

National Aeronautics and
Space Administration



Cross-Basin Assessment

NASA Western Water Action Office

March 2025

Report Prepared by Metropolitan Group

NASA Western Water Action Office **Cross Basin Needs Assessment Findings**

Sharon Vasquez-Ray
Program Manager, NASA WWAO

June 24, 2026

WWAO's river basin needs assessments



WWAO works to understand western water practitioner **needs**, conducting assessments over major western river basins since 2016

- **Basins/Watersheds Studied**

- California
- Upper & Lower Colorado River Basin
- Columbia River Basin
- Rio Grande Basin
- Missouri River Basin
- Arkansas-White-Red River Basin
- Great Basin

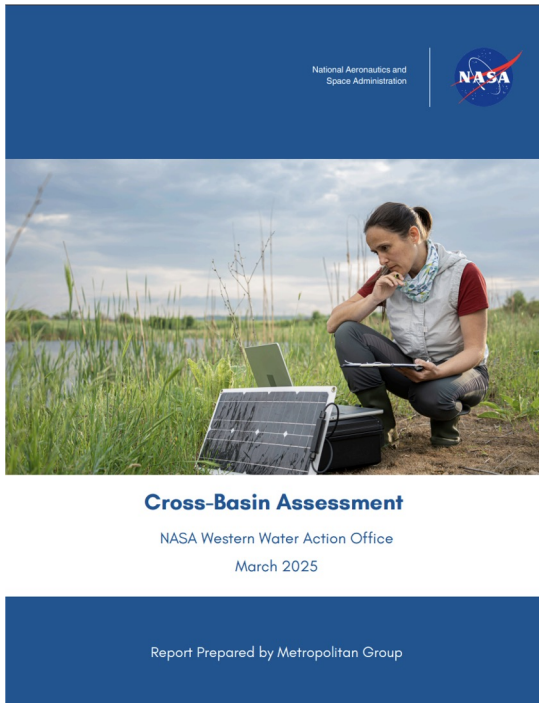


WWAO's Needs Assessment Workshops

- Bring together ~30 **diverse water end users/decision makers**— regional, state, federal, tribal, private sector
- End users collaborate with **NASA SMEs**, combining basin expertise with specialized scientific knowledge
- **identify** key water resource management needs and **capture** them as detailed **use cases** (template & training)
- Needs identified within 5 to 6 pre-determined **focus areas**
 - Focus areas based on basin characterization study and/or end user interviews (ex. Watershed Health, Hydroclimate Extremes, Infrastructure)
- Develop **15–20** use cases per workshop
- Use cases documented in a Needs Assessment Report (HQ/public)



Cross Basin Assessment Report



Project Timeline & Scope

- **March 2025 (Cross-Basin Assessment):** WWAO commissioned **Metropolitan Group (MG)** to deliver Cross-Basin Assessment Report.
- 6 Needs Assessment Reports included
- *Great Basin Assessment not included.* Upon completion of GB assessment, MG mapped GB workshop outcomes against CB report

Cross-Basin Assessment Objectives

- **Shared Themes:** Determine common challenge areas identified across basins
- **Dominant Regional Use Cases:** Determine if there are water management use cases that strongly align with a particular region
- **Strategic Insights:** Develop results that can inform NASA's strategic western water planning to create impact under NASA's Earth Science to Action (ES2A) framework

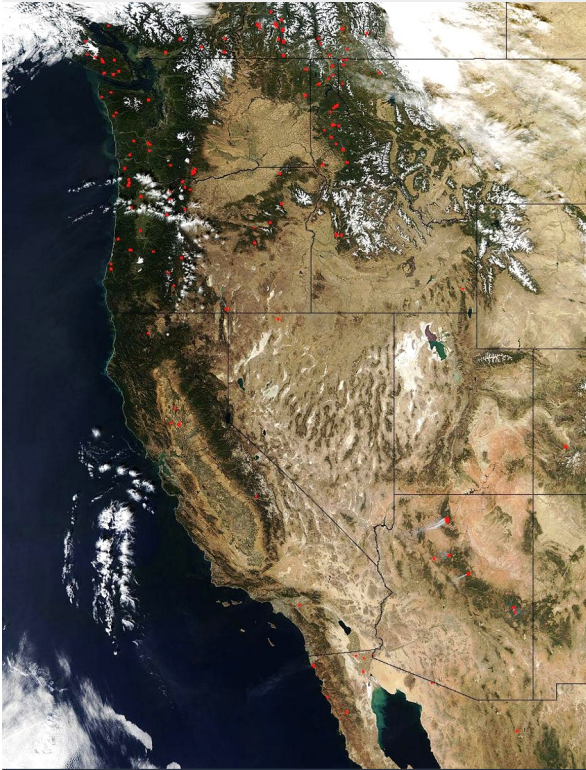


Caveats

- **Some Older Use Cases:** The Cross-Basin Assessment spans 10 years; some older use cases may no longer reflect current conditions.
- **Participant Bias:** Because findings rely heavily on workshop participants' perspectives, assessment outcomes are directly tied to who attended.
- **Private-Sector (PS) Under-representation:** PS companies were under-represented, possibly due to open information-sharing format.
- **Skewed Priorities:** Lack of commercial diversity potentially skewed needs assessments toward traditional water-management priorities.
- **Missed AI Trends:** While a companion WWAO study showed the private sector values emerging AI uses in industry/manufacturing, these needs were largely omitted from the assessments.



Western water needs broadly similar across basins



- **Geography was not the dominant factor**
 - Water challenges, and needs for Earth observations, were fairly consistent across the West
- **Similar challenges areas appeared repeatedly**
 - water availability
 - drought and extremes
 - runoff and streamflow forecasting
 - agriculture and irrigation
 - watershed health
 - groundwater
 - water quality
 - infrastructure

Implication:

Scaling solutions across basins may be more valuable than building one-off basin-specific tools.



No “killer” use case; Water quantity over quality

- **No obvious single cross-basin use case stood above others.** →

Needs fell into groupings:

- snow
- precipitation/drought/reservoirs
- runoff forecasting
- groundwater
- watershed health
- agriculture/ET

Implication:

Work with end users to determine what is actually scalable.

- **Water quantity needs dominated over water quality needs**

- Use cases focused more on how much water exists and where it moves than on composition/quality
- **Strongest measurement needs:** Volume, Flow rate
- **Moderate needs:** extent, elevation/depth, composition

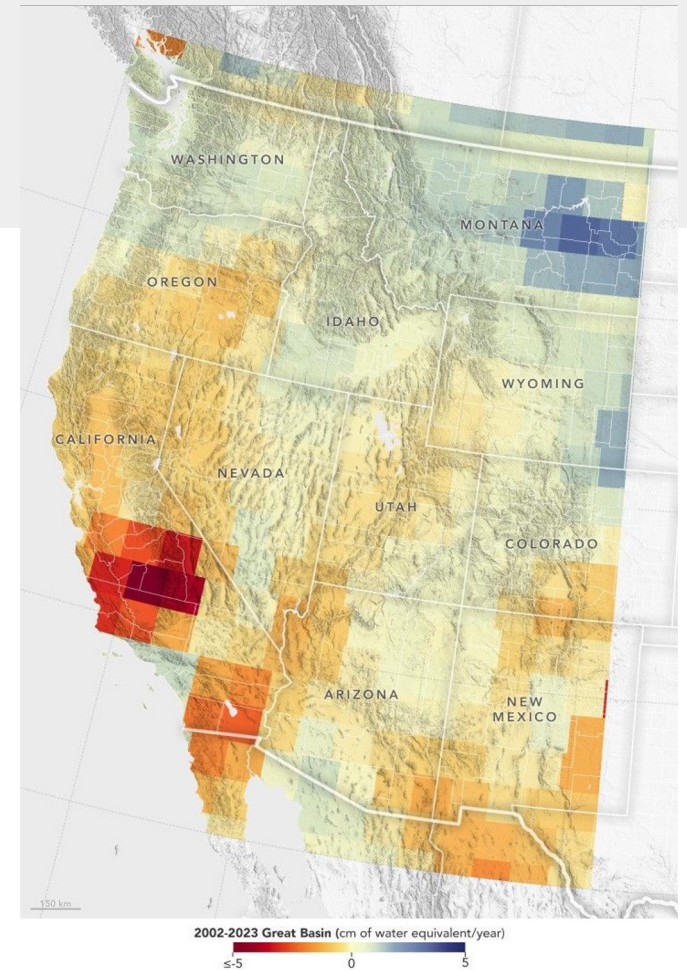


Groundwater Use Case Cluster*

- Groundwater **use and recharge remain poorly quantified**, with high uncertainty in estimates and limited understanding of withdrawals.
- **Monitoring networks** are sparse, fragmented, and insufficient for tracking groundwater conditions or supporting decisions.
- **Groundwater and surface water systems** are interconnected but often managed separately, limiting integrated water management.

**More information and detail in the CB Report for all use case clusters*

Groundwater decline in Great Basin (2002–2023) and surrounding regions.
<https://science.nasa.gov/earth/earth-observatory/groundwater-declines-in-the-us-southwest-152970/>



Watershed Health Use Case Cluster

- Water quality issues, infrastructure risks, and ecosystem impacts are often **detected too late** due to limited monitoring
- Land and water management decisions **lack timely tools to track changes** in runoff, erosion, habitat, and resilience
- **Data fragmentation** and **lack of integrated tools** limit watershed-scale planning and decision-making



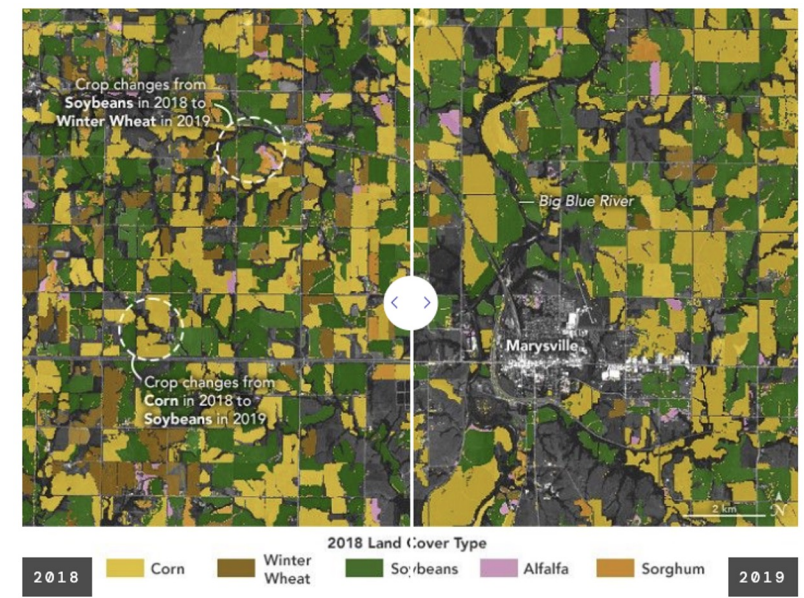
Snake River.
https://www.usgs.gov/media/images/snake-river-2?utm_source=chatgpt.com



Agriculture, Irrigation, & ET Use Case Cluster

- **Tracking & Mapping Gaps:** Many states lack standardized field-scale metrics for crop water use and no consistent, high-resolution maps of irrigated lands
- **Low Tool Adoption:** Farmers underutilize satellite tools due to trust/accessibility/usability barriers
- **ET Data Limitations*:** Much ET data comes with weeks of latency, is too coarse, and varies across models; Farmers need ET + soil moisture + crop type + weather forecasts, localized and synthesized

**More ET use cases in older needs assessments*

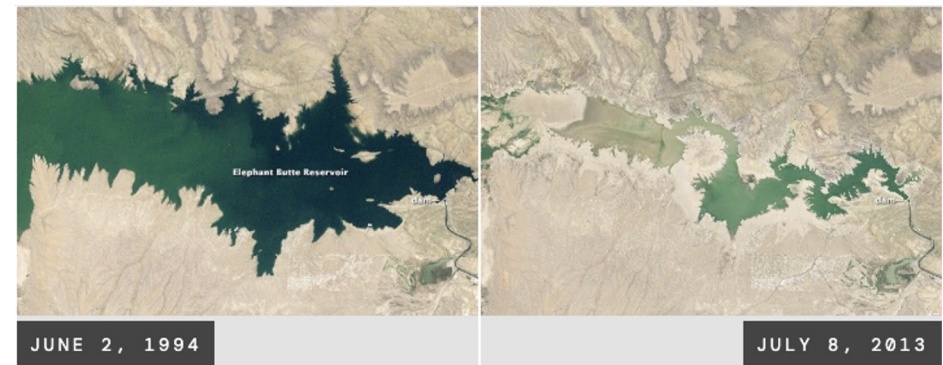


2018–2019 northeast Kansas farmland showing crop rotation impacts on yields using Landsat and USDA data.
<https://science.nasa.gov/earth/earth-observatory/how-to-rotate-crops-154601/>



Precipitation/Drought/Reservoirs Use Case Cluster

- **Imprecise Forecasting:** Inaccurate sub-seasonal and runoff forecasts lack the accuracy and resolution needed for timely decisions around drought, floods, and reservoir operations
- **Lagging & Coarse Data:** Drought, evaporation losses, and changing water conditions are often detected too late or with insufficient detail
- **Unmonitored Risks:** Erosion, sedimentation, and vegetation changes alter storage capacity and flood risks without adequate tracking



Elephant Butte Reservoir, New Mexico
<https://science.nasa.gov/earth/earth-observatory/on-this-day-in-2013-elephant-butte-reservoir-151549/>



Runoff/Streamflow/Water Availability Use Case Cluster

- **High Forecast Uncertainty:** Outdated models and sparse networks fail to capture critical snowpack, soil moisture, and changing climate dynamics.
- **Disconnected Modeling:** ET metrics lack legal defensibility, and models fail to integrate real-time surface and groundwater interactions.
- **Siloed Data Delivery:** Water models and datasets are fragmented and complex, and need to be better integrated into decision-ready tools.
- **Monitoring Challenges:** Snowpack, soil moisture, ET, and evaporation are under-monitored despite being critical for water supply forecasting.



Great Basin: Unique Use Cases

- December 2025: WWAO completes **final needs assessment: The Great Basin**, 17 use cases developed
- Finds areas of convergence with other needs assessments, while uncovering unique needs and opportunities. **Unique findings include:**
 - Shrinking terminal lakes create **toxic dust storms**, shifting the focus of water management from consumption to public health and air quality.
 - Wet winters **fuel the growth of invasive grasses**, reversing standard models by using precipitation—rather than drought—to predict fire risk.
 - Water management requires **discovering and mapping hidden, uncharted springs** using high-resolution imagery, rather than just monitoring known aquifers.



Great Salt Lake
https://commons.wikimedia.org/wiki/File:Great_Salt_Lake_Utah_USA_-_50603.jpg



Additional Notes

NASA Water-Related Data Portal

- Developed as a use case during the Missouri Needs Assessment, describes the need for a **broadly applicable, comprehensive, user-friendly portal** for accessing water data (*L4 products?*)
- While only being built out as a use case in one assessment report, the desire was **echoed by practitioners** in several of the workshops

Higher Resolution Data

- Calls for higher-resolution data, both spatially and temporally, were present in many use cases.



WWAO Needs Assessment Reports – 130 use cases



Great Basin Report
March 2026



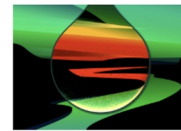
Cross Basin Assessment
March 2025



Western Snow
Conference: Snow
Community Needs
July 2025



Arkansas White
Red River Basin
Report December
2024



Western Water
Rapid Needs
Assessment
December 2016



Missouri River
Basin July 2023



Rio Grande River
Basin July 2022



Columbia River
Basin February
2020



Colorado River
Basin September
2018

wwao.jpl.nasa.gov/resources/reports-publications/#water-resource-management-needs-assessments

Announcement will be sent to WWAO mailing list when Cross Basin Report contains additional material!

