White River Update
Water Year 2025

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White River Alliance and Colorado River Watch

Image credit: Western Colorado Outdoors

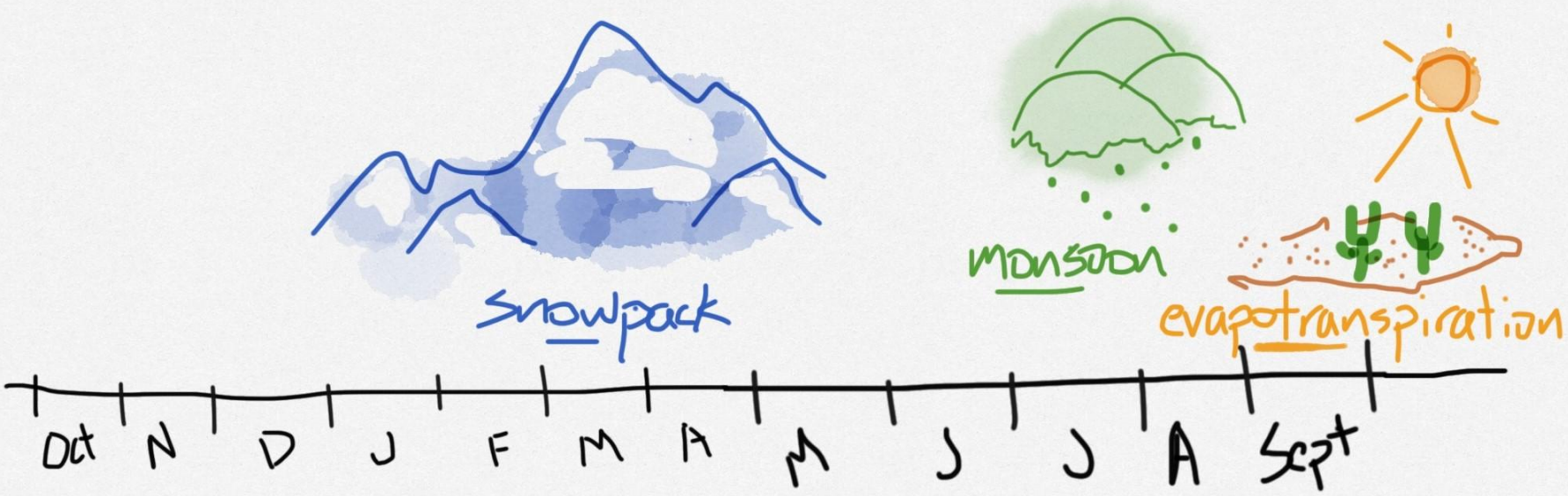
Water year 2025 snapshot

- Snowpack was low and monsoons were late
- White River runoff was well below average
- Drought persists and soils are dry
- Elk Fire caused significant damage to the benthos
- There was a moderate algae bloom in November
- Climate outlook remains grim

Outline of this presentation:

- Main factors influencing White River discharge
- Overview of regional water year 2025
- Preliminary results of macroinvertebrate study
- Trends on the White River

The main contributions to river discharge

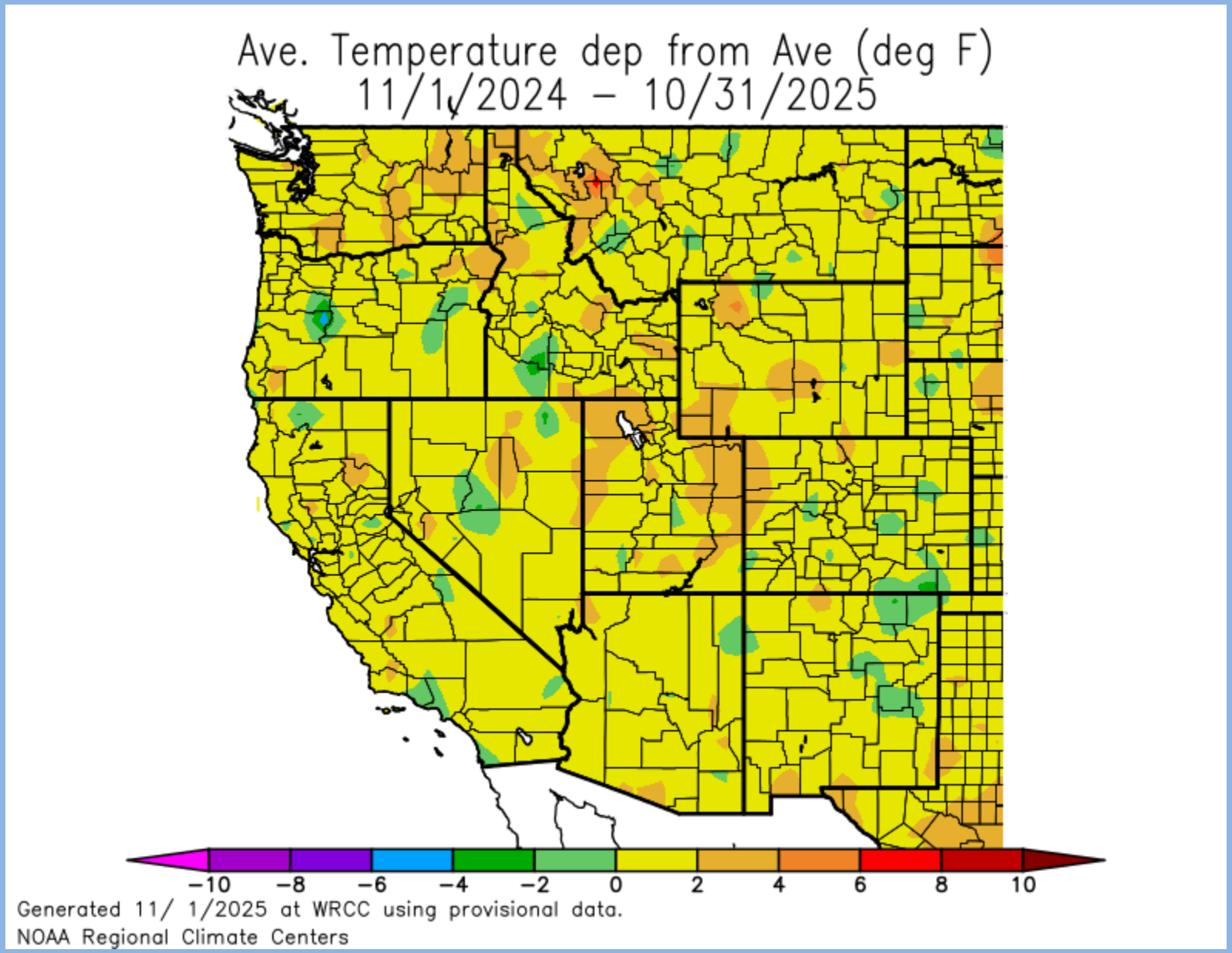


Regional water year summary

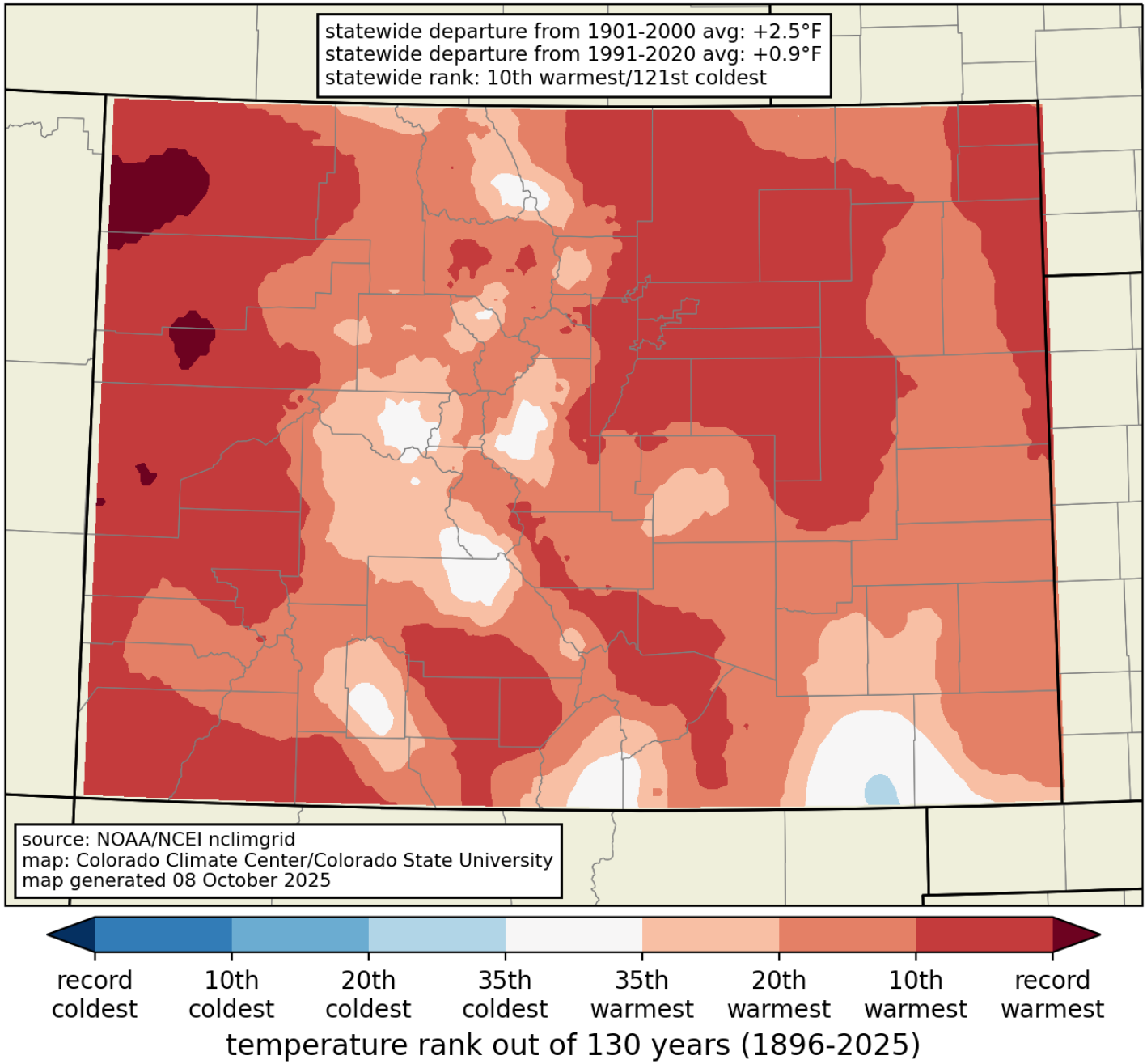
- Average daily temperatures were much above the historical average for the region.
- Snowpack and total precipitation in 2025 were significantly below normal.
- The 2025 water year began and ended in drought.

sources: CIRES, NOAA

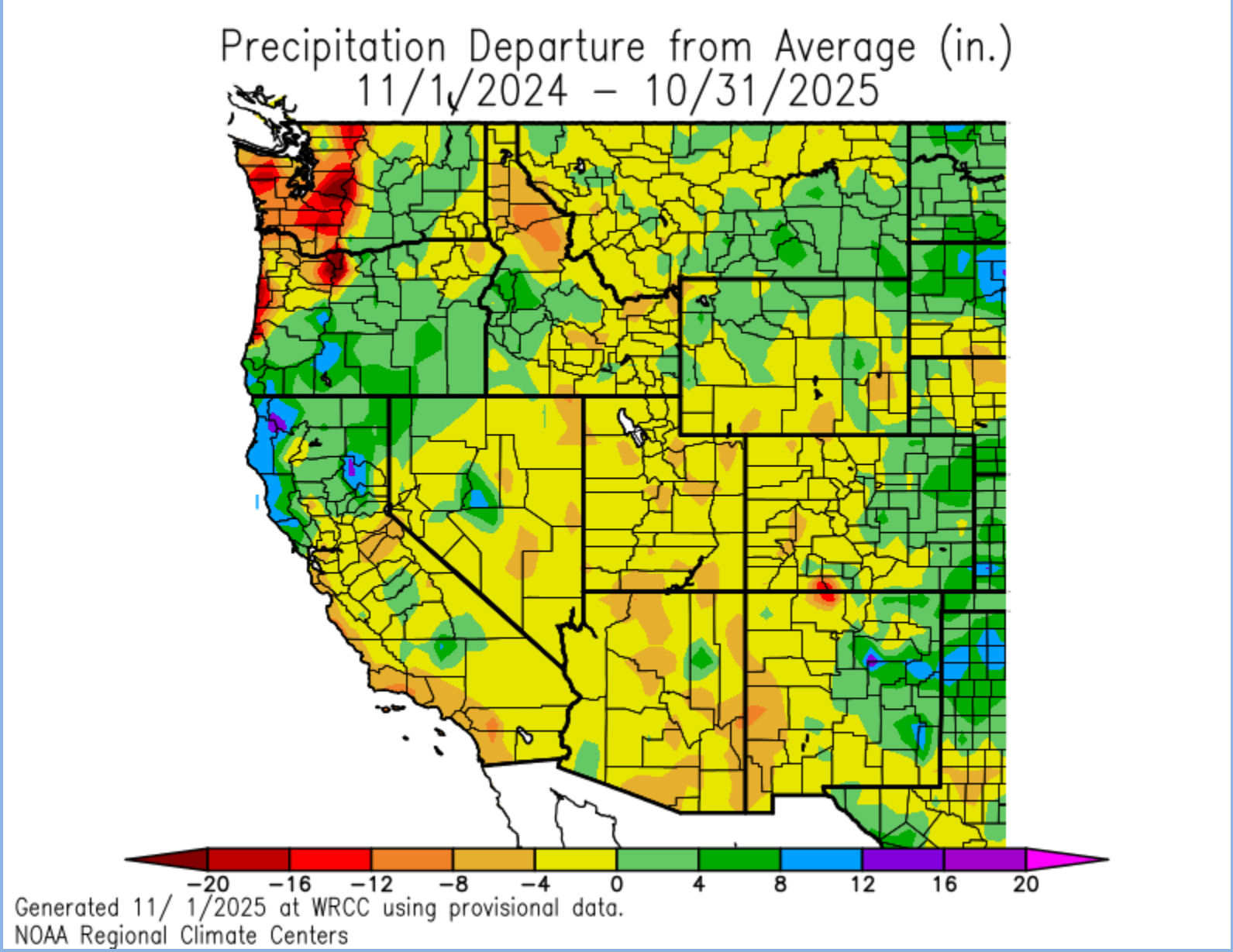
Temperatures remained above average over the entire region.



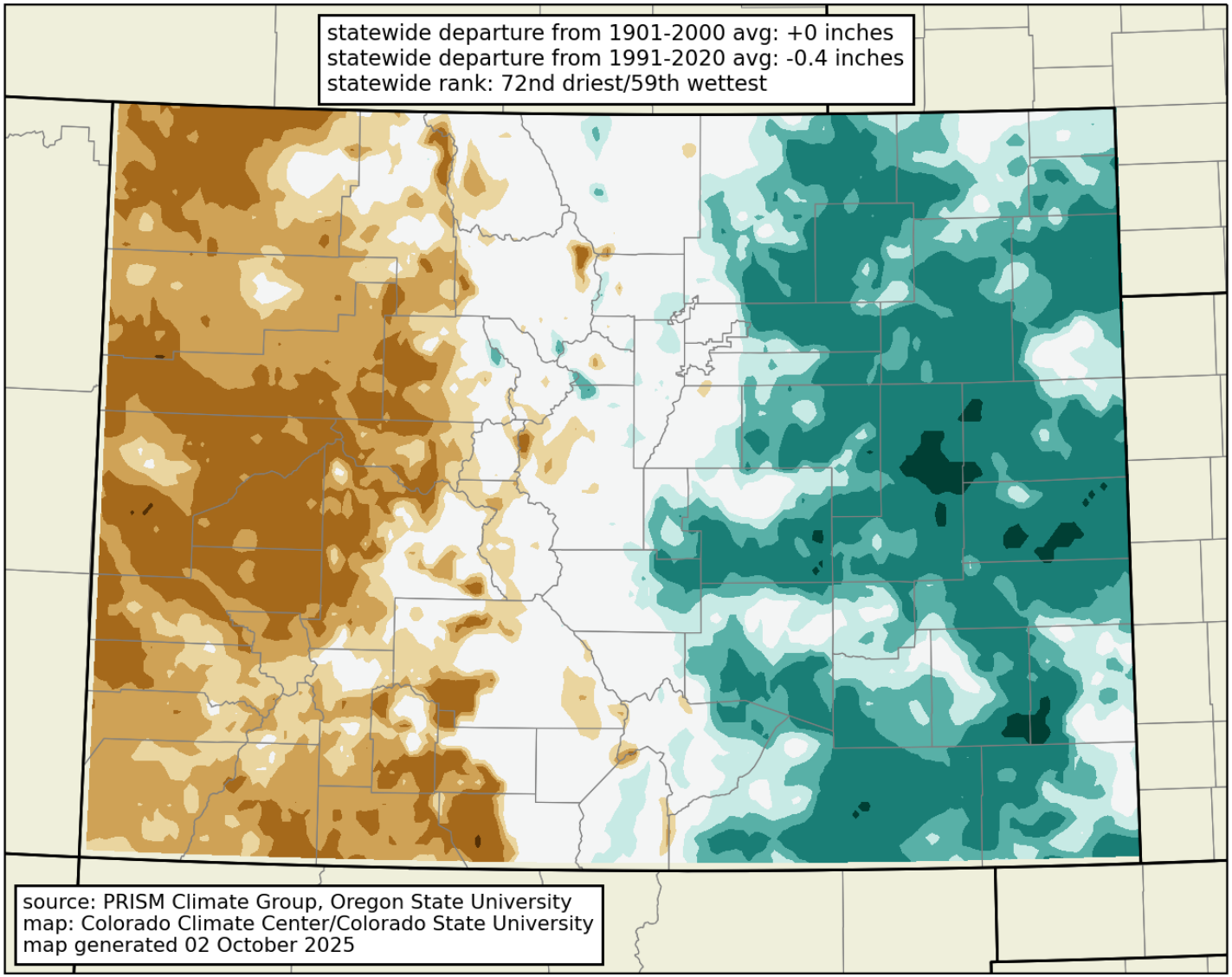
average temperature rank
12 months ending September 2025 (Oct-Sep)

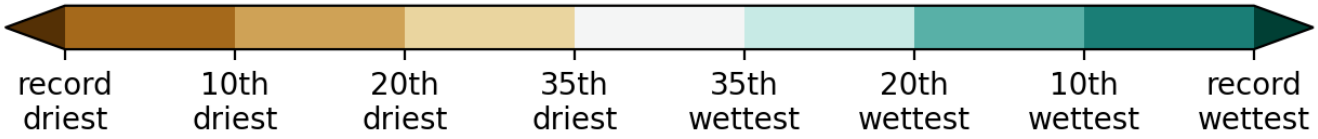


Regional 2025 water year precipitation remained below average.



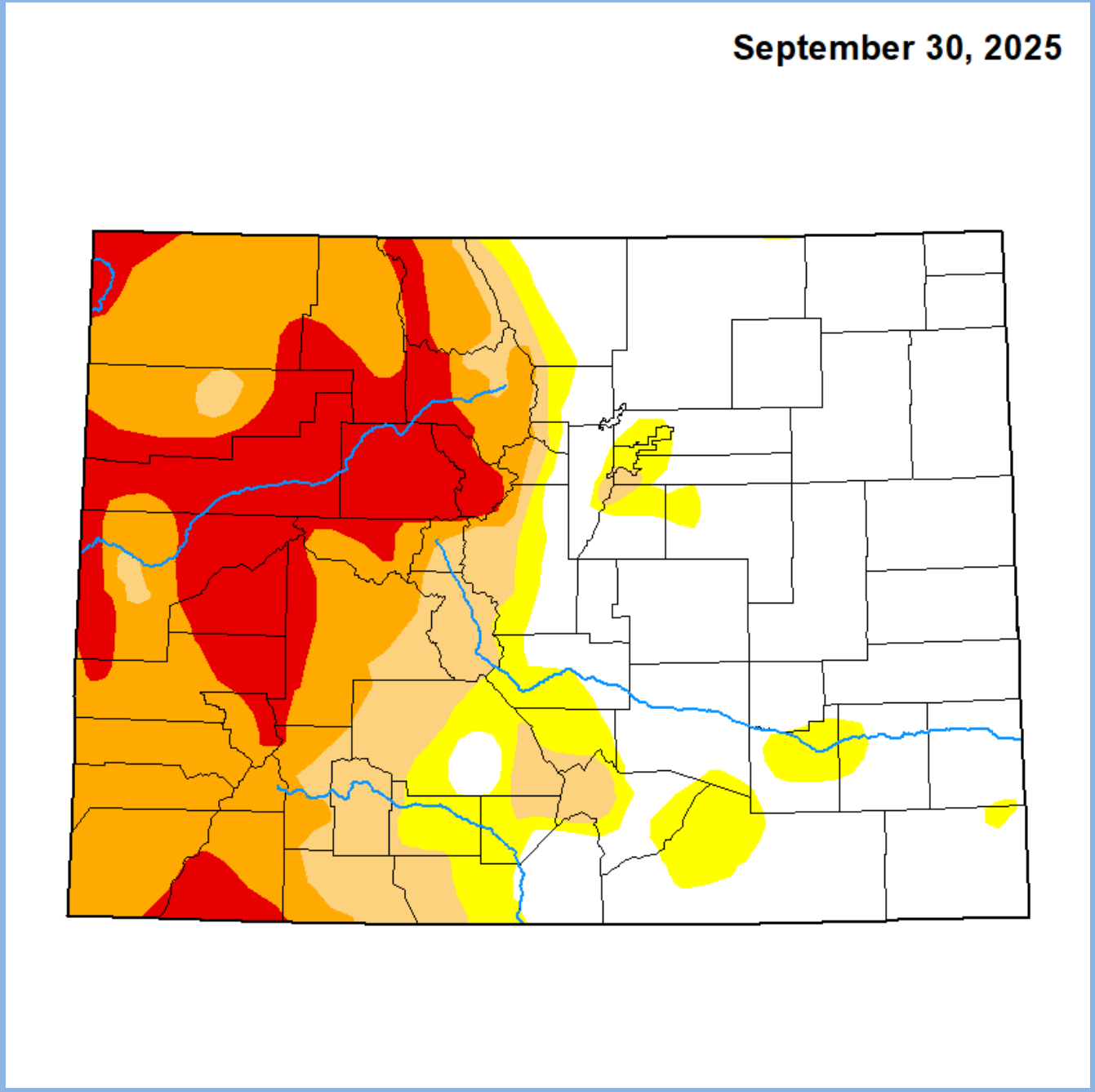
precipitation rank (preliminary PRISM data)
12 months ending September 2025 (Oct-Sep)



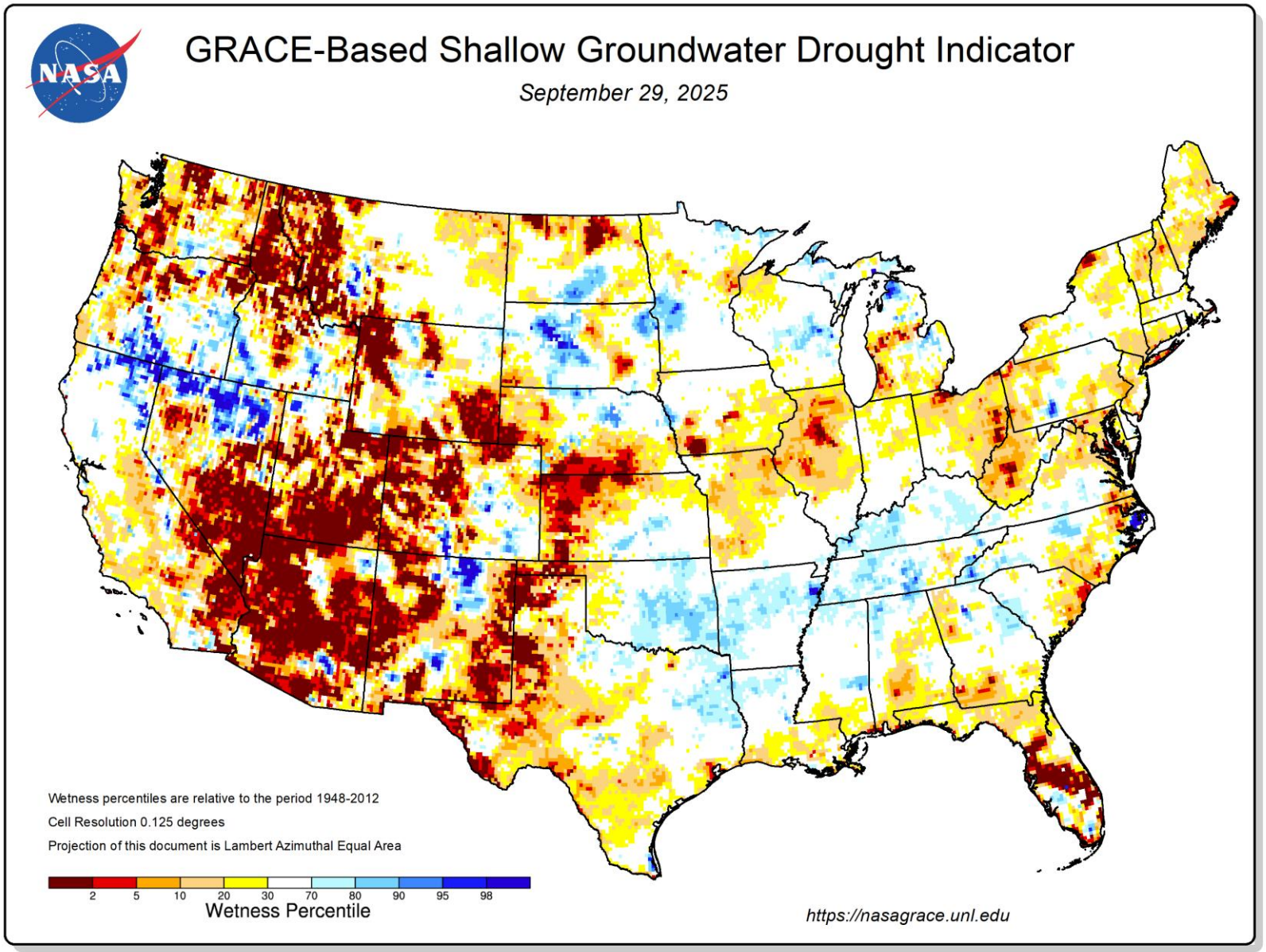


precipitation rank out of 130 years (1896-2025)

USDA Drought Monitor, end of water year 2025.

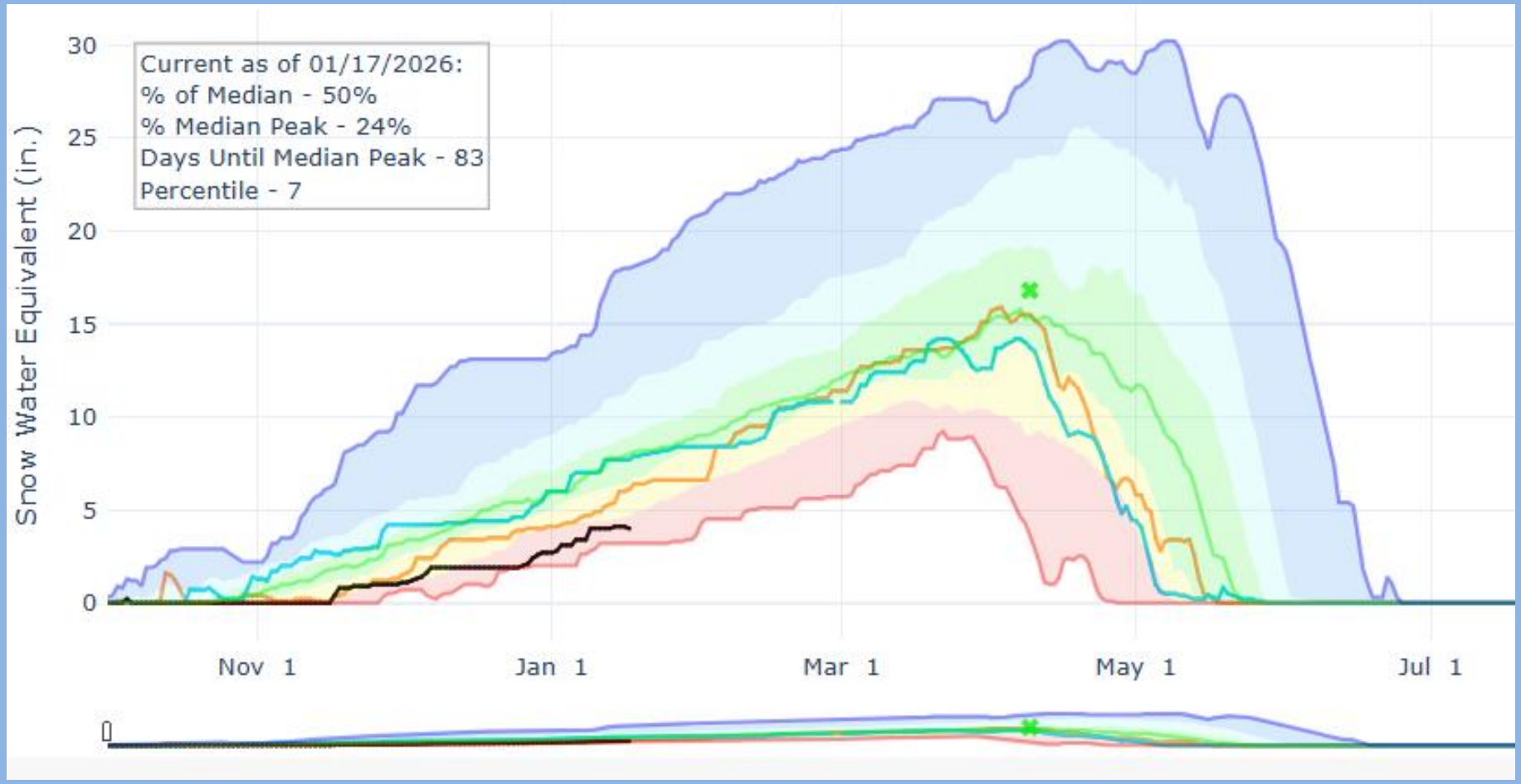


Water year 2025 ended really dry.



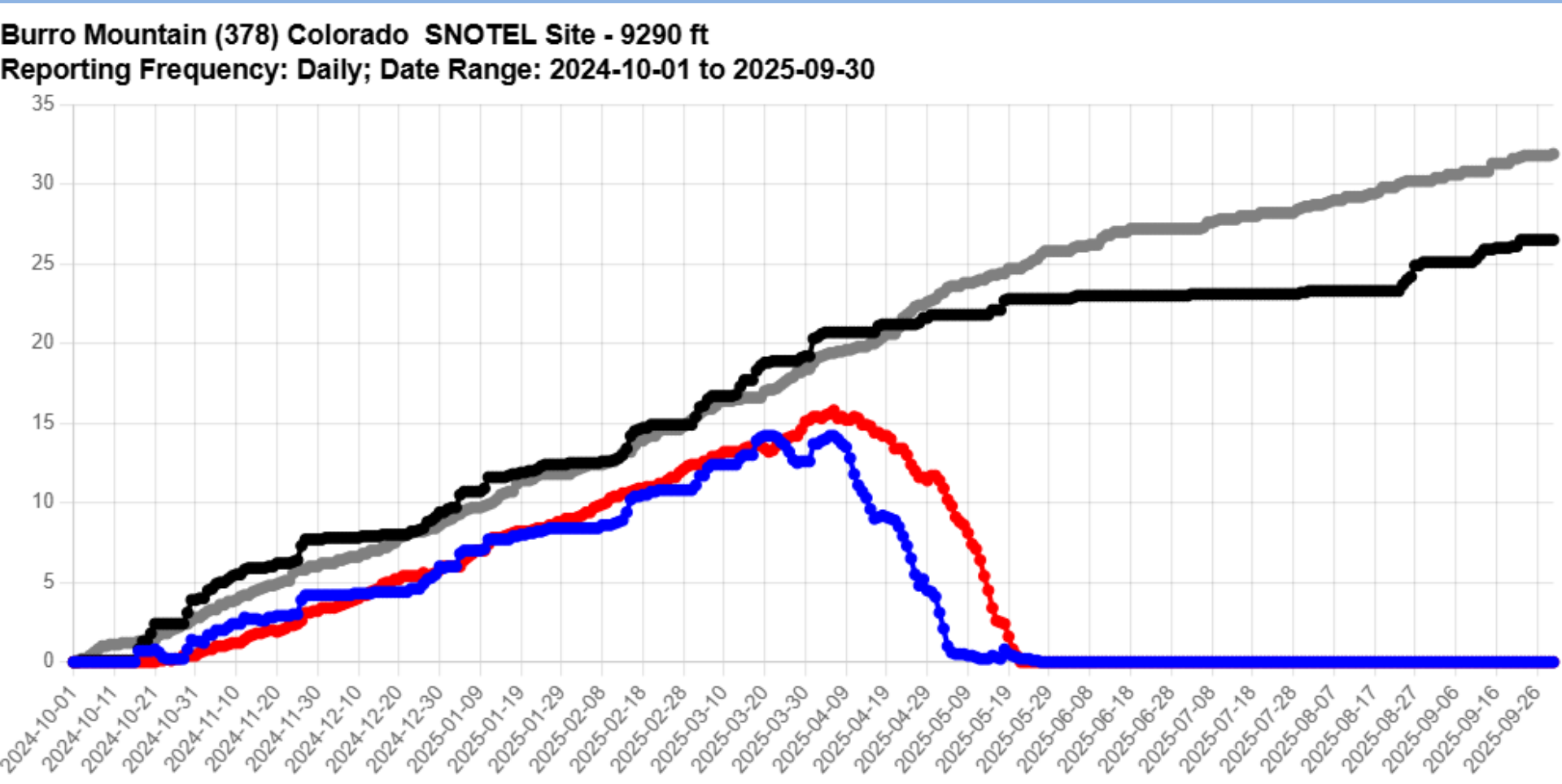
Trends on the upper White River

Snow water equivalent at Burro Mtn water years 2024 (orange), 2025 (green), and 2026 (black).

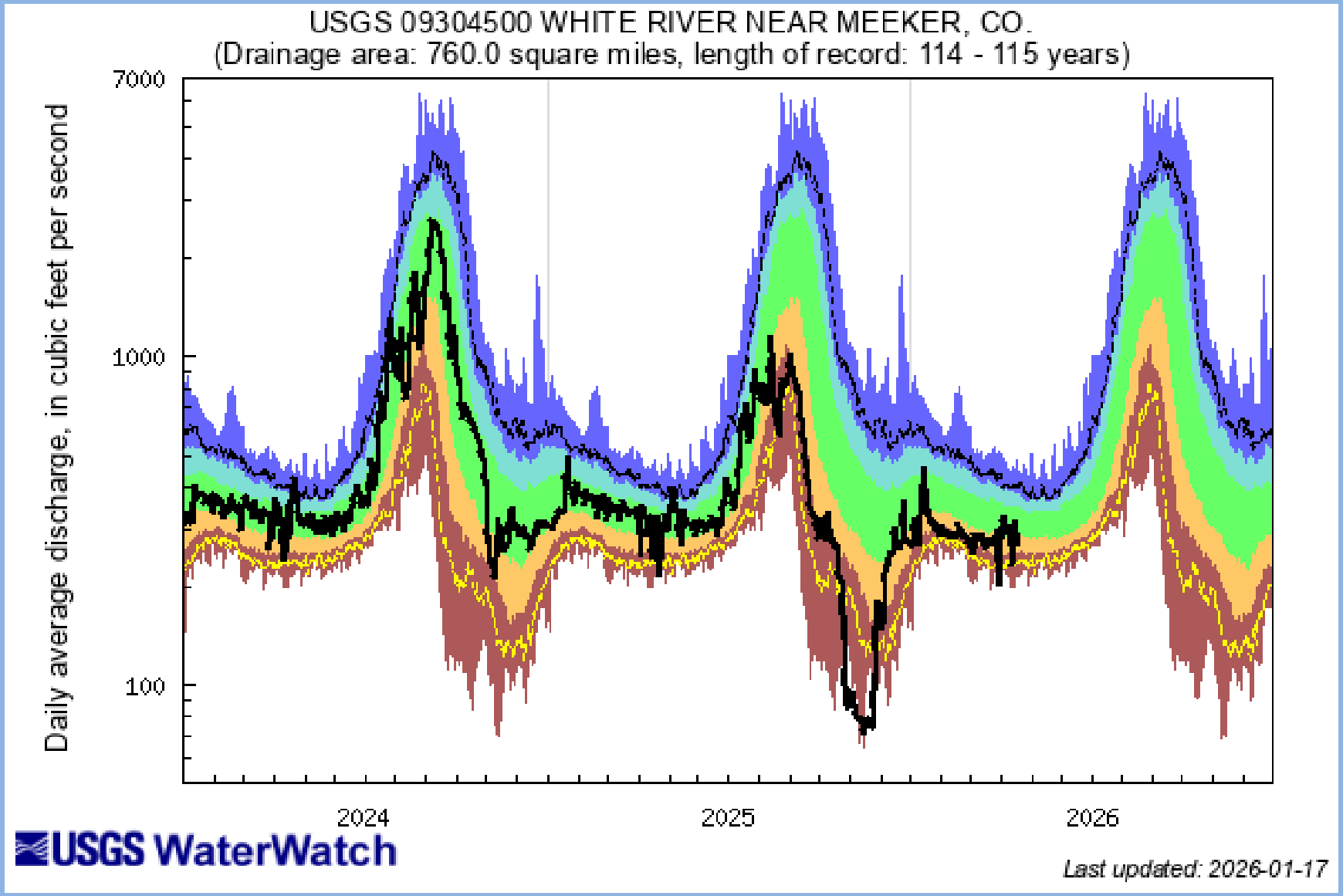


Burro Mtn snotel, NWCC

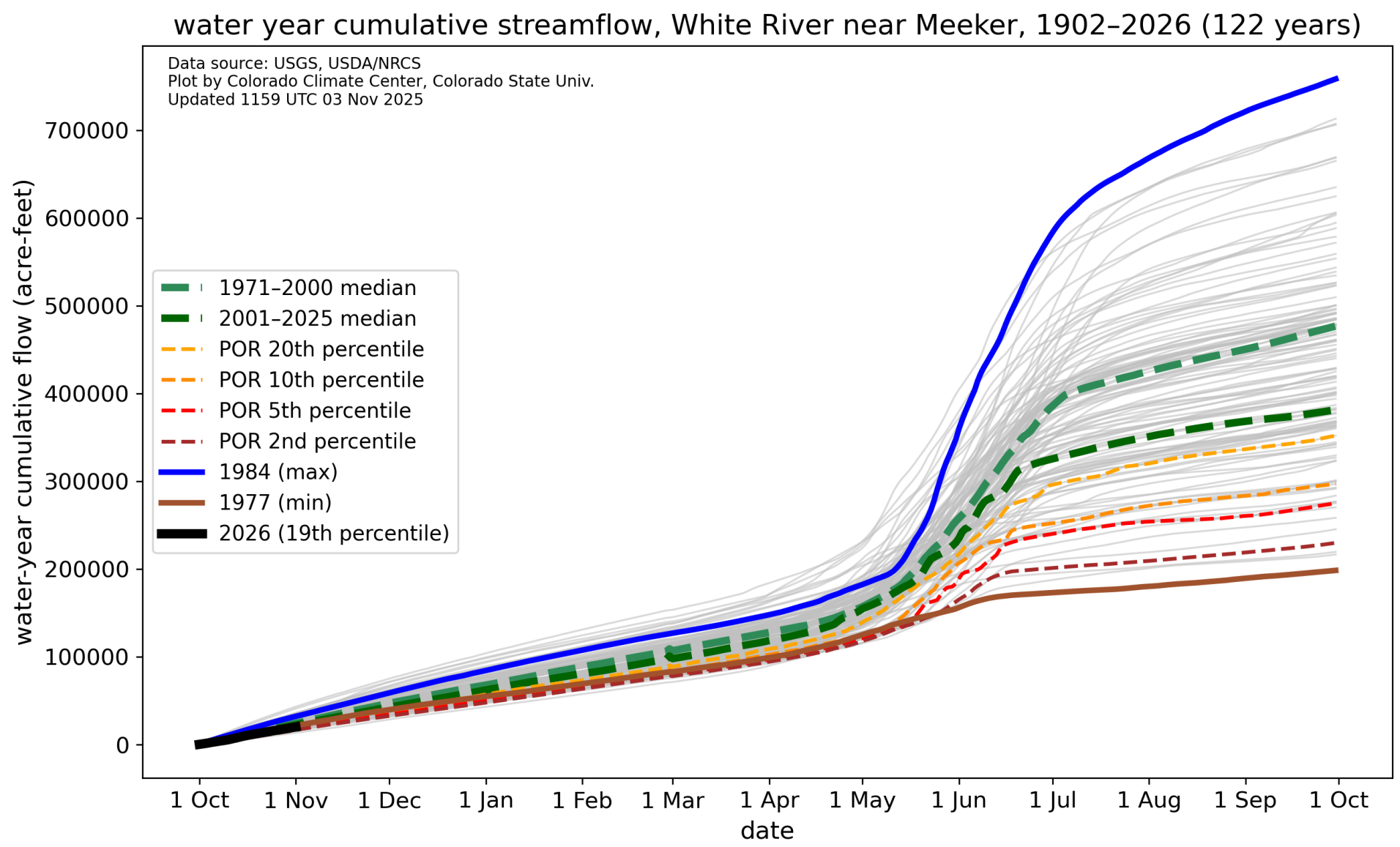
Burro Mtn 2025 daily snow water equivalent (blue) vs. 30-year median (red) and 2025 accumulated precipitation (black) vs. 30-year median (gray).



Daily flow in the white river (black line), water years 2024-2026 (to date)



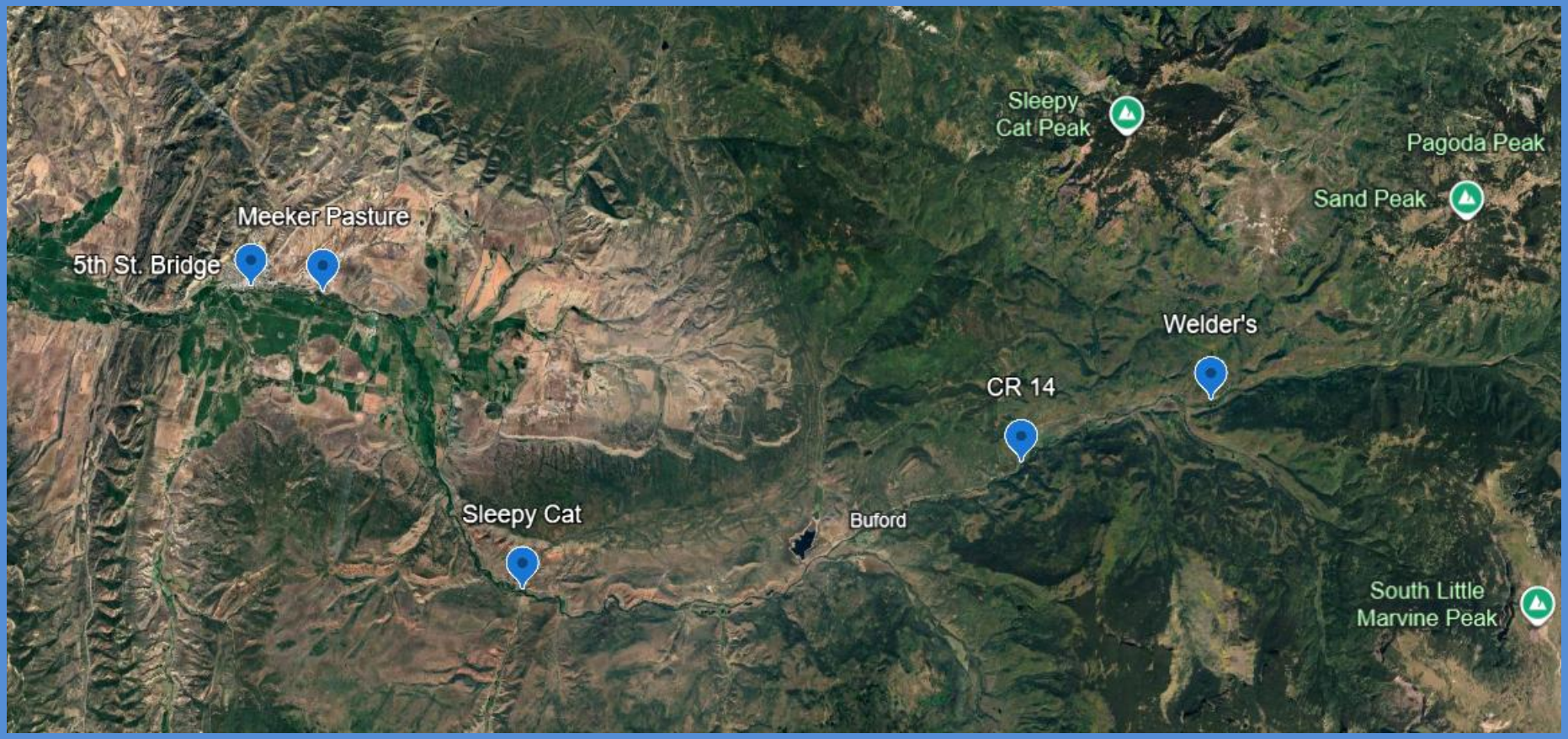
Historical runoff trends in the White River



Macroinvertebrate indicators of river health:

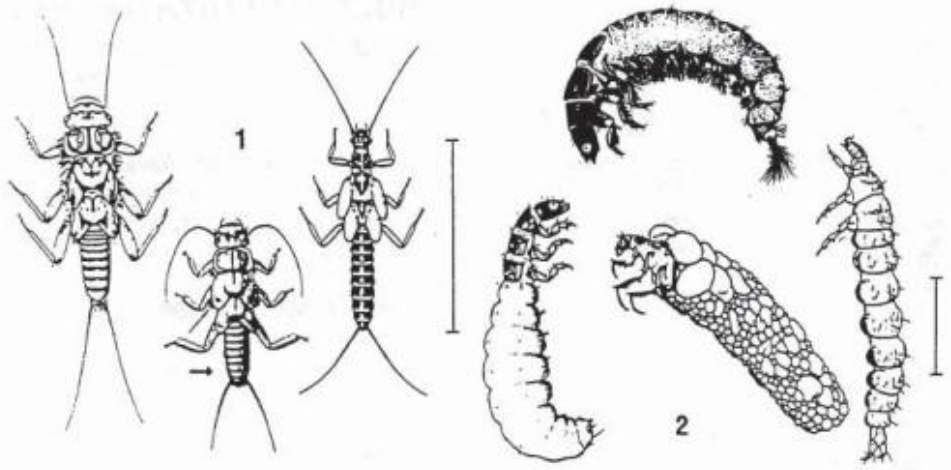
To assess long-term trends in river health we sampled benthic macroinvertebrate communities at five locations upstream from the Town of Meeker. We plan to repeat sampling at the same sites each September into the future. To assess effects of insecticides we obtained before and after samples at sites chosen because of their proximity to application of aerial sprays. In this first year we were able to obtain only one such paired sample.

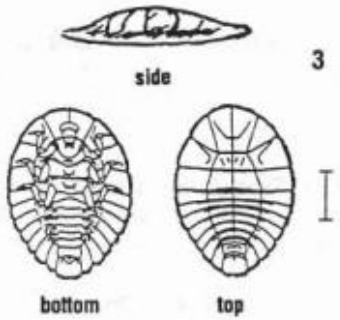
Sample sites, blue pins on Google Earth map, with reference topographical features, green, on the Flat Tops.

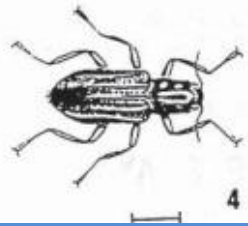


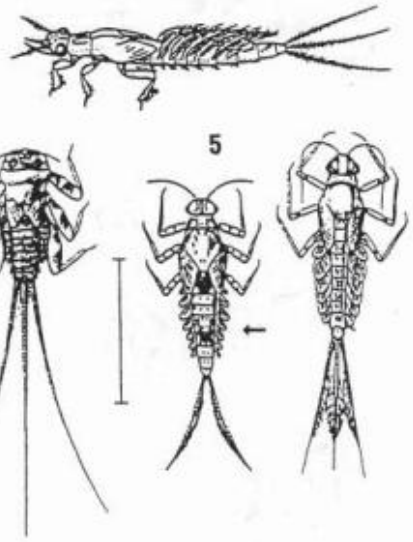
Aquatic macroinvertebrates are standard indicators of stream health. Prominent among them are the EPT taxa: Ephemeroptera (mayflies), Plecoptera (stoneflies), and Trichoptera (caddisflies). These are the canaries in the coal mine. If you see lots of EPT on the bottom cobbles, you're looking at a healthy river. The following slides show taxa typically found in varying degrees of pollution.

Insects that are the most sensitive to pollutants:









Stream Insects & Crustaceans

GROUP ONE TAXA

Pollution sensititve organisms found in good quality water.

1 ***Stonefly: Order Plecoptera.*** 1/2" - 1 1/2", 6 legs with hooked tips, antennae, 2 hair-like tails. Smooth (no gills) on lower half of body. (See arrow.)

2 ***Caddisfly: Order Trichoptera.*** Up to 1", 6 hooked legs on upper third of body, 2 hooks at back end. May be in a stick, rock or leaf case with its head sticking out. May have fluffy gill tufts on underside.

3 ***Water Penny: Order Coleoptera.*** 1/4", flat saucer-shaped body with a raised bump on one side and 6 tiny legs and fluffy gills on the other side. Immature beetle.

4 ***Riffle Beetle: Order Coleoptera.*** 1/4", oval body covered with tiny hairs, 6 legs, antennae. Walks slowly underwater. Does not swim on surface.

5 ***Mayfly: Order Ephemeroptera.*** 1/4" - 1", brown, moving, plate-like or feathery gills on sides of lower body (see arrow), 6 large hooked legs, antennae, 2 or 3 long, hair-like tails. Tails may be webbed together.

6 ***Gilled Snail: Class Gastropoda.*** Shell opening covered by thin plate called opercu-

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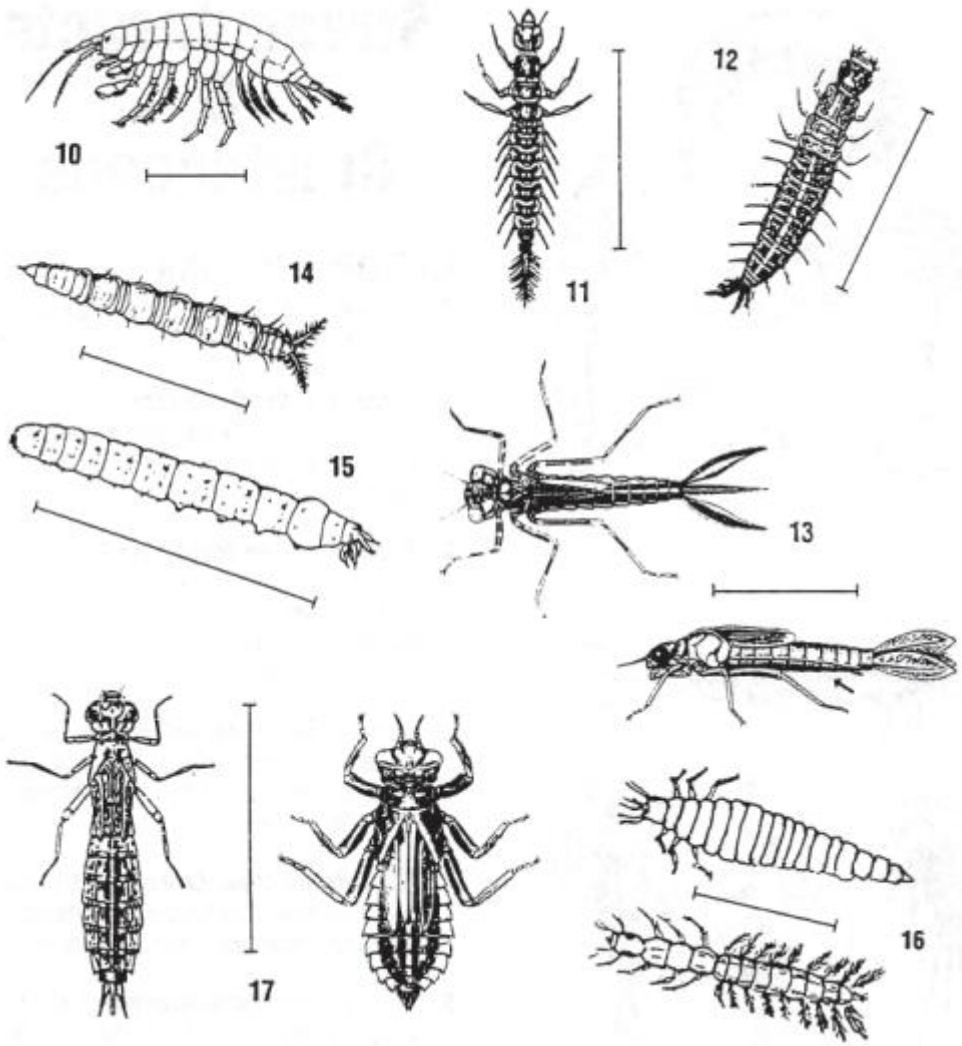
Moderately tolerant of pollutants:



GROUP TWO TAXA CONTINUED

10 ***Scud: Order Amphipoda.*** 1/4", white to grey. body higher than it is wide, swims sideways, more than 6 legs, resembles small shrimp.

11 ***Alderfly Larva: Family Sialidae.*** 1" long. Looks like small hellgrammite but has 1 long, thin, branched tail at back end (no hooks). No gill tufts underneath.

12 ***Fishfly Larva: Family Corydalidae.*** Up to 1 1/2" long. Looks like small hellgrammite but often a lighter reddish-tan color, or with yellowish streaks. No gill tufts underneath.

13 ***Damselfly: Suborder Zygoptera.*** 1/2" - 1", large eyes, 6 thin hooked legs, 3 broad oar-shaped tails, positioned like a tripod. Smooth (no gills) on sides of lower half of body. (See arrow.)

14 ***Watersnipe Fly Larva: Family Athericidae (Atherix).*** 1/4" - 1", pale to green, tapered body, many caterpillar-like legs, conical head, feathery "horns" at back end.

15 ***Crane Fly: Suborder Nematocera.*** 1/3" - 2", milky, green, or light brown, plump caterpillar-like segmented body, 4 finger-like lobes at back end.

16 ***Beetle Larva: Order Coleoptera.*** 1/4" - 1", light-colored, 6 legs on upper half of body, feelers, antennae.

17 ***Dragon Fly: Suborder Anisoptera.*** 1/2" - 2", large eyes, 6 hooked legs. Wide oval to round abdomen.

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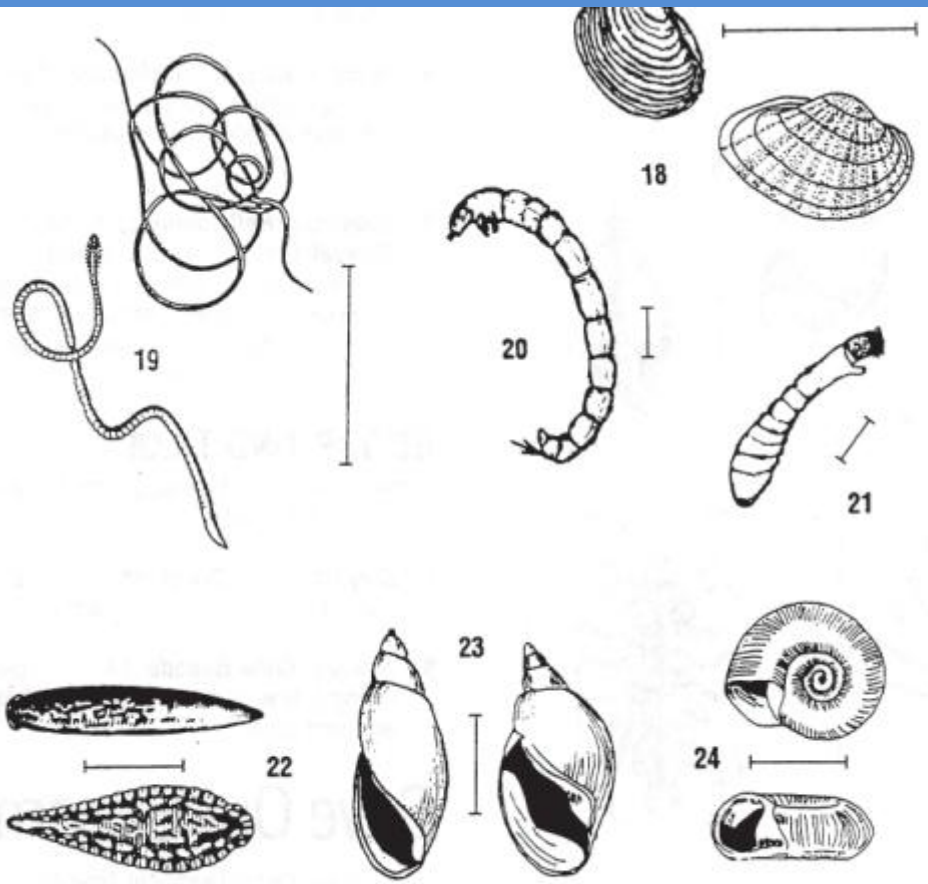
Insects that tolerate higher levels of pollutants:



GROUP THREE TAXA

Pollution tolerant organisms can be in any quality of water.

19 ***Aquatic Worm: Class Oligochaeta.*** 1/4" - 2", can be very tiny; thin worm-like body.

20 ***Midge Fly Larva: Suborder Nematocera.*** Up to 1/4", dark head, worm-like segmented body, 2 tiny legs on each side.

21 ***Blackfly Larva: Family Simulidae.*** Up 1/4", one end of body wider. Black head, suction pad on other end.

22 ***Leech: Order Hirudinea.*** 1/4" - 2", brown, slimy body, ends with suction pads.

23 ***Pouch Snail and Pond Snails: Class Gastropoda.*** No operculum. Breathe air. When opening is facing you, shell usually opens on left.

24 ***Other Snails: Class Gastropoda.*** No operculum. Breathe air. Snail shell coils in one plane.

DEFENDERS OF SOIL, AIR, WOODS, WATERS AND WILDLIFE
THE IZAAK WALTON LEAGUE

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Common aquatic insect Families:

The following slides show some of the common Families of aquatic insects in the White River.

Image credits: Macroinvertebrates of Eastern North America

Image credits: Macroinvertebrates of Eastern North America

Image credits: Macroinvertebrates of Eastern North America

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Examples of case building caddisflies

Glossosoma

Brachycentrus

Image credits: Macroinvertebrates of Eastern North America

Statistical measures:

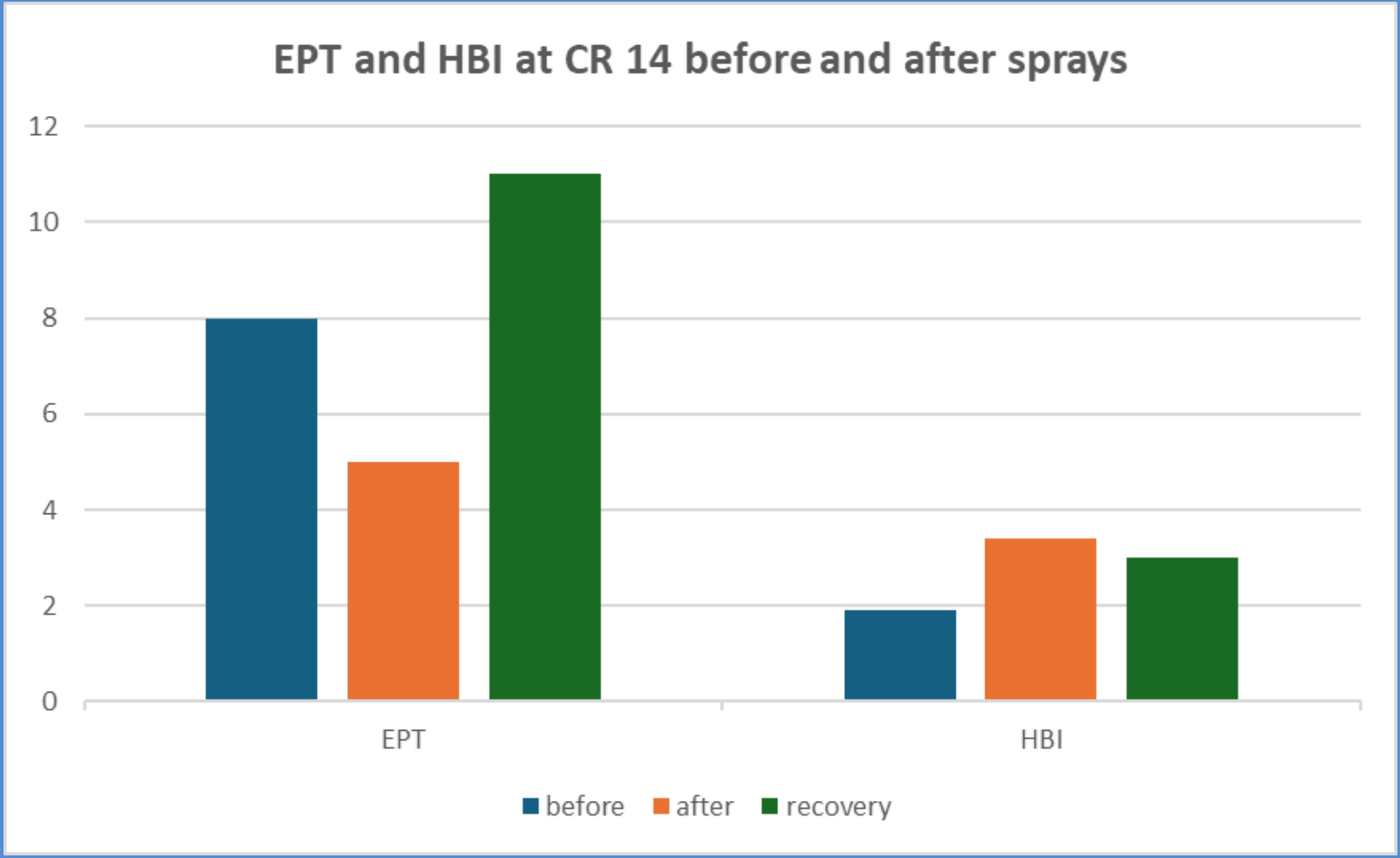
- EPT taxa and EPT index
  - how many different kinds of EPT in the sample and the proportion of EPT to total count
- Shannon-Wiener Biodiversity Index
- Simpson Biodiversity Index
  - biodiversity indexes measure how many different macroinvertebrate taxa are in the sample and how balanced is their distribution

- Hilsenhoff Biotic Sensitivity Index (HBI)
  - HBI rates insects' pollution tolerance on a scale of 0 – 10. Zero indicates extreme sensitivity to pollutants while a score of ten indicates that the insect tolerates high levels of pollution. Stoneflies, for example, typically have an HBI score of zero, while earthworms have an HBI score of 10. A low HBI for the total sample (e.g. below 3.0) indicates good water quality.

Results related to the effects of aerial spray permethrins:

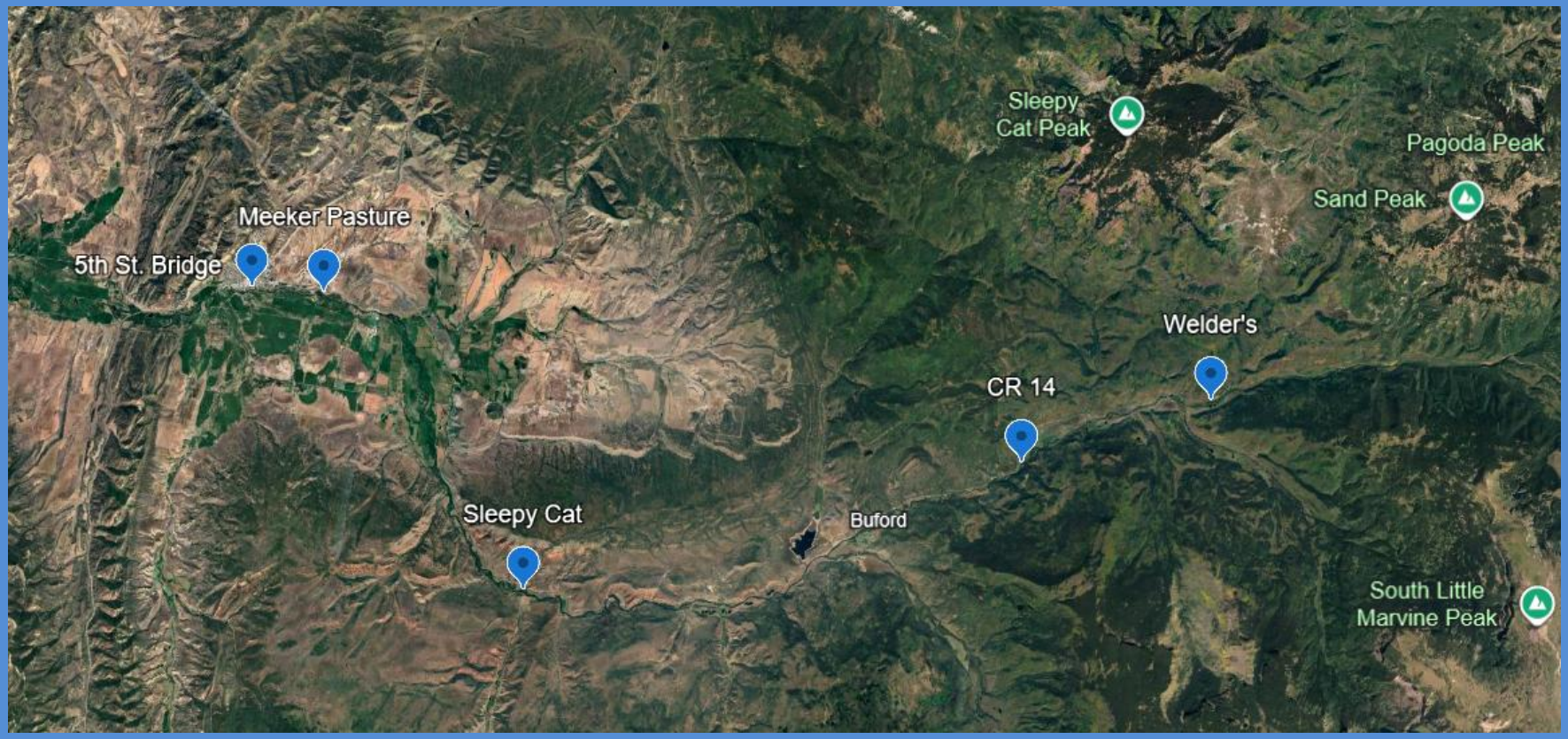
Photo credit: Tallman Aerial Spraying

EPT taxa (mayflies, stoneflies, and caddisflies) and HBI (Hilsenhoff biotic sensitivity index) at CR 14 before and after spray event.

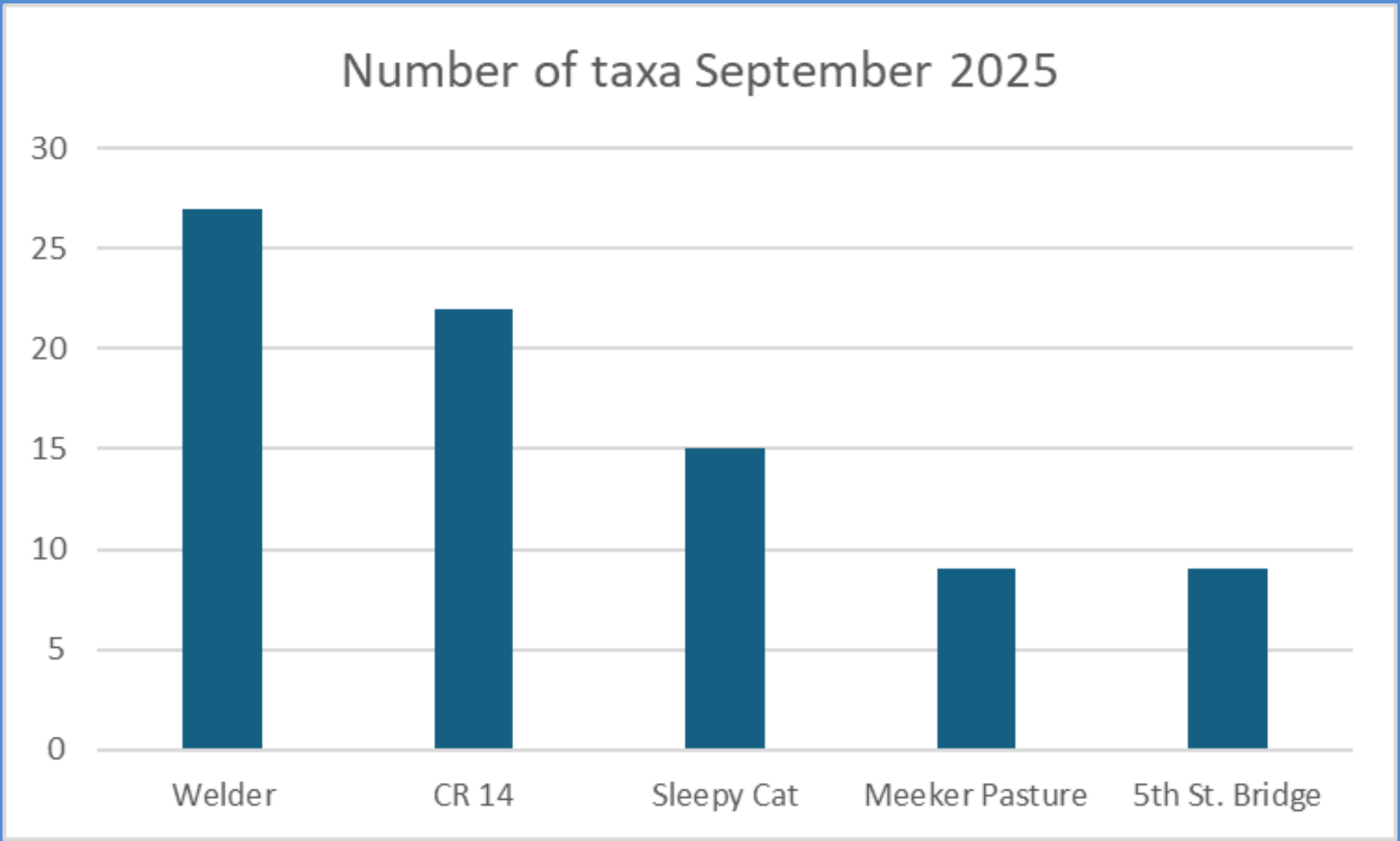


Comments: The number of EPT taxa decreased and water quality decreased, as measured by HBI, after the spray event. The number of EPT then recovered to a maximum by the September sample, and water quality, as measured by HBI, improved slightly from its low after the spray. This pattern is consistent with known harmful effects of permethrins on aquatic macroinvertebrates. Details of the count show that while the proportion of EPT taxa decreased, numbers of midge and riffle beetles increased in the interval after spraying. Midges and beetles are more tolerant of deteriorating water quality.

Results of this year's longitudinal study:



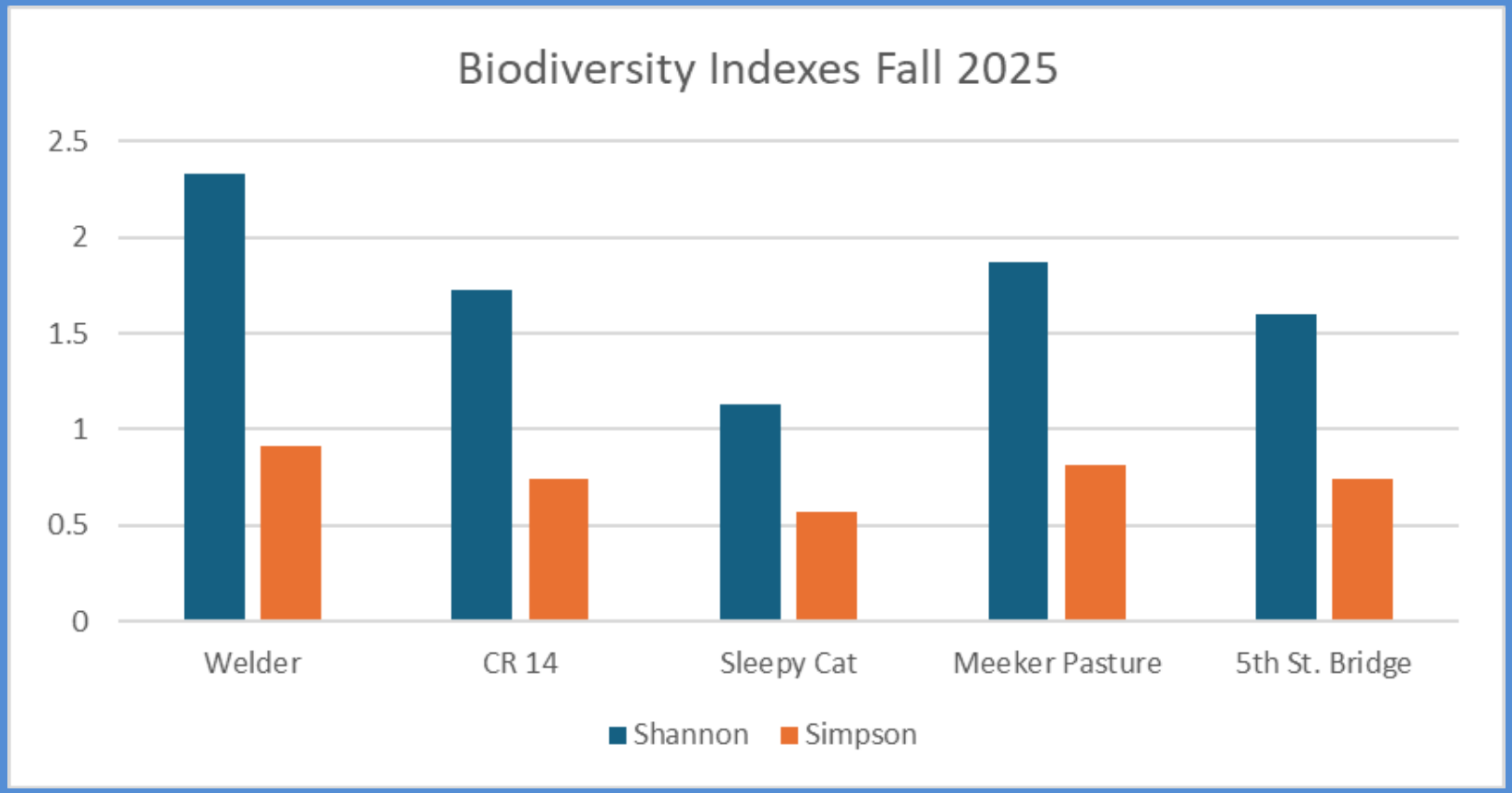
Number of macroinvertebrate taxa at the sample sites in September 2025.



Sample size: n = 378 at Welder, n = 624 at CR 14, n = 572 at Sleepy Cat, n = 37 at Meeker Pasture, n = 126 at 5th St. Bridge.

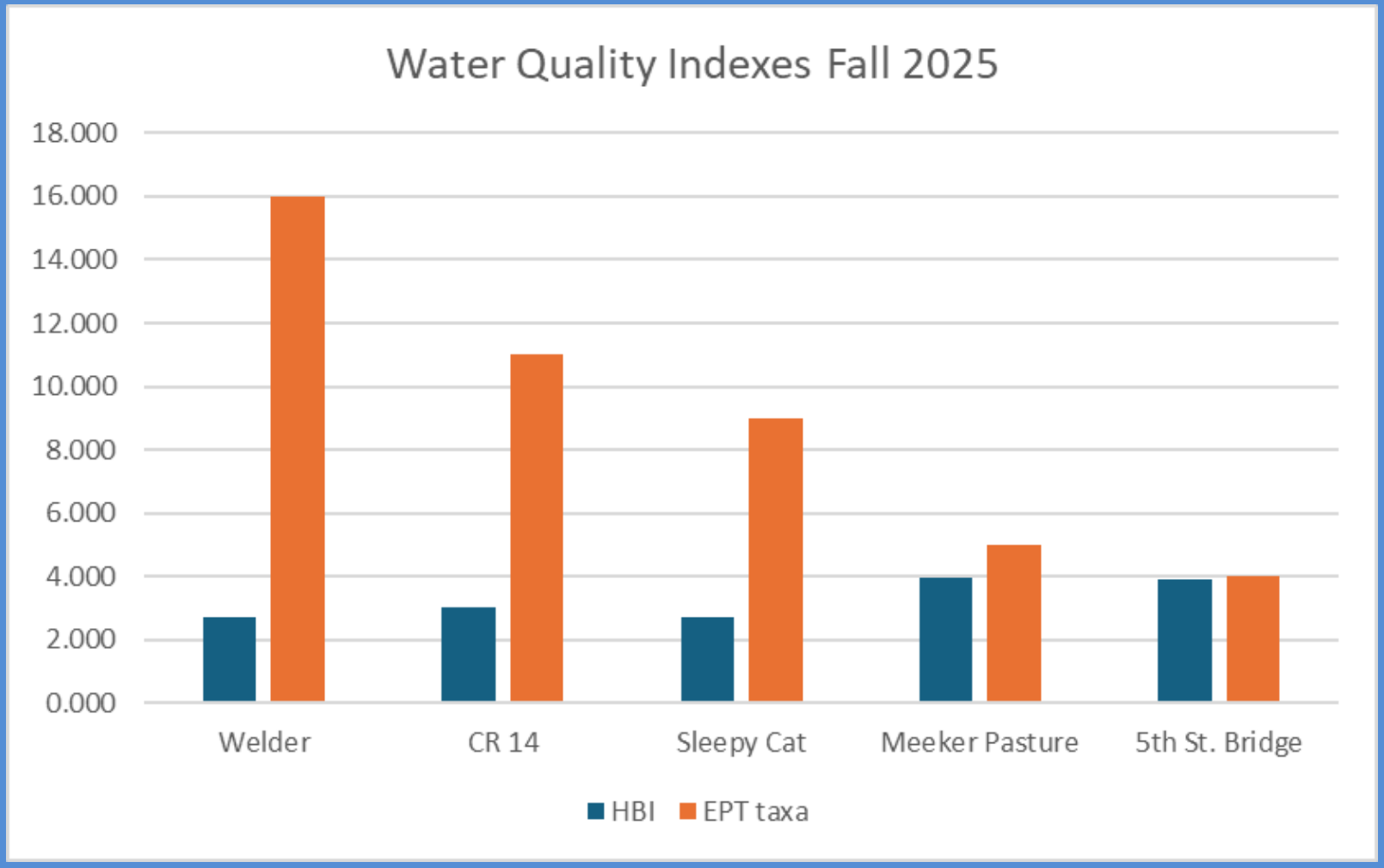
Comment: We found fewer taxa, counted by Family, at the downstream sites than near the headwaters. Counts at Meeker Pasture and 5th St. Bridge were most certainly impacted by debris from the Elk Fire, so may not reflect the normal state of the river. A greater variety of macroinvertebrates, as represented in the number of different Families, reflects a healthier benthic ecosystem.

Shannon-Wiener and Simpson measures of biodiversity of the aquatic macroinvertebrate community at the different sample sites.



Comment: The biodiversity of the aquatic macroinvertebrate community, as measured by the Shannon-Wiener and Simpson indexes, decreased from the headwaters downstream to Sleepy Cat. Counts at Meeker Pasture and 5th St. Bridge were likely confounded by effects of the Elk Fire. Shannon-Wiener is sensitive to low-count taxa while Simpson is sensitive to taxa with large numbers of individuals in the count. Both those factors undoubtedly affected the indexes in Meeker Pasture and 5th St. Bridge, where counts were exceptionally low and some taxa were over-represented. We anticipate that in a normal year the indexes would follow the trend seen in the up-river sites.

Water quality indexes (EPT taxa and HBI) in September 2025.



Comments: Biological measures of water quality decrease as you descend the river. EPT taxa (mayflies, stoneflies, and caddisflies) are generally more sensitive to low water quality – conditions including pollutants, toxins, low oxygen saturation, etc. – than are other taxa like chironomids (midges) and damselflies. A high EPT taxa count indicates good water quality. Conversely, HBI (Hilsenhoff biotic sensitivity index) increases as water quality deteriorates. High HBI means low water quality. The trends of EPT and HBI shown on this graph are consistent.

Preliminary conclusions from macroinvertebrate counts:

- River health declines from the headwaters on downstream.
- Our data support other observations that aerial spray permethrins harm aquatic macroinvertebrate populations.
- Debris from fire scars disrupted the benthic ecosystem.
- We found only minimal algae growth.
- Our results are subject to several caveats.

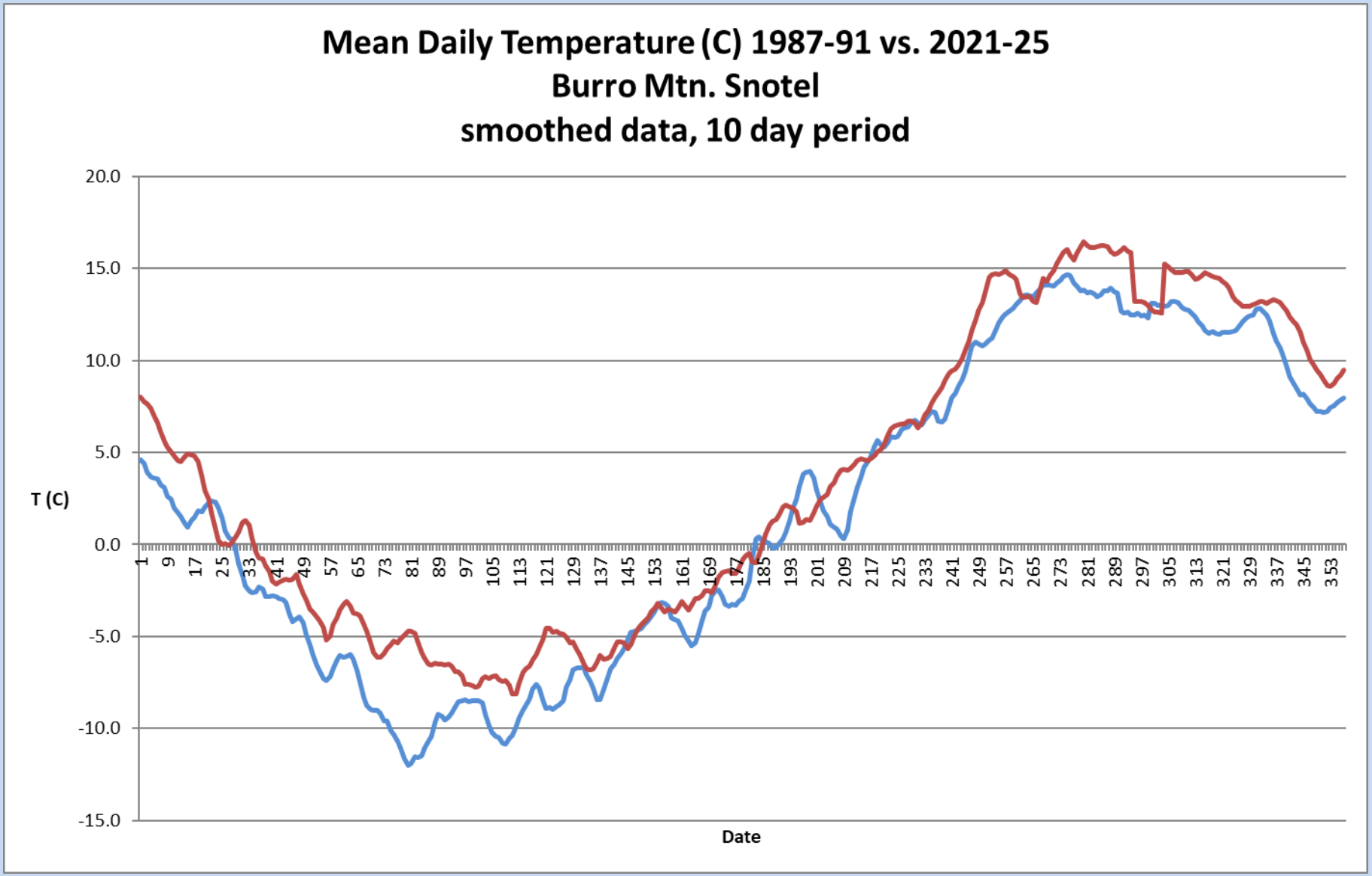
Plans for future study:

- Sample all sites yearly in September to monitor long-term health of the river.
- Try for at minimum 20 paired samples, before and after aerial spraying, to determine effects of permethrins on the aquatic macroinvertebrate community.

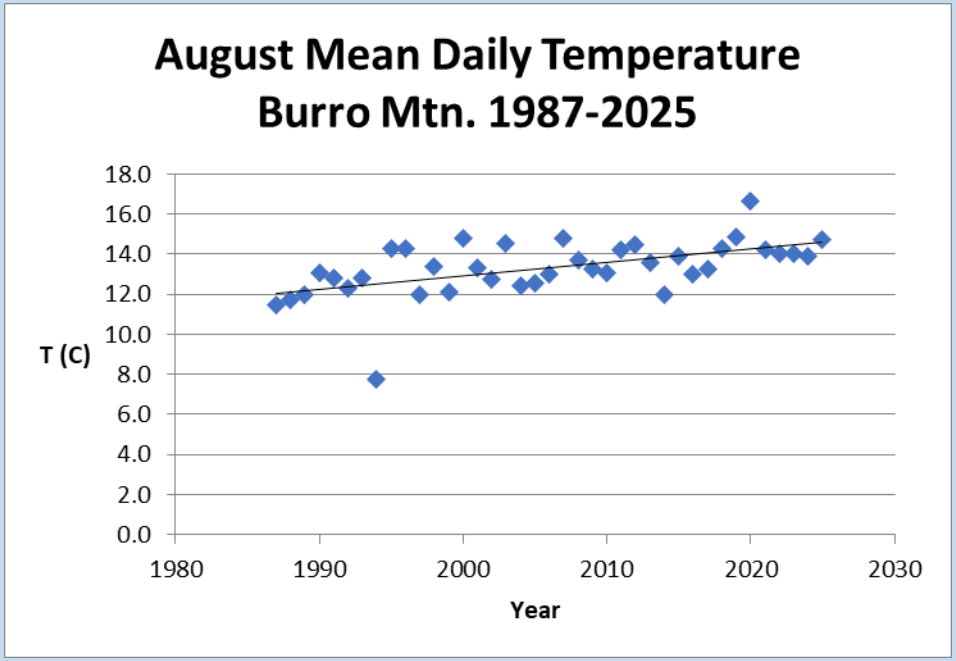
Climate change on the White River:

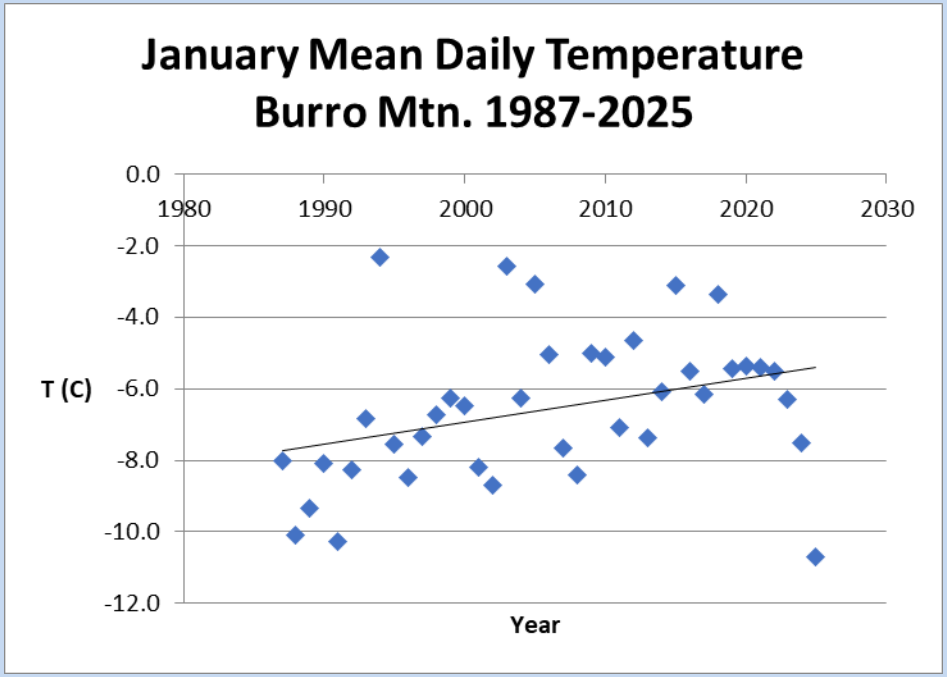
Following are data updated through water year 2025 showing historical trends in temperature, flow, and peak runoff on the White River. It is the sad fact that we could pretty much just relabel these slides for every other river basin on the Western Slope and southern Rockies of Colorado: the Yampa, the Gunnison, the Dolores, the Animas, the Rio Grande, the San Juan, and the Grand River itself, the Colorado.

Mean daily temperatures on the Flat Tops have increased significantly, especially mid-winter and late summer.



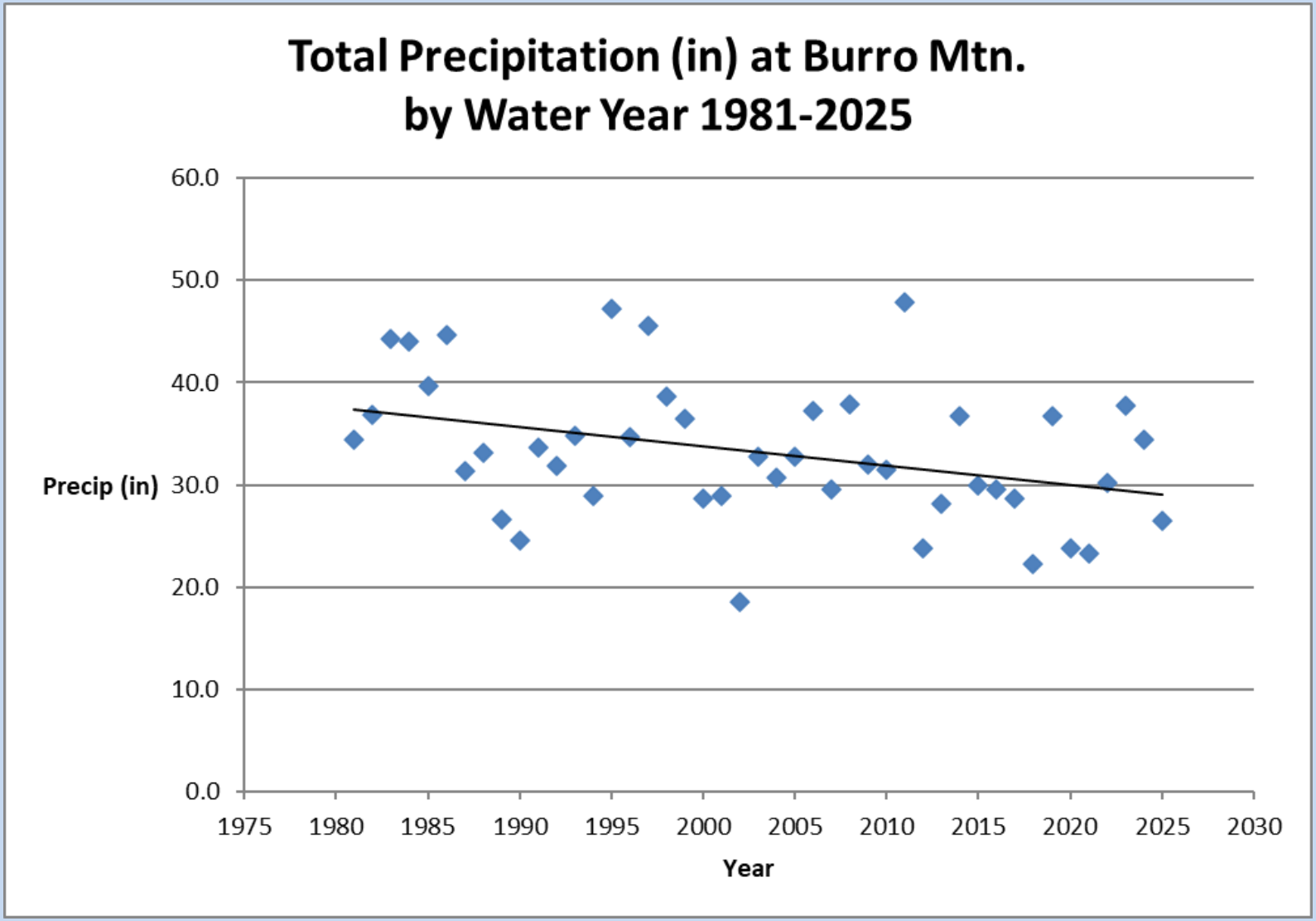
January and August temperatures have increased by about 3.5 C (6.5 F) on the Flat Tops over the past 35 years.



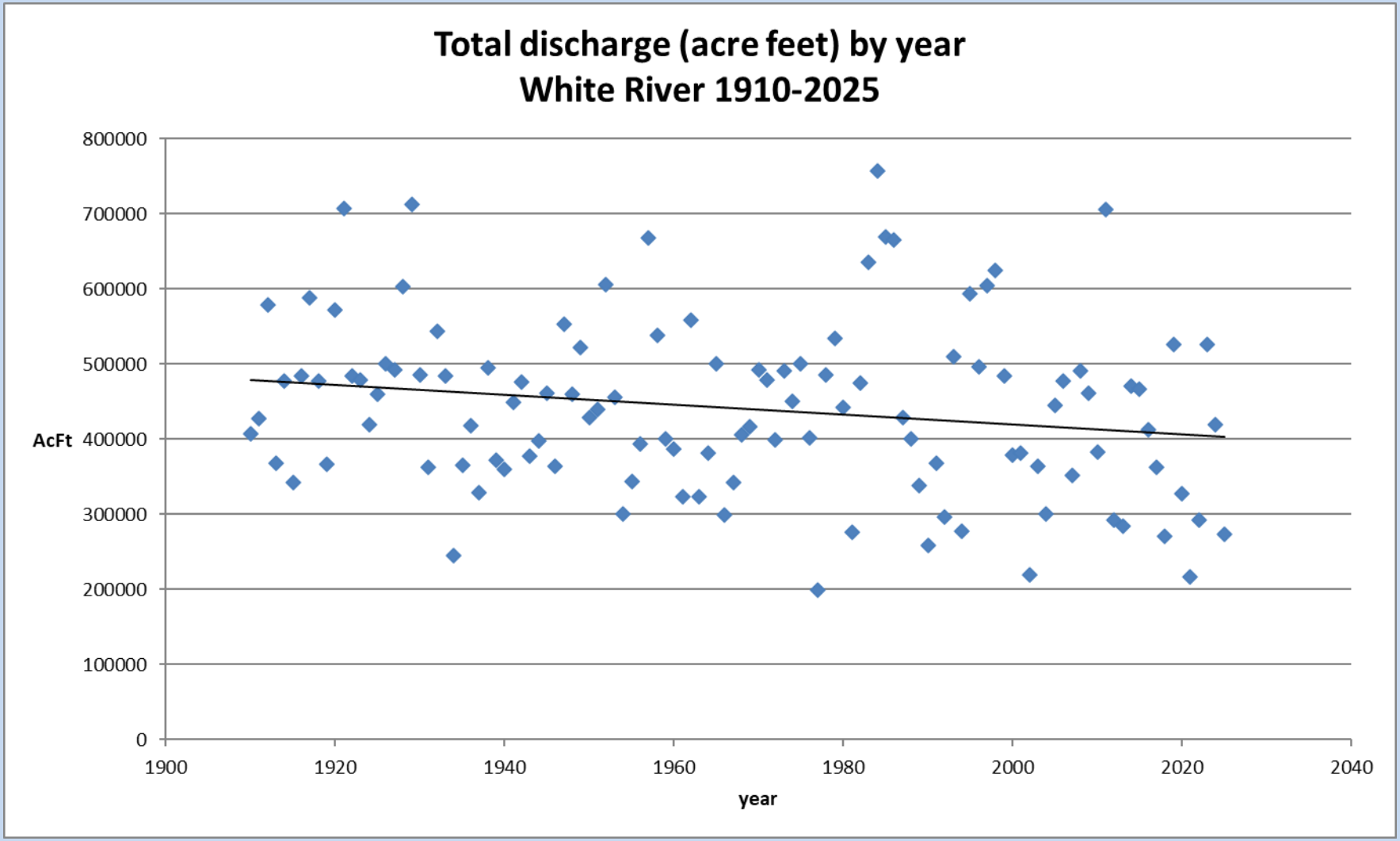


Data from Burro Mtn. Snotel.

Precipitation on the Flat Tops , mostly available in snow pack, is decreasing. There is less water for runoff into the headwaters of the White River.

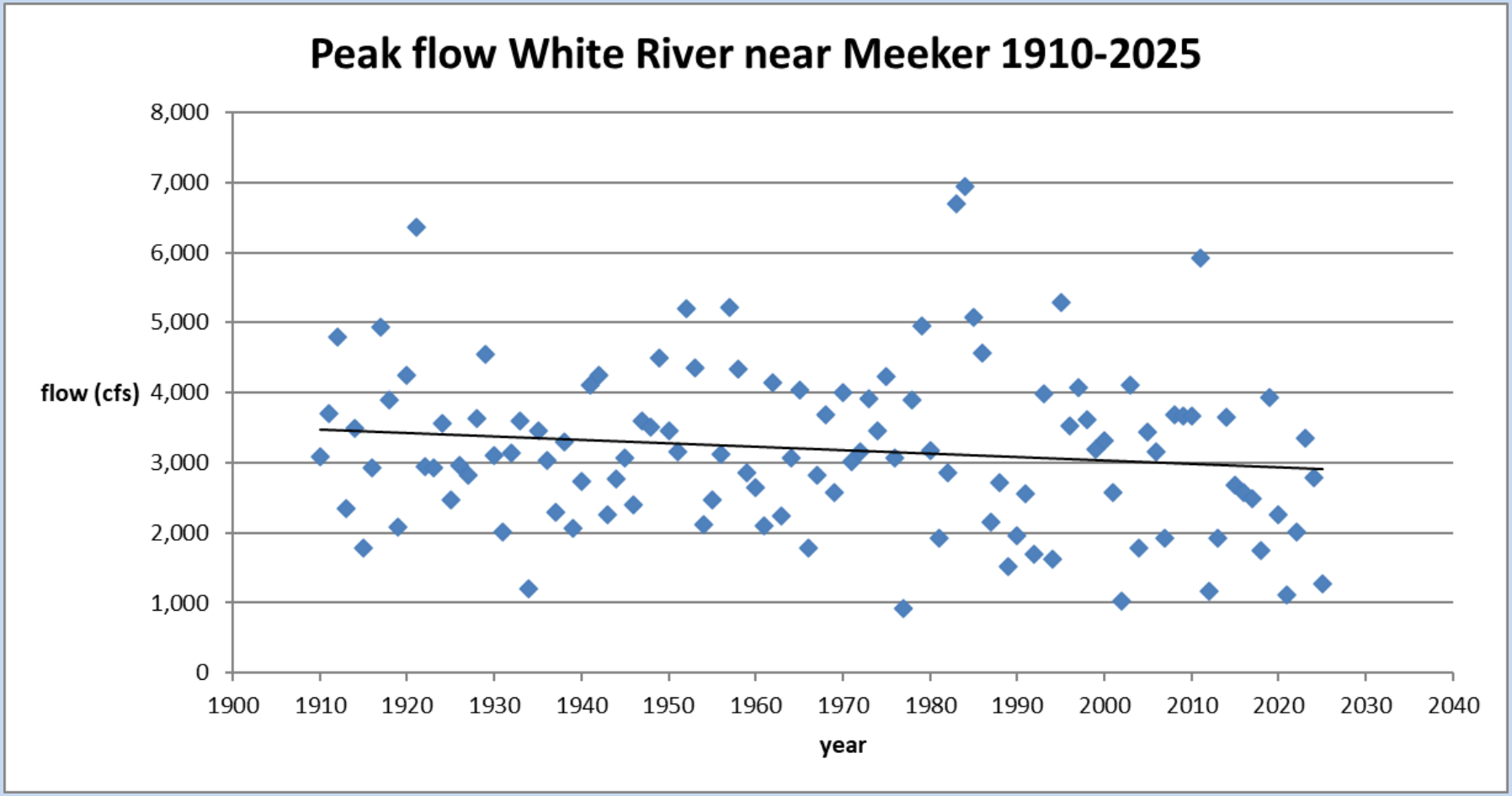


Total yearly runoff in the White River is decreasing, down by about 70,000 acre feet on average over the period of record. That represents about a 14% loss in water volume.

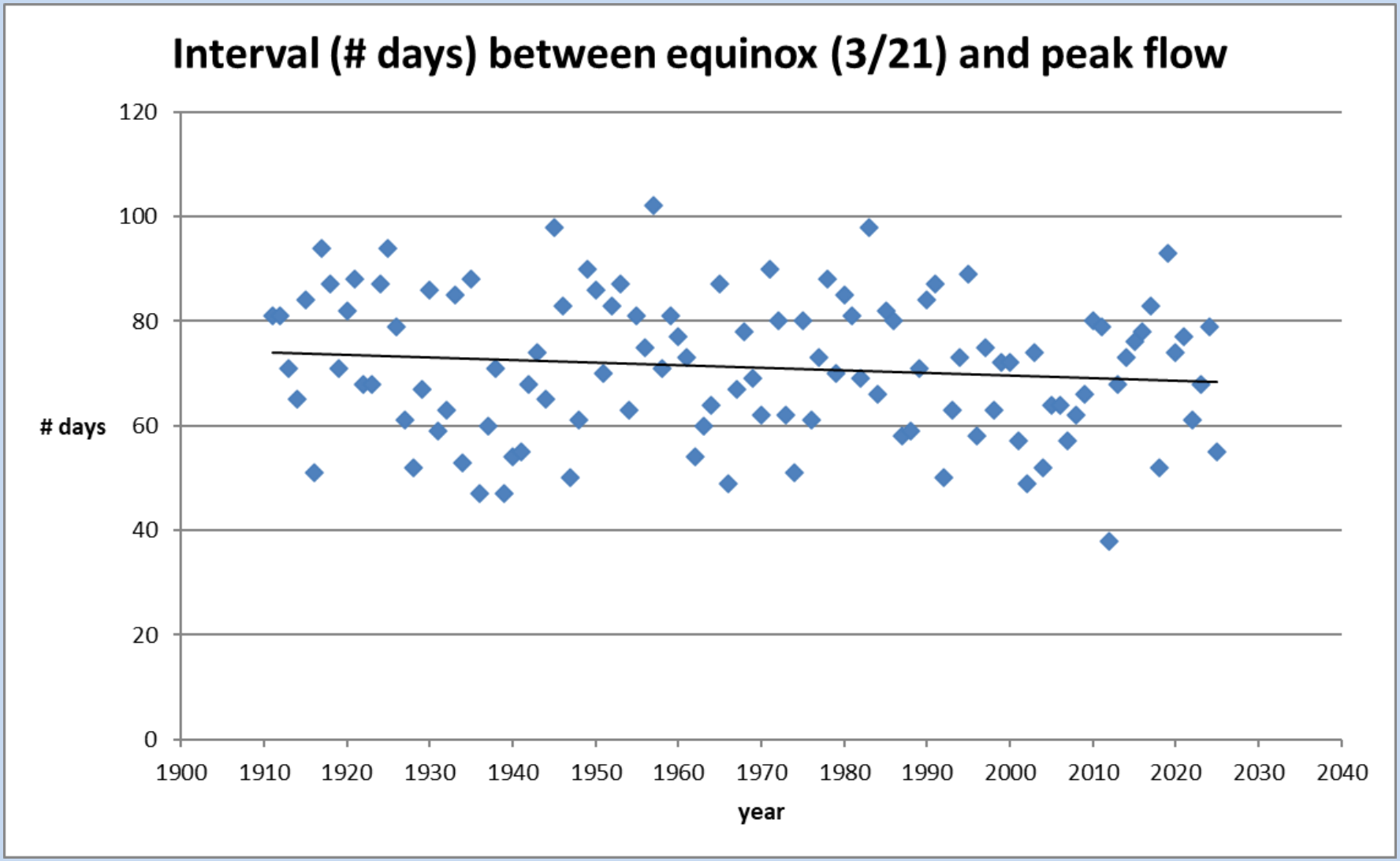


This and following flow data from USGS gauge station 09304500, Near Meeker

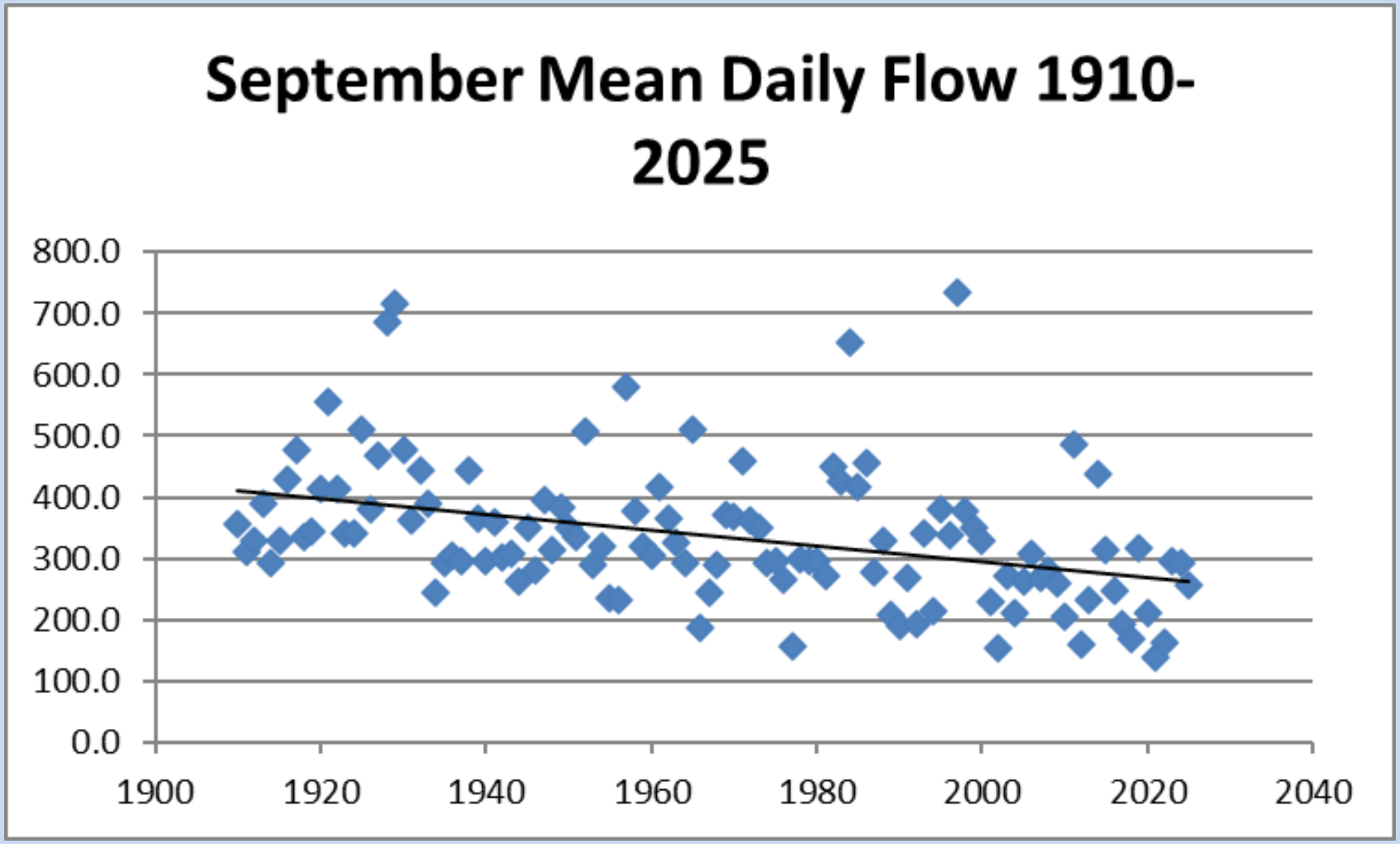
Peak flow is decreasing, now roughly 500 cfs lower on average than it was in 1910. Lower peak flow is less effective at scouring algae off the stream bed, so algae remains on the substrate from one year to the next. Decreased flow has other effects on the river ecosystem as well, including changes in sediment transport and fish habitat.



Spring runoff occurs earlier than in the past. Earlier runoff results in longer period of low flow in the summer and higher water temperatures. Both may increase algae bloom and fish stress.



Daily mean flow is decreasing in all months except April (reflecting shift of Spring runoff earlier into April). Decrease in September mean flow is particularly striking.



Bluff, UT 2025. Meeker, CO 2060?

What we can do

- Confronting climate change requires action at global scale.
- A key contribution in our region would be to stop methane leaks in the Uinta and Piceance Basins
- Individual efforts to decrease greenhouse gas emissions are important but nowhere near sufficient.
- Prepare for the worst.

Thank you!

References

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