

# Drought monitoring in Colorado

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COLORADO  
**CLIMATE**  
CENTER

NASEM Future of Drought  
July 2025



**ATMOSPHERIC SCIENCE**  
COLORADO STATE UNIVERSITY

The Colorado Climate Center at CSU provides valuable climate expertise to the residents of the state through its threefold program of:

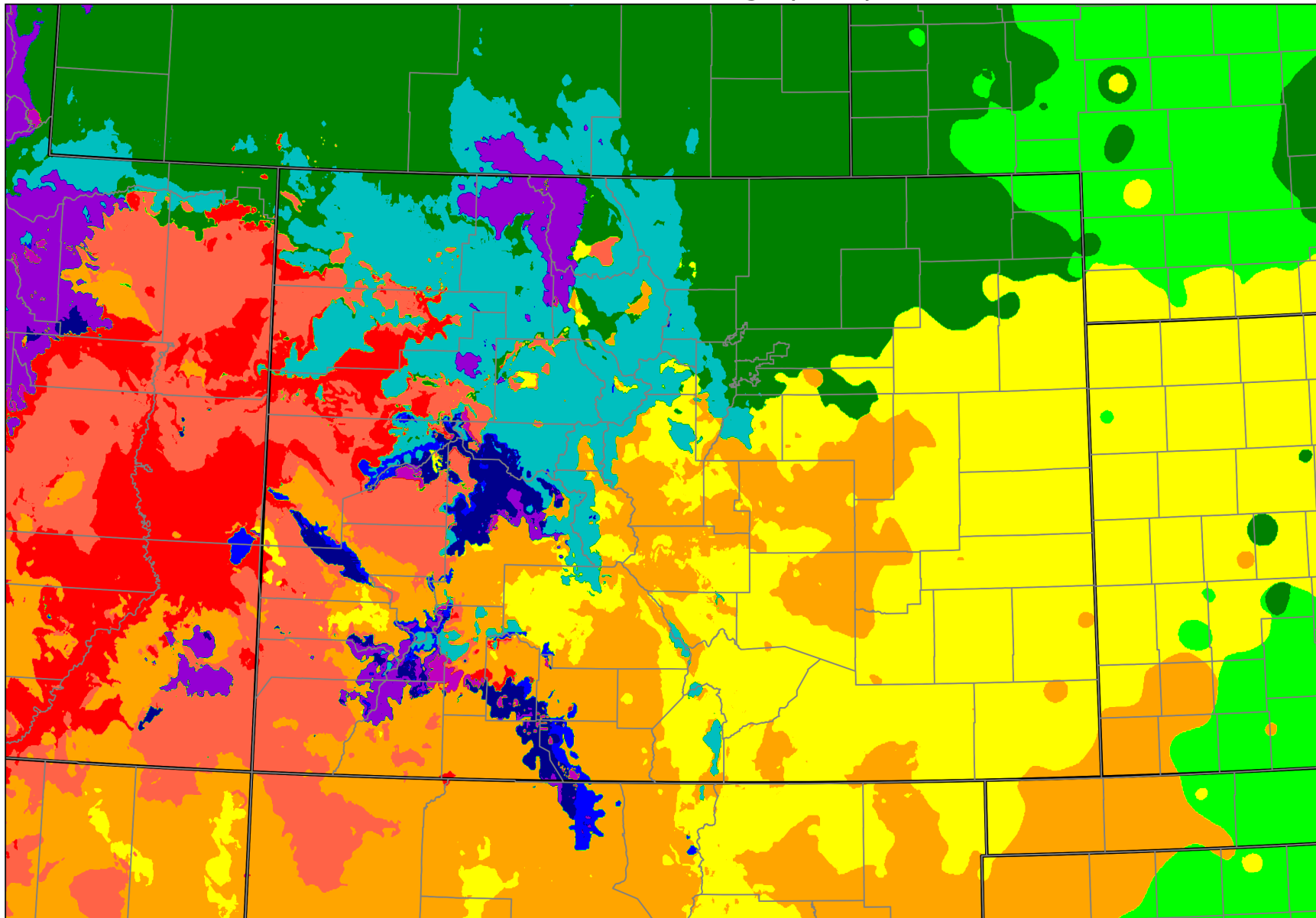
- 1) ***Climate Monitoring***  
(data acquisition, analysis, and archiving)
- 2) ***Climate Research***
- 3) ***Climate Services***  
(providing data, analysis, climate expertise, education and outreach)



COLORADO STATE UNIVERSITY



month of maximum average precipitation



Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

**Colorado: the  
only state where  
every month is  
the wettest  
month on  
average  
somewhere**

Month of maximum average  
precip  
Data: PRISM Climate Group,  
[prism.oregonstate.edu](http://prism.oregonstate.edu),  
1991-2020 normals

Figure: Russ Schumacher/Colorado Climate Center  
Data: PRISM climate group ([prism.oregonstate.edu](http://prism.oregonstate.edu)), 1991-2020 normals

# Drought monitoring at the Colorado Climate Center goes back nearly 50 years

## National Integrated Drought Information System - NIDIS

*A Pathway for National Resilience*

Fall 2009

Volume 1 Issue 1

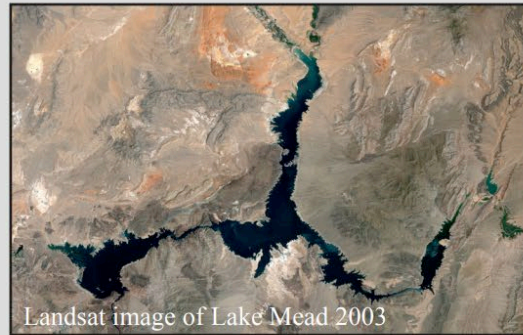
### Upper Colorado River Basin Pilot

The first NIDIS drought early warning and information system pilot was successfully launched during October 2008 with a meeting of stakeholders in Boulder, CO. In this newsletter, find these related articles...

#### Upper Colorado River Basin Scoping Workshop

1-2 October, 2008, NOAA David Skaggs Research Center, Boulder, CO.....2

**Colorado State Climatologist is Key to the Success of the UCRB Pilot.....2**



Landsat image of Lake Mead 2003

### Welcome!

Welcome to the first edition of the NIDIS Newsletter. A lot has happened in the past year, and we want to update the drought risk management and water resources communities on NIDIS activities. In our newsletter you will find information about the various NIDIS meetings that have been held in



Nolan Doesken at the White House

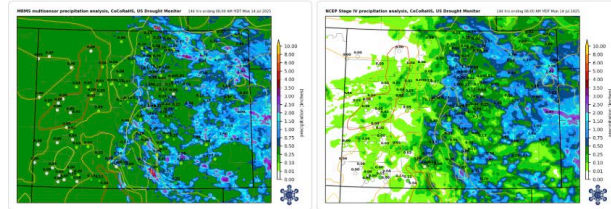


# Colorado Drought Update

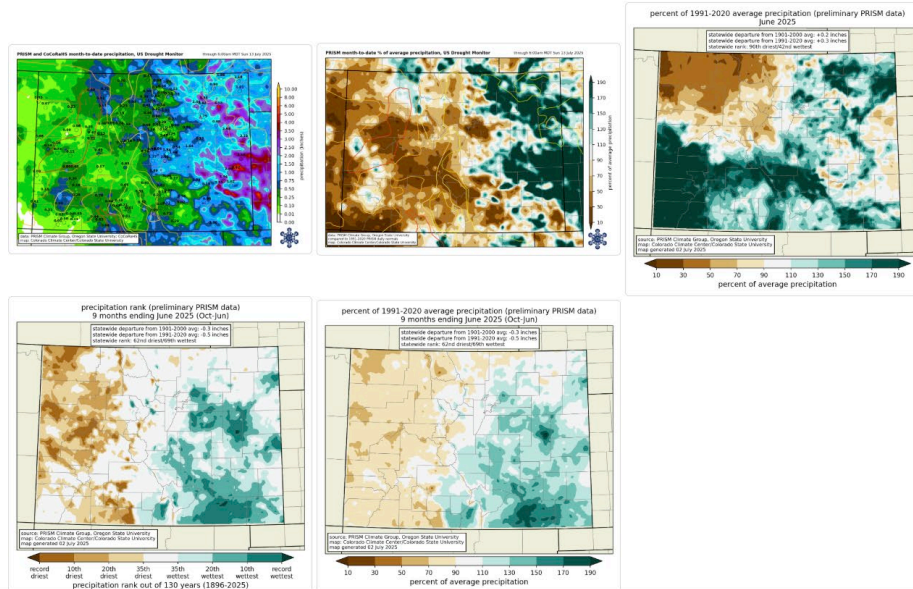


## precipitation

### this week's USDM period

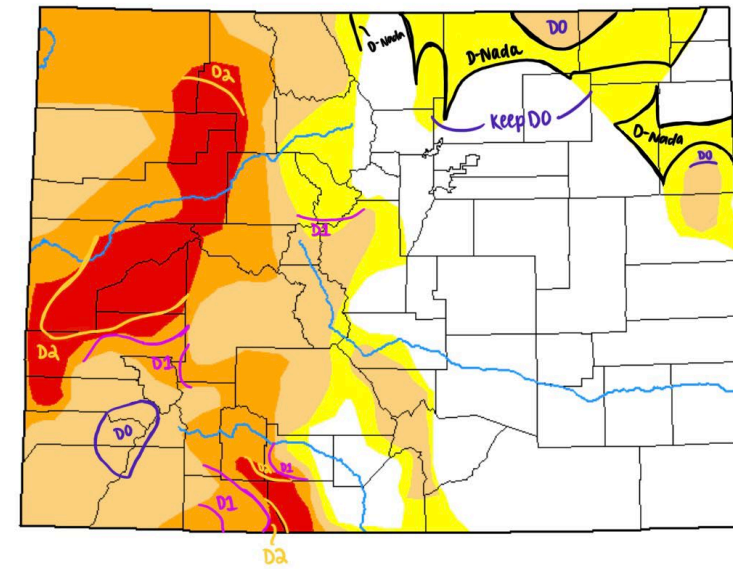


### recent precipitation



## U.S. Drought Monitor Colorado

July 1, 2025  
(Released Thursday, Jul. 3, 2025)  
Valid 8 a.m. EDT



#### Intensity:

- None
- 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. For more information on the Drought Monitor, go to <https://droughtmonitor.unl.edu/About.aspx>

Author:  
Curtis Riganti  
National Drought Mitigation Center



[droughtmonitor.unl.edu](https://droughtmonitor.unl.edu)

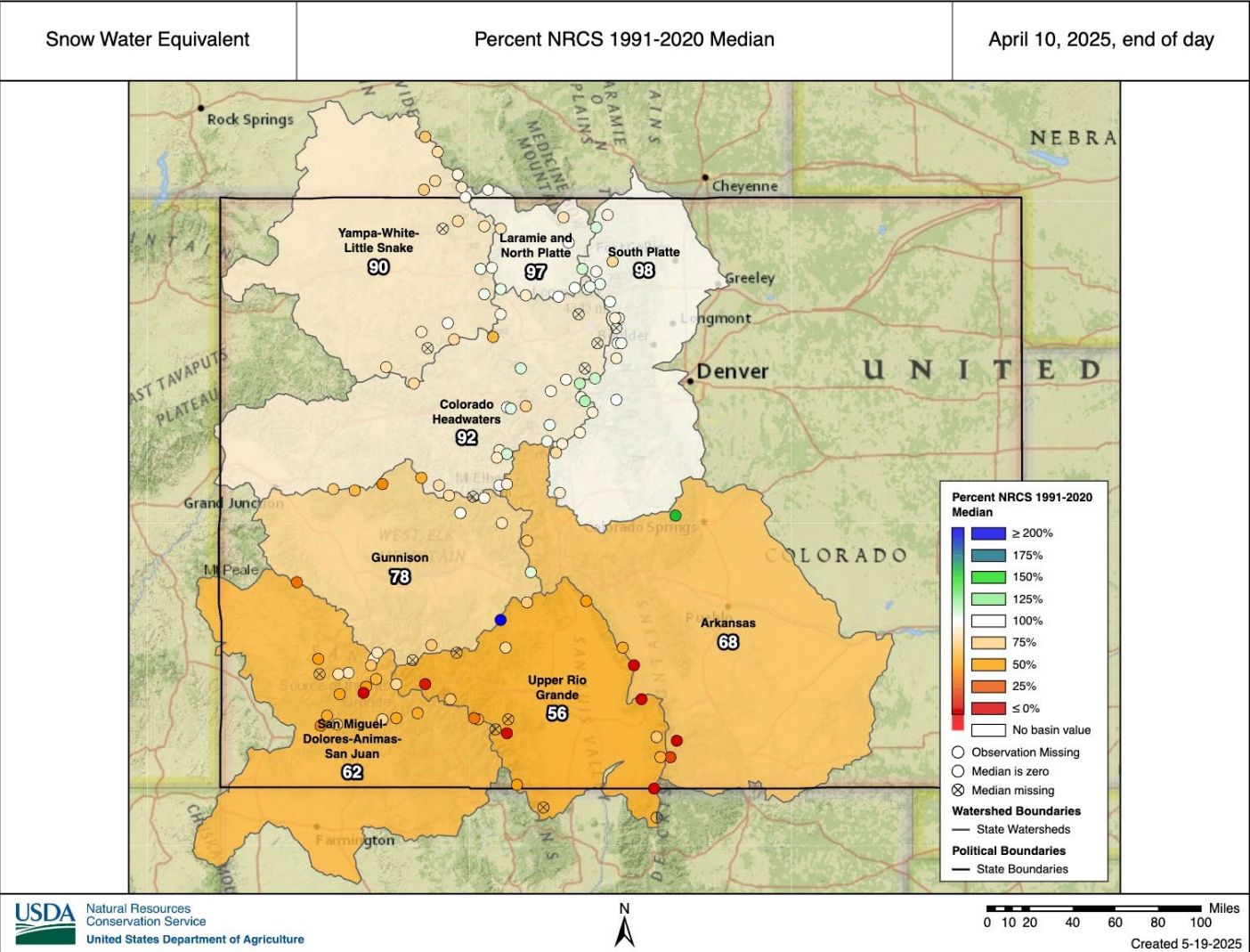
Example recommendations to USDM author

<https://climate.colostate.edu/drought/>

COLORADO CLIMATE CENTER



# Seasonal cycle of drought indicators



Winter and spring:  
mountain snowpack

Mountain  
snowpack as  
of April 10

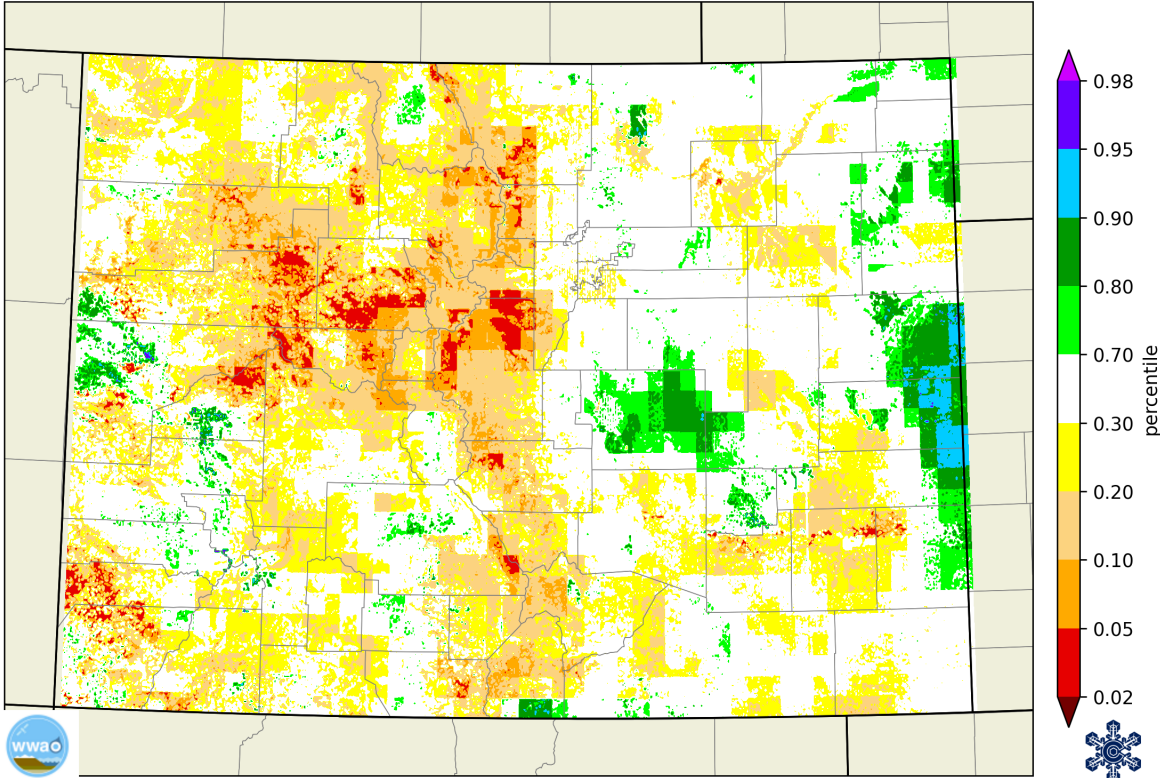
Percent of  
1991-2020  
median





# Seasonal cycle of drought indicators

WLDAS 1-meter Soil moisture percentile, 10 Jul 2025

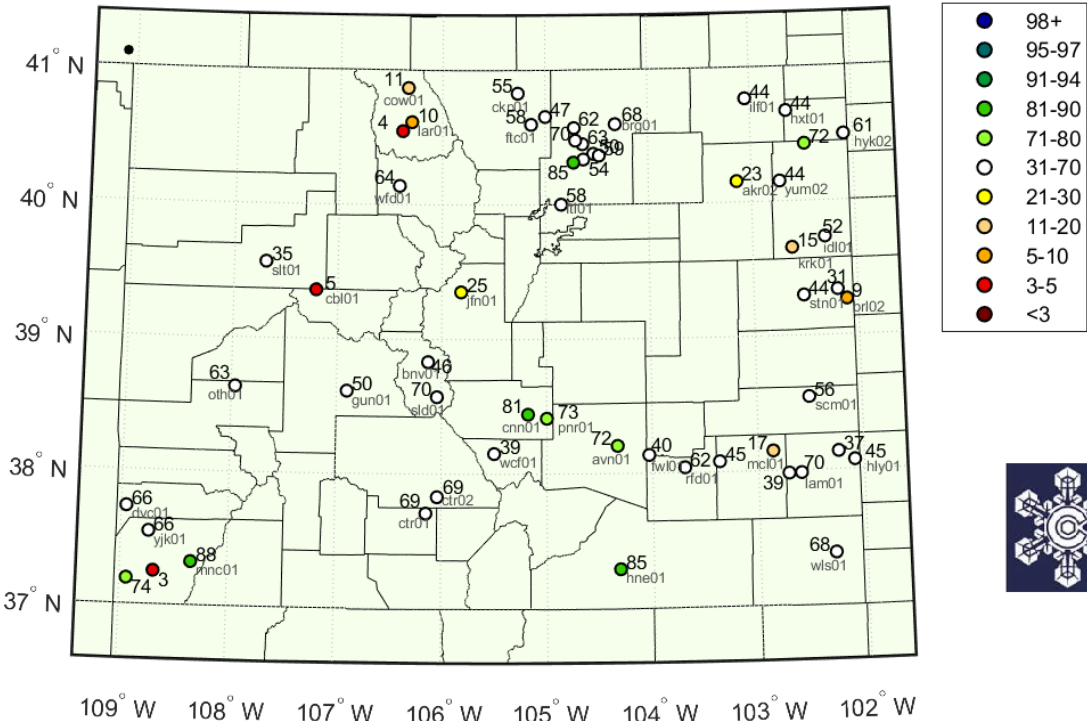


WLDAS 1-m soil moisture

Summer: rainfall, evaporative demand, soil moisture

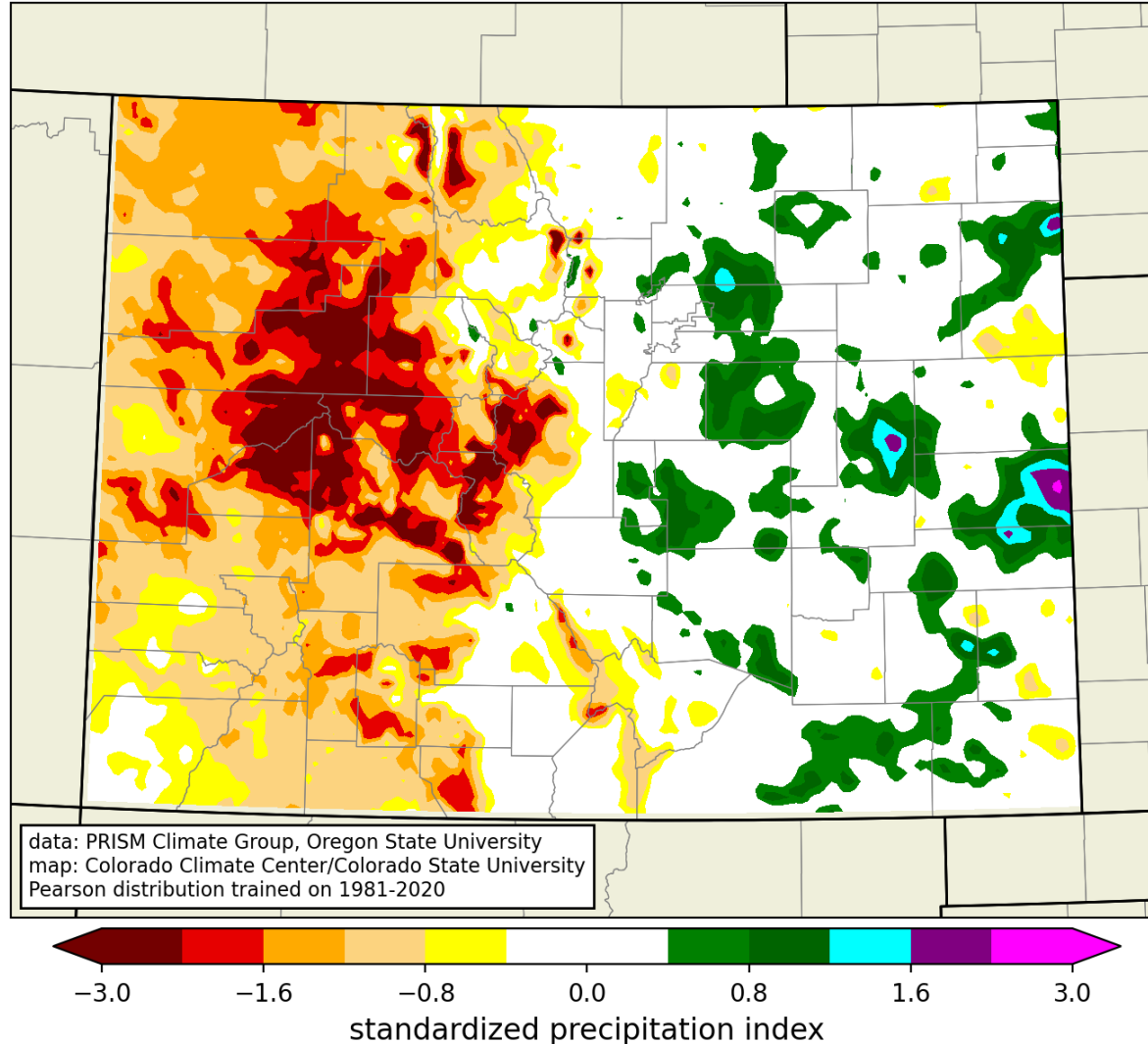
## CoAgMET water balance

Growing Season Water Balance (P/PET) Percentiles  
June 27, 2025



# Seasonal cycle of drought indicators

180-day SPI based on PRISM data, Sun 13 Jul 2025



**Year-round: Standardized  
Precipitation Index**  
(originally developed by  
Colorado State  
Climatologists Tom McKee  
and Nolan Doesken)

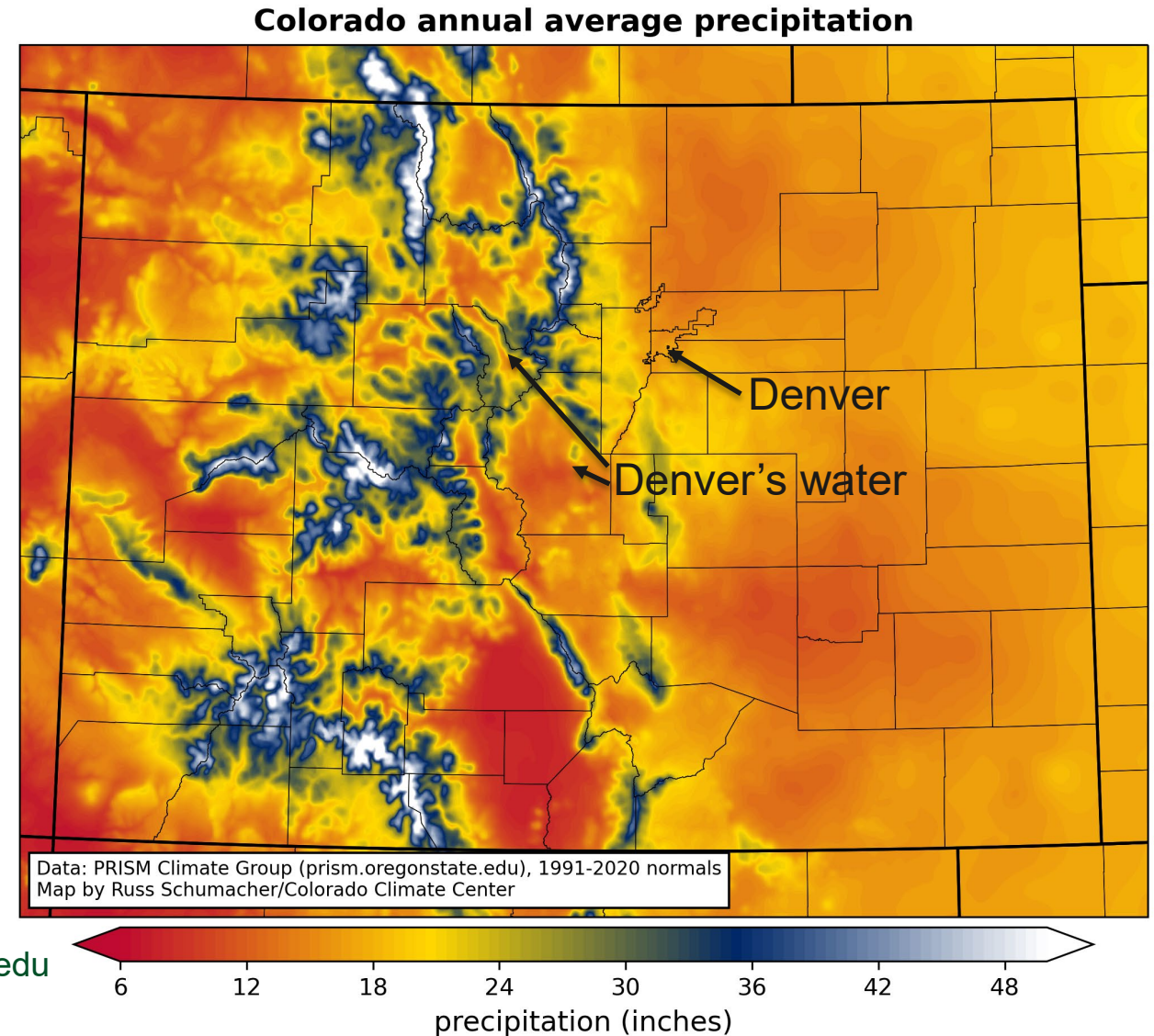


# Challenge: Does drought reflect local conditions, or where the water comes from?

Most of the water supply for the largest cities comes from reservoirs in the mountains, fed by melting snow.

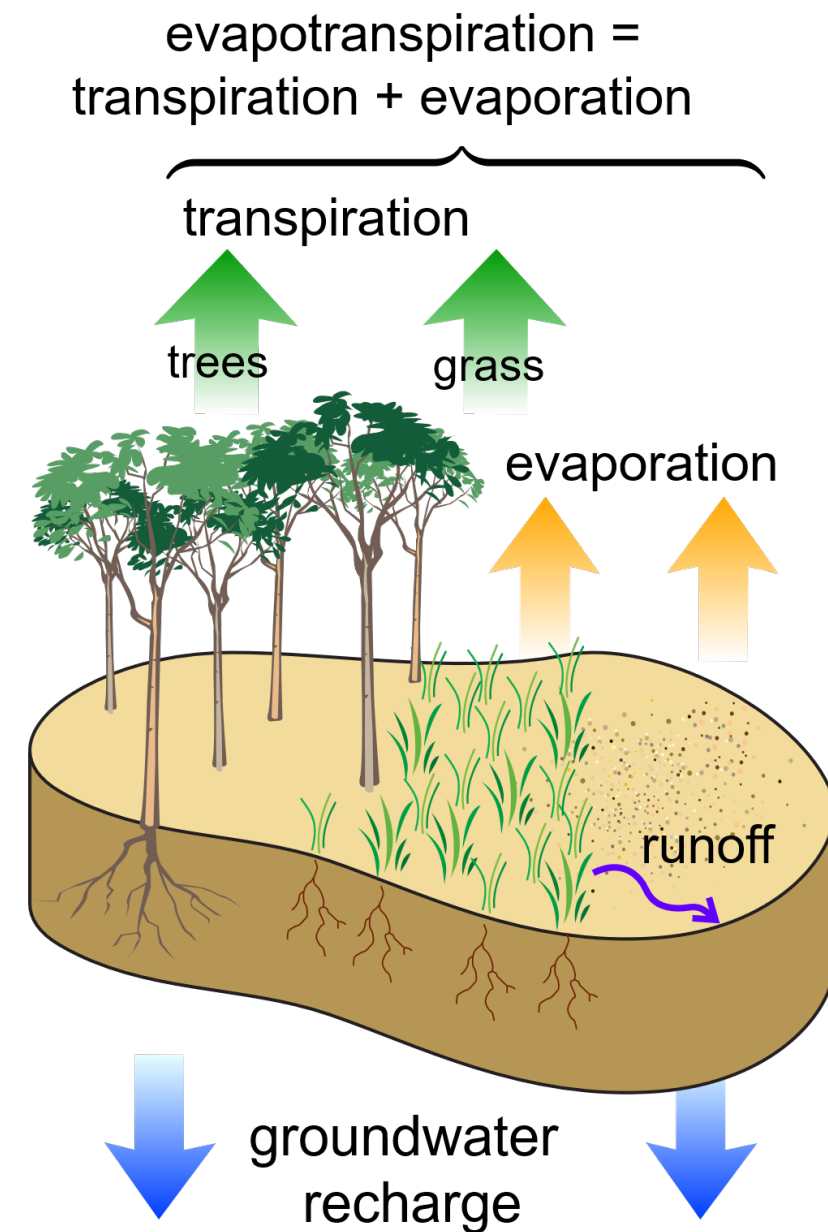
For water availability, it doesn't matter all that much how much precipitation falls in the cities! The USDM could just be a graph of snowpack and reservoir levels.

But lack of rainfall locally has plenty of other impacts



Data: PRISM Climate Group, [prism.oregonstate.edu](http://prism.oregonstate.edu)  
1991-2020 normals

Challenge: increasing importance of evaporative demand and temperature-driven drought

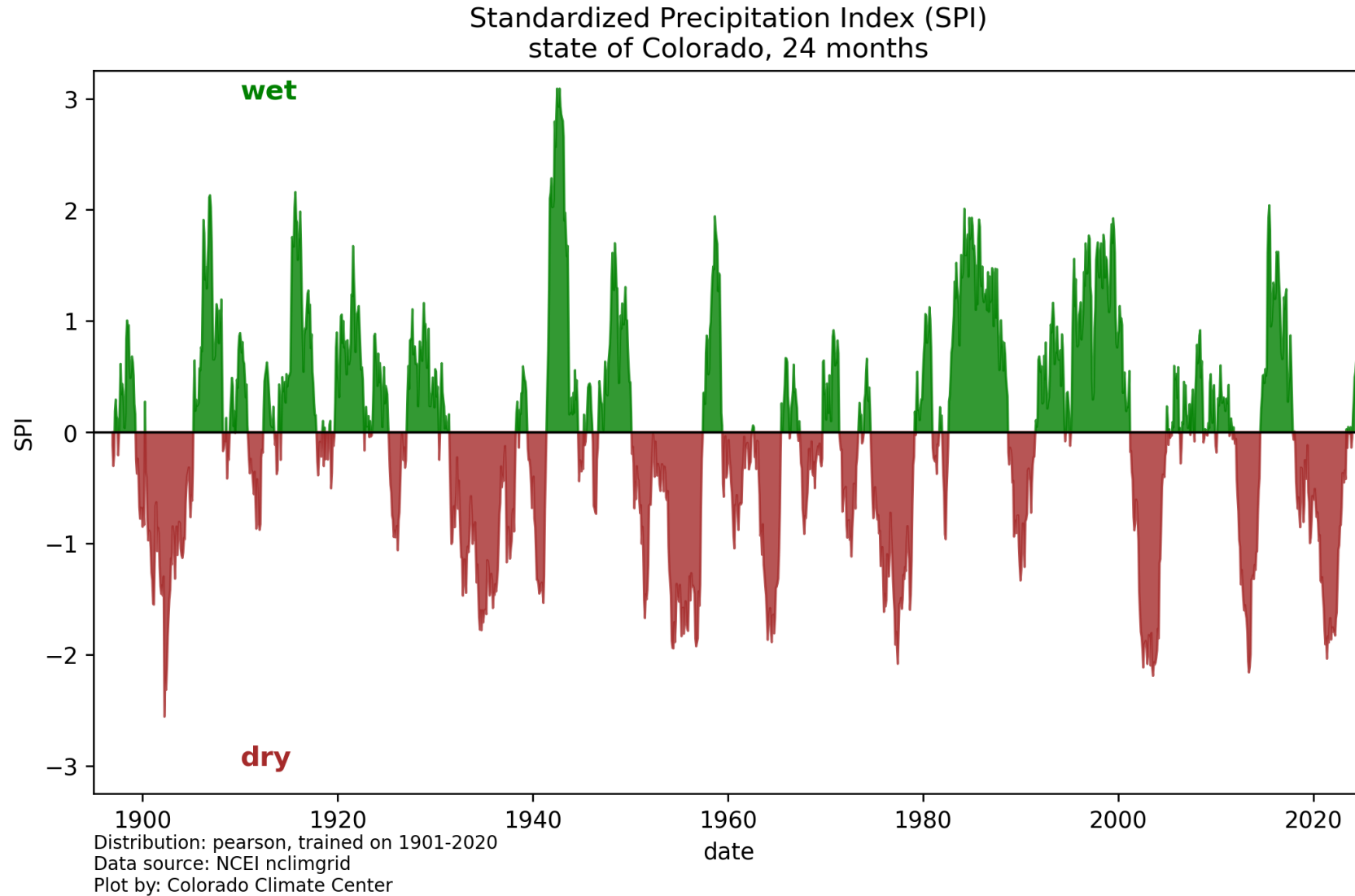


By M. W. Toews - Own work, CC BY 4.0,  
<https://commons.wikimedia.org/w/index.php?curid=2843655>





# Wet and dry periods come and go, and droughts have always been a part of our climate...

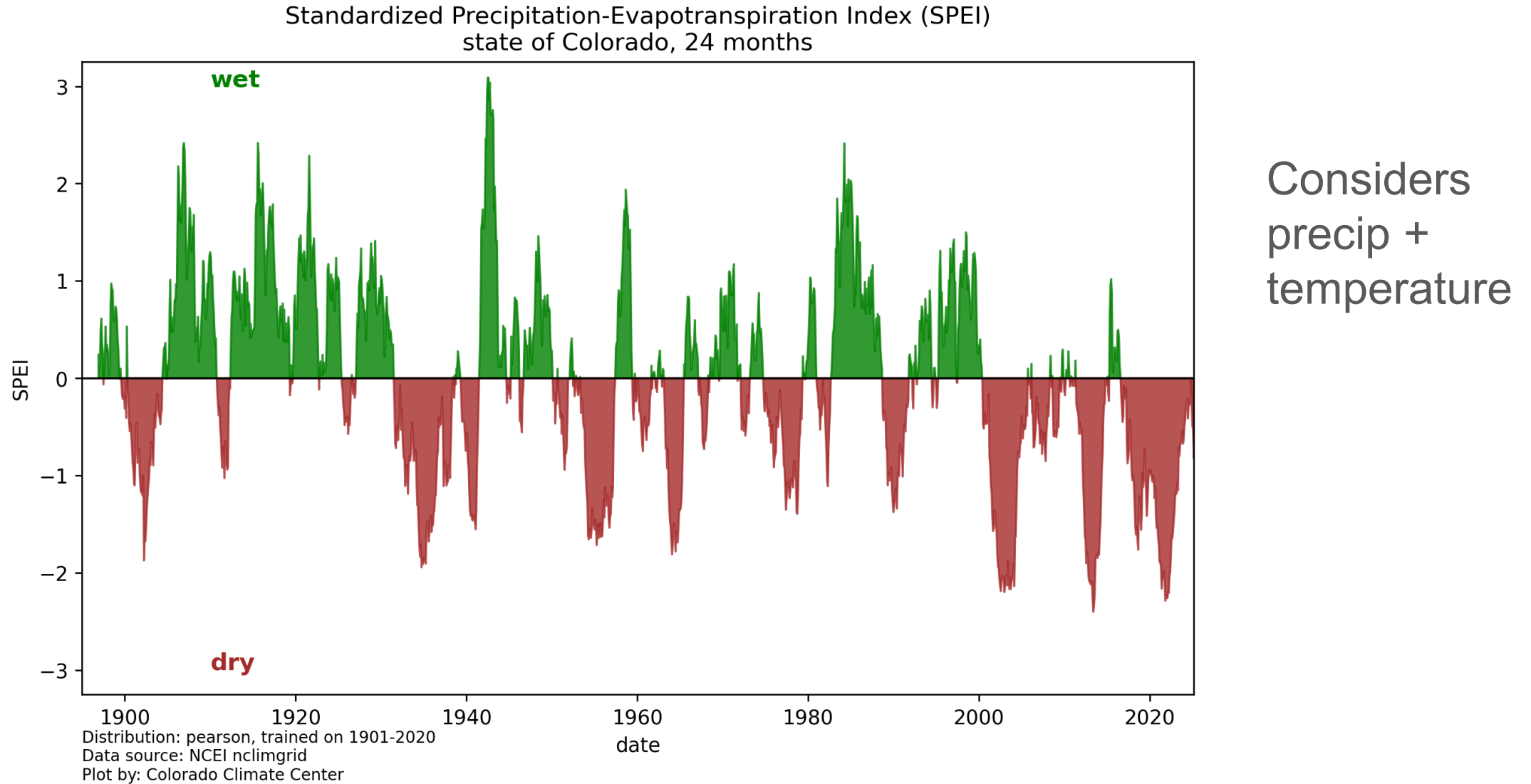


Considers  
precip only

Standardized precipitation index (24 months, Colorado statewide)



...but a warmer atmosphere is “thirstier”, making droughts more intense and more likely



Standardized precipitation-evapotranspiration index (24 months, Colorado statewide)



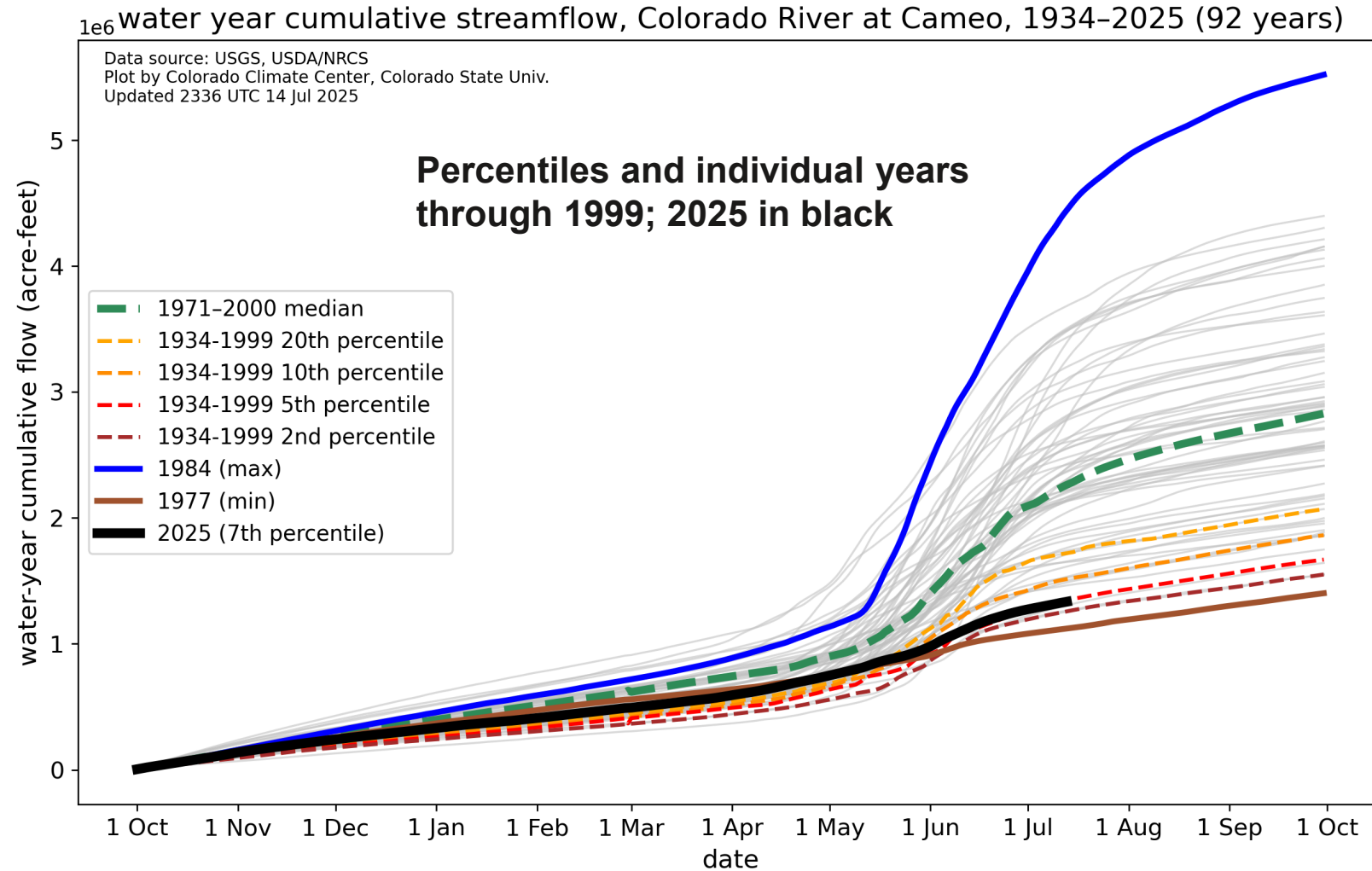


# Challenge: Is it drought, or aridification (or both)?

In the southwestern US, the period since 2000 has been a 'megadrought', with low streamflows and declining reservoirs

As a result, what would have been a severe (D2) drought prior to 2000, now might look like only moderate (D1) drought

How to think about this for a product like the US Drought Monitor?

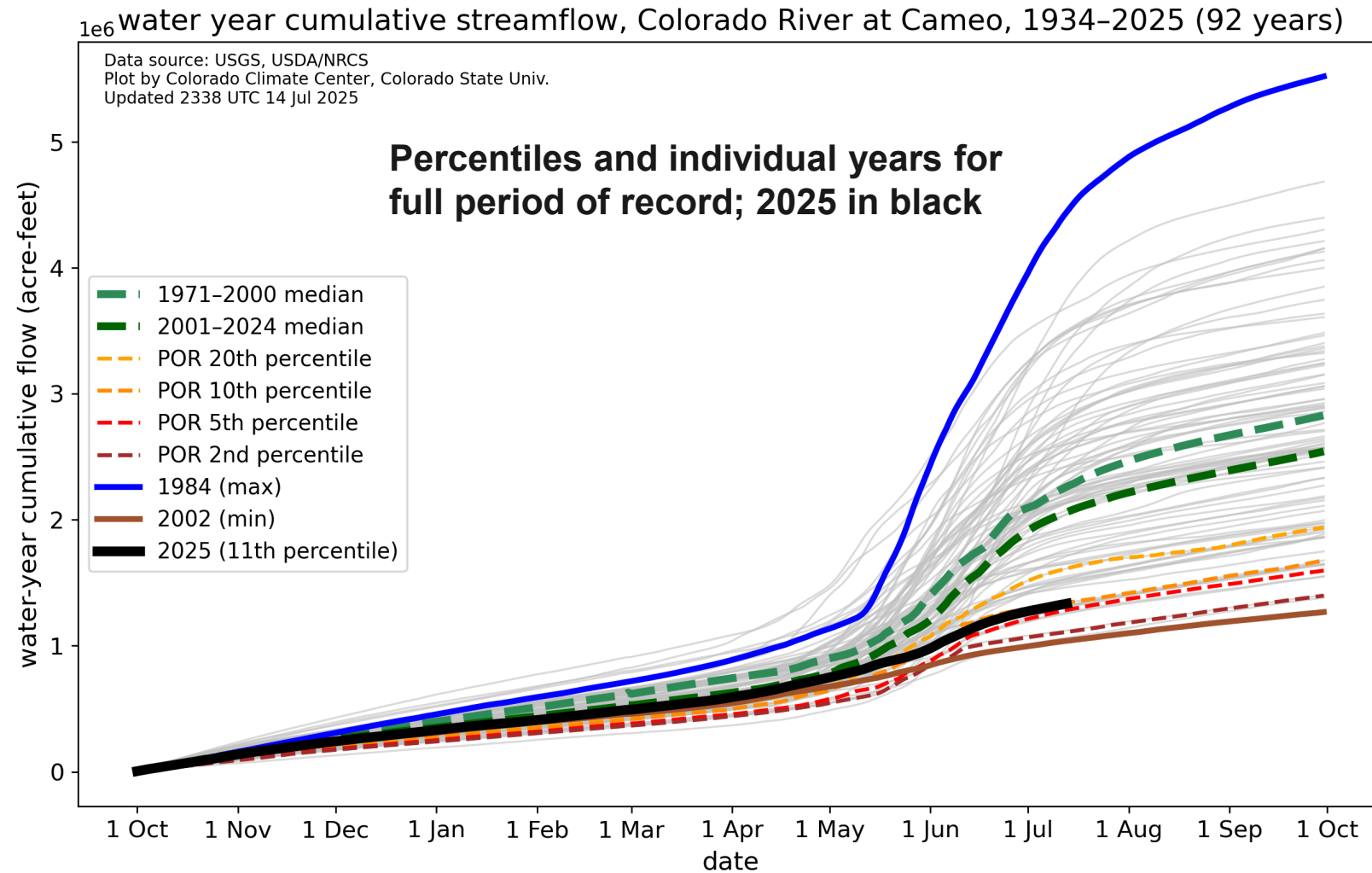


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Data: USDA/NRCS



# Concerns from partners and users

- We often get input and reports about the USDM not reflecting local conditions and impacts
  - Colorado has some very data-sparse areas, so sometimes there isn't much data to go on
  - Focus on either short-term or long-term drought, when the USDM uses 'convergence of evidence' to consider all timescales
  - Not understanding the percentile/return period basis for the USDM, in both directions:
    - If conditions have been worse three times in the last 10 years, it's probably not D3 or D4
    - And it doesn't have to be as bad as the Dust Bowl to be D3 or D4!
- But people often just want to know their concerns are being heard
  - We have trusted partners in CSU Extension, FSA, etc., who know they can pass along information and that we will carefully consider it and respond
  - We have multiple ongoing projects to expand collection of physical data (e.g., soil moisture) and impacts (e.g., including photos with CoCoRaHS condition monitoring reports)

**“As with rainbows, each person experiences their own drought.”**  
– Kelly Redmond (2002, BAMS)







**[https://climate.colostate.edu/  
russ.schumacher@colostate.edu](https://climate.colostate.edu/russ.schumacher@colostate.edu)**

**Subscribe for monthly climate updates!**

**<https://climate.colostate.edu/subscribe.html>**

# Thank you!

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**Or for even more in-depth looks at Colorado's  
climate, subscribe to our blog/newsletter:**

**<https://climate.colostate.edu/blog>**



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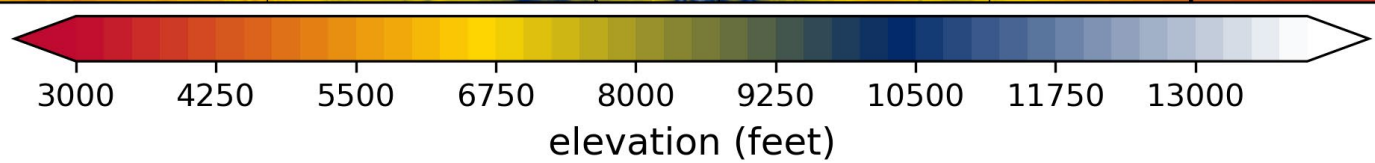
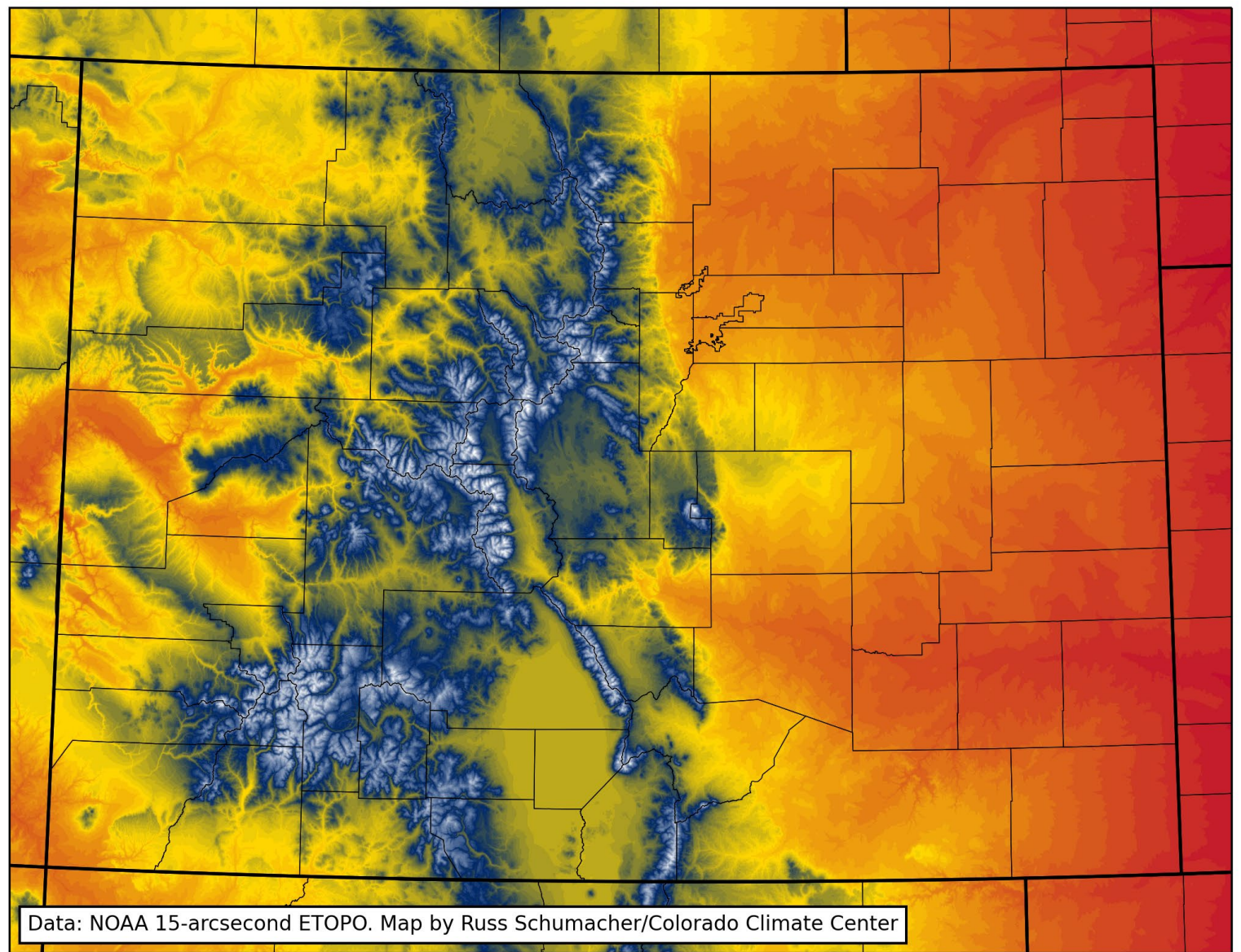


# Brief history of the Colorado Climate Center

- Until 1973, the federal government operated a “state climatologist” program – but in 1973 this was abolished
- Later that same year, Colorado established the Colorado Climate Center at CSU with support through the Colorado Agricultural Experiment Station



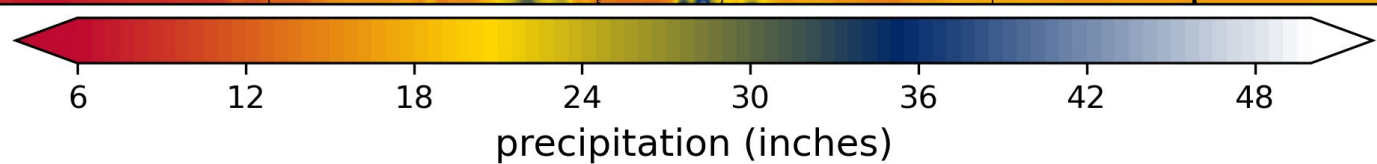
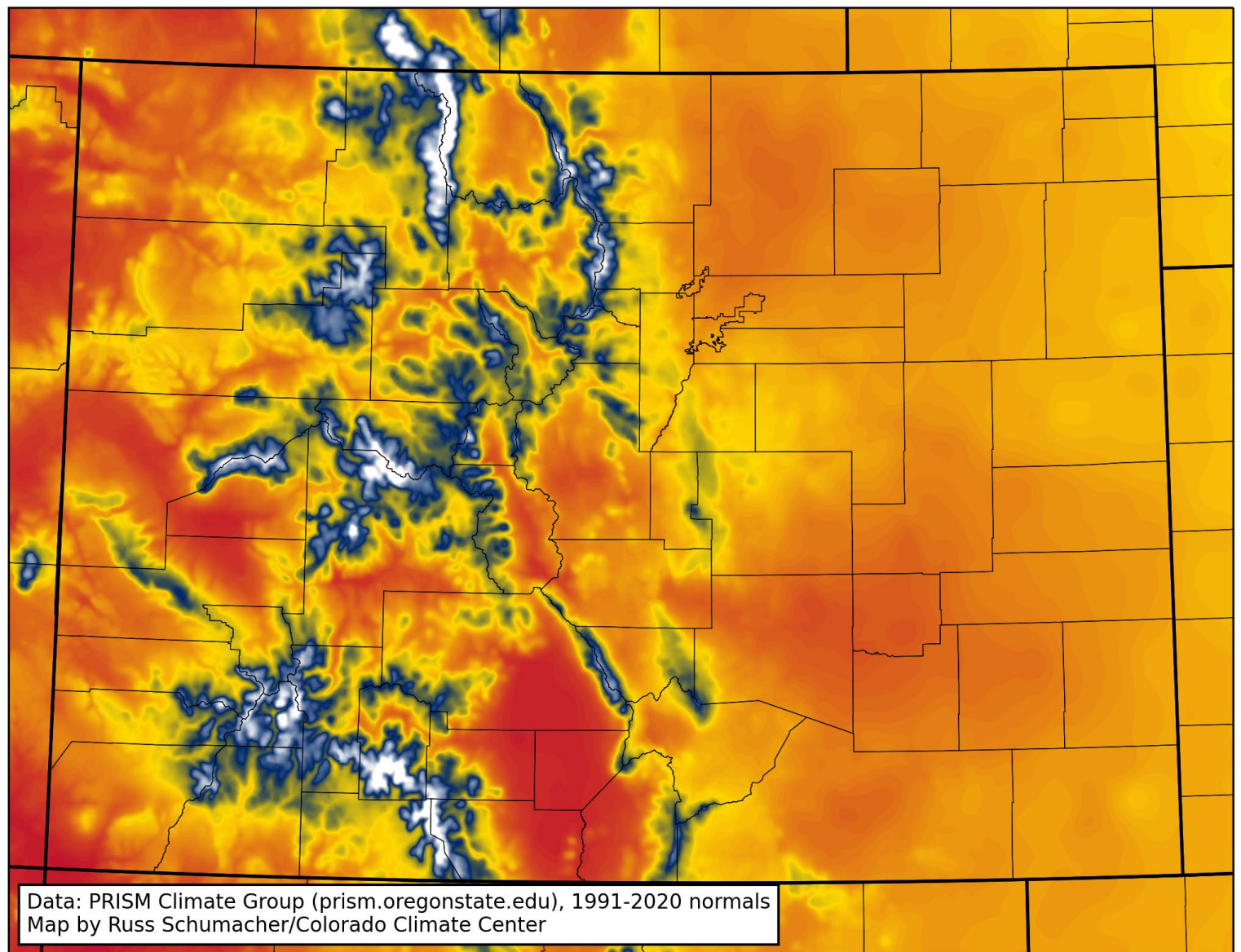
# Topography

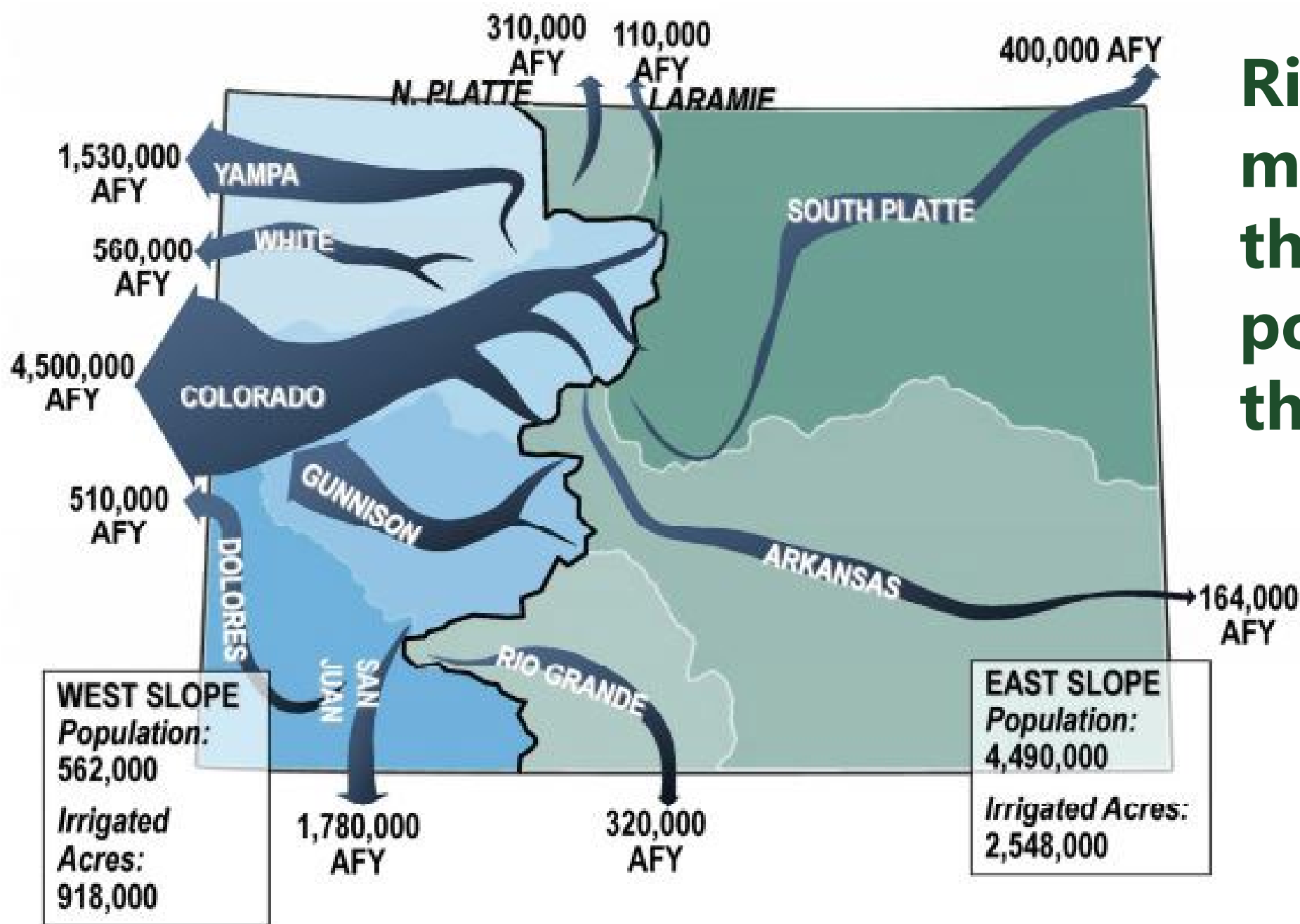




# Annual average precipitation

Data: PRISM Climate Group,  
[prism.oregonstate.edu](http://prism.oregonstate.edu),  
1991-2020 normals





**River flows are much larger to the west; population to the east**

