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National Water-Quality Assessment

The Northeast Stream Quality Assessment

In 2016, the U.S. Geological Survey (USGS) National Water-Quality Assessment (NAWQA) is assessing stream quality in the northeastern United States. The goal of the Northeast Stream Quality Assessment (NESQA) is to assess the quality of streams in the region by characterizing multiple water-quality factors that are stressors to aquatic life and evaluating the relation between these stressors and biological communities. The focus of NESQA in 2016 will be on the effects of urbanization and agriculture on stream quality in all or parts of eight States: Connecticut, Massachusetts, New Hampshire, New Jersey, New York, Pennsylvania, Rhode Island, and Vermont (fig. 1).

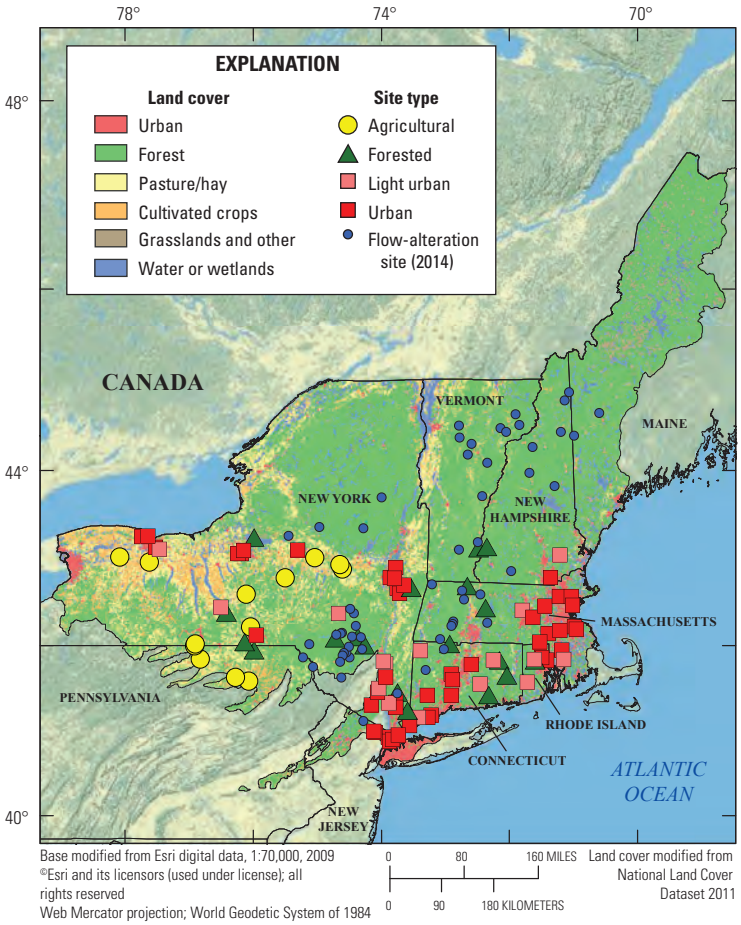


Figure 1. The Northeast Stream Quality Assessment study area; boundary based on four U.S. Environmental Protection Agency level III ecoregions of the United States. Ninety-five streams in urban, agricultural, and forested settings will be sampled in 2016. Sixty-six streams in forested settings, and distributed across a flow-alteration gradient, were sampled in 2014.

Findings will provide the public and policymakers with information about the most critical factors affecting stream quality, thus providing insights about possible approaches to protect the health of streams in the region. The NESQA study will be the fourth regional study conducted as part of NAWQA and will be of similar design and scope to the first three, in the Midwest in 2013, the Southeast in 2014, and the Pacific Northwest in 2015 (http://txpub.usgs.gov/RSQA/).

Objectives

- Determine the status of stream quality across the region on the basis of nutrients, contaminants, toxicity, sediment, flow, habitat, and biological communities.
- Evaluate the relative influence of the measured chemical and physical stressors on biological communities in the streams sampled.
- Evaluate relations between watershed characteristics (both natural and anthropogenic) and the measured stressors and biological communities of the streams.
- Develop models and management tools to predict stressors and ecological conditions in wadeable streams across the region.

Approach

Ninety-five sites will be sampled across the region (fig. 1) for up to 9 weeks during June, July, and early August 2016 for contaminants, nutrients, and sediment. This water-quality "index" period will culminate with an ecological survey of habitat, algae, benthic invertebrates, and fish at all sites. Streambed sediment will be collected during the ecological survey for analysis of sediment chemistry and toxicity. Urbanization, particularly in the greater Boston to New York City corridor and around other major cities in New England and New York, is causing water-quality concerns in the region. Additionally, the effects of agricultural practices on water quality are concerns in the western parts of the NESQA study area. The study design therefore will sample 63 sites with watersheds that reflect a wide range of urbanization, 19 sites with undeveloped forested watersheds, and 13 sites with agricultural watersheds. The study builds on sampling in 2014 of flow-alteration sites in the Northeastern Highlands, which focused on streamflow modifications as a stressor to stream ecosystems (fig. 1, blue symbols). The resulting data therefore should span ranges of many specific stressors (for example, contaminants), enabling a better understanding of the effects of those stressors on stream ecology.

Study Components

Ecological condition assessments.—Algal, benthic macroinvertebrate, and fish communities will be sampled and physical habitat will be surveyed once at each site during August 2016. These assessments will be done along a 150-meter section of each stream.

Brook trout (*Salvelinus fontinalis*). Photograph by Barry Baldigo, U.S. Geological Survey

Water sampling.—Water samples will be collected weekly by using depth- and width-integrating methods. Samples will be collected, preceding ecological sampling, for 9 weeks at the mostly urban and agricultural sites and for 4 weeks at the mostly forested and least disturbed sites. Water samples will characterize water chemistry during late spring through midsummer, a period of potential concern for chemical runoff. All samples will be analyzed for nutrients, suspended sediment, major ions, pesticides, and pesticide degradates. Samples collected during selected weeks 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 95 sites for about 6 weeks to collect dissolved chemicals from stream water. These time-integrating samplers will be used to characterize chronic contaminant exposure to organisms. The POCIS samples will be analyzed for pesticides, pharmaceuticals, and wastewater-indicator compounds.

Sediment sampling.—Surficial streambed sediment will be collected from depositional areas at all 95 sites and analyzed for some or all of the following: 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. Sediment tends to accumulate different contaminants than does water and can be an important contaminant source to organisms.

Time-integrating suspended-sediment samplers will be deployed at about 14 sites to characterize sources of sediments entering the streams. These sediment samples will be analyzed for radionuclides and trace elements.

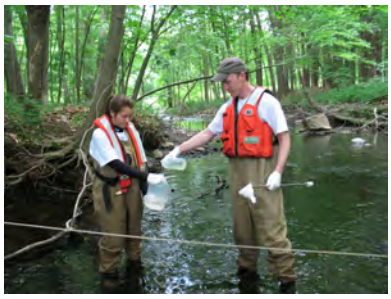
Stream water sampling. Photograph by Kelly Rausch, U.S. Geological Survey

Toxicity testing.—Bed sediment samples from about one-half of the sites will be tested by using standard whole-sediment toxicity tests with amphipod crustaceans (*Hyalella azteca;* 28-day exposures), midge larvae (*Chironomus dilutus;* 10-day exposures), and freshwater mussels (*Lampsilis siliquoidea;* 28-day exposures) to measure potential effects of contaminants on survival and growth. Many stream organisms are sensitive to various contaminants, notably some current-use insecticides and PAHs.

Continuous monitoring.—Stream water level and temperature will be monitored continuously at all 95 sites across the region, and continuous water-quality monitors will be deployed at 5 sites. Continuous monitoring for parameters such as dissolved oxygen and nitrate concentration, in conjunction with periodic sampling of nutrients and periphyton biomass, can provide useful information on the effects of nutrients in streams.

Daily pesticide sampling.—Small-volume automated samplers will be deployed at seven sites to assess short-term temporal variations in concentrations of pesticides and pesticide degradates. 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.

Unconventional oil and gas.—Part of the NESQA region overlies the Marcellus Shale formation, parts of which are undergoing rapid development of natural gas wells. A reconnaissance-level assessment of methane in streams for NESQA sites in Pennsylvania and south-central New York is planned.



Stream water sampling. Photograph by Kelly Rausch, U.S. Geological Survey

Algal toxins.—Relatively little is known about the occurrence of toxic algae in small streams. A reconnaissance survey of microcystin, a toxic chemical produced by some cyanobacteria, will be carried out in NESQA streams during July 2016. Depending on results from the reconnaissance survey, followup sampling might be done to better understand sources in selected watersheds.

Mercury in fish.—Fish specimens from each of the 95 sites will be analyzed for total mercury. Fish from a subset of sites will be analyzed for isotopes of mercury, a technique that can indicate the sources of the mercury. The study could provide new insights given the large sample size and diversity of stream settings being sampled.

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ISSN 2327-6916 (print)
ISSN 2327-6932 (online)
http://dx.doi.org/10.3133/fs20163021