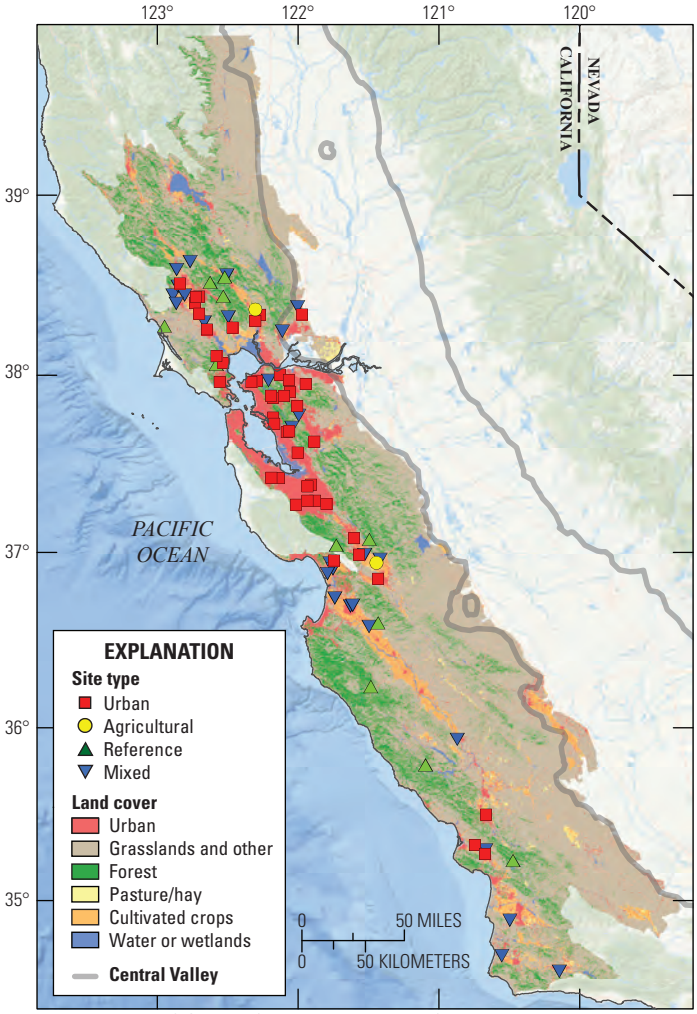
National Water–Quality Program

The California Stream Quality Assessment

In 2017, the U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) project is assessing stream quality in coastal California, United States. The USGS California Stream Quality Assessment (CSQA) will sample streams over most of the Central California Foothills and Coastal Mountains ecoregion (modified from Griffith and others, 2016), where rapid urban growth and intensive agriculture in the larger river valleys are raising concerns that stream health is being degraded. Findings will provide the public and policy-makers with information regarding which human and natural factors are the most critical in affecting stream quality and, thus, provide insights about possible approaches to protect the health of streams in the region.



Base modified from U.S. Geological Survey and other Federal and State digital data, various scales; Albers Equal-Area Conic projection, Standard parallels are 29° 30″ and 45° 30″, Central meridian -121°; North American Datum of 1983. Land cover modified from National Land Cover Database 2011. Base-map image is the intellectual property of Esri and is used herein under license. Copyright © 2014 Esri and its licensors. All rights reserved.

Figure 1. California Stream Quality Assessment study area and provisionally selected sampling sites; the boundary is based on the U.S. Environmental Protection Agency level III ecoregions of the United States (https://www.epa.gov/eco-research/level-iii-and-iv-ecoregions-continental-united-states).

The CSQA study will be the fifth regional assessment of streams by the NAWQA project, and it will be similar in design and scope to the others: the Midwest in 2013, the Southeast in 2014, the Northwest in 2015, and the Northeast in 2016 (http://txpub.usgs.gov/RSQA/).

Objectives

1. Determine the status of stream quality—contaminants, nutrients, toxicity, sediment, flow, habitat, and biological communities—across the region.
2. Evaluate the relative influence of the measured chemical and physical stressors on biological communities in the streams sampled.
3. Evaluate relations between measured stressors and biological communities and the natural and anthropogenic characteristics of the watersheds.
4. Develop models and management tools to predict stressors and ecological conditions in wadeable streams across the region.

Approach

Eighty-five sites have been provisionally selected to be sampled for up to 6 weeks in March, April, and May 2017 (fig. 1). This water-quality index period will culminate with an ecological survey of habitat, algae, benthic invertebrates, and fish at all sites. Sediment will be collected during the ecological survey for analysis of sediment chemistry and toxicity. Final site selection will depend on streamflow conditions during winter 2017. Sampling is planned at 44 sites in watersheds with urban land uses, 28 sites in watersheds with mixed urban and agricultural land uses, 2 sites in watersheds with agricultural land uses, and 11 sites in undeveloped watersheds. The resulting data should span a wide range of stressors, allowing the effects of those stressors on stream ecology to be better understood.

Study Components

Assessing Ecological Condition—Algae, benthic macroinvertebrate, and fish communities will be sampled and physical habitat assessed once at all 85 sites in April or early May 2017. Samples will be collected along multiple transects within the stream reach following USGS NAWQA protocols.

Water Sampling—Using depth- and width-integrating methods, water samples will be collected weekly for 6 weeks at most sites and at the 12 reference sites for 4 weeks preceding the ecological sampling. The samples are to characterize the water chemistry during late winter and early spring, a period of potential concern for chemical runoff.

Photograph by Alan Cressler, U.S. Geological Survey

Water samples will be analyzed for nutrients, suspended sediment, major ions, and pesticides and pesticide degradates. Some samples also will be analyzed for mercury, pharmaceuticals, and wastewater-indicator compounds.

Integrated Water Sampling—Passive polar organic chemical integrative samplers (POCIS) will be deployed in streams at all 85 sites for the 6-week water-sampling period to collect dissolved chemicals from stream water. These time-integrating samplers will be used to characterize longer-term chronic exposure of organisms to contaminants. The POCIS samples will be analyzed for pesticide and pharmaceutical compounds.

Biofilms, colonies of microorganisms attached to stream substrates, will be sampled at most sites by deploying ceramic tiles in the streams for the 6-week water-sampling period, allowing time for the biofilms to accumulate on the tiles. Samples will be analyzed for pesticides, with a particular focus on pyrethroid insecticides.

Photograph by Amanda Egler, U.S. Geological Survey

Streambed Sediment Sampling—Streambed sediment will be sampled coincident with the ecological sampling at all 85 sites. Surficial bed sediment will be collected from depositional areas and analyzed for trace elements, radionuclides, pesticides, polycyclic aromatic hydrocarbons (PAHs), halogenated organic compounds (compounds containing chlorine or bromine atoms, such as DDT), wastewater-indicator compounds, and hormones. Not all analyses will be done at all sites. Sediments tend to accumulate different contaminants than does water and can provide additional understanding of contaminant effects on organisms.

Geochemical Analysis of Suspended Sediment—Suspended sediment traps will be installed at 7 of the 85 sites to collect composite samples of suspended sediment. High concentrations of suspended sediment adversely affect stream health, and source identification can provide insight toward appropriate mitigation strategies. Geochemical analysis of suspended sediments will be used to identify their potential origins.

Toxicity Testing—Bed-sediment samples from all sites will be tested using standard whole-sediment toxicity tests with amphipod crustaceans (*Hyalella azteca* 28-day exposures) and midge larvae (*Chironomus dilutus* 10-day exposures) to measure potential effects of contaminants on survival and growth. Amphipods and fish are sensitive to many contaminants, notably some current-use insecticides and PAHs.

Continuous Monitoring—Water level and temperature will be monitored continuously at all 85 sites across the region. USGS currently operates real-time streamflow-gaging stations at approximately 30 of the provisionally selected sites.

Daily Pesticide Sampling—Small-volume automated pesticide samplers will be deployed at seven streams to better assess temporal variations in concentrations of pesticides and pesticide degradates. Five of these streams are among the 85 CSQA sites, and two are in the Central Valley (sites not shown in fig. 1). The samplers will collect daily and weekly composite samples that will be analyzed by the U.S. Environmental Protection Agency's Office of Pesticide Programs. Results will provide valuable information for determining short-term acute exposure of aquatic organisms to pesticides and for optimizing temporal sampling strategies.

Cyanobacterial Toxins—Harmful blooms of cyanobacteria (also called blue-green algae) are of considerable concern, and relatively little is known about their occurrence in small streams. A reconnaissance survey of microcystins, toxic chemicals produced by cyanobacteria, will be carried out in CSQA streams in May 2017.

Mercury in Fish—Mercury contamination is a widely recognized concern in the coastal ranges of California. Fish from most of the 85 sites will be analyzed for total mercury, and fish from a subset of sites will be analyzed for isotopes of mercury using a technique that can indicate the sources of the mercury. The study could provide new insight into occurence, processes, and sources of mercury in coastal California fish given the large number of samples and diversity of stream settings being investigated.

References Cited

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For Additional Information

Visit the NAWQA website to access reports, water-quality data, and maps: http://water.usgs.gov/nawqa

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