Snowpack and River Health: The Impacts of Climate Change
March 26, 2019
Why is snowpack important?

- **Colorado River Basin**
  - Growing demands
  - Shrinking supply

- **Water Supply**
  - Healthy Rivers
  - Recreation
  - Tourism
  - Habitat
  - Reservoirs
  - Drinking Water

- **Critical Factors**
  - Amount
  - Type
  - Wind
  - Evaporation
  - Soil Moisture
Good vs. Bad

- **Cloudy**
- **Sunny**

**Runoff**

- **High Soil Moisture**
- **Low Soil Moisture**

**Wind**

*Denver Water*
Climate Change
- Temperature changes
- Snowpack
  - Since 1915 average snowpack decline 15-30% (NPJ CAS 2018)

Impacts
- Timing and Amount of Run-Off
  - 2000-2014 Colorado River flows averaged 19% below 1906-1999 average (Udall/ Overpeck)
- Water Demands
- Dust on Snow
- Dense Forest
- Fire Risk
- Post Fire Impacts
Observed and Projected Colorado Average Annual Temperatures, 1950—2070

Observed temperatures through 2018 (bars) reveal that Colorado’s climate has warmed about 2 degrees over the past 30 years. Projected temperatures through 2070 from 36 global climate models under a medium-low emissions scenario and a high emissions scenario all show further substantial warming. By 2050, a “normal” year in Colorado is expected to be up to 3 degrees warmer than 2012, the warmest year on record.

Median projection, high emissions scenario

Median projection, medium-low emissions scenario

There is an apparent long-term declining trend in spring snowpack; in the 21 years from 1998 to 2018, 16 years were below the long-term median.
Local Conditions

Yampa Basin

- **2018**
  - Snowpack ~89%
  - Streamflow ~61% (at Maybell)
  - Hot, dry summer
  - Low and warm flows
  - River Closure Steamboat Springs
  - First “Call” on the Yampa River

- **2019**
  - Snowpack 125% (3/26/19)
  - Streamflow projected 105% (3/1/19)
What does this mean for drought?

- Run-Off, Weather, Climate
- Less snow, more rain
- Growing aridity
- Droughts indicate water scarcity
- One good winter won’t be enough
  - Snowpack and drought recovery
  - Dry soil
  - Snowpack vs. streamflow
Notice: We anticipate this map will not be available next year due to staffing constraints. Alternate maps: [https://go.usa.gov/xmzvK](https://go.usa.gov/xmzvK)

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median

- unavailable *
- <50%
- 50 - 69%
- 70 - 89%
- 90 - 99%
- 110 - 129%
- 130 - 149%
- >=150%

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

Provisional Data Subject to Revision

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
Colorado

SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Jan 02, 2019

Laramie and North Platte

Yampa and White
102
103

Upper Colorado Headwaters

Gunnison
91

San Miguel, Dolores, Animas and San Juan
70

Upper Rio Grande
76

South Platte

Arkansas

Miles

Current Snow Water Equivalent (SWE) Basin-wide Percent of 1981-2010 Median

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Prepared by: USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov
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Colorado
SNOTEL Current Snow Water Equivalent (SWE) % of Normal

Mar 01, 2019

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Basin-wide Percent of 1981-2010 Median

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Prepared by
USDA/NRCS National Water and Climate Center
Portland, Oregon
http://www.wcc.nrcs.usda.gov
Snow Water Equivalent In
STATE OF COLORADO

Current as of 02/19/2019:
% of Median - 142%
% Median Peak - 129%
Days Until Median Peak - 19
Percentile - 94

Statistical shading breaks at 10th, 30th, 50th, 70th, and 90th Percentiles.

For more information visit: 50 year normals calculation description.
U.S. Drought Monitor
Colorado

October 2, 2018
(Released Thursday, Oct. 4, 2018)
Valid 8 a.m. EDT

Drought Conditions (Percent Area)

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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:
David Miskus
NOAA/NWS/NCEP/CPC

http://droughtmonitor.unl.edu/
U.S. Drought Monitor
Colorado

December 4, 2018
(Released Thursday, Dec. 6, 2018)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

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Author:
Deborah Batch
National Drought Mitigation Center

http://droughtmonitor.unl.edu/
U.S. Drought Monitor
Colorado

January 1, 2019
(Released Thursday, Jan. 3, 2019)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

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Intervals:
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Author:
David Miskus
NOAA/NWS/NCEP/CPC

http://droughtmonitor.unl.edu/
U.S. Drought Monitor
Colorado

February 5, 2019
(Released Thursday, Feb. 7, 2019)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

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Author: Richard Tinker
CPC/NOAA/NWS/NCEP

http://droughtmonitor.unl.edu/
U.S. Drought Monitor
Colorado

March 5, 2019
(Released Thursday, Mar. 7, 2019)
Valid 7 a.m. EST

Drought Conditions (Percent Area)

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<tr>
<th>Current</th>
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<td>Start of Water Year 09-25-2018</td>
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Author:
Eric Luebchau
U.S. Department of Agriculture

http://droughtmonitor.unl.edu/
March 19, 2019
(Released Thursday, Mar. 21, 2019)
Valid 8 a.m. EDT

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Author:
Jessica Blunden
NCEI/NOAA

http://droughtmonitor.unl.edu/
March 19, 2019
(Released Thursday, Mar. 21, 2019)
Valid 8 a.m. EDT

U.S. Drought Monitor
Colorado

March 24, 2019
SNOTEL Current Snow Water Equivalent (SWE) % of Normal
Laramie and North Platte

Yampa and White
125

Upper Colorado Headwaters
136

Gunnison
154

San Miguel, Dolores, Animas and San Juan
164

Upper Rio Grande
147

South Platte
127

Prepare by:
USDA/ARS/CSC National Water and Climate Center
Portland, Oregon
http://www.nwrc.usda.gov

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Lake Powell
- 38% Full (3/1/19)
- Snowpack 138% (3/18/19)
- Projected inflow 2019 WY 9.931 MAF (92% of normal)
- Inflow 2018 WY 4.6 MAF (43% of normal), 3rd driest year on record (2002, 1977)
- Projected Release 9 MAF
- Lake Mead 41% Full (3/1/19)

State of the River, April 3rd, Colorado River District
Lake Powell Unregulated Inflow
Water Year 2019 Forecast (issued March 1)
Comparison with History

**Water Year 2019 Forecast**
- Mar Most Prob: 9.931 maf (92%)
- Jan Min Prob: 4.81 maf (44%)
- Jan Max Prob: 10.38 maf (96%)
- Average: 10.83 maf (1981-2010)

**Mar Most Apr-Jul:** 7.3 maf (102%)
**Mar Min Apr-Jul:** 5.3 maf (74%)
**Mar Max Apr-Jul:** 10.7 maf (149%)
Questions?
What does this mean for river health?

What can be done locally?

Kelly!