

Snow Metrics and Water Management

An Analysis of the Colorado River Headwaters

Drew Fant, Colin Kinsman, & Rachael Stein

Purpose: Colorado exhibits significant year-to-year variability in hydrological conditions due to fluctuations in snowpack, precipitation, and temperature patterns influenced by complex climate systems, with one year having no statistical correlation with the next year's hydrological conditions.

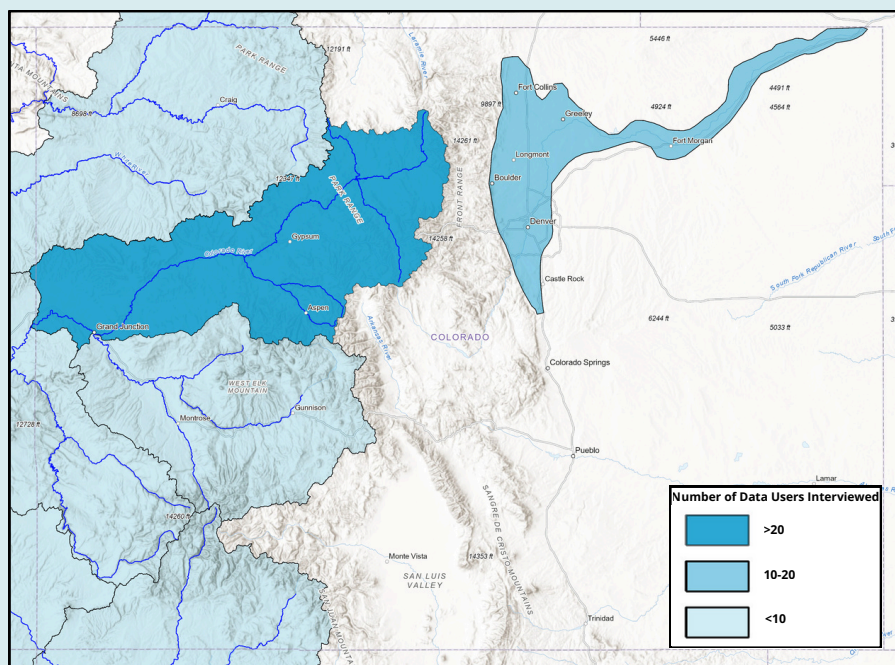
The snowpack in Colorado serves as a critical seasonal reservoir, storing water resources during the winter months and gradually releasing them during the spring and summer, thus impacting streamflow and water supply for municipalities, outdoor recreation, hydropower, and ecosystem services.

Our research examines how current hydrological data inform resource management strategies across the Basin Headwaters to identify gaps between available data and decision-maker needs, and assess the time frames within which they are working.

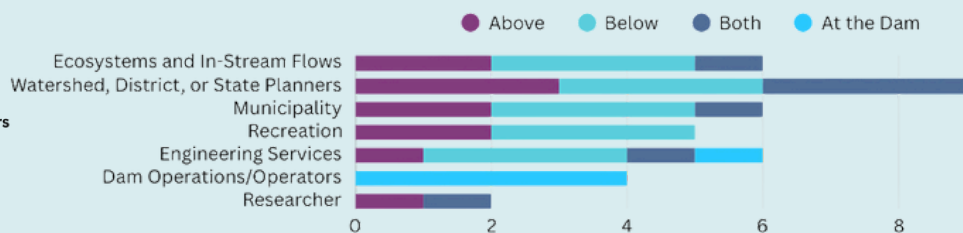
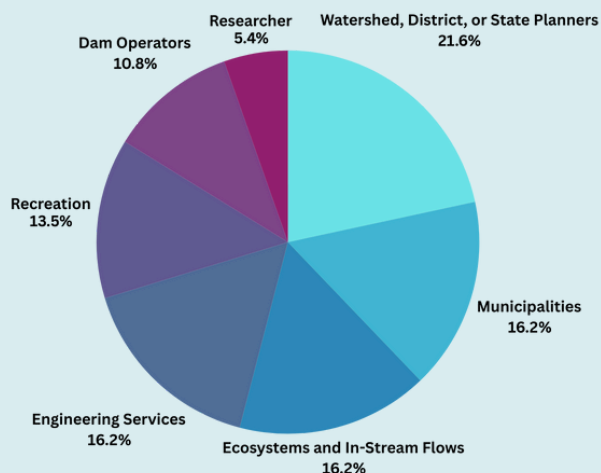
Methods: Participatory, mixed-methods approach, conducting 39 semi-structured interviews with municipal, county, conservation, education, and resource management professionals in the Colorado River Headwaters.

Data Users and providers recruited using combined outreach and referrals.

Qualitative analysis of interview data identified data sources, metrics, unmet needs, and cross-sector usability barriers to inform recommendations. Topic investigations specific to the Colorado River and field research to create a soil moisture dataset.



Stakeholder Representation:



We engaged stakeholders from several sectors including municipalities, water planners, recreation, researchers, and engineering to understand how data is applied to water management and decision making. This cross-sector perspective helped reveal how different roles interact with snow and water conditions on the ground.

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Key Findings:

#1: Geographic location plays a big role in data uses and needs

- Data sources depend on accessible water availability storage (reservoirs, snowpack, etc.)

#2: There is a reluctance to uptake long term planning metrics

- Urgent issues make it hard to focus on long term needs despite researchers thinking it is important

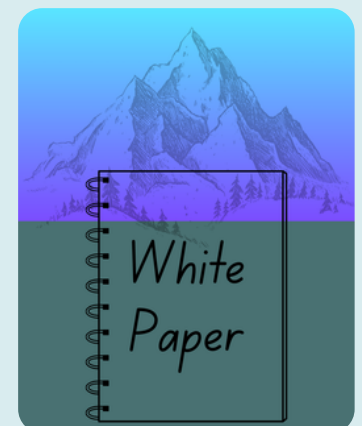
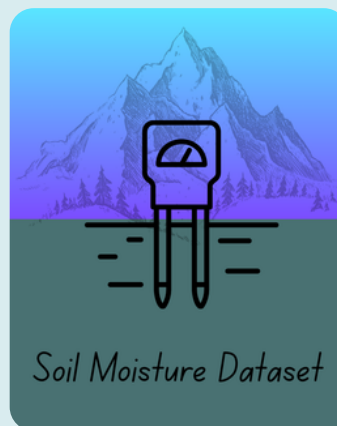
#3: There is a need for data translation for qualitative and quantitative information

- Data translation to specific use cases
- Conversations and opportunities for data users to work with researchers to apply and translate their findings to direct use cases

#4: Researchers and users gravitate towards a select few metrics

- SNOTEL- Snow Telemetry Site- In situ measurement used to measure Snow Water Equivalent (SWE), snow depth, precipitation, other weather observations
- Soil Moisture- Permanent probes or manual field measurements used to measure water content
- ASO- Airborne Snow Observatory- Airborne LiDAR and imaging used to measure SWE, snow depth, and other snow variables
- Instream Flow- Permanent streamgages or manual field measurements used to measure the volume of water moving in a stream or river over a given period of time

Deliverables: Our two deliverables collectively contribute to addressing the information gap between scientific understanding within the Colorado River Headwaters and the practitioner space. Establishing a more comprehensive understanding and better lines of communication will help achieve water security in a changing climate.



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