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# The National Research Program in the Hydrological Sciences

The National Research Program (NRP) in the hydrological sciences encompasses a broad spectrum of scientific investigations and focuses on long-term integrated studies related to water resource and environmental problems. The NRP provides an infrastructure within which the USGS can develop new information, theories, and techniques to understand, anticipate, and solve water-resource problems facing managers of Federal lands and the Nation.

Research in the NRP is focused on (1) site specific or problem specific studies of special interest to the USGS and DOI and (2) broad investigations on topics of scientific importance in the hydrologic sciences. This combination of approaches is essential to the development of scientific understanding and to the application of that understanding to problems related to the use and preservation of the Nation's water resources.

Water quality samples are collected in the Yukon River Basin, Alaska

The NRP makes a deliberate effort to anticipate research needs that will be pertinent to hydrologic science issues of the future. New information, theories, techniques, and tools developed by scientists within the program are used by other USGS scientists and managers, by members of the hydrologic community outside the USGS, nationally and internationally, and by the public. The emphasis of NRP research activities changes through time, reflecting the emergence of needed new areas of inquiry and the demand for new tools and techniques with which to address water-resources issues and problems.

The program is directly linked to and funded by other USGS programs and initiatives to ensure that NRP research addresses current water-resource needs. These programs include the Water, Energy, and Biogeochemical Budgets Program (WEBB), the Toxic Substances Hydrology Program, the National Water Quality Assessment (NAWQA) Program, the Integrated Priority Ecosystems Program, the Volcano Hazards Program, the Ground-Water Resources Program, and the National Streamflow Information Program. Research investigations are often pursued in collaboration with scientists in USGS Water Science Centers; with scientists in the Geology, Biology, and Geography Disciplines of the USGS; and with scientists at other educational and research institutions. The NRP's staff of about 250 permanent and 90 non-permanent individuals is located principally at USGS centers in Reston, Virginia; Denver, Colorado; and Menlo Park, California.

## NRP SCIENTISTS

- **Conduct research**
- **Provide scientific leadership and training**
- **Communicate results to scientific peers, water resource managers, and the public**

Samples are prepared for laboratory analysis at a field site in Minnesota.

## Research Areas and Topics

Research in the NRP is subdivided into research areas. Scientists, representing each area of research, serve as technical advisors to NRP managers and as a peer resource for other research scientists. NRP managers are the Chiefs of the Branches of Regional Research who are located in the Eastern, Central, and Western Regions and the Chief Scientist for Hydrology, who oversees the entire national program. Below is a brief description of the research areas and topics.

A multi-level monitoring well is set up in a fractured rock aquifer in New Hampshire

| Research Areas | General Topics |
|---|---|
| WATER CHEMISTRY<br>Assess natural and contaminant chemicals in water and sediment, and study fundamental chemical and biochemical processes that affect the movement of organic and inorganic solutes in aquatic systems. | • Organics in aquatic systems<br>• Carbon cycling and climate<br>• Isotope hydrology and paleohydrology<br>• Trace elements and radionuclides<br>• Weathering and watershed processes<br>• Transport and biogeochemical reactions<br>• Gases in aquatic systems |
| GROUND-WATER HYDROLOGY<br>Understand the processes that control movement and availability of subsurface water, its transport of dissolved substances, microbes, particulate and other fluid phases, and its interactions with the geological environment. | • Development of quantitative ground-water models<br>• Ground water—surface water—atmospheric interactions<br>• Unsaturated-zone hydrology<br>• Fractured-rock hydrology<br>• Ground water in geologic processes |
| SURFACE-WATER HYDROLOGY<br>Quantify, understand, and model the physical processes that control the distribution and quality of the Nation's surface-water resources. | • Flow and transport in rivers<br>• Watershed modeling<br>• Estuarine hydrodynamics<br>• Climate variability and surface-water hydrology<br>• Statistical analysis of floods and droughts |
| GEOMORPHOLOGY AND SEDIMENT TRANSPORT<br>Understand stream-channel morphology and erosional processes that govern the source, mobility, and deposition of sediment. | • Sediment transport dynamics<br>• Changes in river channels over time<br>• Channel morphology and sediment transport<br>• Flow and sediment mechanics |
| ECOLOGY<br>Investigate the ecological and biogeochemical processes that affect the quality of water in aquatic systems. | • Microbiology<br>• Aquatic Ecology<br>• Climate and Ecology<br>• Biogeochemistry |

**Descriptions of research projects in the NRP and recent publications are on the Internet at *http://water.usgs.gov/nrp/***

## The Need for Hydrologic Research

Research in the hydrologic sciences is important to the Nation to address changes in hydrologic regimes. Research combined with the transfer of research results is essential to provide information and data to help water resource managers make the best possible decisions. National needs requiring continued support for hydrologic research include:

- The magnitude and frequency of **floods and droughts** are changing as a result of changes in climate, water use, and land use. Data collection and intepretation are needed to understand the changes.
- **Water shortages** in some areas will arise from climate change, distribution problems, depletion of resources and/or water-quality constraints. New tools and modeling capabilities are essential to optimize the use of water resources.
- **Increasing population** and shifting centers of population will stress the Nation's water-supply systems for the future.
- Concerns are increasing about water quantity and quality for **ecosystem protection and restoration**. Water resource managers need scientific information on how much water should be allocated to preserve or restore an ecosystem and how the quality of that water affects the ecosystem.
- **Water quality** is a major concern in many parts of the United States. Specifically, contamination of water supplies is a continuing concern to the health and safety of the public and the environment. Pathogens are an increasing concern in drinking-water supplies.
- New chemical products are being continually introduced to the environment. The **fate and transport of chemicals and particles** through environmental pathways, as well as their health risks, are often unknown.
- **Future use of water resources** will require continued monitoring, increased understanding of hydrologic processes, and improved predictive tools. This information is essential for the safe use and conservation of surface water and ground water.

For Additional Information
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