WATER SUPPLY AND DEMAND MODELING IN THE NAVARRO RIVER WATERSHED

INFORMATIONAL FACT SHEET

The State Water Board is developing tools to better understand water supply and demand in select watersheds across California. The project involves three pilot watersheds, including the Navarro River watershed, with plans to expand the modeling effort to include additional watersheds of interest.

Background

The State Water Board is responsible for allocating surface water through California's water rights priority system. Watershed-specific supply information from year to year is generally lacking, making water management planning difficult, especially in times of water shortage. Recent droughts (2013-2016, 2021-2023) highlighted the need for specialized data and tools to assess water availability and demand and evaluate how limited water resources are allocated.

Figure 1. The Navarro River Watershed Subbasins and Flowlines

In 2021, in response to the drought emergency in Sonoma and Mendocino Counties, the State Water Board developed tools and information to better understand water supply and demand in the Russian River watershed. Staff developed a water supply model and evaluated water diversion data to estimate watershed demand. Staff also used a tool to allocate water to right holders based on the modeled available surface water supply, water demand data and water right priorities. The supply and demand data, when integrated into the water allocation tool, was a key component in the State Water Board's implementation of drought emergency actions in the watershed.

The State Water Board established the Supply and Demand Assessment Unit in 2022 to develop supply models and demand assessments for new watersheds using an approach similar to the one used for the Russian River during the most recent drought. This effort will enable the board to prepare

for future dry conditions in other watersheds and provide data to help local water managers better understand supply constraints, develop local responses and plan for droughts. The work could also inform future curtailments, if needed.

Water Supply and Demand Modeling

Evaluating water supply and demand in a watershed enables improved comparison of the available water in the system and the demands associated with different water uses. State Water Board staff are working with Paradigm Environmental, Inc. to develop water supply (hydrologic) models that assess surface water availability in select watersheds where low flows and drought conditions may threaten water supplies, impair critical habitat, and create uncertainty for water users. Water supply modeling tasks are underway in Butte Creek (tributary to the Sacramento River), the Napa and Navarro Rivers, and six additional watersheds. These watersheds were selected because: 1) water demand is highly dependent on surface water and any future curtailment in the watersheds by the State Water Board can benefit from such a modeling framework; and 2) they contain areas of salmonoid habitat and important fisheries. These watersheds provide a range of watershed characteristics and conditions that will likely be encountered in future work and establish outreach and engagement protocols.

Modeling watershed-specific scenarios can improve understanding of water availability based on available surface water, water demands, and water right priority. All data and tools developed under this effort will be open source and available to the public so local water managers and other interested parties can assess surface water availability conditions and evaluate potential management options.

Navarro River Watershed

Watershed Background

The Navarro River watershed is located in southern Mendocino County within Pomo Tribal territory and has a drainage area of 315 square miles. Elevations range from under 300 feet near the riverbed to over 3,000 feet at the southern and eastern peaks. Originating from the confluence of Rancheria and Anderson Creeks near Philo, the river is quickly joined by Indian Creek and flows northwest through Anderson Valley, converging with the North Fork Navarro River before ultimately flowing into the Pacific Ocean. The Navarro River watershed has a Mediterranean climate with a mean annual precipitation of 47 inches. Since the mid-1800s, timber production, livestock grazing, and agricultural uses have been the predominant land uses, while still allowing the watershed to retain native vegetation on approximately 97% of the land.

The watershed is a crucial habitat for salmonids, especially coho salmon and steelhead trout, which have experienced substantial population declines and are listed as threatened under the federal Endangered Species Act. This reduction has been attributed to reduction of streamflow, particularly

during late spring and summer, that could have resulted in increase in stream temperature and decrease in stream dissolved oxygen which are crucial for aquatic habitats such as salmonids. Increase in sediment load of Navarro River might also have had a crucial impact on the salmonid's population decline. As a result, in 2000, the U.S. EPA and the North Coast Regional Water Quality Control Board implemented Total Maximum Daily Loads (TMDLs) for temperature and sediment for the Navarro River and its tributaries.

Model and Data Specifications

The model uses a large library of publicly available data from state and federal agencies, including the following types:

- Meteorological: Historical weather data such as precipitation, evapotranspiration (the amount of water evaporated or used by plants), air temperature, vapor pressure, and wind speed allow for modeling conditions that affect water supply.
- Hydrological: Current and historical data on the river's streamflow rate is used for calibration and validation of the model.
- Water use and diversion: Data showing how much water has been taken out of the river in the past serves as a proxy for watershed demand and how it affects streamflow.
- Geospatial: Data that describe where the boundaries and channels of the watershed are, as well as its physical properties, such as soil type, land cover type, and topography. These datasets are important for understanding characteristics that influence how water moves through and is absorbed by the landscape.

All datasets used in the model are subject to extensive quality control and quality assurance procedures that ensure their accuracy. This is particularly important when it comes to incorporating required water use and diversion data that is self-reported by water right holders. The cleaned data is then used to run the water supply model to simulate hydrological processes in the watershed at the scale of small tributaries (small catchments), allowing for water management decisions to be made at a very fine geographic scale.

The Loading Simulation Program in the programming language C++ (LSPC) is the water supply (hydrologic) model that was selected for this watershed. LSPC has been used extensively in California to model and manage the state's unique watersheds. Calibration of the LSPC model of the Navarro River involved analyzing critical hydrology parameters. The model has demonstrated good performance in simulating Navarro River streamflow for both wet and dry years. The calibrated model will then be validated using observed streamflow that was not incorporated in the calibration phase. Data produced by the LSPC model will be used as an input for the Drought Water Rights Allocation Tool (DWRAT, or Allocation Tool) to allocate water within each catchment based on available surface water, water demands, and water right priorities. Further details on the model are available in the Navarro River Watershed Model Work Plan, submitted by Paradigm.

Additional Resources

More information is available on the Supply and Demand Assessment Navarro River webpage. To sign up to receive email updates, please visit bit.ly/swb-subscribe and select the Water Rights' "Watershed Supply & Demand Allocations" email subscription list.

For additional questions, please contact State Water Board project staff at DWR-SDA@waterboards.ca.gov.