

THE MANY IMPACTS OF DROUGHT IN THE CALIFORNIA DELTA



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San Luis Reservoir with storage at 18 percent capacity (38 percent of historical average), Aug. 2021 | Photo by [Kelly M.Grow](#), CA DWR



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About the CCST Disaster Resilience Initiative:

Ongoing, complex, and intersecting disasters—including climate change, extreme heat, power outages, and the COVID-19 pandemic—are radically disrupting the ways in which Californians live and work. CCST is committed to delivering science and technology advice to improve our resilience to disasters, reduce harm, and improve the lives of all Californians.

SUMMARY

- In the past 50 years California has experienced a significant drought about once a decade.
- Observations and model data show that climate change has already increased drought severity in California and will do so to an even greater degree in the future.
- Water shortages during drought can trigger a cascade of overlapping and compounding impacts that can exacerbate water management challenges.
- Communities, economies, and ecosystems that rely on the Delta can be greatly impacted by drought.

COMPOUNDING AND CASCADING IMPACTS OF DROUGHT IN CALIFORNIA

Although there is no single scientific or statutory definition of “drought” in California, it generally refers to periods of below-average precipitation or runoff that results in water shortages for end uses. Water shortages during drought can make it challenging to meet the needs of all end users simultaneously. As a consequence, drought can initiate a cascade of overlapping and compounding impacts that commonly occur together. These impacts are collectively known as “drought syndrome.”

The Sacramento-San Joaquin Delta conveys about 45% of California’s runoff. Water that flows through the Delta is managed for various end uses, including freshwater supplies for drinking water, agricultural irrigation, and maintenance of healthy ecosystems. The symptoms of drought syndrome (green box) can harm these end uses both in the Delta and in downstream regions that rely on water exported from the Delta. Drought impacts can also persist over time, long after drought has subsided and the water delivery system has recovered.

COMMON IMPACTS OF DROUGHT SYNDROME

WATER QUANTITY

Drought reduces water flows through the Delta, impacting water quality and availability all throughout the Delta and downstream regions.

WATER TEMPERATURE

Lower water flows result in higher water temperatures, leading to higher mortality of native fishes such as salmon.

SALINITY INTRUSIONS

Lower flows of water through the Delta result in greater intrusion of salt water from the ocean, leading to contamination of the freshwater supplies that farmers and cities depend on.

INVASIVE SPECIES

Invasive aquatic vegetation and fishes thrive in drought conditions, altering the Bay-Delta food webs and habitats.

NUTRIENT & CONTAMINANTS

As water levels drop in the Delta, the relative concentrations of nutrients and contaminants can increase, resulting in poorer water quality.

HARMFUL ALGAL BLOOMS

Toxic algae thrive in drought conditions and can cause illness or death in humans and animals.

SELECT EXPERTS

The following experts can advise on drought impacts in the Delta:

LAUREL LARSEN, PhD (Moderator)
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EXPERTISE: HYDROECOLOGY, LANDSCAPE DYNAMICS, ENVIRONMENTAL RESTORATION

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EXPERTISE: ECOLOGY OF INVASIVE AQUATIC VEGETATION; DELTA ECOSYSTEM MANAGEMENT

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EXPERTISE: CROP PRODUCTION, SOIL QUALITY, AND SALINITY MANAGEMENT

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EXPERTISE: HYDRO-ECONOMIC MODELING AND WATER MANAGEMENT

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EXPERTISE: CHARACTERIZATION AND CAUSES OF REGIONAL CLIMATE EXTREMES

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Figure: Floating vegetation in the California Delta becomes more prevalent during drought, clogging waterways | Photo by Michael Whiting

CLIMATE CHANGE INCREASES RISK OF DROUGHT

Drought is a recurring feature of California's climate. Prior to the current drought, the Delta has experienced four historic droughts in the past 50 years (1976-1977, 1987-1992, 2007-2009, 2012-2016).

Warming temperatures have already increased the risk of California drought, and climate models predict that rising temperatures and shifting precipitation patterns will produce even more severe droughts in the future. Climate change is expected to exacerbate the many challenges of managing water in the Delta.

DROUGHT IMPACTS ON COMMUNITIES

Drought can impact the well-being and livelihood of communities in many ways. Water hyacinth and other invasive floating plants thrive in drought conditions and their rapid spread can impede boat traffic, marina ramps, water pumps, and more in the Delta.

Lower water exports from the Delta during drought can result in a greater reliance on groundwater in communities south of the Delta. During the 2012-2016 drought, 2,027 domestic wells failed in the Central Valley due to overdraft of groundwater.

DROUGHT IMPACTS ON ECONOMIES

The Delta provides water to \$30 billion worth of crops and supports \$300 million in recreational boating. During drought, water shortages can lead to agricultural curtailments and subsequent crop following.

At the peak of the 2012-2016 drought, nearly \$1.8 billion in gross revenues and 10,000 jobs were lost statewide. Most of the lost jobs were in agriculture and disproportionately affected disadvantaged and migrant communities.

DROUGHT IMPACTS ON ECOSYSTEMS

The Delta region is home to 56 threatened and endangered species. Drought has accelerated the decline of native species and ecosystem health.

In 2014 – during the 2012-2016 drought – the depletion of cold-water reservoirs used to manage water temperature resulted in 95% mortality of the endangered Chinook Salmon larval winter run. Herbicides used to manage invasive floating plants during drought bind very strongly to sediments and their accumulation can contaminate Delta habitats.



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