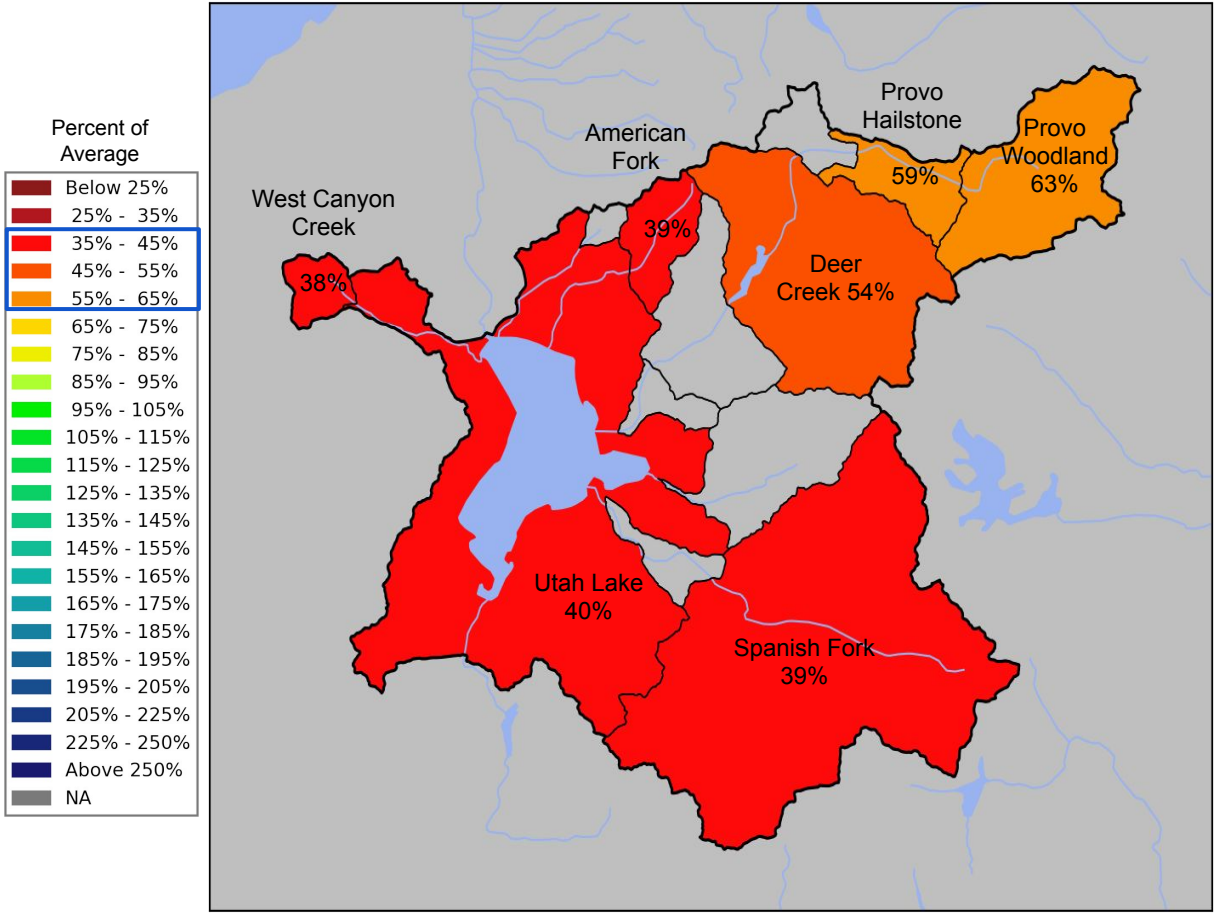
March 2021 - Utah Water Supply Forecasts - Six Creeks

Parleys Creek



2021/03/01:
Max 1983: 41.98
Min 1961: 1.7
Average: 14.2
Median: 10.7
ESP: 6.51
Official 10: 12.4
Official 30: 9.6
Official 50: 6.6
Official 70: 5.2
Official 90: 3.7

March 2021 - Utah Water Supply Forecasts - Provo - Utah Lake



Provo River Basin Forecasts

January: **50**% of Normal

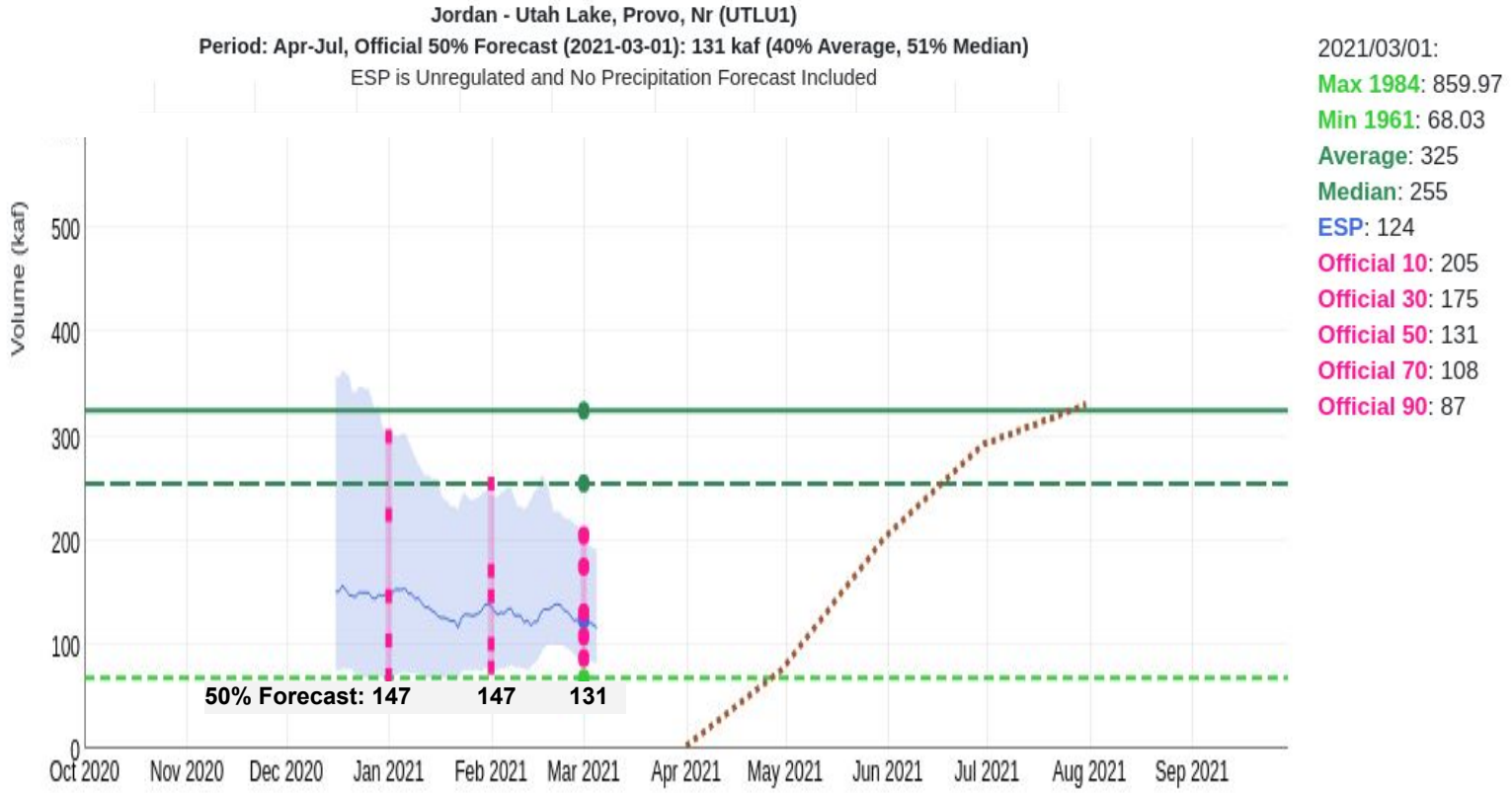
February: **50**% of Normal

March: **45**% of Normal

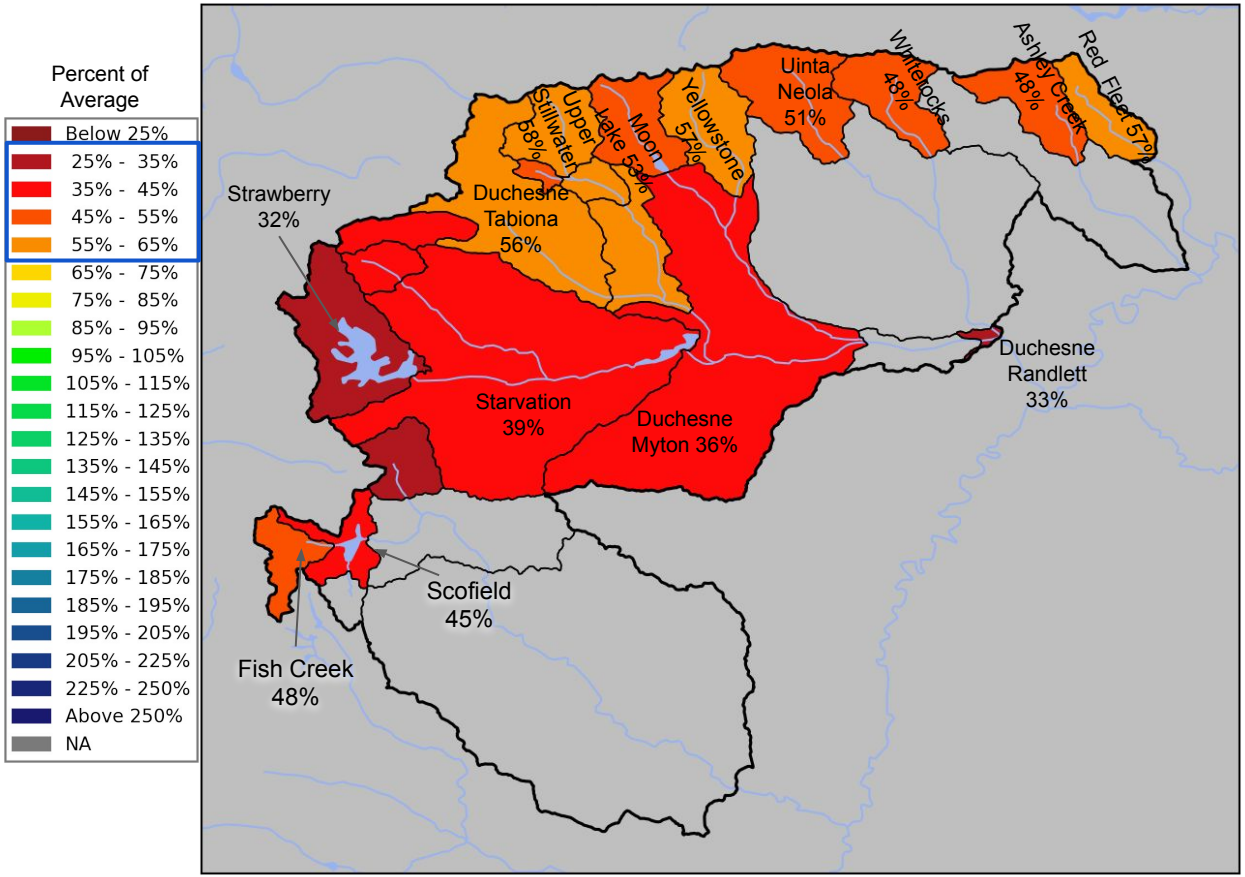
- Forecasts range from 40-65% of normal

March 2021 - Utah Water Supply Forecasts - Provo/Utah Lake

Utah Lake Inflow



March 2021 - Utah Water Supply Forecasts - Duchesne



Duchesne River Basin

January: **50**% of Normal
February: **50**% of Normal

March: **50**% of Normal

- Forecasts range from 30-60% of normal

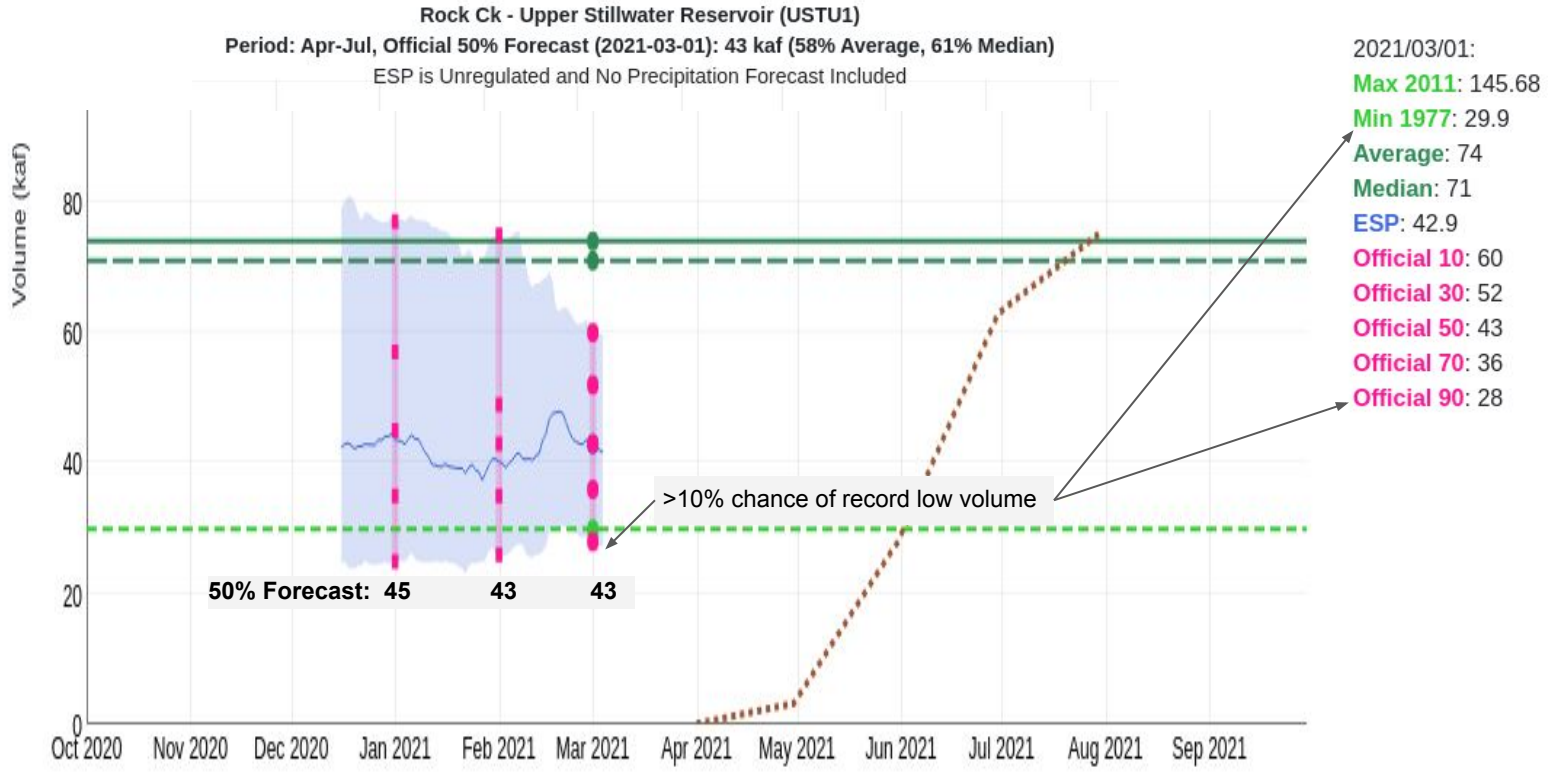
Price River Basin

January: **50**% of Normal
February: **50**% of Normal

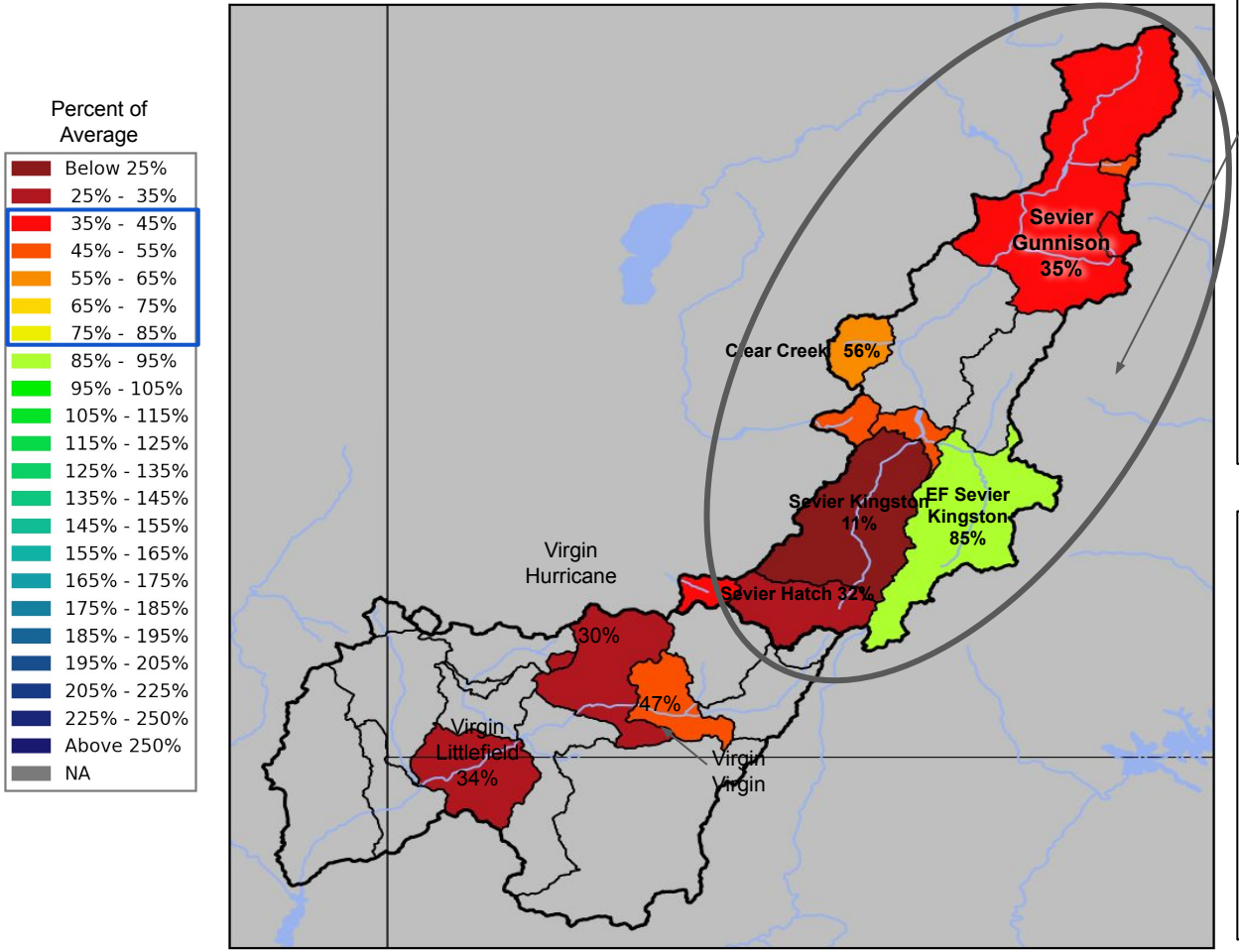
March: **45**% of Normal

March 2021 - Utah Water Supply Forecasts - Duchesne

Upper Stillwater Reservoir



March 2021 - Utah Water Supply Forecasts - Sevier and Virgin



Sevier River Basin Forecasts (regulated i.e. predicted Obs)

January: **40**% of Normal
February: **40**% of Normal

March: **45**% of Normal

- Forecasts range from 11-85% of normal

Virgin River Basin Forecasts

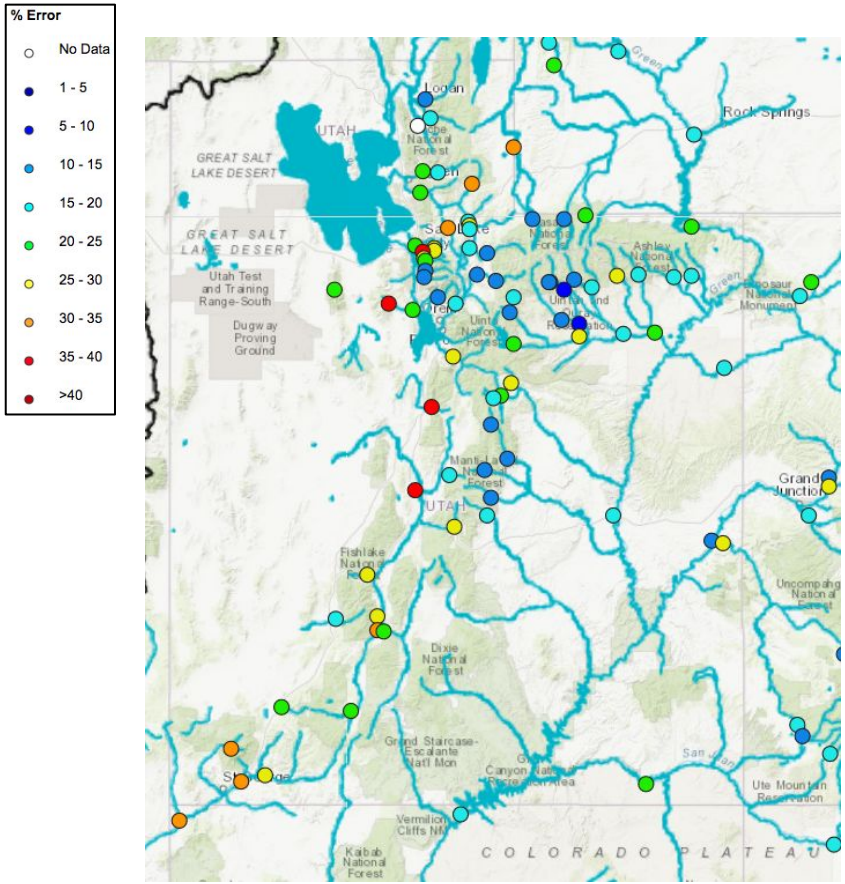
January: **35**% of Normal
February: **40**% of Normal

March: **40**% of Normal

- Forecasts range from 30-47% of normal

Historical (1981-2010) Forecast Verification

March Forecast Error: April-July Volume



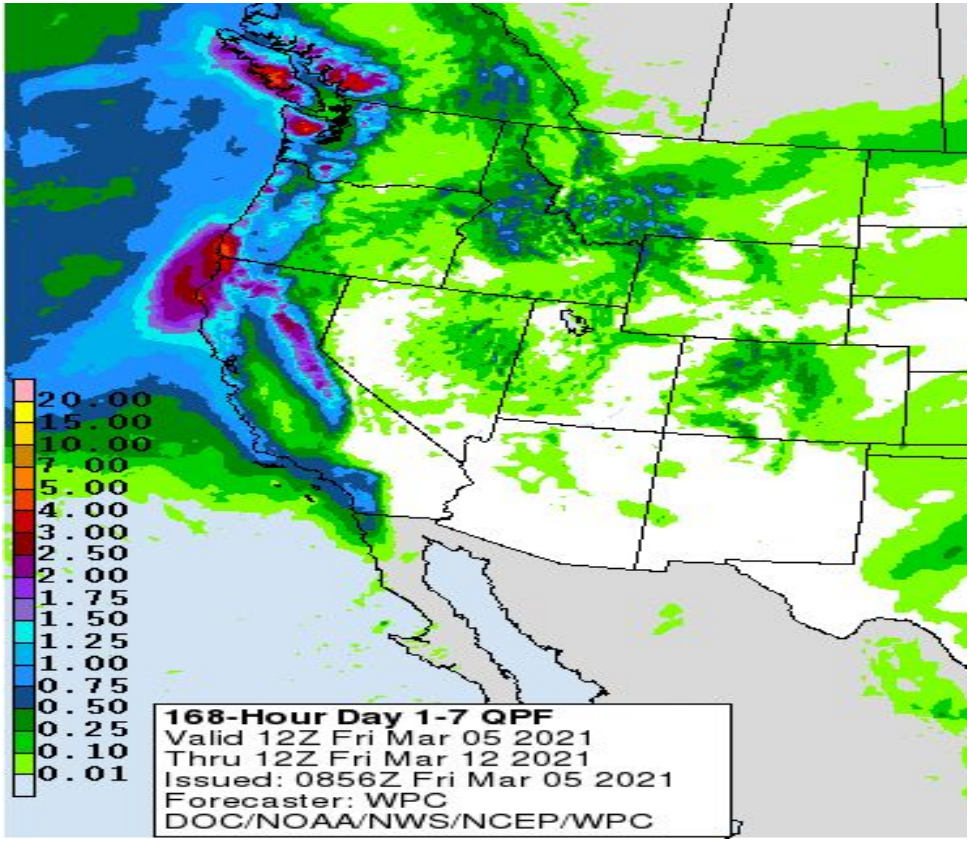
Location	February Forecast Error
BEAR - UTAH-WYOMING STATE	18%
BEAR - WOODRUFF NARROWS	36%
LOGAN - LOGAN- NR	19%
WEBER - OAKLEY- NR	17%
WEBER - ROCKPORT RES	24%
BIG COTTONWOOD CK	19%
PARLEYS CK	32%
PROVO - WOODLAND- NR	16%
PROVO - DEER CK RES	23%
VIRGIN - VIRGIN	31%

Forecasts are better than just going with average
Error tends to decrease each month into the spring

Where Forecasts are Better:
- -Headwaters
- -Primarily snow melt basins
- -Known diversions / demands

Where Forecasts are Worse:
- -Lower elevations (rain or early melt)
- -Downstream of diversions / irrigation
- -Little is known about diversions / demands

Upcoming Weather: WPC March 5-12 Precipitation Outlook



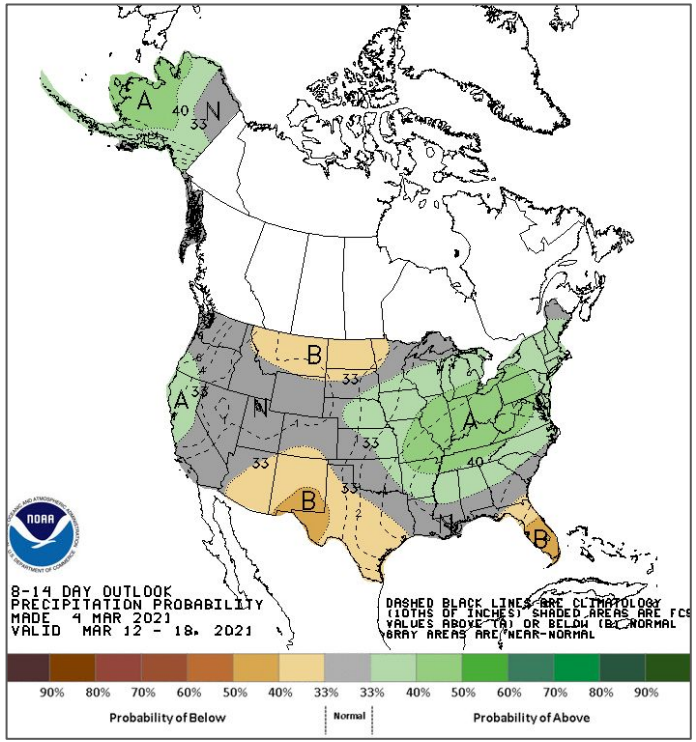
- Ridge builds today and remains in place through early next week. Dry conditions with temperatures 5-10 degrees above normal are expected.

- Large scale trough develops by next Tues-Thurs (March 9-11). Cooler temperatures are likely. Weather models are currently forecasting modest precipitation amounts.

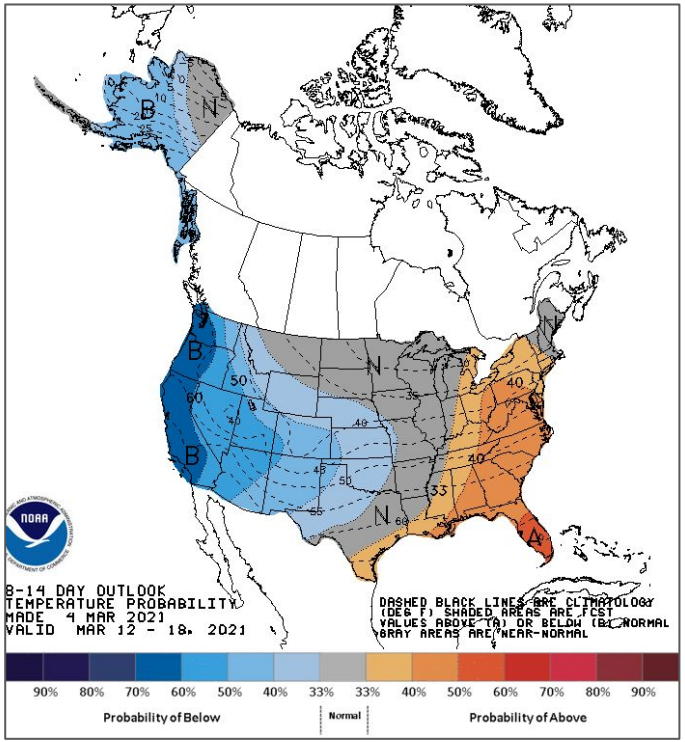
Upcoming Weather: 8-14 Day Outlook (March 12-19)

Model uncertainty is quite high in the 8-14 day period. While there is elevated odds for below normal temperatures across our region, there is little signal for precipitation odds.

Precipitation Outlook



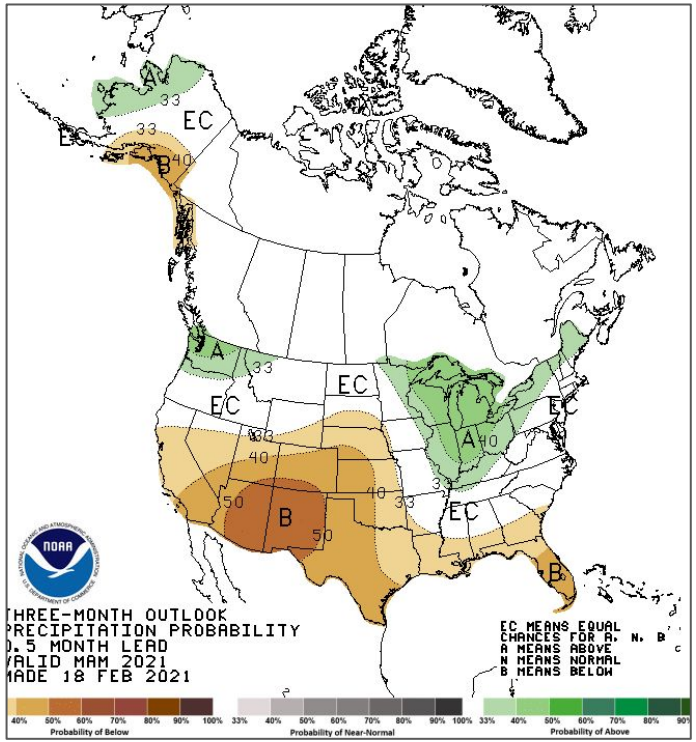
Temperature Outlook



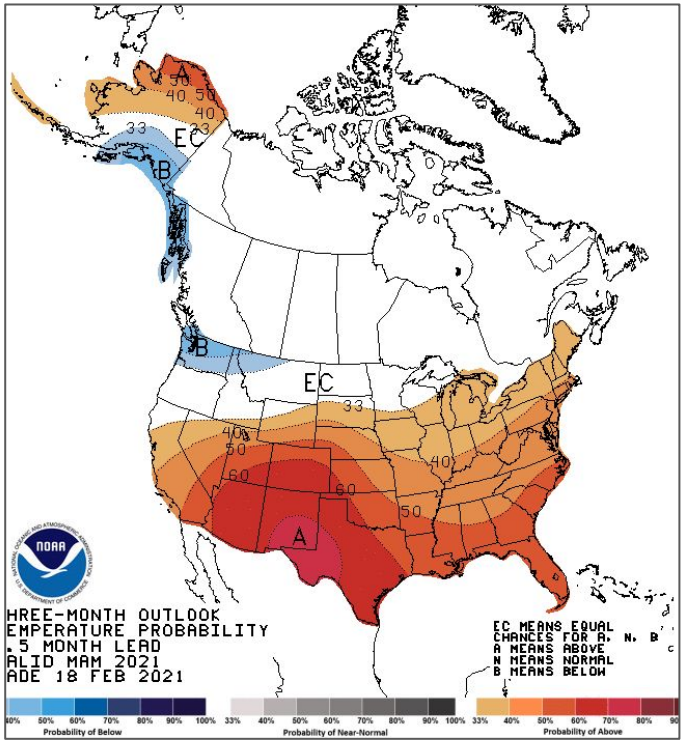
CPC Seasonal Outlook for Spring (March-May)

Elevated odds of below normal precipitation across especially the southern half of Utah/Colorado and the Lower Basin. Weaker precip signal further north.

Precipitation Outlook



Temperature Outlook



Summary

- Water year precipitation and snow are still below to much below normal across the state, as is soil moisture.

- Above normal February precipitation in the Bear, Weber, Six Creeks, Sevier.
  - Some improvements in water supply forecasts in these basins since February 1.

- Water Supply Forecasts reflect the dry conditions.
  - All water supply forecasts are below normal.

- Weather models indicating a typical spring pattern through the middle of the month with periods of warm/dry intermixed with periods of cool/wet. Model uncertainty tends to increase during the transition to Spring.
  - Currently no indication of an extended warm and dry period which is good news for water supply.

CBRFC Hydro Science Update - Post Fire Streamflow Forecasting

CBRFC post fire decision support role

Python/GIS fire tool development

Hydrologic model considerations

Pre/post fire streamflow simulations

CBRFC Decision Support Role

- Be proactive and transparent in addressing stakeholder concerns related to how streamflow forecasts may be influenced by recent fire activity.
  - Communicate model limitations

- Determine if hydrologic model parameters need to be adjusted in basins significantly impacted by recent fire activity to account for changes in runoff timing, magnitude, and efficiency.
  - 10-day streamflow forecasts vs. water supply forecasts vs. peak flow forecasts
  - Snowmelt runoff vs. rain-on-snow events vs. rain events

- Forecasting challenge: How will the timing and magnitude of runoff change after a fire?
  - Numerous basins impacted to varying degrees
    - Burn coverage
    - Burn severity
    - 2021: Very dry soils + fire impacts

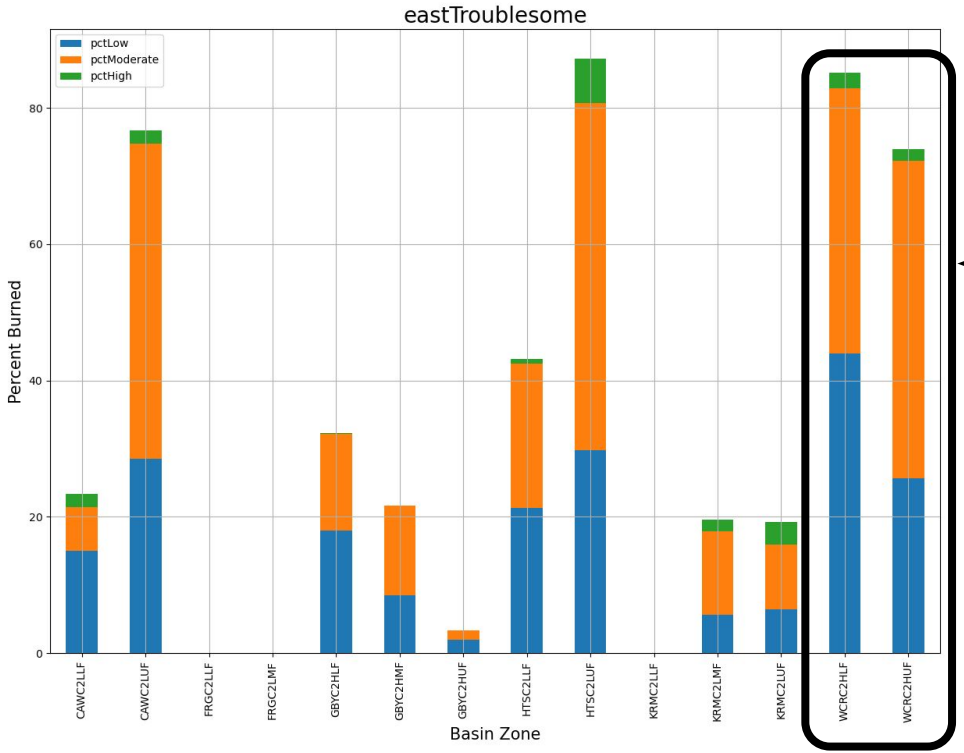
- Continually evaluate CBRFC hydrologic model performance in fire affected basins
  - Model verification - are the model parameter adjustments improving the streamflow forecast?
  - Compare any hydro forecaster intervention in both burned & nearby unburned basins.
    - Example: spatial snowmelt rate analysis

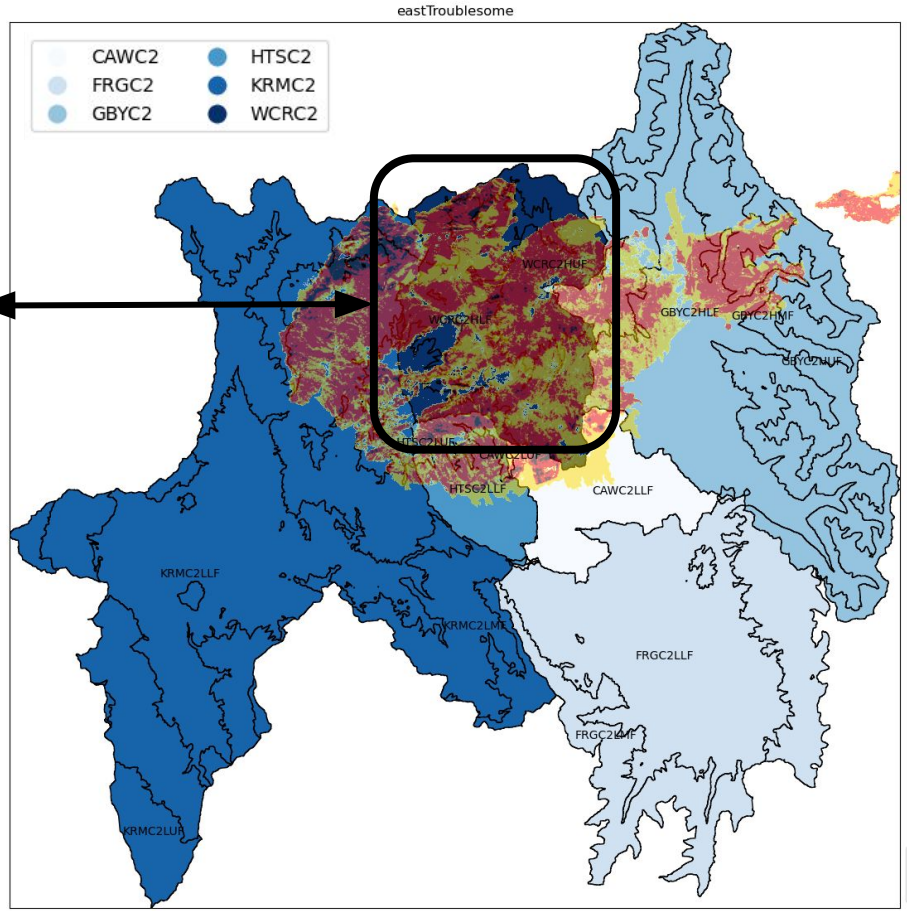
- Stakeholder/RFC collaboration
- Document/database

Python/GIS Fire Tool Development

- Python/GIS Fire Tool
  - Goal: quickly ingest/process burn data and consider impacts to CBRFC streamflow forecasting efforts.
  - Input: geo tiff or .shp file of burn area / severity
    - source: Burned Area Reflectance Classification (BARC)
      - a satellite-derived data layer of post-fire vegetation condition.
      - The BARC has four classes: high, moderate, low, and unburned.
  - Outputs
    - Maps (various scales)
    - Plots (broken down by CBRFC elevation zone)
      - Size of fire (mi^2)
      - % of elevation zone burned & burn severity (low, moderate, high)
    - Tables
      - Tabular data of plots (html, .csv)
    - Shapefiles of burn areas
  - Future development:
    - Type of vegetation burned (forest, shrub, etc..)

Fire Tool Output Examples - East Troublesome Fire





Willow Creek basin (WCRC2)
-CBRFC water supply forecast point > model reservoir inflow/pool elev/outflow
-both elevation zones >70% burned

SAC-SMA Hydrologic Model Considerations

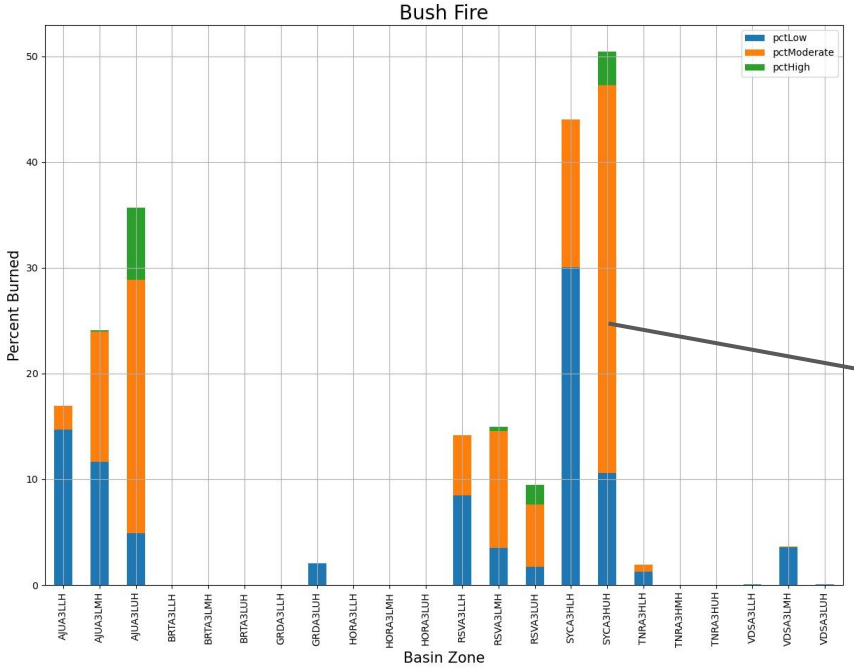
- A few CBRFC model adjustment options:
  - No change -> establish baseline verification using current model parameters
    - Analyze model performance at beginning of runoff season & compare with non-fire affected nearby basins; stay flexible during runoff season
  - Adjust UNIT-HG model
    - would not affect model simulated volume (only affects timing)
  - **Adjust soil moisture (SAC-SMA) model**
    - **will affect model water balance and both timing and magnitude of model simulated flow**
  - Define/configure new 'burn' zone in model
    - Most time consuming and complicated in an operational forecast setting

Relevant SAC-SMA Model Parameters:

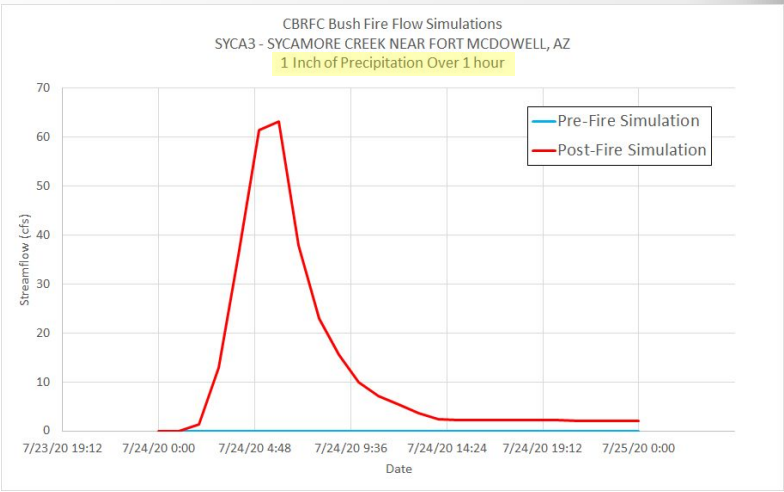
- **UZTWM** - upper soil zone layer tension water capacity (bucket size), units = millimeters
  - parameter indicates the amount of rain that must fall after a long dry period before any runoff is produced

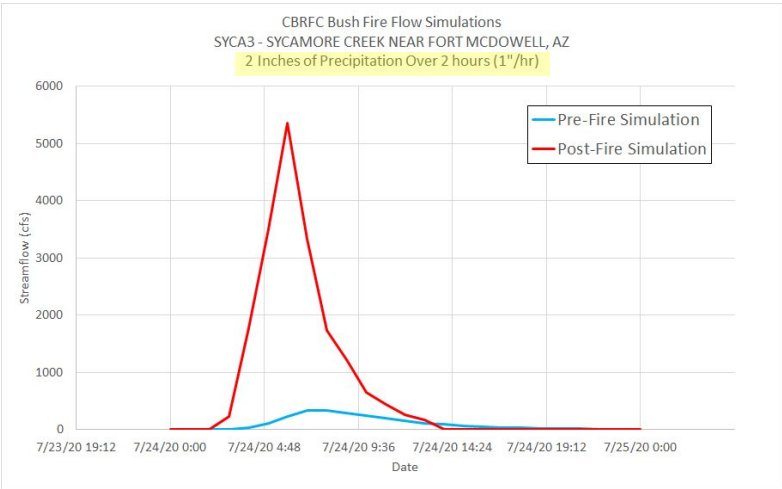
- **UZFWM** - upper soil zone layer free water capacity (bucket size), units = millimeters
  - primary function is to control when surface runoff occurs
  - surface runoff can only occur when the intensity rate of the rainfall or rain+melt is sufficient to fill the upper zone free water storage.

Pre/Post Fire Hydrologic Model Simulation Analysis - Lower Colorado



Basin upper elevation zone >50% burned





Model Upper Elevation Zone Changes

Parameter	Pre Fire	Post Fire
UZTWM	30	10
UZFWM	40	10

Pre/Post Fire Hydrologic Model Simulation Analysis - Upper Colorado

Upper zone

Parameter	Pre Fire	Post Fire
UZTWM	20	10
UZFWM	40	15

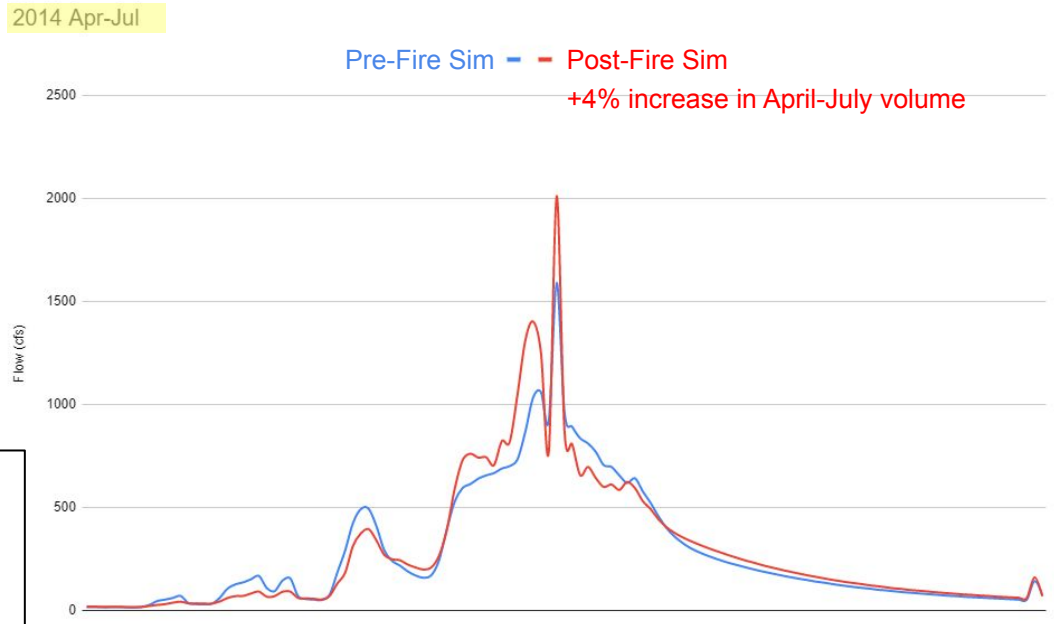
Lower zone

Parameter	Pre Fire	Post Fire
UZTWM	40	10
UZFWM	40	15

1981-2015 Simulation Analysis: April-July Volume

	PreFire	PostFire
Model Bias	-2.1%	+1.4%
Volume % Change		+0.2 to +10.3% Average: +3.6%

Willow Creek Reservoir Inflow Simulations



CBRFC Hydro/Fire Summary

- Developed Python/GIS tool
- Comparing pre vs. post fire model simulations in offline forecast system
- Operational SAC-SMA model parameter adjustments in basin zones that are > 50% burned.
  - Implementing before April 1, 2021
- Evaluate operational hydrologic model performance during spring runoff
- Develop best practices
- Stay proactive & transparent

2021 Water Supply Webinar Schedule

**All Times Mountain Time (MT)*

Colorado River Basin

~~Friday~~	~~Jan 8th~~	~~10 am~~
~~Friday~~	~~Feb 5th~~	~~10 am~~
Friday	Mar 5th	10 am
Wednesday	Apr 7th	10 am
Friday	May 7th	10 am

Great Basin

~~Friday~~	~~Jan 8th~~	~~11:30 am~~
~~Friday~~	~~Feb 5th~~	~~11:30 am~~
Friday	Mar 5th	11:30 am
Wednesday	Apr 7th	11:30 am
Friday	May 7th	11:30 am

Peak flow forecast webinar Thursday, March 18th, 10 am MT

Additional briefings scheduled as needed

Webinar schedule & registration information has been posted to the CBRFC web page

CBRFC Contacts & WY21 Basin Focal Points

Michelle Stokes
Hydrologist In Charge

John Lhotak
Development and Operations Hydrologist

Paul Miller
Service Coordination Hydrologist

Cass Goodman
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