

Effects of Nutrient Enrichment on Stream Ecosystems— National Water-Quality Assessment

The U.S. Geological Survey (USGS) nutrient enrichment studies are planned and implemented through the National Water-Quality Assessment (NAWQA) Program. In 2001, the NAWQA Program began an intensive study of nutrient enrichment—elevated concentrations of nitrogen and phosphorus—in streams in five agricultural study basins across the Nation.

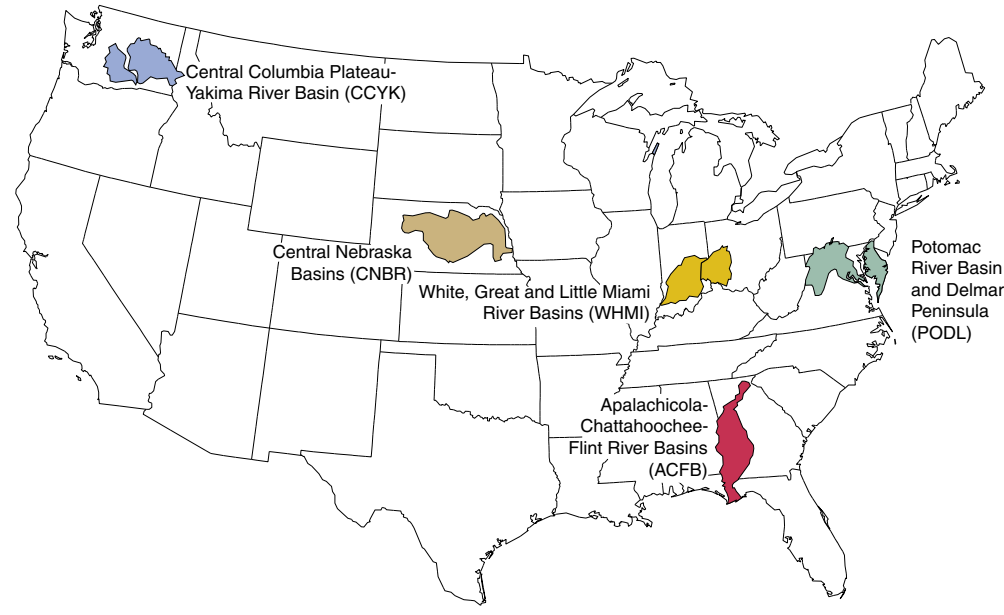


Excessive nutrients can cause overgrowth of algae and aquatic plants in streams, such as in this stream in the Apalachicola-Chattahoochee-Flint River Basins.

This study is providing nationally consistent and comparable data and analyses of nutrient conditions, including how these conditions vary as a result of natural and human-related factors, and how nutrient conditions affect algae and other biological communities. This information will benefit stakeholders, including the U.S. Environmental Protection Agency (USEPA) and its partners, who are developing nutrient criteria to protect the aquatic health of streams in different geographic regions.

Objectives of the Nutrient Enrichment Study

1. Determine the total algal biomass and the abundance, type, and diversity of algal and aquatic invertebrate communities in streams with different nutrient conditions, watershed characteristics, habitat, climate, and other natural factors.
2. Determine the interrelations among nutrient conditions, algal communities, and stream metabolism, which is defined as the gain and loss in dissolved oxygen associated with photosynthesis and plant and animal respiration. Adequate levels of dissolved oxygen are critical to fish and other aquatic life.
3. Determine the transport, chemical transformation, and retention of nutrients (referred to as “nutrient cycling”) in the water column and surrounding sediments, and resulting effects on biological communities in stream reaches. Such cycling differs in different geologic and hydrologic settings, and is controlled, in large part, by ground-water and surface-water interactions.
4. Determine the extent to which associations between nutrient conditions and biological communities occur over geographic regions that share common natural features, landscape characteristics, and biological communities.



Central Nebraska Basins.



White, Great and Little Miami River Basins.



Apalachicola-Chattahoochee-Flint River Basins.



Potomac River Basin and Delmarva Peninsula.



Central Columbia Plateau-Yakima River Basin.

“Snapshot Assessments”

Streamflow, nutrient concentrations and other chemical characteristics, dissolved-oxygen concentrations, biological communities, and stream and riparian habitat are assessed at 25-30 sites within each Study Unit. Data from these one-time “snapshot” assessments will be used to define relations among nutrients, stream metabolism, and biological communities in diverse environmental settings (study objectives 1 and 2), and to aid in statistical analyses for regionalization of nutrient conditions (objective 4).

Detailed Small-Scale Assessments

Processes controlling stream metabolism and nutrient cycling (which includes transport, transformation, and retention) are being assessed in a single stream reach within three of the five Study Units. These more detailed, small-scale studies will help to determine the effects of these processes on biological communities (objectives 1 and 2), and help to identify environmental settings that have chemical, physical, and biological characteristics associated with nutrient enrichment (objective 4)



Data on streamflow, nutrient concentrations and other chemical characteristics, dissolved oxygen, biological communities, and stream and riparian habitat are collected at 25–30 sites within each of the Study Units.

In 1991, NAWQA began evaluating the quality of streams, ground water, and aquatic ecosystems in 51 major river basins and aquifer systems (known as “Study Units”) across the Nation. The assessments characterize the ambient water resource—the source of about 60 percent of the Nation’s drinking water and water for industrial, irrigation, and recreational uses.

Baseline assessments during the first decade of NAWQA studies

- Pesticides
- Nutrients
- Volatile organic compounds
- Trace elements
- Dissolved solids
- Radon
- Condition of aquatic habitats and fish, invertebrate, and algal communities.

These findings are described in numerous reports that can be accessed at URL:

<http://water.usgs.gov/nawqa/pubsmain.html>

During the next decade of studies, 42 of the Study Units will be intensively reassessed to determine trends at many of the streams and ground-water monitoring sites; fill critical gaps in characterizing water-quality conditions; and build upon earlier NAWQA findings that show how natural features and human activities affect water quality and aquatic ecosystems.

National priority topics to be addressed in the second decade of NAWQA studies

- Effects of nutrient enrichment on stream ecosystems
- Effects of urbanization on stream ecosystems
- Bioaccumulation of mercury in stream ecosystems
- Transport of contaminants to public-supply wells
- Sources, transport, and fate of agricultural chemicals

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The USGS promotes public access to water-quality information

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

Visit the EPA Web site to access information on nutrient criteria:

<http://www.epa.gov/waterscience/standards/nutrient.html>
and for biennial national water quality inventory reports:

<http://www.epa.gov/305b/>