

Establishing a Collaborative and Multipurpose National Network of Reference Watersheds and Monitoring Sites for Freshwater Streams in the United States

A significant challenge faced by water-resource scientists in the public and private sectors is the need for reliable long-term data and information from watersheds minimally disturbed by human activities. Monitoring in areas with minimal human disturbance helps to provide (1) an understanding of natural patterns of variability that can be used to differentiate changes due to land and water use from changes associated with natural climatic cycles and (2) reference information that can be used to establish water-quality criteria or appropriate expectations for watershed restoration. Many agencies and organizations monitor streams in pristine and minimally disturbed watersheds or conduct research and other activities that would be useful to a reference watershed network (fig. 1). Much of the monitoring consists of one to several measurements at many sites, typically representing a particular hydrologic condition and a relatively short period of time. These synoptic measurements provide important information for understanding natural spatial patterns and variability. Unfortunately, there are relatively few sites among networks with long-term records for streamflow, water chemistry, and stream ecology necessary to distinguish changes associated with natural climatic cycles.

The National Water Quality Monitoring Council (NWQMC) is proposing the development of a collaborative and multipurpose national network of reference watersheds and monitoring sites that would provide quality-assured data and information for use in understanding the effects of land use change, water use, atmospheric deposition, and climate change on freshwater ecosystems. The scope of the collaborative effort will initially be limited to freshwater streams. Future collaborations would expand to freshwater lakes and wetlands. Membership in the network would be voluntary and open to individuals and institutions interested in participating in monitoring and (or) research in minimally disturbed and pristine watersheds. Funding support for the network would come from the participating agencies. The Council would provide the organizational structure and leadership to develop, enhance, and maintain collaborative, comparable, and cost-effective monitoring, research, and reporting among the Federal, State, tribal, interstate, academia, local and private sector organizations that choose to participate.

The collaborative effort would consist of three different types of activities in a tiered framework that are linked together by research and modeling. The three types of activities

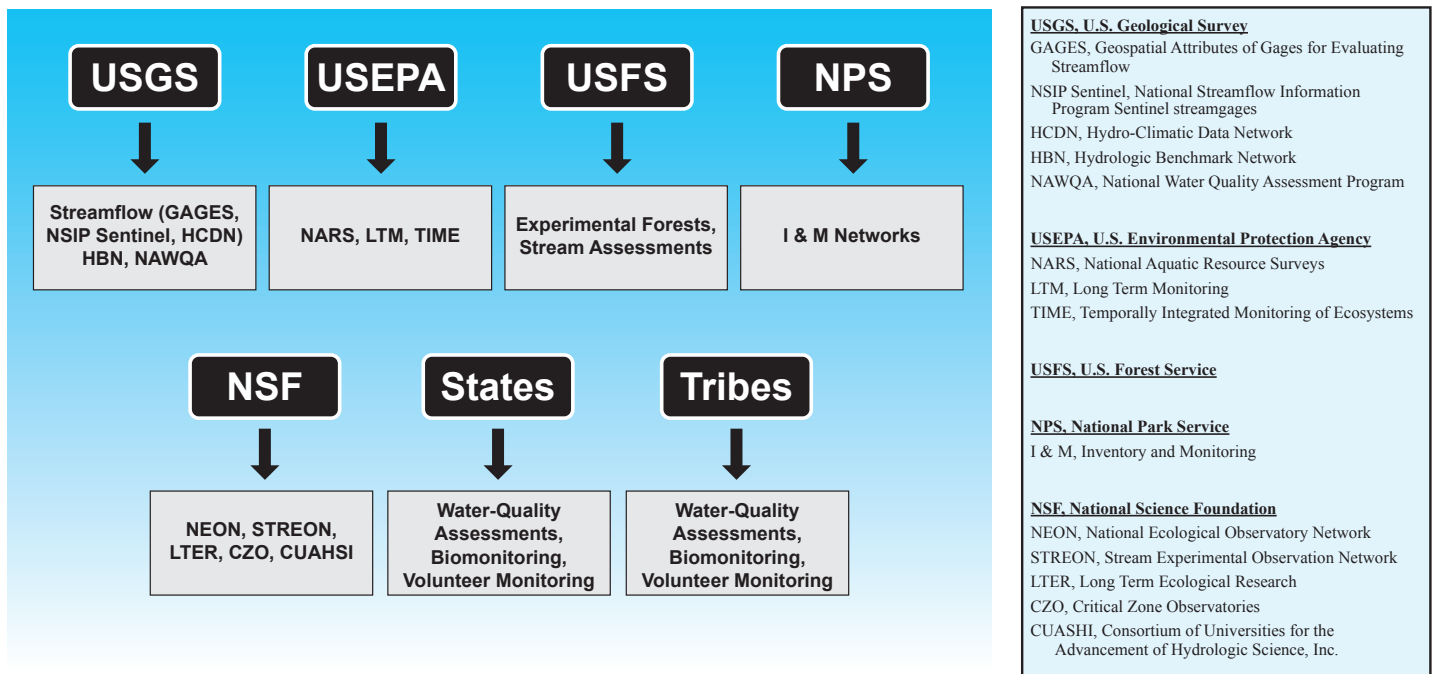


Figure 1. Monitoring networks and programs of Federal and State agencies and non-Governmental organizations that are candidates for inclusion in the design and operation of a collaborative reference watershed network.

include: (1) research and high frequency, long-term monitoring of a limited set (50–100) of pristine and minimally disturbed watersheds on protected lands, geographically distributed across Level 2 ecoregions in the United States (http://www.epa.gov/wed/pages/ecoregions/na_eco.htm#Level II) to better understand the interrelations between stream hydrology, water quality, and aquatic biota and changes in climate and characteristics of the surrounding watershed; (2) periodic synoptic sampling of a larger number of reference watersheds to understand the natural patterns of ecosystem variability and to provide context for guiding the establishment of water-quality criteria or other assessment thresholds at the State and National scale; and (3) inventories and remote sensing that will provide a census of specific characteristics simultaneously and uniformly across large regions. Research and modeling help to integrate information and understanding across the range of scales addressed by the activities in the tiered framework. Research is necessary to understand cause and effect and to develop predictive models. Modeling can be used to extrapolate to reference areas that are not being monitored, to forecast changes in reference watersheds under different policy and climate scenarios and to quantify uncertainty (fig. 2).

Operation of the network would focus on providing access to quality-assured data and information products resulting from the monitoring and research at a national network of sites that use nationally consistent field and laboratory protocols, procedures for quality assurance and quality control, and data management. Data from this network would (1) characterize reference conditions for a broad suite of physical, chemical, and biological measures that respond to anthropogenic and climate-related effects on hydrology and water quality at watershed,

regional, and national scales; and to the extent possible, (2) integrate with other network data such as National Atmospheric Deposition Program (NADP), National Oceanic and Atmospheric Administration Climate Reference Network (NOAA-CRN), Clean Air Status and Trends Network (CASTNET), and the USGS Climate Response Network (CRN) groundwater wells to provide a more holistic approach to understanding the effects of environmental stressors on reference watersheds.

Outcomes and benefits would include:

- A unique national database of high-quality observations from pristine and minimally disturbed watersheds that can be used to:
 - Establish “background” conditions for select hydrologic variables and water-quality measures to guide the establishment of streamflow and water-quality criteria; and
 - Evaluate the effect of land use change, water use, atmospheric deposition, and climate change on freshwater ecosystems.
- Internet access to real-time data and annual data summaries and syntheses that are responsive to current environmental issues; and
- Increased efficiency of monitoring with improved coordination and collaboration, increased comparability of results by use of common procedures and protocols, and increased opportunities to leverage existing work and financial resources.

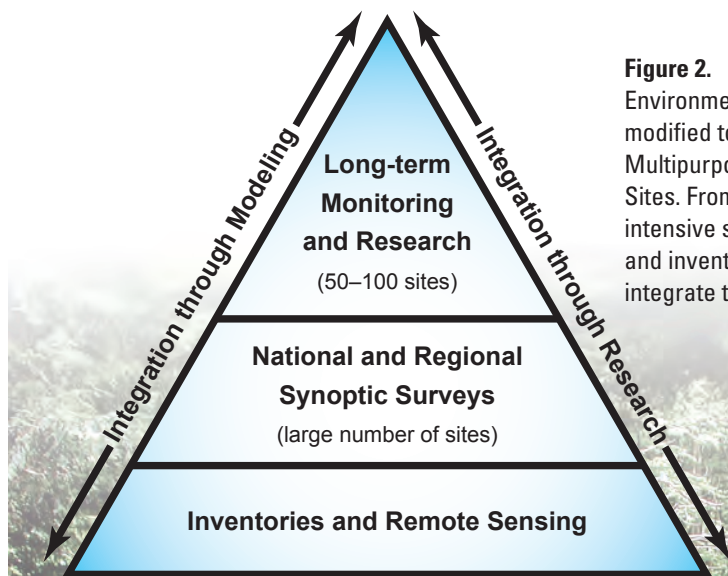


Figure 2. The National Science and Technology Council’s Committee on Environment and Natural Resources (CENR) tiered monitoring framework modified to show the structure of the proposed Collaborative and Multipurpose National Network of Reference Watersheds and Monitoring Sites. From top to bottom, the tiers reflect long-term monitoring and research intensive sites, spatially extensive regional and national synoptic surveys, and inventories and remote sensing. Modeling and research help to link and integrate the tiers.

For more information, contact:

Bill Wilber, wgwilber@usgs.gov, (703) 648-6878 or Jeff Deacon, jrdeacon@usgs.gov, (603) 226-7812, U.S. Geological Survey