Safe and Sustainable Water Resources (SSWR) Research Program

Need for Research

Water is one of our Nation's most precious resources. We depend upon it for our lives and our livelihoods, for healthy ecosystems, and a robust economy. Yet a host of challenges threaten the safety and sustainability of our water resources, including biological and chemical contaminants, aging water-system infrastructure, demands of the energy, agriculture and manufacturing sectors, population change, climate change, extreme events and homeland security events.

Through an integrated science and engineering approach, the SSWR research program is developing cost-effective, sustainable solutions to these 21st century complex water issues and proactively addressing emerging concerns.

Research Objectives

SSWR research program efforts are being done in partnership with other EPA programs, federal and state agencies, academia, nongovernmental agencies, public and private stakeholders, and the global scientific community. The program's activities are guided by four objectives:

- Address current and future water resource challenges for complex chemical and microbial pollutants.
- Transform the concept of 'waste' to 'resource.'
- Quantitate the benefits of water quality.
- Translate research into real-world solutions.

Research Topics

To achieve the overarching objectives and address their respective scientific challenges, SSWR projects are organized into four interrelated research topics:

- Watershed Sustainability
- Nutrients
- Green Infrastructure
- Water Systems (Drinking Water and Wastewater)

Each topic has been designed to produce practical tools and solutions to ensure that natural and engineered water systems have the capacity to meet current and future water needs. The four research topics are described in more detail on the following page.

Program Vision

The SSWR research program uses an integrated, systems approach to support innovative scientific and technological solutions that ensure clean, adequate, and equitable supplies of water to protect human health and to protect and restore watersheds and aquatic ecosystems.

Watershed Sustainability

Advancing the sustainable management of the Nation's water resources is a national priority. Adequate and accessible supplies of clean water need to be created and maintained to ensure sufficient water quality and quantity to support current and future environmental, economic, and public health requirements; however, adverse impacts on watersheds and water resources continue to be major drivers of changes in aquatic ecosystems and the global hydrologic cycle.

Research under this topic aims to advance integrated water resource and watershed management approaches, models, and decision-making tools to ensure sustainable water resources. The research focuses on national-scale assessments of aquatic resource conditions; watershed integrity and resilience; new or revised ambient water quality criteria to protect human health and aquatic life from chemical and microbial contaminants; protection of water resources while developing energy and mineral resources; and the creation of a national water quality benefits model framework.

Nutrients

Nutrient pollution (i.e., nitrogen and phosphorus) remains one of the most challenging environmental and human health issues in the U.S., with a considerable impact on local and regional economies. Progress has been made to reduce the nutrient loadings that can cause adverse environmental impacts (e.g., acid rain, harmful algal blooms, and degradation of drinking-source waters); however, nutrients are still released and discharged at concentrations that have significant adverse impacts. One of the main challenges involves limiting nutrient discharge and runoff into waterways, while minimizing impacts to the nutrient sources.

Research under this topic aims to improve the science needed to define appropriate nutrient levels and to develop technologies and management practices to monitor and attain appropriate nutrient loadings. Research efforts span multiple types of water bodies, and coordinate across media (water, land, and air) and various temporal and spatial scales to develop numeric nutrient criteria, decision support tools, and cost-effective approaches to nutrient reduction.

Green Infrastructure (GI)

Across the Nation, more than 700 cities rely on combined sewer systems to collect sewage and stormwater and convey it to treatment facilities. When flows exceed system capacity, untreated stormwater, human, commercial, and industrial waste, toxic materials, and debris, are discharged directly into surface waters. For many cities, combined sewer overflows (CSOs) remain one of the greatest challenges to meeting water-quality standards.

Research under this topic explores the use of GI to control stormwater runoff with the aim of capturing the research at multiple scales—from a localized-scale, such as permeable pavement in parking lots, to a watershed-scale, such as the application of GI models to optimize best management practices. The research will also explore the use of GI for water quality improvement, groundwater recharge, and minimizing impacts on leaking underground storage tanks through stormwater diversion and capture. GI research can also play an important role in the revitalization of brownfields and abandoned properties in U.S. cities facing urban blight.

Water Systems

Drinking water and wastewater systems challenged by limited resources, aging infrastructure, shifting demographics, climate change, and extreme weather events need transformative approaches to meet public health and environmental goals, while optimizing water treatment and maximizing resource recovery and system resiliency.

Research under this topic aims to push forward the next generation of technological, engineering, and process advances to maintain safe and sustainable water resources for humans and the environment, while also augmenting and improving water resources. Tools and technologies are being developed for water reuse, and the sustainable treatment of water. Research will also focus on the economic recovery of water, energy, nutrients, and other resources through innovative municipal water services and whole system assessment tools. This topic focuses on small drinking water systems, which are systems that serve less than 10,000 people. Of all community water systems in the U.S., 97% are considered small systems.

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