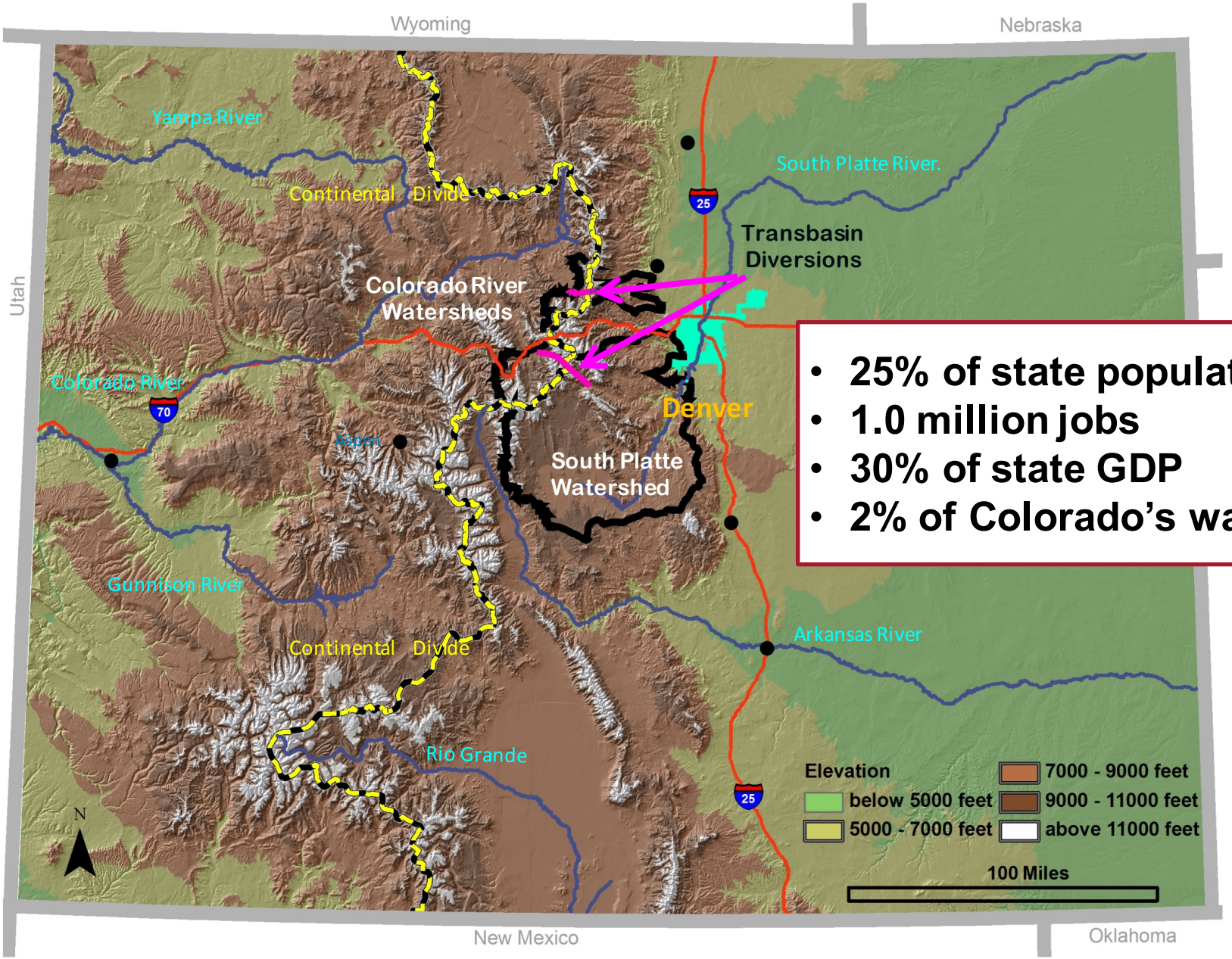
DROUGHT

Laurna Kaatz

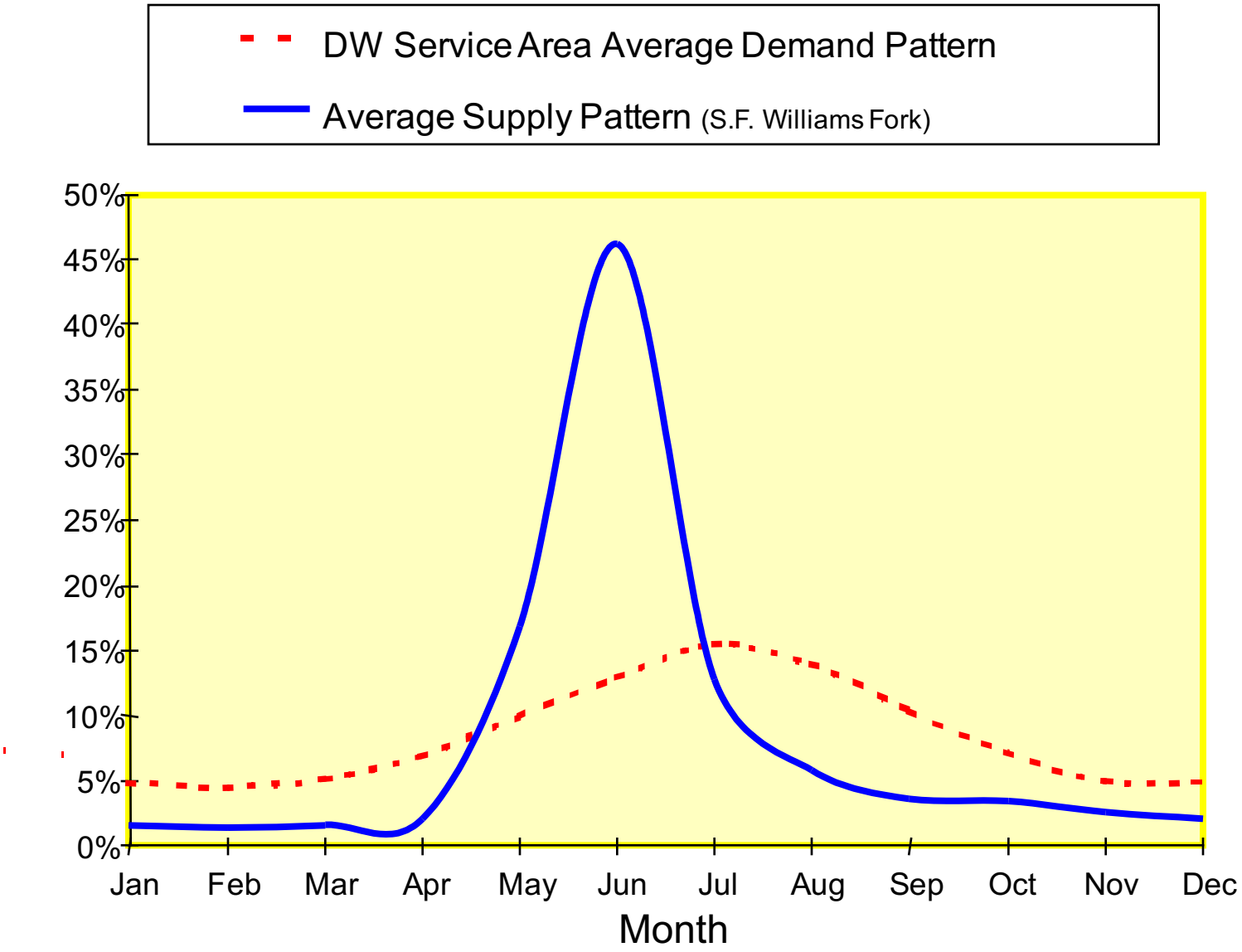
Climate Adaptation Program Director

Colorful Colorado



- 25% of state population
- 1.0 million jobs
- 30% of state GDP
- 2% of Colorado's water

Comparison of Water Supply and Demand Patterns

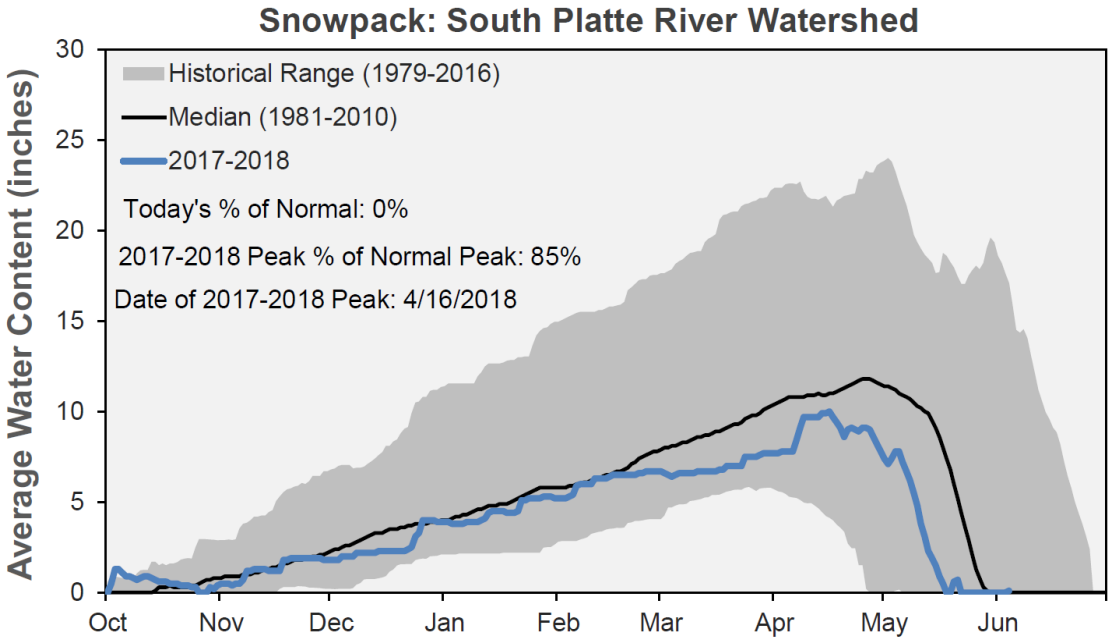


Factors Affecting Water Supply

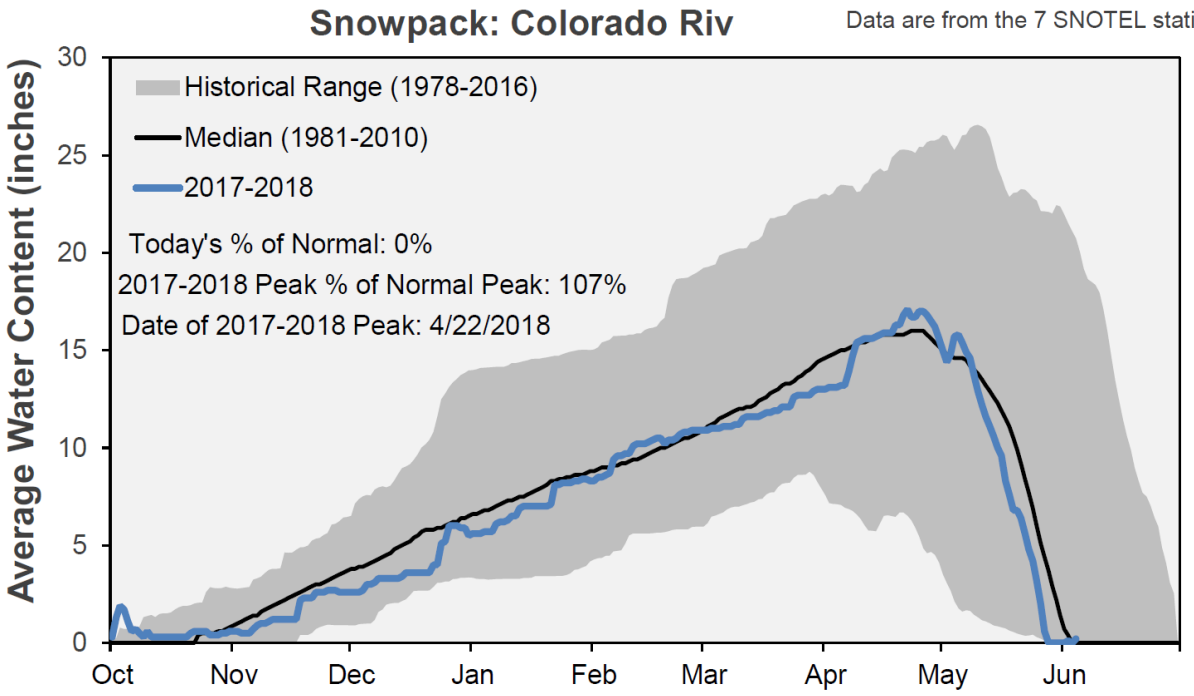
Objective: Fill Reservoirs and Balance System

- Available Flow (natural flows)
  - Variations in annual, seasonal and daily weather patterns and runoff
  - System losses (evaporation, carriage losses)
- System Constraints
  - Tunnels, canals, reservoirs
  - Stream channels
  - Treatment plants and distribution
  - Water quality
- Water Rights and Agreements
  - Colorado water law
  - Contracts & agreements
  - Minimum, maximum flows
  - Environmental factors
- Demand
  - Existing vs. Future
  - Variations in annual, seasonal and daily de...
  - Indoor versus outdoor demand
  - Future conservation savings
  - Demands of other entities
  - Social values

2018



Data are from the 7 SNOTEL stations above Denver Water's Upper South Platte diversion facilities.



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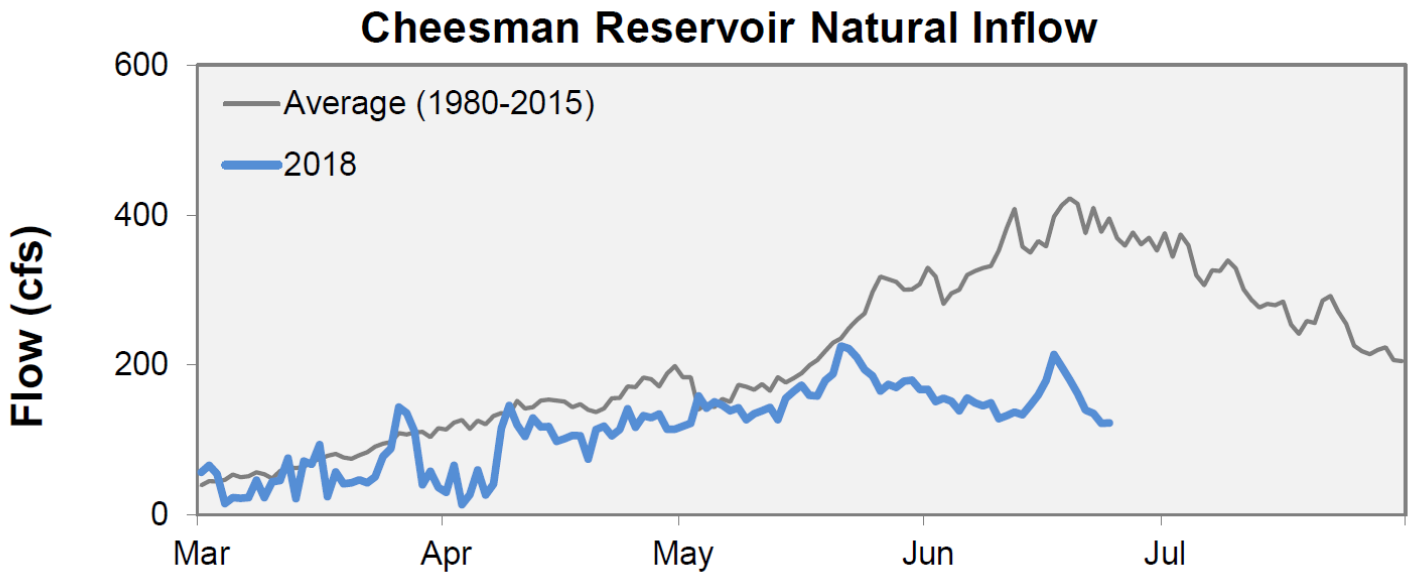
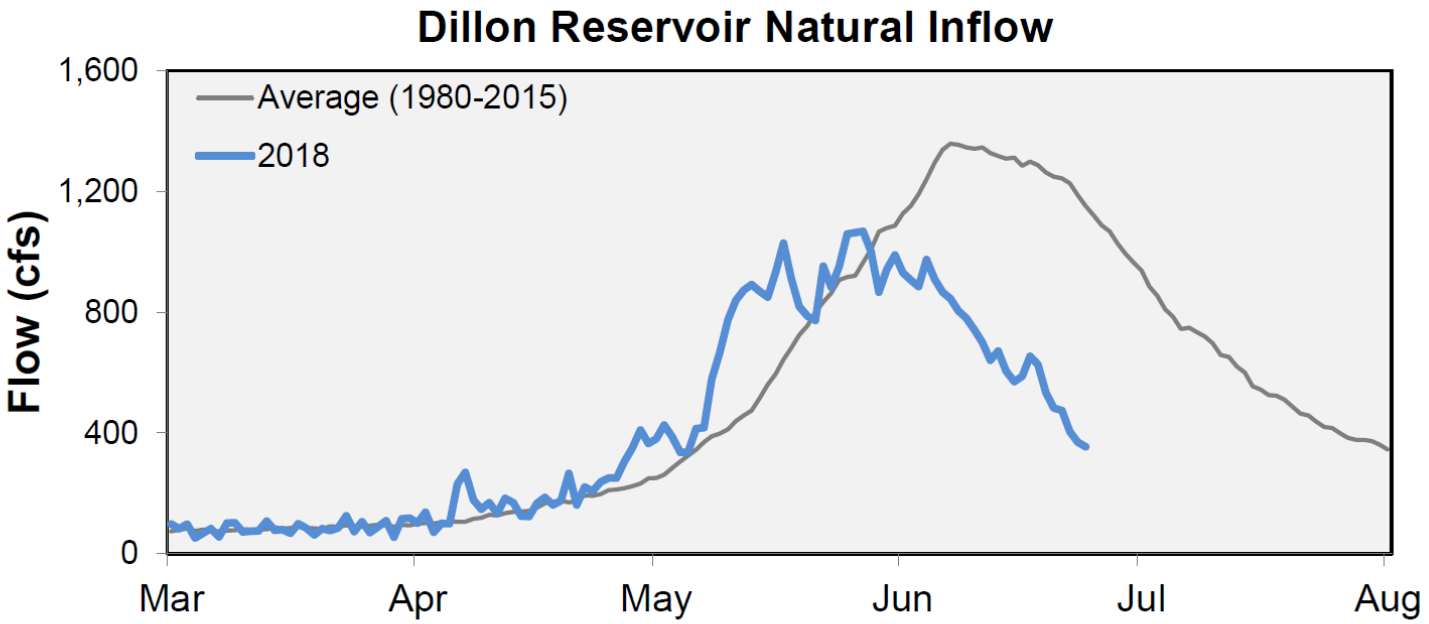
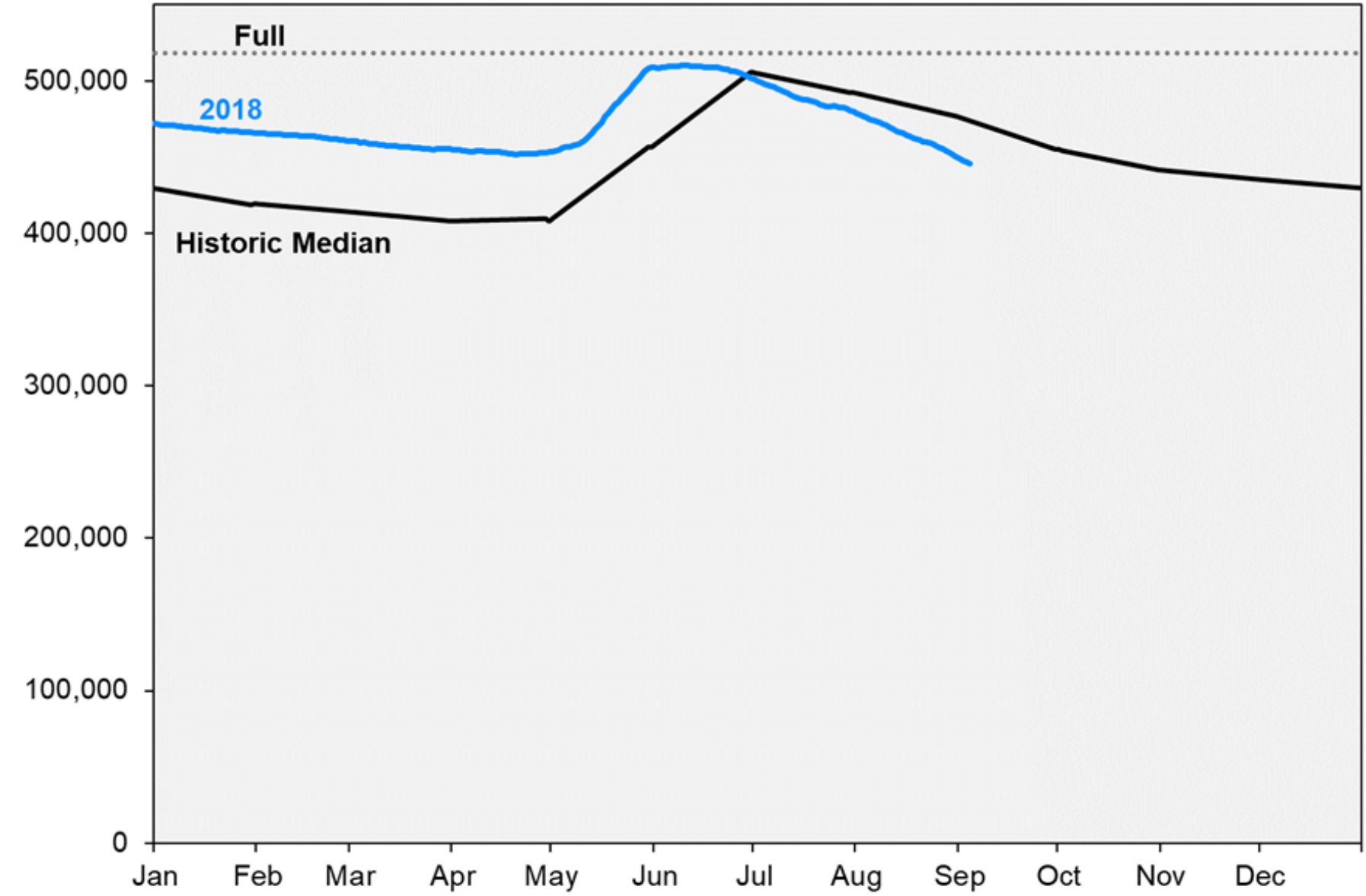
East Slope



West Slope



SUPPLY RESERVOIR CONTENTS



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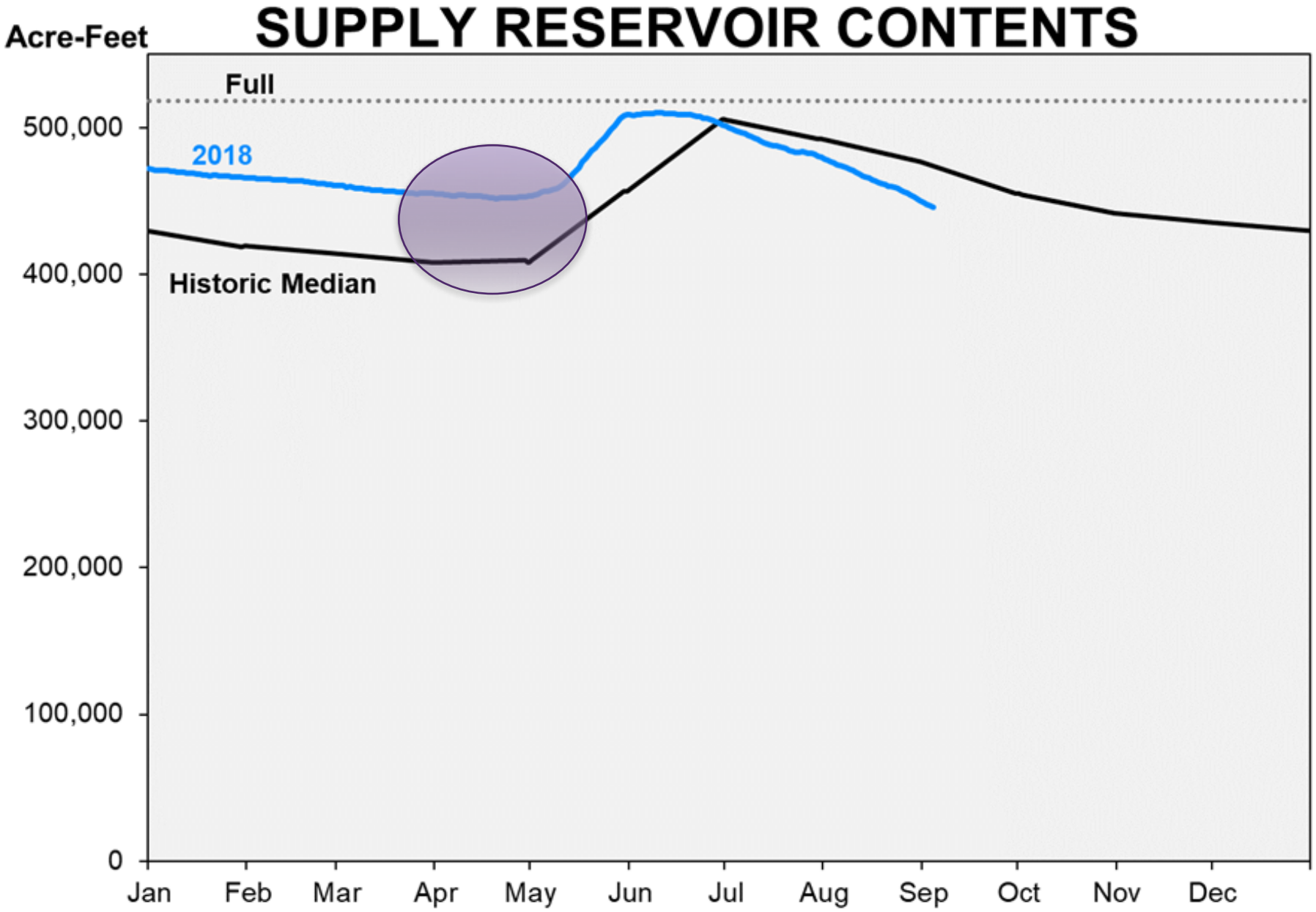
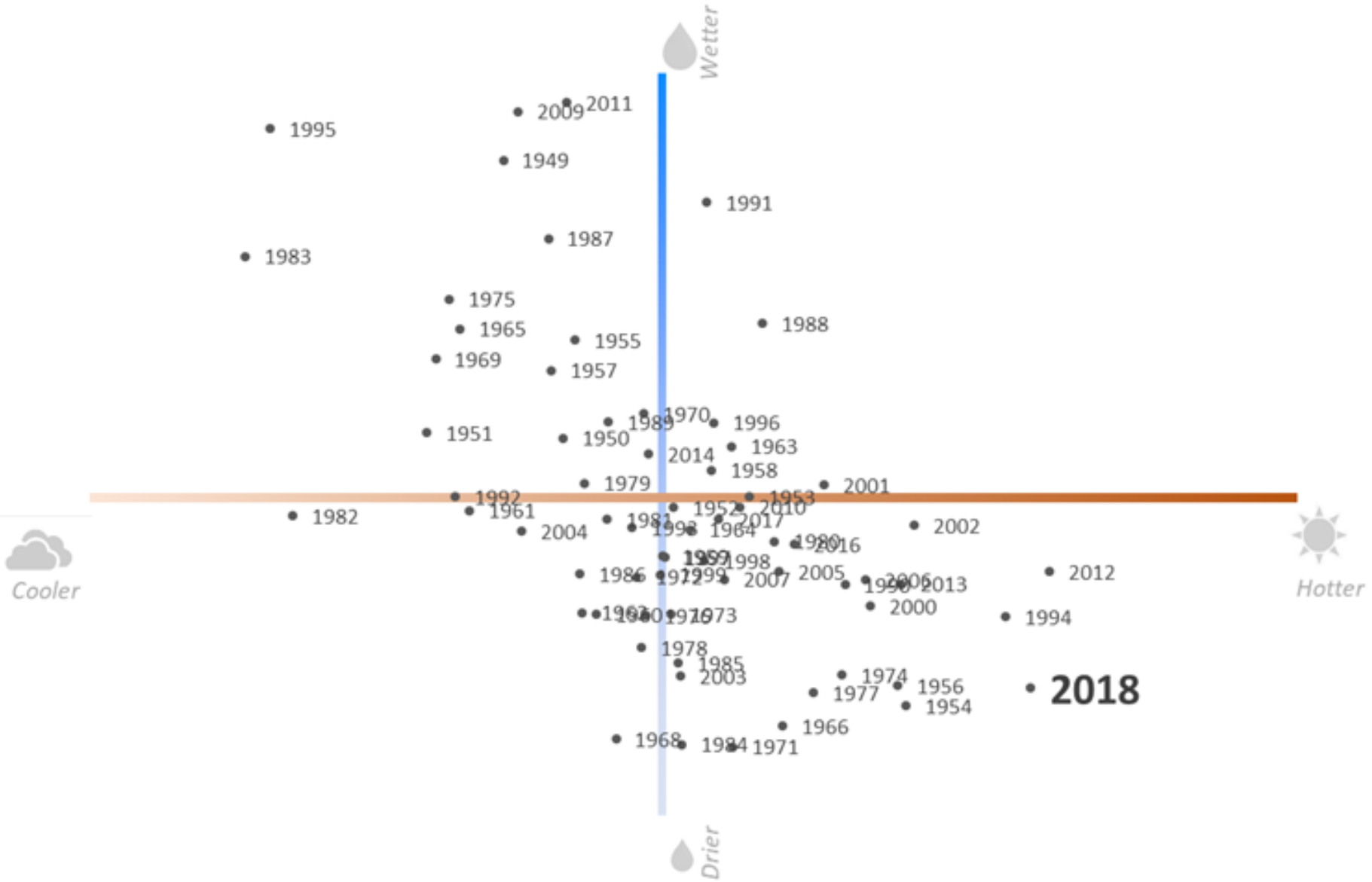


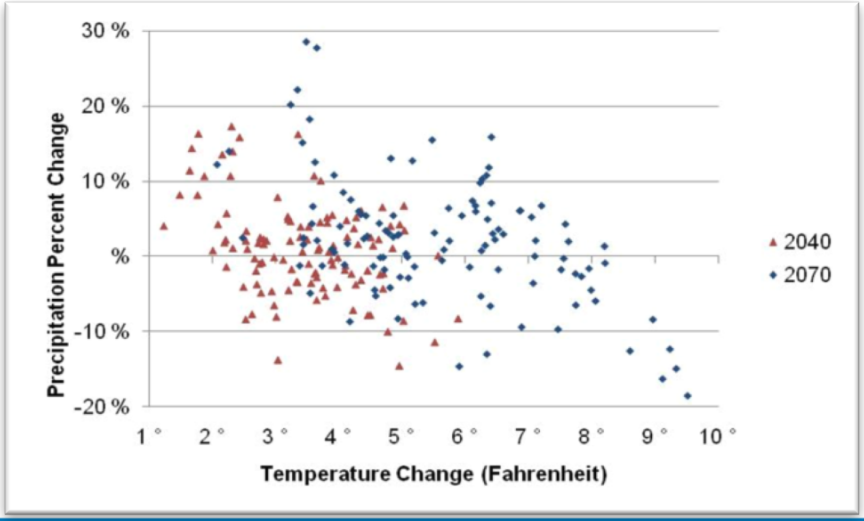
Denver Metro Area Weather Variation: May 15 to July 15

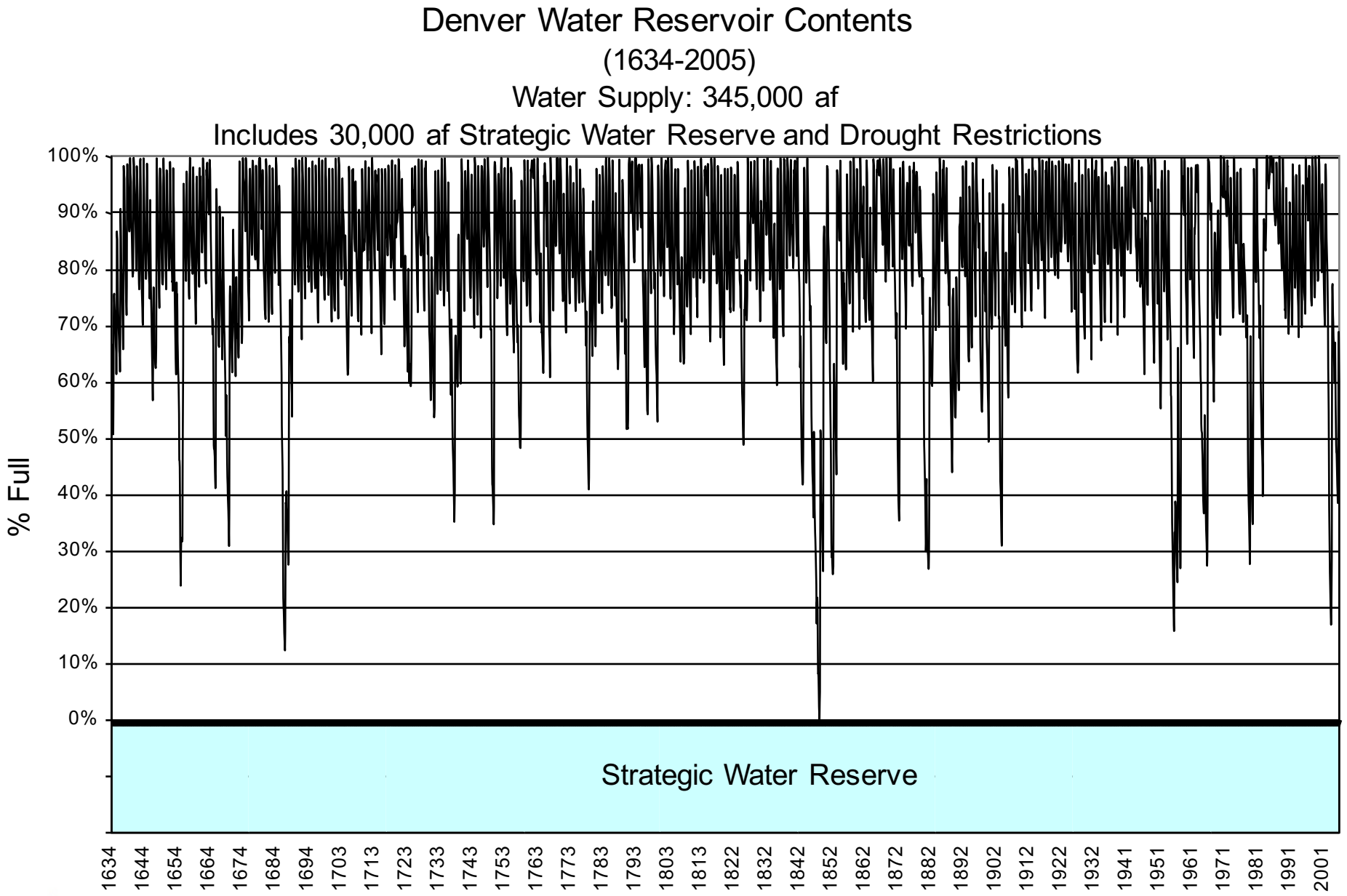


The weather average (where the axes cross) is 1981-2010.

Flash Drought in a semiarid region

- Context matters:
  - Current conditions: drought year?
  - Timing: spring vs late fall vs winter
  - Location: service area vs watersheds, headwaters vs downstream
- Another acute challenge?
  - Extreme heat, forest fire, compact call, flash drought?
- WWWM?
  - Vulnerable to warming
  - Year types?
    - Dry → drier
    - Ave → dry
    - Wet → ave, wet, wetter?




Denver Water Reservoir Contents
(1634-2005)
Water Supply: 345,000 af
Includes 30,000 af Strategic Water Reserve and Drought Restrictions
% Full
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
Strategic Water Reserve
1634
1644
1654
1664
1674
1684
1694
1703
1713
1723
1733
1743
1753
1763
1773
1783
1793
1803
1813
1822
1832
1842
1852
1862
1872
1882
1892
1902
1912
1922
1932
1941
1951
1961
1971
1981
1991
2001
Year

Summary of Lessons: For scientists (and their science) to be relevant for decision-makers:

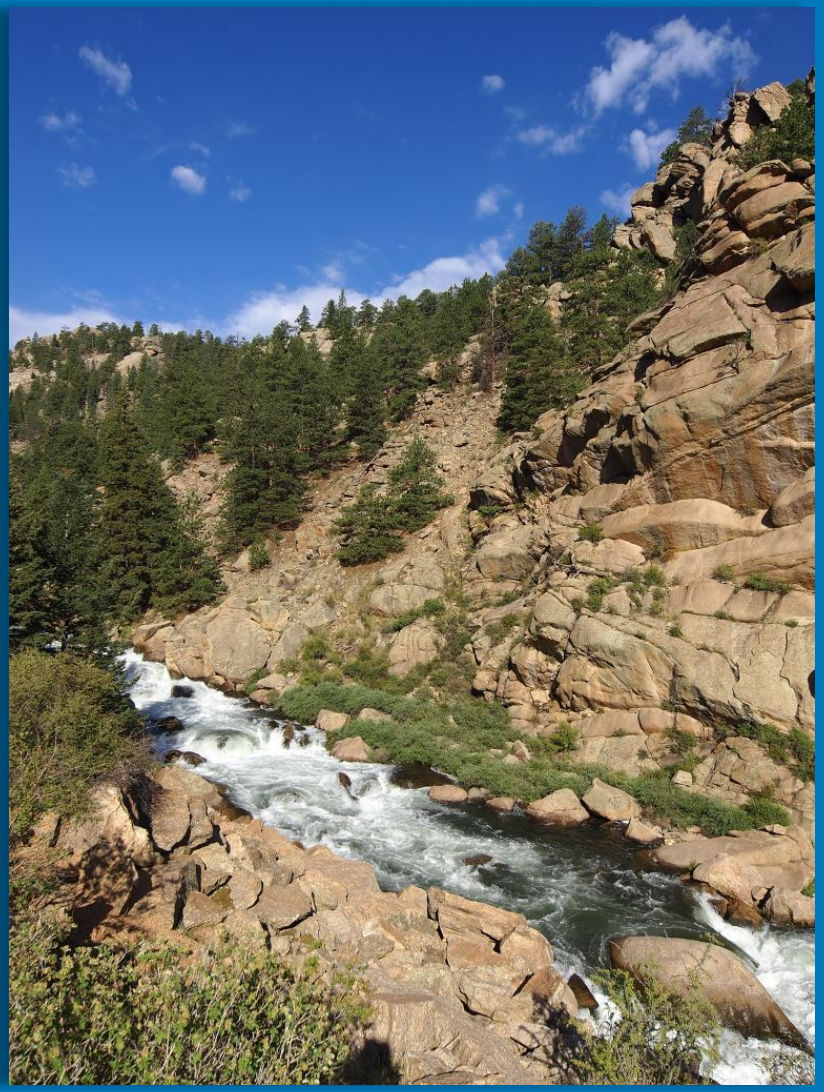
1. TRUST
2. UNDERSTANDING
3. PROOF
4. CAPACITY

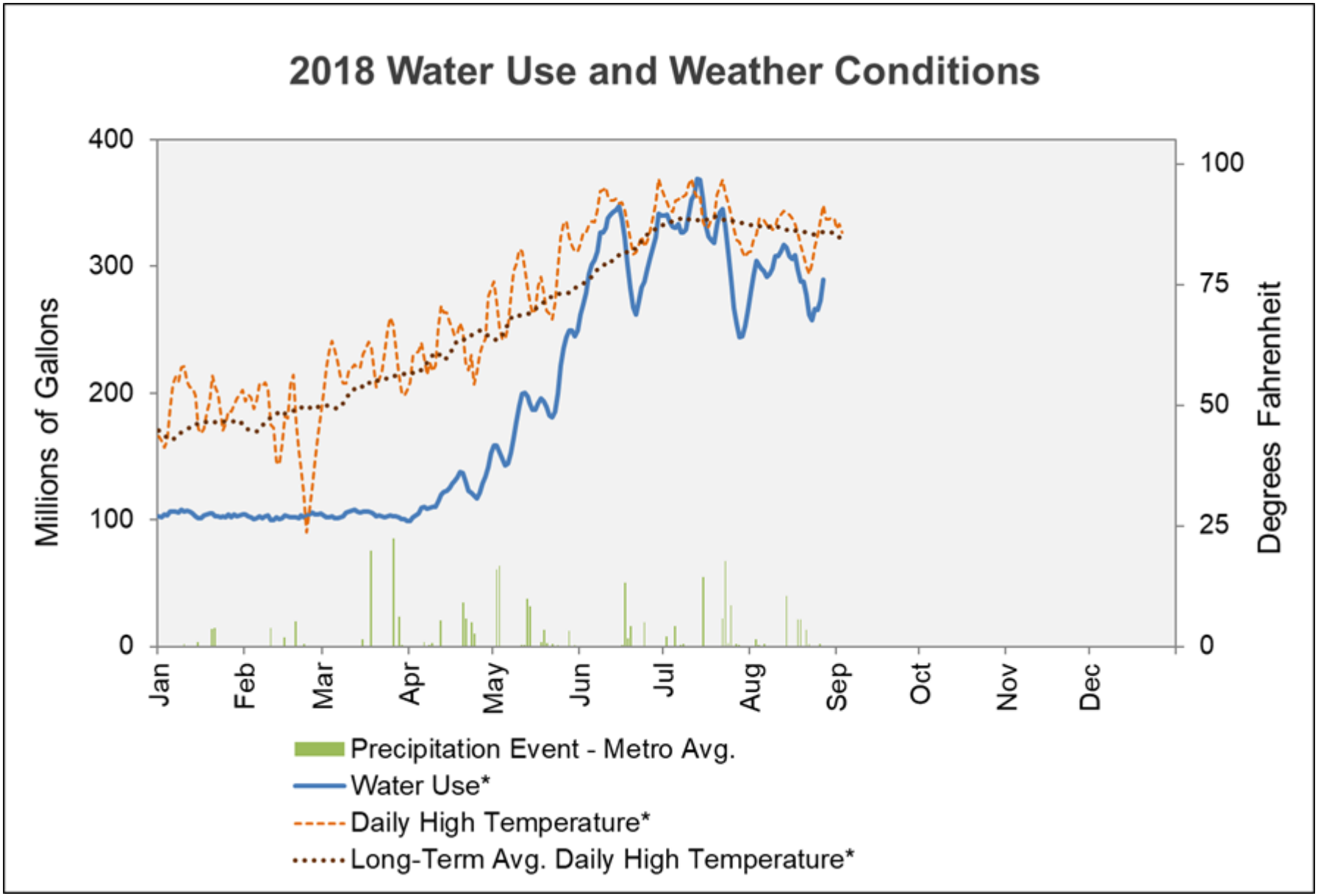
Summary of Lessons with coproduction

1. TRUST and Respect
2. Mutual UNDERSTANDING
3. PROOF imbedded in the process
4. CAPACITY – non factor

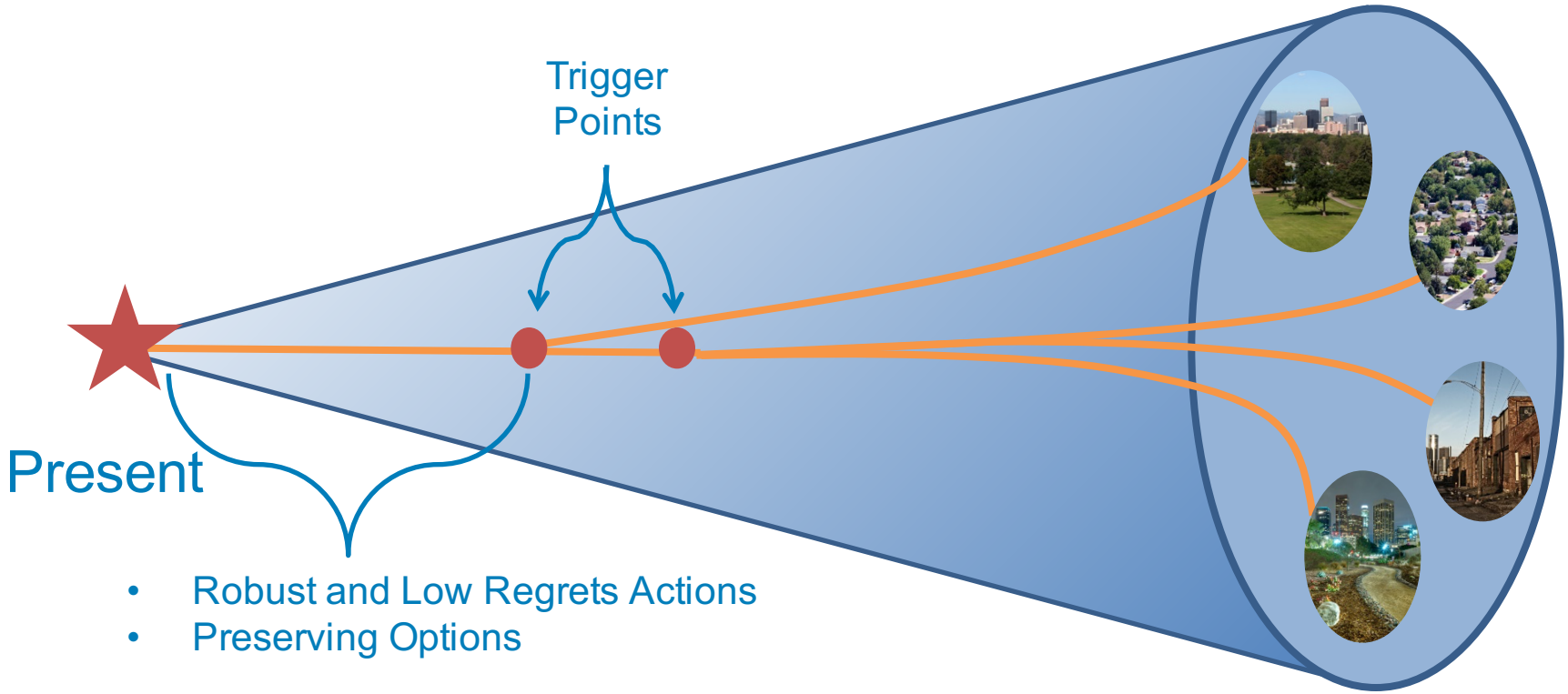
Conclusions

- Proven skillful forecasts
- Snow, etc.
- Streamflow
- Spring storms
- Wet years
- Social science




2018 Water Use and Weather Conditions
Millions of Gallons
400
300
200
100
0
Degrees Fahrenheit
100
75
50
25
0
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Precipitation Event - Metro Avg.
Water Use*
Daily High Temperature*
Long-Term Avg. Daily High Temperature*

Embracing Uncertainty



Learn with Others

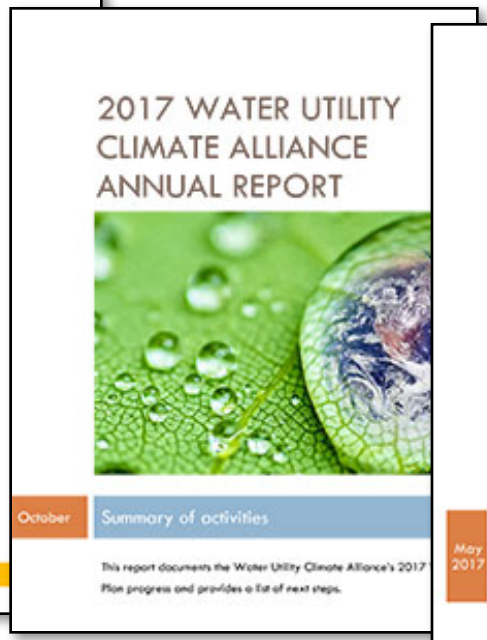
WUCA
Water Utility Climate Alliance
10 YEARS · 2008-2018

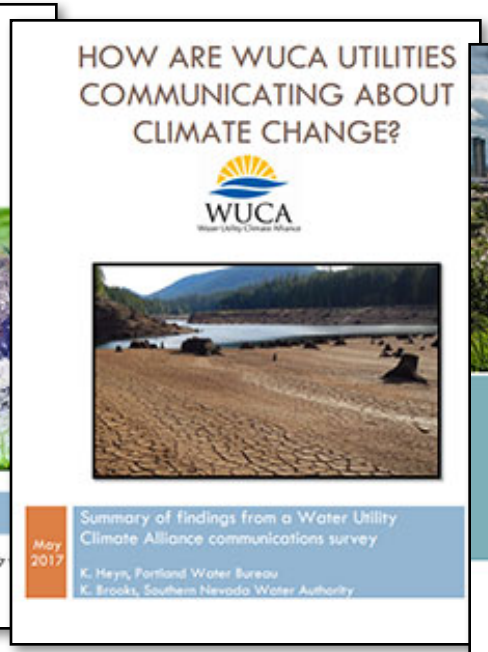
Water Utility Climate Alliance

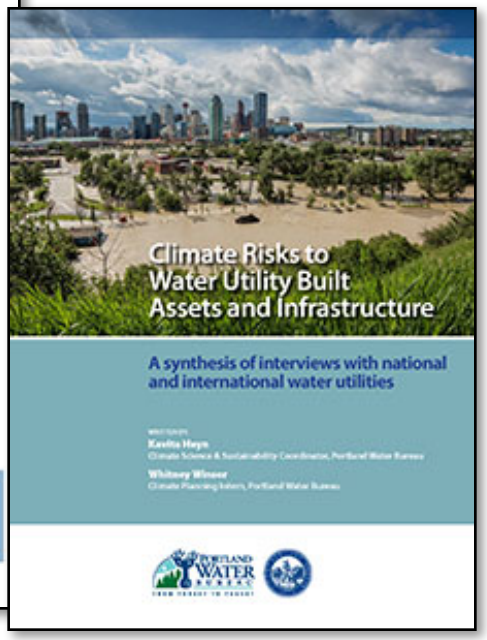
Vision: Climate-resilient water utilities, thriving communities

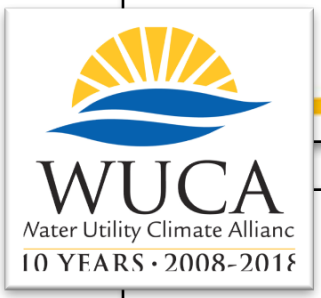
Mission: Collaboratively advance water utility climate change adaptation

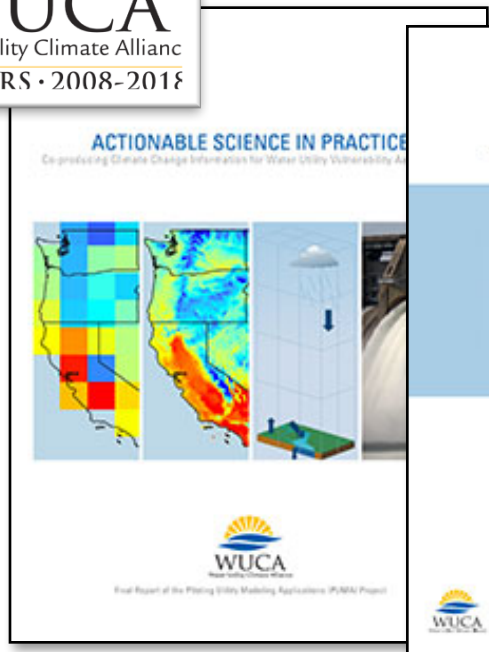
http://www.wucaonline.org/

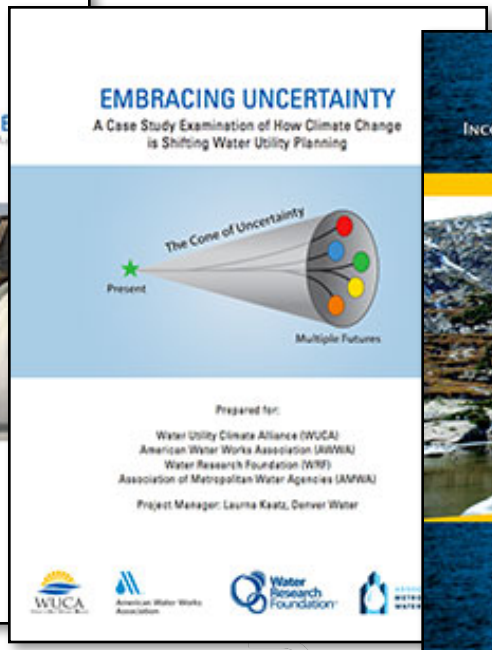


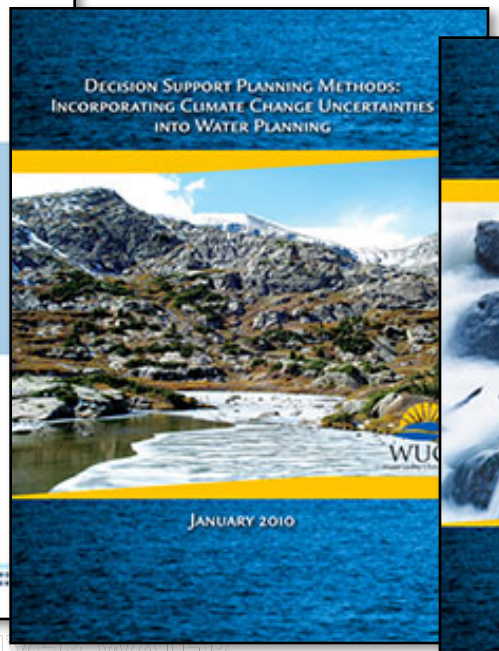


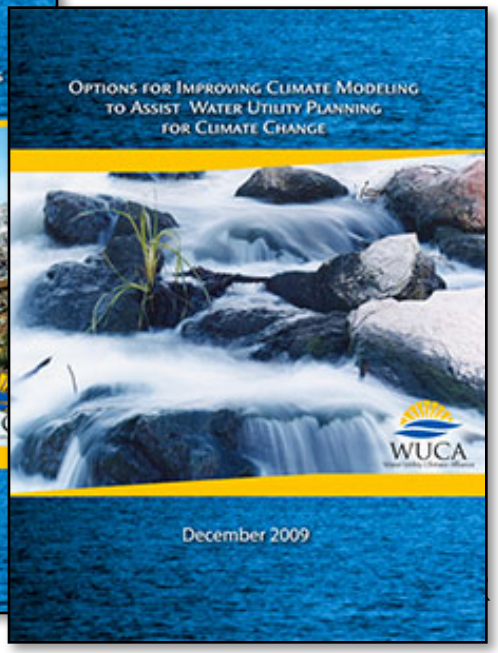






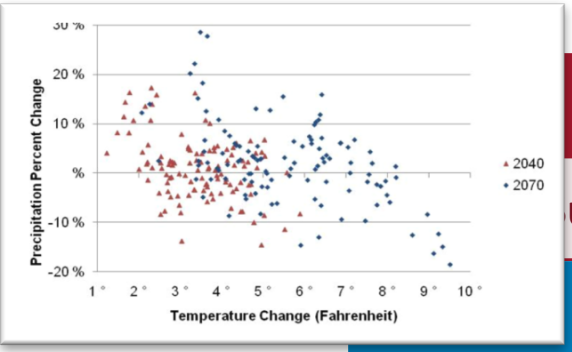






Available at: **WUCAonline.org**

What Will Warming Mean?

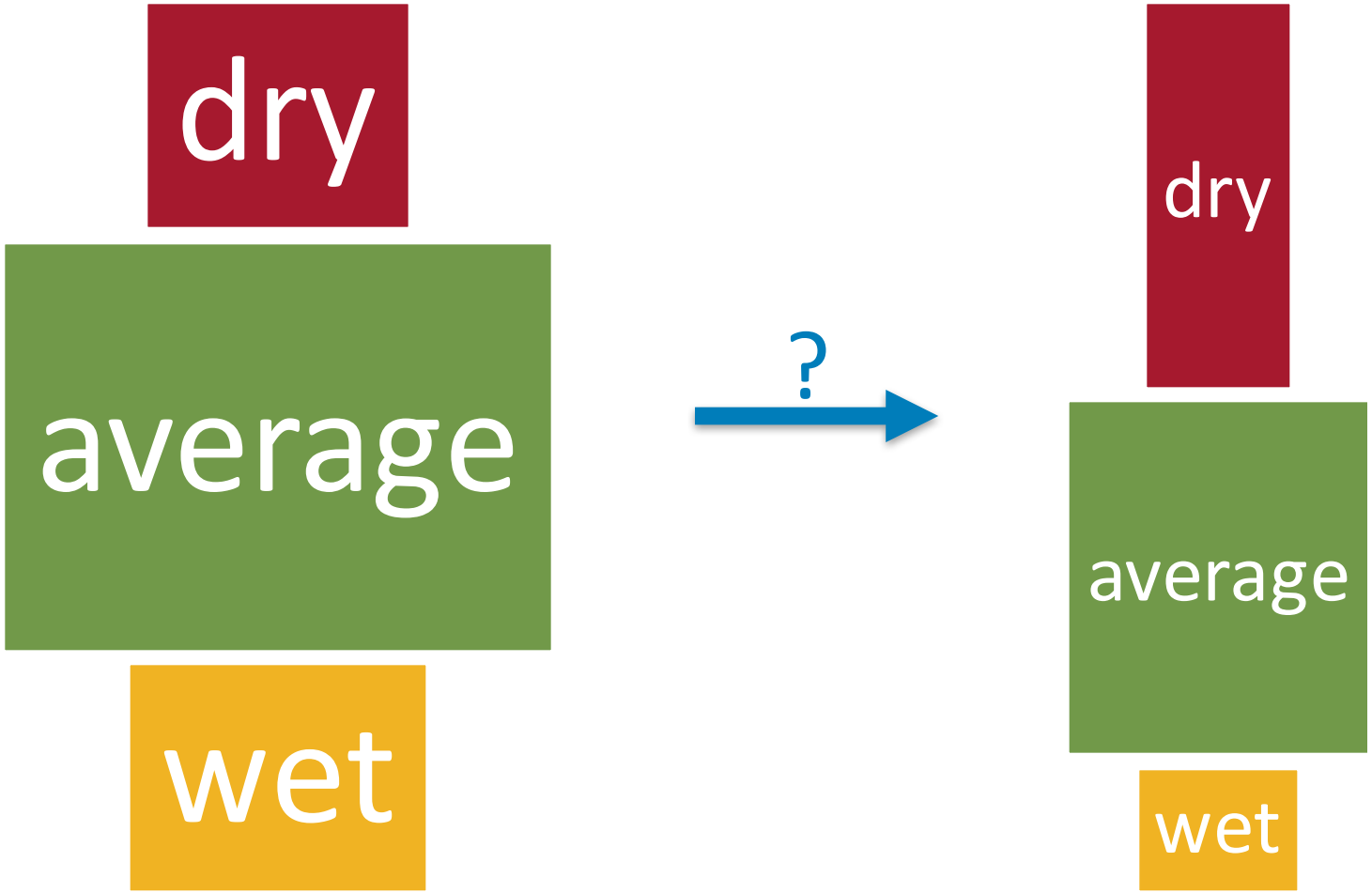


	2° F Warming	5° F Warming
upply	7%	14%

5° F Warming Means	
Reduced Supply	20%
Additional precipitation needed to offset 5° F warming	**10%**

2017	Reduced Supply
3°F with wet winters	5%
6°F + more daily variability	22%

What Will Warming Mean?



Thank you.

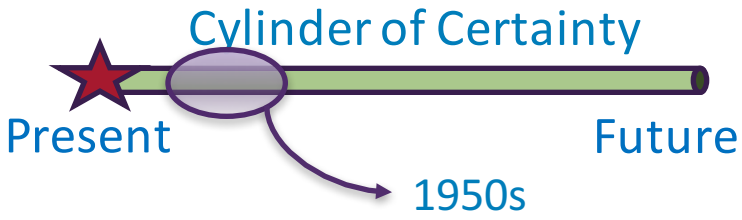
Laurna Kaatz

Laurna.Kaatz@denverwater.org

Planning for Drought - 2002

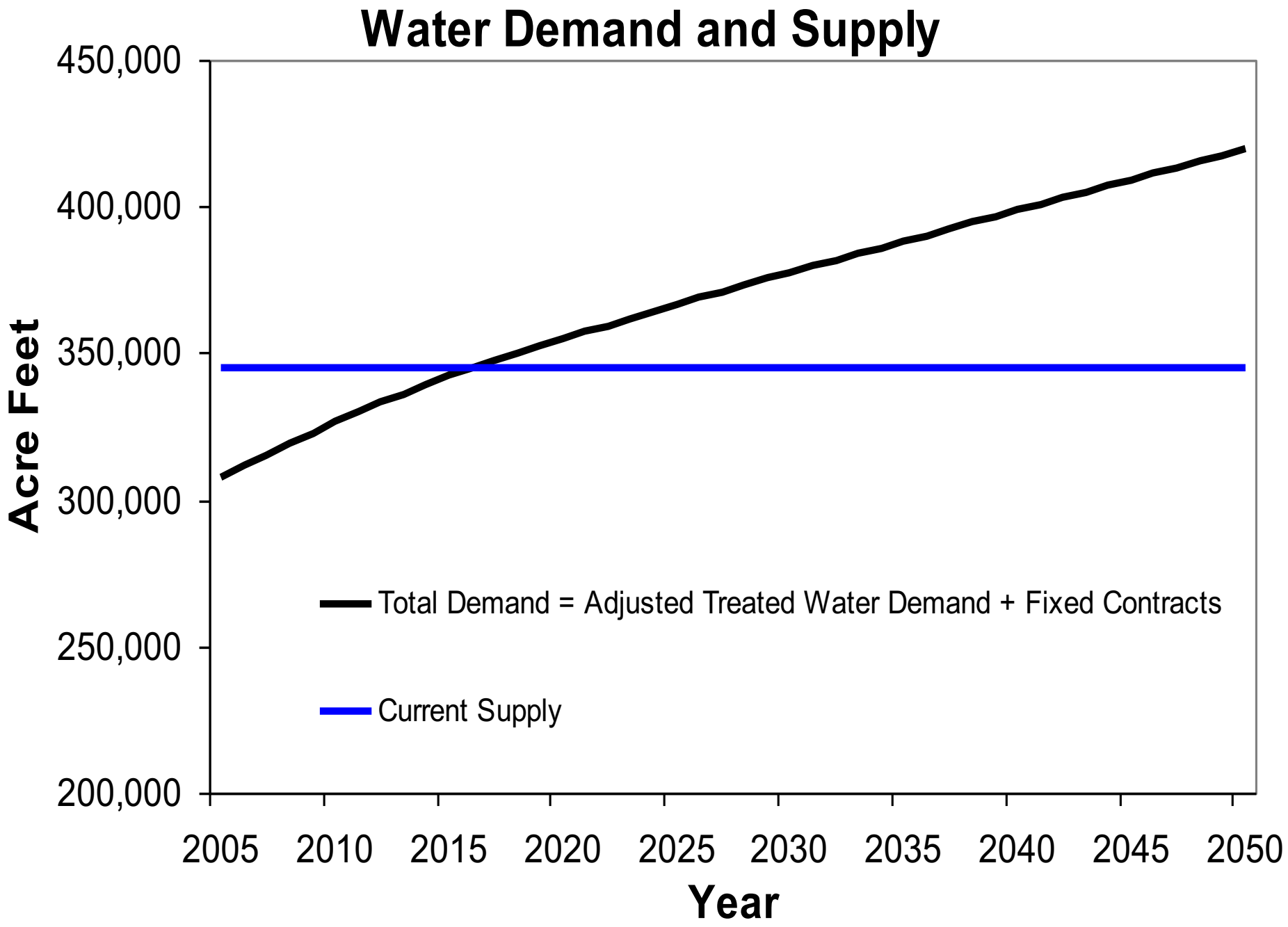
Deterministic thinking

Integrated Resources Planning



Observed hydrology and extrapolation of past trends

Unprecedented Simultaneous Natural Disasters


Water Demand and Supply
450,000
400,000
350,000
300,000
250,000
200,000
Acre Feet
Total Demand = Adjusted Treated Water Demand + Fixed Contracts
Current Supply
2005
2010
2015
2020
2025
2030
2035
2040
2045
2050
Year

Projected Changes for North Central Colorado