

Building a FAIR Collaboratory for Equity in Water Allocation

California Water and Environmental Modeling
Forum
2026 Annual Meeting



Nancy Thomas and Jill Fantauzza

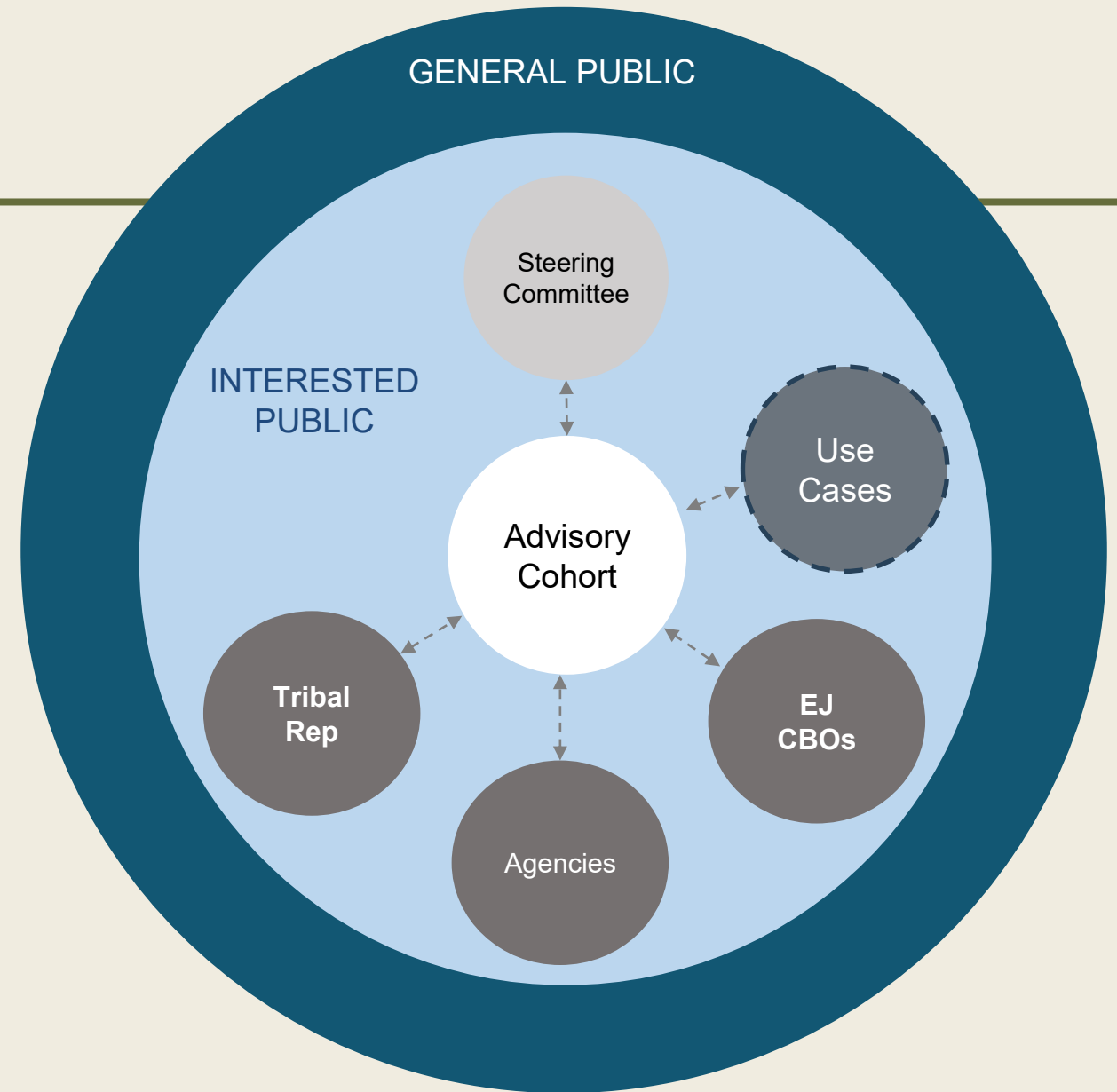
UC Berkeley's Geospatial Innovation Facility

COEQWAL (Collaboratory for Equity in Water Allocations)

Our Vision: Create a more inclusive, equitable approach to water planning and stewardship for ALL Californian's, including those that have been historically marginalized

Engagement Structure

- **Steering Committee:** 12–15 Tribal, agency, NGOs, and water district reps
- **Advisory Cohort:** 40–50 community voices of diverse water interest (esp. Tribal, EJ CBOs)
- **Use case groups** include additional partners focused on topical issues
- **Public Engagement:** Open workshops and outreach materials



What do communities want to see in COEQWAL?

- **Website design** that represents our communities and reflects their values
- **Background information** in an easy-to-use format that introduces key water literacy concepts
- **Data visualizations** that enhance understanding of relationships and tradeoffs between different scenarios
- **Level the playing field** so all Californian's can use the same CalSim3 model and output data to share with communities and advocate to water boards

What do communities want to see in COEQWAL?

- **Website design** that represents our communities and reflects their values
- **Background information** in an easy-to-use format that introduces key water literacy concepts (**Learn**)
- **Data visualizations** that enhance understanding of relationships and tradeoffs between different scenarios (**Explore**)
- **Level the playing field** so all Californian's can use the same CalSim3 model and output data to share with communities and advocate to water boards (**Share**)

Many Pathways to Data Exploration

[COEQWAL Website Demo](#)

What is the future of **California's water?**

Water connects all Californians and is vital to our communities, farms, and the environment. Delivering water to meet all needs is not easy, especially as our climate changes.



What water issues matter to you?

Water is important to all of us – from farmers in the Central Valley to communities in the Delta, from salmon in the Sacramento River to urban water users in Los Angeles. We can consider how decisions affect the issues people care about.

Community water systems

Whether people and communities can reliably access safe drinking water for daily life, health, and essential services

Farms and groundwater

Whether agricultural water deliveries can sustain food protection, while preventing over-draft of groundwater basins

Rivers, salmon and the Delta ecosystem

Whether rivers, salmon, and the Delta estuary receive the flows they need to remain functional and resilient

The Delta as a living place

Whether the Delta is a place where communities, farms, and ecosystems coexist and thrive.

Operations and impacts

How water management decisions affect trade-offs, equity and resilience.

Coming soon



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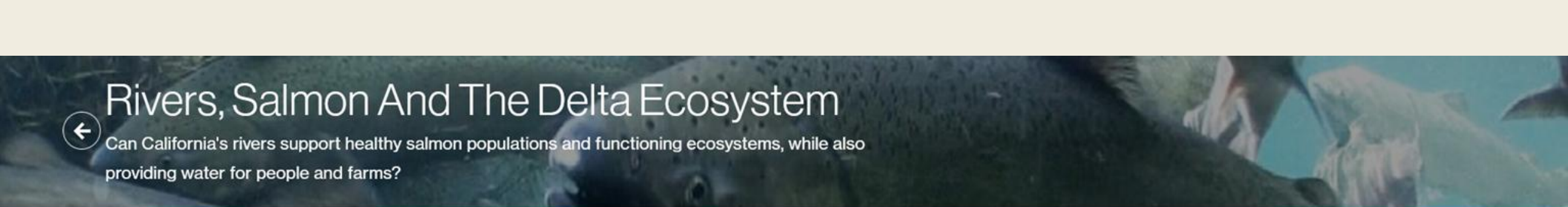
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Coming soon





Rivers, Salmon And The Delta Ecosystem



Can California's rivers support healthy salmon populations and functioning ecosystems, while also providing water for people and farms?

[Intro](#)[Importance](#)[Focus](#)[Keep in mind](#)[Management strategies](#)[Model results](#)[Explore further](#)

Intro

Rivers are essential sources of water, but they are more than channels that move water from mountains to farms and cities. They are also living systems supporting a great diversity of species. Salmon depend on cold water in rivers for spawning and rearing, and to migrate to and from the ocean. Wetlands, birds, other fish, and other wildlife depend on rivers too.

Why This Matters

California's rivers begin in the mountains and flow through valleys to the Delta and ocean. Along the way, they sustain ecosystems and provide water for farms and communities. River systems are deeply interconnected. Decisions about storage, environmental flows, and water deliveries create trade-offs, where changes in one part of the system can ripple elsewhere.

Salmon are central to this story. They travel hundreds of miles between rivers and the ocean and are part of Tribal traditions, fishing economies, our food supply, and California's natural heritage. When salmon struggle, it signals stress in the broader river system.

← Rivers, Salmon And The Delta Ecosystem

Intro

Importance

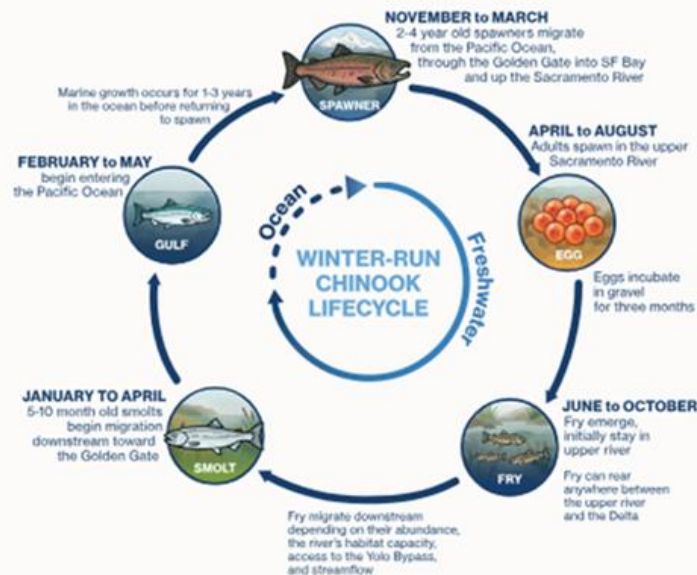
Focus

Keep in mind

Management strategies

Model results

Explore further



WINTER-RUN CHINOOK Sacramento River Evolutionary Significant Unit
Endangered Species at high risk of extinction

What The Models Show

Trade-offs – Water stored in reservoirs supports cities and farms, but can reduce natural winter and spring flows that benefit ecosystems. Releasing water to support salmon can limit storage needed later for temperature control or supply. For example, prioritizing cold-water storage in Shasta Reservoir can improve egg survival, but reduce flows for juvenile outmigration. Increasing flows can benefit juveniles, but deplete cold-water pools and increase egg mortality. Decisions about when and how much water to release shift outcomes across life stages, regions, and sectors.

Equity – River conditions affect communities differently. Tribal nations, fishing communities, farmers, and downstream towns may experience changes in distinct ways. Salmon declines can impact cultural practices, subsistence, and local economies. Water rights and location also shape who experiences shortages or protections first. For example, decisions that benefit one salmon life stage may help some communities while increasing risks for others who depend on salmon at different times.

Resilience – Resilience means rivers can withstand droughts, floods, and warming while maintaining ecosystem health. Protecting cold-water storage, maintaining habitat connectivity, and managing flows across seasons all support this. Because salmon depend on multiple life stages, actions that help one stage but harm another can still lead to decline. River systems respond to average conditions, extreme events, and cumulative stress over time.

Want to know more?

Water is limited and every choice has trade-offs. COEQWAL allows you to explore different water scenarios and understand how decisions shape potential futures for communities, farms, rivers, and the Delta.

Learn how water in California's Central Valley is managed

Explore how water outcomes shift under different scenarios

Share your insights about California's water future

Learn

Did you know that California has one of the most complex water systems in the world?

Learn how water flows through California's Central Valley and the tools we use for water planning and decision-making

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Explore

LEARN MORE ABOUT

How water moves through California



How climate change affects California water



How water is managed in California



How equity shapes California water



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- California's Water
- Natural Water Flow
- Humans
- Water Transformation
- What Has Happened?

How Water Flows Through California

Why California's Water Is Unique

All living things need water to survive.

However, in California, most of our water falls far from where most people live, work, and farm.

To address this mismatch, we have transformed the way water moves across our state.



The Snowpack Advantage: Nature's Water Storage

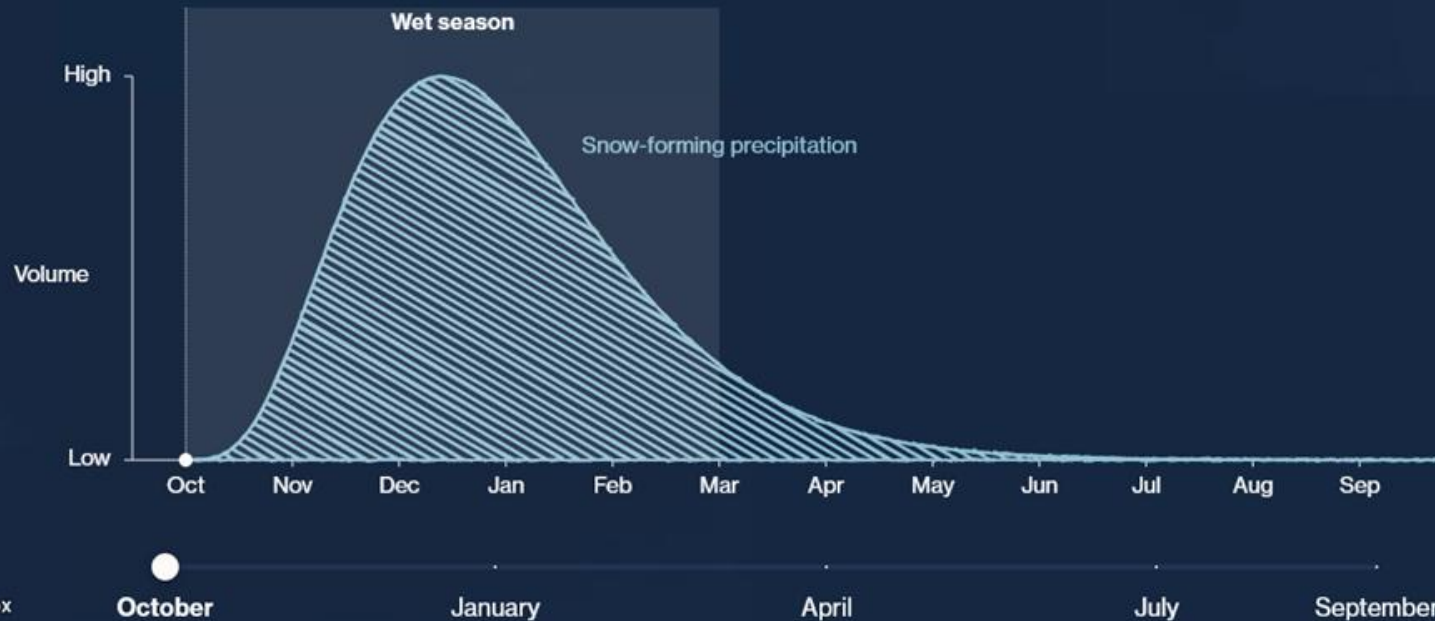


At high elevations in California's mountains, abundant snow isn't just fun or pretty.
It is a frozen water tower, storing water in the mountains.

As snow melts in late spring, it feeds rivers and keeps many flowing through our dry summer.
Slide to see the snowpack change over time!

From Snow to Snowmelt — an Illustration

GIS data source: Snowpack spatial accumulation from [NOAA](#).



- California's Water
- Natural Water Flow
- Humans
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Sierra Nevada Mountains

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What if we managed water differently?

Explore how water allocations change under different scenarios through three lenses — trade-offs, equity, and resilience — and discover new possibilities for California's water future.

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What is the COEQWAL scenario library and how should I use it?

THE MODEL

COEQWAL uses the **CalSim3** water planning model to evaluate how different **scenarios** affect outcomes for communities, farms, and the environment.

Each scenario pairs a **water management strategy** (the operating rules, policies, and infrastructure decisions that determine how water is allocated) with a **hydroclimate** (the temperature and precipitation patterns that determine how much water is available).

THE LIBRARY

COEQWAL has compiled a library of over 100 scenarios.

Each scenario is associated with dozens of outcome variables that describe how water is allocated to different locations and users.

Visualization tools can be used to compare scenarios, examine outcomes, and interpret results across different perspectives.

A summary of all scenarios can be accessed [here](#).

WHAT YOU'LL LEARN

By exploring the scenario library, you will gain understanding of how:

- 💧 **Management strategies affect trade-offs and synergies among outcomes**
- 💧 **Benefits and impacts are distributed among water users and locations**



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Select scenarios using key outcomes:

List

⦿ Radar chart

⦿ Distribution comparison

⦿ Resilience heatmap

Scenario library

How to read this chart?

Show map

📍 Choose locations to track

View by climate

Historical hydroclimate

Search scenarios

🔗 definitions

⦿ baselines

⦿ key operations

⦿ selected only

🔗 group by theme

search scenarios		Community deliveries	Agricultural revenue	Environmental flows	Reservoir storage	Groundwater storage	Delta estuary ecology	Freshwater for Delta exports	Freshwater for in-Delta uses	Winter-run salmon
definitions ☐ baselines ☐ key operations ☐ selected only ☒ group by theme										
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☐ S0020 Current operations Existing operational rules for Central Valley water allocations, as specified by DWR in 2023. Strategy also represents recent (2020) land use and allows for TUCPs. 1 ... more										
☐ FARMS AND GROUNDWATER										
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Scenario library

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selected only

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☐ S0020

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☐ FARMS AND GROUNDWATER

☐ S0025

Groundwater pumping limits in the San Joaquin Valley

Groundwater pumping limits applied to farms in the San Joaquin Valley region, reflecting compliance with SGMA requirements. [... more](#)

☐ S0026

Groundwater pumping limits and reduced crop acreage in the San Joaquin Valley

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☐ S0027

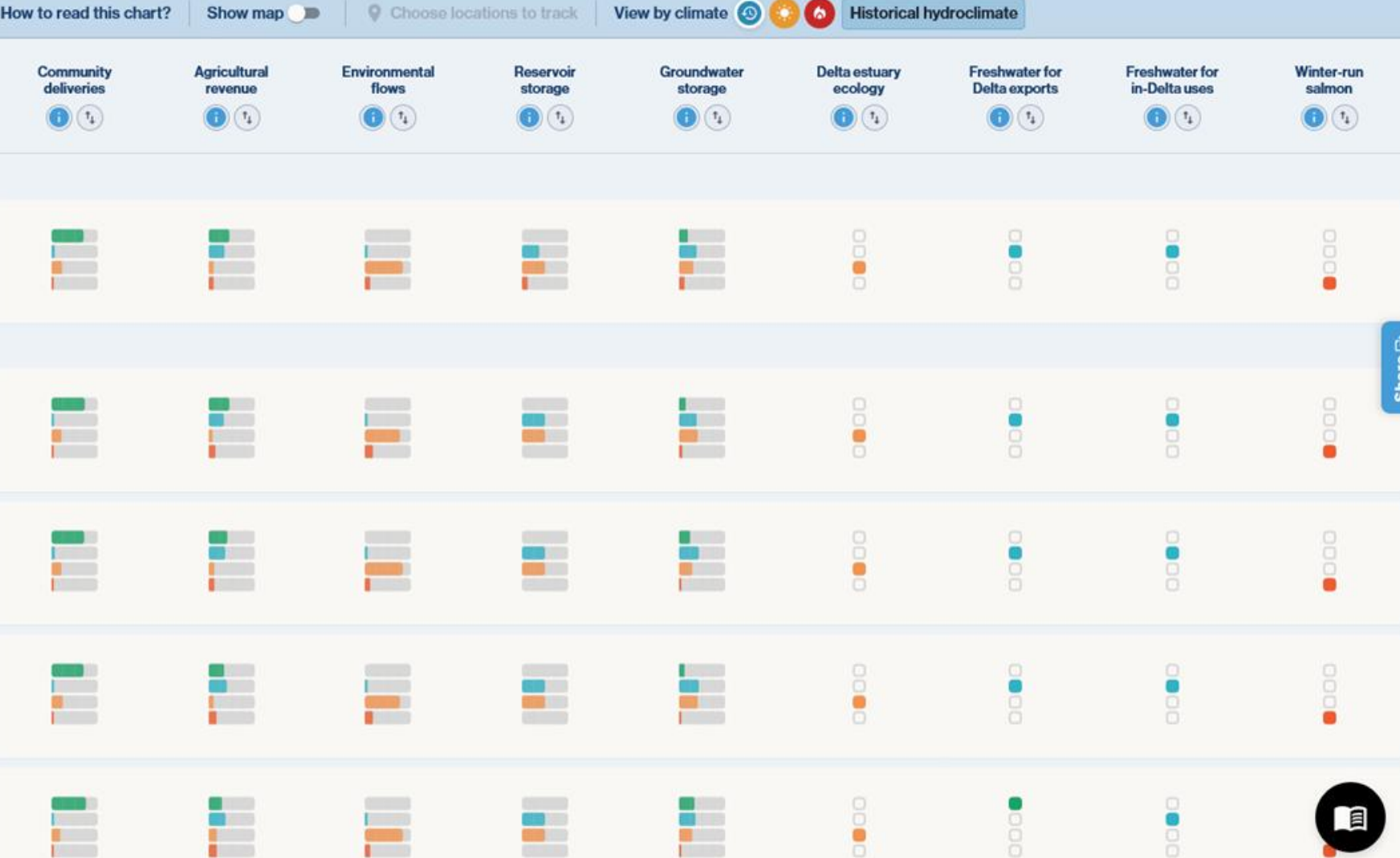
Groundwater pumping limits in the Central Valley

Groundwater pumping limits applied throughout the Sacramento and San Joaquin Valley, reflecting compliance with SGMA requirements. [... more](#)

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Reservoir storage

Tier reflects the degree to which a reservoir fills each spring in advance of the summer delivery season (Apr-Oct) during which reservoirs provide water to irrigators and communities. Tiers are designated for select key reservoirs based on how frequently those reservoirs have April 30 (end of month) storage above or below certain thresholds. These thresholds are different for each reservoir and are set here based on percentiles of recent historical data, but may be adjusted in the future. The scheme described here yields tier designations that will be "1" if storage conditions are more consistently higher than recent historical conditions; "2" if they are roughly equivalent to recent conditions; "3" if they are moderately lower than recent conditions; and "4" if they are consistently and substantially lower than recent conditions

Outcome levels:

- Reservoir storage is greater than or equal to the **top threshold** for each reservoir for at least **90% of years** (as represented by April values). As of July 2025, this threshold is set at the 50th percentile of recent historical data as available through CDEC.
- Reservoir storage is greater than or equal to the **middle threshold** for each reservoir for at least **67% of years** (as represented by April values). As of July 2025, this threshold is set at the 33rd percentile of recent historical data as available through CDEC.
- Reservoir storage is greater than or equal to the **middle threshold** for each reservoir for at least **30% of years** (as represented by April values). As of July 2025, this threshold is set at the 33rd percentile of recent historical data as available through CDEC.
- Reservoir storage is **not high enough to meet the conditions of Tiers 1-3**. Reservoir storage is below the middle threshold (at or below the lower threshold) for more than **70% of years** (as represented by April values). As of July 2025, the lower threshold is set as the 20th percentile of recent historical values.

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[Scenarios to track](#) [View by climate](#) [Historical hydroclimate](#)

Reservoir storage	Groundwater storage	Delta estuary ecology	Freshwater for Delta exports	Freshwater for in-Delta uses	Winter-run salmon
i t	i t	i t	i t	i t	i t

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Community deliveries Agricultural revenue Environmental flows Reservoir storage Groundwater storage Delta estuary ecology Freshwater for Delta exports Freshwater for in-Delta uses Winter-run salmon

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☒ RIVERS, SALMON AND THE DELTA ECOSYSTEM

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☒ S0032 Functional environmental flows with groundwater regulations Functional flow requirements implemented on tributaries to the Sacramento and San Joaquin River, combined with groundwater pumping limits and reduced irrigated... ... more									
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Salmon-friendly flows with groundwater regulations
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View by climate



Historical hydroclimate

Chart controls

☐ choose outcome axes

☐ show all scenarios

☐ dots only

☐ highlight current operations

☐ show range

📷 capture view

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How to read this chart?

Show map ☐

📍 Choose locations to track

View by climate



Historical hydroclimate

Chart controls

☒ choose outcome axes☐ show all scenarios☐ dots only☐ highlight current operations☐ show range

capture view

Choose outcome axes

☒ All key outcomes☐ All regional outcomes☒ Community deliveries☐ North of Delta☐ South of Delta☒ Agricultural revenue☐ North of Delta☐ South of Delta☒ Environmental flows☐ North of Delta☐ South of Delta☒ Reservoir storage☐ North of Delta☐ South of Delta☒ Groundwater storage☐ North of Delta☐ South of Delta☒ Delta estuary ecology☒ Freshwater for Delta exports☒ Freshwater for in-Delta uses☒ Winter-run salmon

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Functional environmental flows

Current operations with functional flow requirements implemented on tributaries... more

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Current operations

Existing operational rules for Central Valley water allocations, as specified by DWR in 2023. Strategy also represents recent (2020) land use and allows for TUCPs. This strategy serves as the baseline for comparison with other scenarios.

Historical hydroclimate

Temperature, precipitation, and streamflow patterns reflect historical conditions

Radar chart · Baseline highlighted



No flow requirements

Current operations without minimum flow requirements on Central Valley rivers.

Historical hydroclimate

Temperature, precipitation, and streamflow patterns reflect historical conditions

Radar chart · Baseline highlighted



Salmon-friendly flows

Sacramento River flow requirements and Shasta cold-water storage protection to support Sacramento River



How to read this chart? **Show map** Choose locations to track **View by climate** Historical hydroclimate

Chart controls choose outcome axes show all scenarios dots only **highlight current operations** show range capture view



Scenario library

Search scenarios

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Sacramento River flow requirements and Shasta cold-water storage protection to support... more

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Functional environmental flows
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What scenarios align with your interests?

Select scenario data and share what you've learned to shape our water future.

Current operations

Existing operational rules for Central Valley water allocations, as specified by DWR in 2023. Strategy also represents recent (2020) land use and allows for TUCPs. This strategy serves as the baseline for comparison with other scenarios.

- **Historical hydroclimate**
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Radar chart - Baseline highlighted



No flow requirements

Current operations without minimum flow requirements on Central Valley rivers.

- **Historical hydroclimate**
Temperature, precipitation, and streamflow patterns reflect historical conditions

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Tell your water story



Click cards in the tray on the left to add them to your story



Current operations

Existing operational rules for Central Valley water allocations, as specified by DWR in 2023. Strategy also represents recent (2020) land use and allows for TUCPs. This strategy serves as the baseline for comparison with other scenarios.

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No flow requirements

Current operations without minimum flow requirements on Central Valley rivers.

Historical hydroclimate

Temperature, precipitation, and streamflow patterns reflect historical conditions

Radar chart · Baseline highlighted



Salmon-friendly flows

Sacramento River flow requirements and Shasta cold-water storage protection to support Sacramento River winter run Chinook salmon life cycle needs.

Historical hydroclimate

Tell your water story

2 cards in your story. Drag to rearrange.

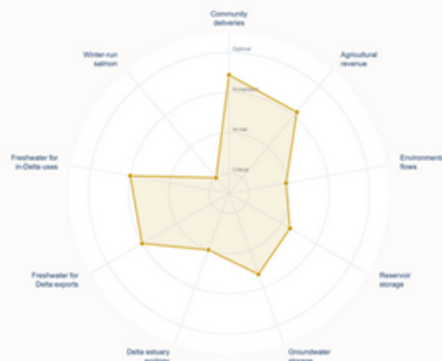
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What Does Success Look Like?

Community members can access and interpret this data and **effectively use it to advocate** for their own water interests.



Ecocultural mapping exercise, California GIS Tribal Summit, July 2025 (Photo credit: Kike Arnal)

How to make CalSim data “accessible”?

Level	Type of Access	Core Requirement
Technical	Physical Availability	Servers are up; API is responding; file is downloadable.
Syntactic	Structural Access	The format is readable (e.g., JSON vs. a proprietary binary format).
Semantic	Meaningful Access	The user understands what "S_FOLSM" represents via metadata documentation.
Cognitive	Pragmatic Access	The user has the domain knowledge and literacy to derive an insight.

Source: AI (Google Gemini)

github.com/berkeley-
gif/coeqwal-website

Sharable code
development for cross-
project collaboration
and transparency

The screenshot shows the GitHub repository page for 'berkeley-gif / COEQWAL-pydsstools'. The repository is public and has 1 branch and 0 tags. The 'Code' button is highlighted. Below the repository name, there is a table of files and folders:

File/Folder	Description	Last Commit
pydsstools-docker	updated packages	10 months ago
.gitignore	include data folder in gitignore	last year
README.md	updated packages	10 months ago

Below the table, the 'README' file is expanded, showing the following content:

DSS to CSV Tools

This repository contains Python scripts to convert CalSim3 output DSS files into CSV format and validate the conversion. It depends on the [pydsstools library](#).

Requirements

- Compatibility:** The `pydsstools` library is compatible with 64-bit Python on Windows 10 and Ubuntu-like Linux distributions. For Linux, ensure that `zlib`, `math`, `quadmath`, and `gfortran` libraries are installed. Using the Docker container in this repo will ensure this.
- Dependencies:** This library depends on `heclib.a`, which must be installed correctly, which is why we are using Docker.

Docker Setup

Included in the repository is a `Dockerfile` that runs a Linux container and installs the necessary libraries, fulfilling the

← Data & downloads

Full scenario run files

Access complete CalSim3 model run files in zipped format, including input and output data in WRESL and DSS formats.

Choose a scenario ▾

Model documentation

Comprehensive documentation for the COEQWAL CalSim3 model, including technical specifications, user guides, and methodology.

Coming soon

API access

REST API endpoints for programmatic access to scenario data, model outputs, and COEQWAL resources.

Coming soon

Scenario data in csv format

Download CalSim3 scenario input and output data in csv format, including SV input and variable output files.

Choose a scenario ▾

Research publications

Peer-reviewed publications and research papers related to the COEQWAL project and CalSim3 modeling efforts.

Coming soon



Follow our project!
<https://coeqwal.berkeley.edu>
u

Thank you!!!

Email: coeqwal@berkeley.edu