



Project Search

Success Stories

May 2005 Edition



Connecticut Department of Environmental Protection, 79 Elm Street, Hartford, CT 06106-5127
– Gina McCarthy, Commissioner

Project SEARCH is the largest statewide volunteer, water quality monitoring/education program in Connecticut. The program partners environmental scientists with high school science teachers and their students to collect water quality data on local rivers and streams. SEARCH scientists provide all of the training and technical support to the schools and work through the program to promote awareness of relevant water quality issues in Connecticut. SEARCH functions both as a community-based stream-monitoring program and as an applied science education program. SEARCH was developed by staff of the Office of Communications and Education at the Connecticut Department of Environmental Protection (CT DEP). Through a partnership with the Science Center of Connecticut and the National Science Foundation the program was integrated into the science curriculum at public and private high schools throughout Connecticut during the period 1994-1999. Subsequent funding from the Environmental Protection Agency's (EPA) Clean Water Act Section 319 grant program have continued to support SEARCH monitoring and public awareness efforts with the schools. Funding from the CT Department of Higher Education's Eisenhower Professional Development grant program has enabled new teachers to be trained and enter the SEARCH program.

recreational use contributes an estimated \$3.63 million dollars to the surrounding five river towns (Moore and Siderelis 2002).

Connecticut has eight major drainage basins: Housatonic, Southwest Coastal, South Central Coastal, Pawcatuck, Hudson, Connecticut, Thames, and Southeast Coastal. Each of these major basins are further subdivided into regional and subregional drainage basins.

The Resource – Connecticut's Rivers and Streams

As a result of its glacial history, Connecticut's landscape features an array of wetlands and water courses. These include approximately 5,800 miles of rivers and streams; from the small, first, second and third order headwater streams, and the larger fourth and fifth order waterways such as the Farmington and Quinnipiac Rivers, to the largest sixth order rivers such as the Connecticut and Thames Rivers.

Rivers and streams support a wide range of important functions including, serving as fish and wildlife habitat, providing numerous recreation opportunities, generating power, navigation, recharging water supplies, conveying treated wastewater and runoff, and supporting agricultural practices. Rivers and streams are also among the most aesthetically pleasing features in our landscape. A study of the recreational use and economic importance of the fourteen mile section of the West Branch of the Farmington River found that

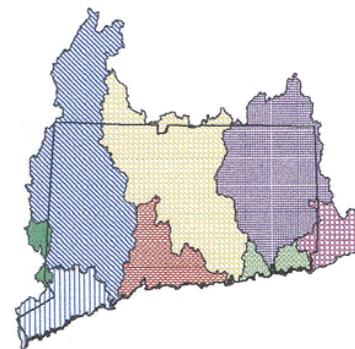


Figure 1. Major Watershed basins in Connecticut

All of Connecticut's rivers and streams eventually drain into Long Island Sound, and thus the water quality of the Sound is inextricably linked to Connecticut's landscape and the networks of rivers and streams draining this land.

Problems: Changing Water Quality Issues and the Need for Public Awareness & Community-based Monitoring Programs

Since the passage of the Clean Water Act in 1972 the primary source of negative impacts on rivers and streams has shifted from point source pollutants, such as factory discharges, to a range of non point source (NPS) pollutants, such as runoff from farms and construction and road salt. (*See NPS sidebar*). While point source pollutants are readily addressed at the state level through regulation and the permitting of discharges, by its nature non-point source pollution cannot be comprehensively managed by these same processes. Non-point source pollution is more effectively addressed at the municipal level through local commissions such as planning and zoning and inland wetlands. With guidance from appropriate federal and state agencies and various non governmental agencies, strategies that promote awareness and education regarding NPS pollution, and that advocate the implementation of best management practices regarding such activities as residential and commercial development, agriculture and forestry operations, will be the most successful in achieving reductions in NPS pollution.

In residential areas that are adjacent to watercourses, individual actions can and often do have impacts on local water quality. Many people still harbor incorrect assumptions about the potential impacts that individual behaviors such as disposing of motor oil, over-fertilizing a lawn, paving a gravel driveway, or the clearing vegetation, can have on water quality. The average citizen is simply unaware of how such “on-site” pollutants are transported to a river or stream some distance away. A combination of informal and formal public awareness and education initiatives is required to effectively connect communities with their local water resources and help guide individual actions.

Due to Connecticut’s large number of rivers and streams, it is impossible for state agencies to monitor even a small percentage of waterways across the state on an annual basis, this is especially true of the many small first order streams. With the third highest population density in the nation (U.S. Census 2000), and increasing levels of landscape disturbance and fragmentation, there is a great need for the above mentioned community directed strategies to comprehensively and effectively address NPS pollution in Connecticut. A recent study found that between 1970 and 2000, despite the fact the State’s population grew by only 12%, the amount of developed land grew by more than 100% (Orfield 2003).

Solutions: Linking Water Quality Monitoring with Environmental Awareness and Education at the Community Level

The demonstrated most effective method of educating and promoting awareness of environmental concepts is through hands on classroom and field activities. Programs that engage adults or children in the meaningful collection and analysis of data, that provide opportunities for these audiences to work directly with scientists, and that address relevant community issues can be especially powerful. Programs such as the school-based project SEARCH and various watershed-based adult monitoring programs work on several levels.

Nonpoint Source Pollution Nonpoint source (NPS) pollution is diffuse in nature, both in terms of its origin and in the manner in which it enters surface and ground waters. It results from a variety of human activities that take place over a wide geographic area. Pollutants usually find their way into waters in sudden surges, often in large quantities and are associated with rainfall, thunderstorms, or snowmelt. NPS pollution generally results from land runoff, precipitation, atmospheric dry deposition, drainage, or seepage. Physical disturbances to a water resource caused by filling, draining, ditching, damming, or otherwise altering wetlands and stream courses are also considered nonpoint sources.

These programs help fill monitoring gaps by annually generating baseline data from selected rivers or streams. They effectively connect individuals with local water resources and often empower these individuals to participate in local planning and municipal conservation initiatives, and they significantly increase overall public awareness of relevant water quality issues among participants (Holloway et al. 1998).

Connecticut is home to 169 individual municipalities each with their own local commissions consisting of volunteers residing within the towns. Although guided by the State, the majority of environmental planning and decision making in Connecticut occurs at the local level through these commissions. This is especially true regarding residential and commercial development, activities that can have significant impacts on water quality.

State partnerships with community-based watershed associations, and education and environmental organizations can be very effective in working with municipal commissions and education systems to better inform town constituencies regarding key environmental issues.

In 1994 the Science Center of Connecticut, Connecticut Department of Environmental Protection and the National Science Foundation partnered to integrate SEARCH, a comprehensive stream-monitoring program originally developed by the CTDEP, within the science curriculum of public and private high schools across Connecticut. The primary goals of the project were to connect teachers and students to their local water resources, increase understanding and awareness about these ecosystems, their function, and connection to the larger landscape, and to provide a substantive applied learning opportunity that would promote key student education outcomes in the sciences.

To accomplish this, the Science Center and CTDEP staff recruited and trained teachers and provided them with the necessary monitoring equipment and ongoing technical support to establish and continue the program within their schools. Key elements of the SEARCH program include:

- Each school selects from one to two streams within their community to monitor on an annual basis. Stream monitoring sites are selected with guidance from the CTDEP. Both fall and spring sampling is conducted by the schools.
- SEARCH staff scientists accompany the schools during their sampling trips and collect replicate data for quality assurance analysis. The project has an approved EPA Quality Assurance Project Plan for an educational program.
- Stream sampling protocols are based on EPA Rapid Bioassessment II methods and include collection and analysis of water chemistry, assessment of the benthic macroinvertebrate community, classification of the overall stream environment, and identification of potential sources for NPS pollution.
- Schools compare data from their streams with a CTDEP designated reference stream to determine level of impairment and submit their data and a formal report to SEARCH staff detailing their results.
- Teachers follow a formal SEARCH curriculum developed by staff with significant input from an

advisory committee consisting of scientists and teachers (Beauchene, Wahle and Weiss 1996). In addition to detailing the sampling methods and providing data sheets, the SEARCH Manual includes activities that further promote awareness and understanding of concepts related to water resources and water quality. In addition to the manual a broad range of other relevant education resources are distributed to teachers including various site and environmental maps, NPS fact sheets, etc.

- SEARCH project staff prepare an annual SEARCH water quality report that compiles the school sampling results and provides summaries by major drainage basin. The report is distributed to schools and interested watershed associations, town commissions and other community organizations.

Results

During the period 1994-2003 SEARCH has been successfully established in 149 Connecticut high schools. Currently, more than 350 teachers have been trained in SEARCH with an estimated 25,000-30,000 students having participated over the past nine years. Highlights of the program include:

- SEARCH schools have collected baseline data at 168 monitoring sites located on 109 rivers or streams. Data generated by SEARCH has been used by the CTDEP as baseline information, to target “red flag” sites, and in state water quality reports. Data has also been shared with consulting firms, watershed associations, town governments and utilities, and other interested parties. For example, the Farmington River watershed Association recently included SEARCH baseline data collected between 1994-2002 into a comprehensive review of available water quality information related to the Farmington River watershed.



Figure 2 Mayfly Larva

- Results of formal evaluations conducted by an independent evaluator confirm that SEARCH has been effective at increasing student awareness of water quality issues (Rofuth and Holloway 1999). For example, students are able to make strong connections due to the stream study occurring locally in the field and not simply by reading about somewhere far away. A student from Shelton sums this up well, “instead of learning about some

river in California or something, this is our river, here in our town.” (Rofuth and Holloway 1999). By defining the river as “*Our River*” the student is demonstrating their enhanced sense of stewardship and responsibility. Another student stated, “everything we do affects these waters; everything is connected and all flushes out to the same place.” (Rofuth and Holloway 1999). These comments strongly demonstrate the kind of learning that occurs by students involved in Project SEARCH.

- Results of formal evaluations indicate that SEARCH is providing many students with a meaningful, applied science learning experience previously unavailable to them within the school science curriculum. Students from two-thirds of the schools interviewed for the case study evaluations noted that SEARCH was their only science course field trip (Rofuth and Holloway 1999).
- Results of a student evaluation conducted by SEARCH staff involving more than 400 students representing a diverse range of educational reference groups in Connecticut indicates that the program is effectively promoting awareness of NPS issues. For example, the majority of students surveyed (77%) were able to provide an example of NPS pollution (Gruner and Sullivan 2001). Results of this survey are being used by project staff to address gaps in knowledge and awareness regarding NPS pollution and other water resource concepts among students. For example, based on the survey results a new NPS site assessment module was developed, pilot-tested and integrated into the SEARCH curriculum. Teachers and students are using this new module to collect information on potential sources of NPS pollution along the streams and rivers they are monitoring.
- During the period 1997-98, a middle school version of SEARCH was developed and pilot-tested in 15 schools representing a diversity of educational reference groups. The middle school program is designed to prepare students for the high school SEARCH program by introducing them to key concepts through a combination of classroom and field experiences. The middle school program was highly successful. For example, the newly opened Two Rivers Magnet Middle School, a science and technology magnet that serves five greater Hartford area towns, is incorporating SEARCH within their field studies curriculum. Also, the Barnes Foundation has

recently funded SEARCH to work with a community environmental organization and teachers in Bristol to integrate middle school SEARCH as a curriculum link to the existing high school SEARCH program in operating in Bristol.

- SEARCH staff work closely each year with representatives from the CTDEP to present the annual student Water Quality Congress. This day-long event styled after a scientific conference featuring poster sessions and full presentations, provides students with an opportunity to share their results and learn about water quality issues in communities across the state.

Future Plans

SEARCH staff will continue to train newly hired teachers from existing SEARCH schools as well as teachers from new schools entering the program. Typically, 10-15 new teachers are trained annually. Staff will also continue to provide ongoing technical support to teachers, and work directly with students to complete stream sampling in the field.

Based on results from the student survey conducted in 2001, SEARCH staff will continue to focus on addressing gaps in student knowledge and awareness of NPS and other water quality related content. A major trust of this effort will be expanding the application of the NPS assessment module to all SEARCH schools over the next several years, as well as conducting additional survey work to determine the effectiveness of this approach.

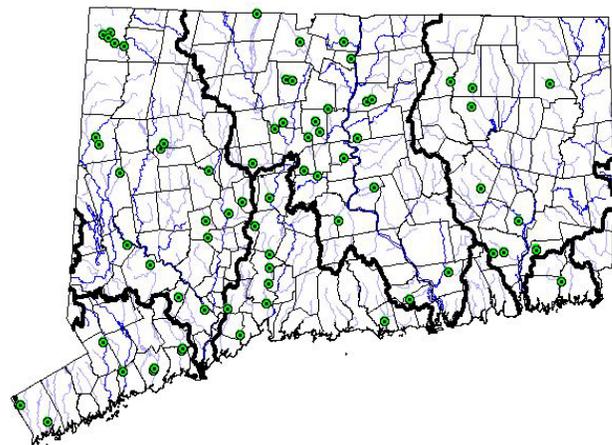


Figure 3. SEARCH sampling sites for 2002-2003 academic year

Plans to expand the SEARCH website to include key SEARCH documents including the teacher's manual, annual water quality reports, and the NPS module are underway. The goal of this effort is to cost-effectively facilitate distribution of SEARCH education resources both within Connecticut and nationally. These documents can be found at <http://www.sciencecenterct.org/projectsearch/>.

Plans are also under development to pilot-test computer GIS based applications with SEARCH schools to expand student understanding of the relationship between rivers and streams and the greater landscape, in particular land use/cover and water quality.

Project Partners and Funding

The primary project partners are: The Science Center of Connecticut, CT DEP, and Connecticut Department of Higher Education (CT DOHE). However over the course of the past nine years, SEARCH staff have partnered with a wide range of organizations on specific program initiatives. These include, The Whitney Water Center, Bristol Regional Environmental Center's, Inc., and Central Connecticut State University. During the period 1994-2003 funding support for Project SEARCH has been provided through the following sources:

- ❖ \$1,500,000 The National Science Foundation (1994-1999) for program development and statewide dissemination to CT High Schools
- ❖ \$115,000 EPA Clean Water Act Section 319 grants awarded by CT DEP (2000- 2003) for stream monitoring and public awareness program
- ❖ \$46,000 Eisenhower Professional Development grants awarded by the CT Department of Higher Education (2000-2002) for training new teachers entering the program
- ❖ \$67,000 The Stroud Water Resources Institute (1997-98) for developing a middle school version of Project SEARCH
- ❖ \$6,000 Long Island Sound Research Fund awarded by the CT Department of Environmental
- ❖ Protection (2001-2003) for support of teacher training workshops and equipment

- ❖ \$10,000 The Barnes Foundation (2002-2003) for expansion to Bristol middle schools

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Section 319 of the Federal Clean Water act authorizes EPA to award grants to states and tribes to support their NPS management programs. The CT DEP passes through a portion of these funds to other state, regional and local government agency and non-government organization to implement programs and projects.

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