



PROTECTION & PROGRESS

2011–2012 | LONG ISLAND SOUND STUDY | BIENNIAL REPORT

PROTECTION & PROGRESS

This report highlights regional efforts to restore and protect Long Island Sound through implementation of a Comprehensive Conservation and Management Plan.

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ACRONYMS & SHORTENED NAMES

CCMP: Comprehensive Conservation and Management Plan
CTDEEP: Connecticut Department of Energy and Environmental Protection
EPA: US Environmental Protection Agency
FUTURES FUND: Long Island Sound Futures Fund
LISS: Long Island Sound Study
NEIWPCC: New England Interstate Water Pollution Control Commission
NFWF: National Fish and Wildlife Foundation
NOAA: National Oceanic and Atmospheric Administration
NYCDEP: New York City Department of Environmental Protection
NYSDEC: New York State Department of Environmental Conservation
THE STUDY: Long Island Sound Study
UCONN CLEAR: University of Connecticut Center for Land Use Education and Research
USFWS: US Fish and Wildlife Service
WWTP: Wastewater Treatment Plant
Unsure about a term used in this report?
See www.LIShealth.net for a definition.

ON THE COVER: Bren Smith harvests sugar kelp in his seaweed/oyster farm off the Thimble Islands in Branford. Smith started seaweed farming as a result of research being conducted by scientists in the Sound (see p. 7).



SUNKEN MEADOW STATE PARK

In October 2012, Superstorm Sandy decided that Mother Nature knows best. The storm caused a breach and eroded away portions of a berm and roadway that restricted tidal flow and fish passage at Sunken Meadow State Park on Long Island. Sunken Meadow Creek now has tidal flow again and is returning to its natural state as an estuary where fresh and salt water mix. Saltwater fish species previously cut off from the creek (including alewife, striped bass, and juvenile bluefish) and various shellfish, waterfowl, shorebirds, and wading birds will all benefit. While Sandy wreaked havoc elsewhere, here it helped to restore 132 acres of tidal wetlands, a "natural" restoration project that had been the highest priority of the National Oceanic and Atmospheric Administration's (NOAA's) Coastal Restoration Program in the Northeast.

AFTER THE STORM: The arrow in the aerial photo (left) points to the berm at Sunken Meadow Creek that was built in the 1950s. The photo above shows the creek without the berm a few days after Superstorm Sandy.

LISS ACTION AGENDA

The Study's 2011 Action Agenda established short-term priority tasks to restore the Sound under the Comprehensive Conservation and Management Plan (CCMP) adopted by the US Environmental Protection Agency (EPA), New York, and Connecticut in 1994. The Action Agenda is divided into four themes:

WATERS AND WATERSHEDS

Promote sustainable pollution control and prevention practices on land and in the water to improve the quality of watersheds and Long Island Sound.

Municipalities are removing nutrient pollution by investing \$2 billion in wastewater treatment plant (WWTP) upgrades, including a \$237 million project at Wards Island in New York City.



HABITATS AND WILDLIFE

Restore and maintain Long Island Sound in a healthy, productive, and resilient condition.

Since 1998, the Study's partners have restored more than 1,270 acres of habitat and opened up more than 240 miles of river habitat for fish passage. In April 2011, volunteers (below) lent a helping hand planting 10,000 dune grass shoots and 400 native shrubs at the Brides Brook in Connecticut's Rocky Neck State Park.



SOUND COMMUNITIES

Support vibrant, informed, and engaged communities that use and appreciate Long Island Sound.

The Study's Citizens Advisory Committee takes pride in its efforts to support the Sound, including at this educational sail in New Haven Harbor, which was part of a seven-harbor summer 2011 tour to promote the CAC's Sound Vision plan.



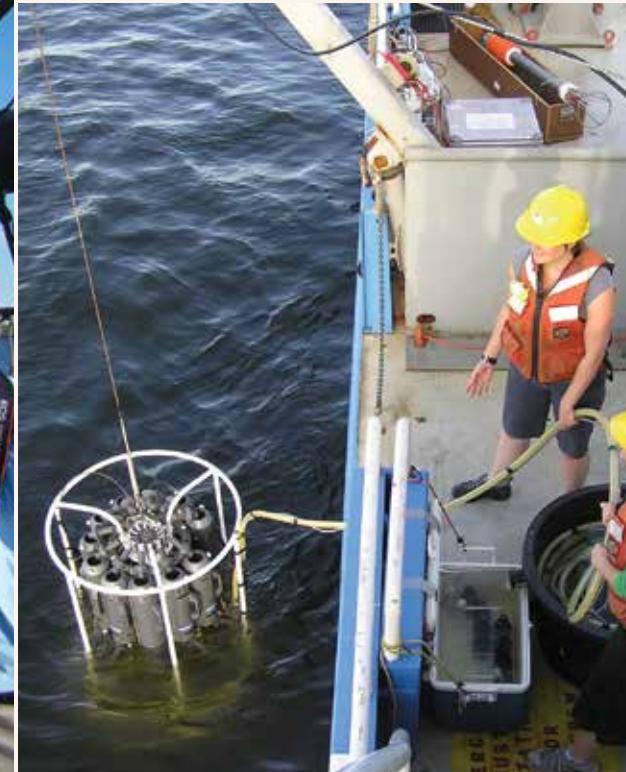
WHAT IS LISS?

The Long Island Sound Study (LISS) is a partnership of federal, state, and local agencies, universities, businesses, and environmental groups dedicated to protecting the Sound. It's managed by the EPA Long Island Sound Office in Stamford, CT.

SCIENCE AND MANAGEMENT

Make ecosystem-based management the foundational principle for management of Long Island Sound.

Since 2000, the Study has funded 33 grants to scientists to conduct research that improves our understanding of the ecological issues facing the Sound. In the photo, students from the laboratory of UMass/Dartmouth Prof. Mark Altabet deploy a rosette sampler as part of a LISS-funded project to learn more about what causes summertime hypoxia in the Western Sound.



PROTECTION & PROGRESS

DIRECTOR'S REMARKS

The theory behind the martial art of jujitsu is to use an attacker's force against him or herself. What if the same theory can be applied to nutrients that degrade coastal water quality? An innovative project just offshore of where the Bronx River empties into Western Long Island Sound is doing just that.

There on a raft anchored offshore, not far from the Hunts Point market, scientists from NOAA, University of Connecticut (UConn), and Purchase College studied a sea farm of shellfish and seaweed. Students from the South Bronx maintained the sea farm through involvement of Rocking the Boat, a nonprofit community development organization. The seaweed and shellfish (ribbed mussels) grow by absorbing and filtering nutrients from the water. When harvested, the nutrients they contain are taken out of the water. As a result, sea farming of shellfish and seaweed could be a powerful tool in cleaning up nutrient-enriched waters, complementing traditional nutrient control strategies as part of a comprehensive clean water strategy. The pilot study is evaluating a range of potential markets for the harvest, including agricultural feeds, biofuels, and pharmaceutical products. The project even caught the interest of CNN and the *New York Times*. If successful, the expansion of sea farming of shellfish and seaweed can mean more local maritime jobs, cleaner water, and quality seafood products.

The lessons learned from the work in the Sound also can be applied elsewhere in the Nation. The need is certainly great. According to EPA, nutrient pollution is one of America's most widespread, costly, and challenging environmental problems. While nitrogen and phosphorus are essential nutrients for the growth of plants and animals, in excess they can overwhelm coastal waters, resulting in poor visibility, low oxygen levels, and loss of healthy wetlands and sea grasses—all problems experienced in Long Island Sound.

In response, EPA, New York, and Connecticut are taking action to reduce the amount of nitrogen entering the Sound by 58.5 percent from 1990 levels, mainly by upgrading WWTPs and controlling stormwater runoff. Investments in wastewater treatment facilities have resulted in these facilities discharging 35 million fewer pounds of nitrogen to the Sound in 2012 compared to 1990, 83 percent of the final reduction goal.

Protection & Progress 2011-2012 highlights a range of tangible steps being taken toward a cleaner, healthier Long Island Sound. Learn more, get involved, and make a difference.

MARK TEDESCO, Director, US EPA Long Island Sound Office

LONG ISLAND SOUND FUTURES

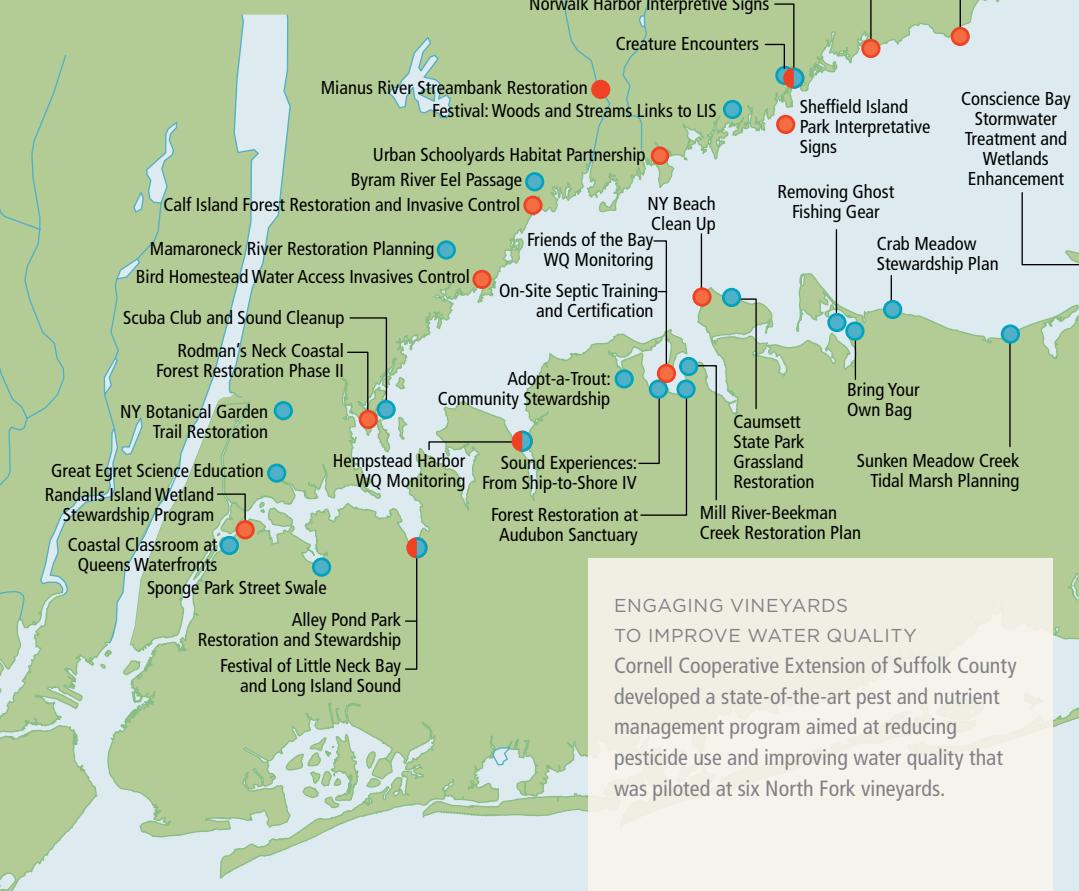
FUND GRANT PROGRAM:

A 'SURROUND SOUND' PARTNERSHIP

FINANCING AN ENVIRONMENTAL PROJECT is a team effort.

In 2011-2012, the Long Island Sound Futures Fund awarded nearly \$3.4 million in grants to groups that matched these funds with an additional \$5.5 million to conduct 74 stewardship, restoration, watershed management, and education projects. During this period, EPA, the US Fish and Wildlife Service (USFWS), the National Fish and Wildlife Foundation (NFWF), Walmart, Wells Fargo, and the Carolyn Conklin Trust provided funds to support the program. Since 2005, 261 projects have been funded, resulting in 128 river miles opened to fish passage, 959 acres of critical fish and wildlife habitat restored or protected, and 600,000 residents educated and involved. See www.longislandsoundstudy.net/grants for descriptions of all projects.

Projects Awarded in 2011 ● 2012 ● 2011-12 ●





AUDUBON ALLIANCE FOR WATERBIRD STEWARDSHIP: Audubon Connecticut reduced threats to priority coastal waterbird species and their habitats by deploying 50 beach stewards to protect nest sites, and by providing stewardship training to land managers in municipalities.

FISH PASSAGE ON SPOONVILLE DAM: The Farmington River Watershed Association in 2012 removed a dam on the Farmington River to restore access to 50 miles of upstream spawning habitat for native fisheries including river herring and shad.



MARINE MEADOWS EELGRASS RESTORATION PROGRAM: Cornell Cooperative Extension of Suffolk County engaged hundreds of volunteers on eastern LI and eastern CT to weave eelgrass shoots into specially designed burlap planting units to be used to restore an acre of eelgrass meadow.



NORWALK HARBOR INTERPRETIVE SIGNAGE PROJECT: The Norwalk Harbor Management Commission installed three interpretive signs at prominent locations in Norwalk Harbor, a Long Island Sound Stewardship Area.



GREAT GULL ISLAND MANAGEMENT: UConn developed a management plan at Great Gull Island and engaged volunteers to remove invasive nuisance plants from seven acres of the island to improve and increase the nesting habitat of threatened and endangered seabirds such as common and roseate terns. The island is owned by the American Museum of Natural History.



WATER QUALITY

A region-wide effort to reduce nitrogen pollution to improve water quality achieved an important milestone thanks to work done by communities across Long Island Sound in 2011 and 2012.

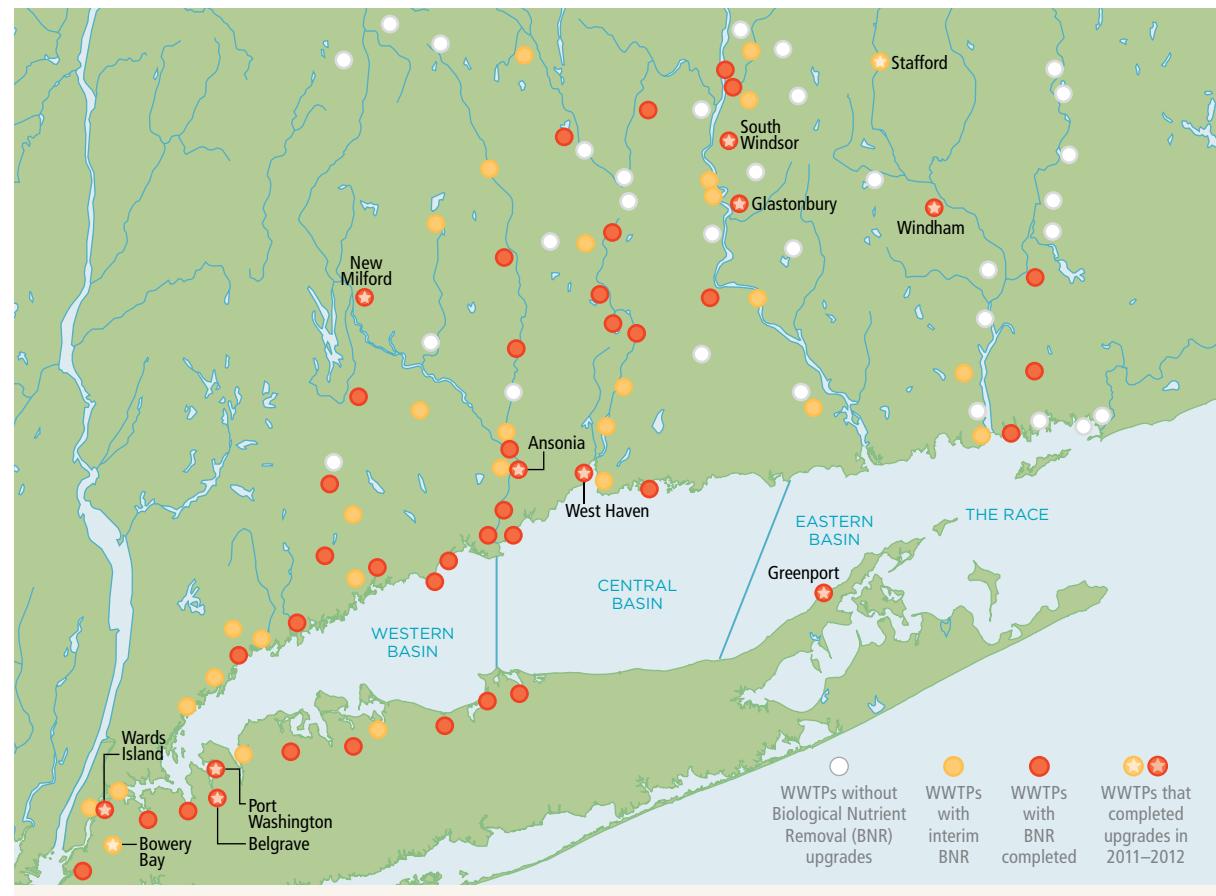
In 2000, the states of New York and Connecticut developed a Total Maximum Daily Load (TMDL) plan to reduce nitrogen loads by 58.5 percent. By 2012, the communities under the TMDL have achieved nearly 83 percent of the target, an increase from 73 percent in 2010. Most communities with WWTPs must reach their individual targets by 2014, with extensions to 2017 granted to New York City and Westchester County.

Nitrogen is a vital nutrient, but, in excess, it can lead to problems, including harmful algal blooms, low oxygen concentrations (hypoxia), loss of underwater vegetation, fish kills, and changes in the Sound's food web. In the 1990s, the Study determined that the largest single source of nitrogen—42 percent or 211,724 pounds per day—came from the treated human waste discharged from WWTPs. Communities with WWTPs are upgrading their plants with a process called biological nutrient removal (BNR), in which bacteria break down and remove the reactive nitrogen found in human waste.

The Study plays an important role in nutrient/hypoxia management in the region by funding various studies to help assess the progress being made to reduce nutrients, and leading a Five State/EPA TMDL Work Group to ensure that nitrogen that drains into the Connecticut River from upland states is also managed and reduced. The Study has also funded projects to demonstrate biologically extracting nutrients from the Sound (see p. 7) and to reduce nutrient runoff (see p. 8).

35,000,000 POUNDS

The amount of nitrogen prevented from entering the Sound in 2012 by advanced wastewater treatment.



WASTEWATER TREATMENT PLANT CONTROL STATUS

PROJECT HIGHLIGHTS 2011-2012

- In 2011, NYCDEP completed a \$122 million combined sewer overflow retention facility in Bayside, Queens. Every time it rains, the facility collects and treats up to five million gallons that was previously discharged into Alley Creek and Little Neck Bay.
- In 2011-2012, the CT towns of Milford, Ansonia, New Milford, and Glastonbury maximized efficiency of their WWTPs to further reduce nitrogen discharges beyond their permitted loads in anticipation of future population growth and foreseeable increased sewage flows.
- NYC completed interim phases at its Bowery Bay and Wards Island WWTPs. Combined, these projects will cost an estimated \$525 million and will result in a reduction of 35,340 pounds of nitrogen per day.
- In the CT Nitrogen Exchange Program, municipalities below their annual nitrogen limits can sell credits. In 2011, 28 facilities received payments totaling \$2,435,958, and 52 facilities purchased credits totaling \$4,398,929.
- In 2011, NYSDEC received EPA approval for the NY waters of the Sound to be a vessel sewage waste "No Discharge Zone." CT waters were designated in 2007. The designation, a goal of the Study's 2003 LIS Agreement, bans boaters from discharging into the water; they must instead dispose of their sewage at specially designated pump-out stations.

THE DATA

REDUCING NITROGEN

IN 2012, 31,522 FEWER EQUALIZED POUNDS per day of nitrogen were discharged from WWTPs compared to the early 1990s baseline level of 59,147 pounds, a 51% decrease. The TMDL sets a final reduction target of 22,774 equalized pounds. A decrease in point source nitrogen loads reflects progress by the states in upgrading wastewater treatment facilities. The effort was helped by the completion of ten upgrades in 2011-2012. CT reported that warmer and drier weather in 2012 improved BNR performance compared to wetter weather in 2011.

Trade equalization is a geographical calculation of the effect a pound of nitrogen leaving a source will eventually have when it reaches Western Long Island Sound where the problem of hypoxia is the greatest.

LIS POINT SOURCE NITROGEN TRADE-EQUALIZED LOADS
(Thousands TE pounds per day)

70



SUCCESS STORY

HARVESTING THE SOUND TO IMPROVE THE WATER

TWO LONG Island Sound research teams are showing that capturing nutrients by growing and harvesting native shellfish and seaweed has the potential to improve the Sound's water quality and provide economic benefits.

The projects are known as nutrient bioextraction, or bioharvesting. They involve the practice of farming and harvesting shellfish and seaweed for the purpose of removing nitrogen and other nutrients from natural water bodies. The shellfish are harvested after eating nitrogen-rich plankton and the seaweeds are harvested after their growth is stimulated by nitrogen.

The Bronx River Watershed Initiative (BRWI) funded the August 2011 installation of a commercial mussel raft in New York City's Bronx River by Pemaquid Mussel Farms and Rocking the Boat, a local youth-development organization. NOAA Northeast Fisheries Science Center's Laboratory in Milford, CT monitored feeding and growth to assess the suitability of the location and estimate how effectively ribbed mussels (*Geukensia demissa*) removed nitrogen and other excess nutrients from the water. The ribbed mussel is a native species that inhabits the intertidal salt marsh habitats, which have been largely replaced by bulkheading and urbanization. Ribbed mussels are not considered to be edible by humans, so they had not been cultivated using aquaculture methods before this study. The Bronx River site did not have enough natural phytoplankton food to be considered a good site for shellfish growth, but the ribbed mussels were still able to survive and grow, and 300 pounds of mussels were harvested at project end.



STUDENTS FROM Rocking the Boat help hang lines during the raft installation (above). UConn marine scientists Charles Yarish, left, and Jang Kim, center, pull up *Gracilaria* (right).

A second team led by Prof. Charles Yarish of UConn's Department of Ecology and Evolutionary Biology and Prof. George Kraemer of Purchase College added a native red seaweed (*Gracilaria tikvahiae*) onto ropes suspended in the water column and attached to the mussel raft. That research team also suspended the seaweed on ropes attached to buoys in a second location off Fairfield, CT. The *Gracilaria* had grown from seed stock that was raised at UConn/Stamford's Seaweed Marine Biotechnology Laboratory and the Bridgeport Regional Aquaculture Science and Technology Education Center. By the end of 2012, the seaweed projects harvested 3,200 pounds of *Gracilaria*, removing about 13 pounds of nitrogen.

The success of bioharvesting will depend on economic considerations. The NOAA Milford team has been working with a NOAA lab in Seattle to assess whether the ribbed



mussels could be used as an alternative feed for finfish farms. Yarish is working with Bren Smith, an oyster farmer in Branford, CT, to see if growing another seaweed, sugar kelp (*Saccharina latissima*), a highly valued food source in health food and restaurant markets, could be a viable business in the Sound.

Sponsors for the two projects included the Futures Fund, which provided a \$110,000 grant for the seaweed project, EPA, NOAA, through the Aquaculture Program and Small Business Innovation Research program, and the New York State Office of the Attorney General as part of the BRWI.

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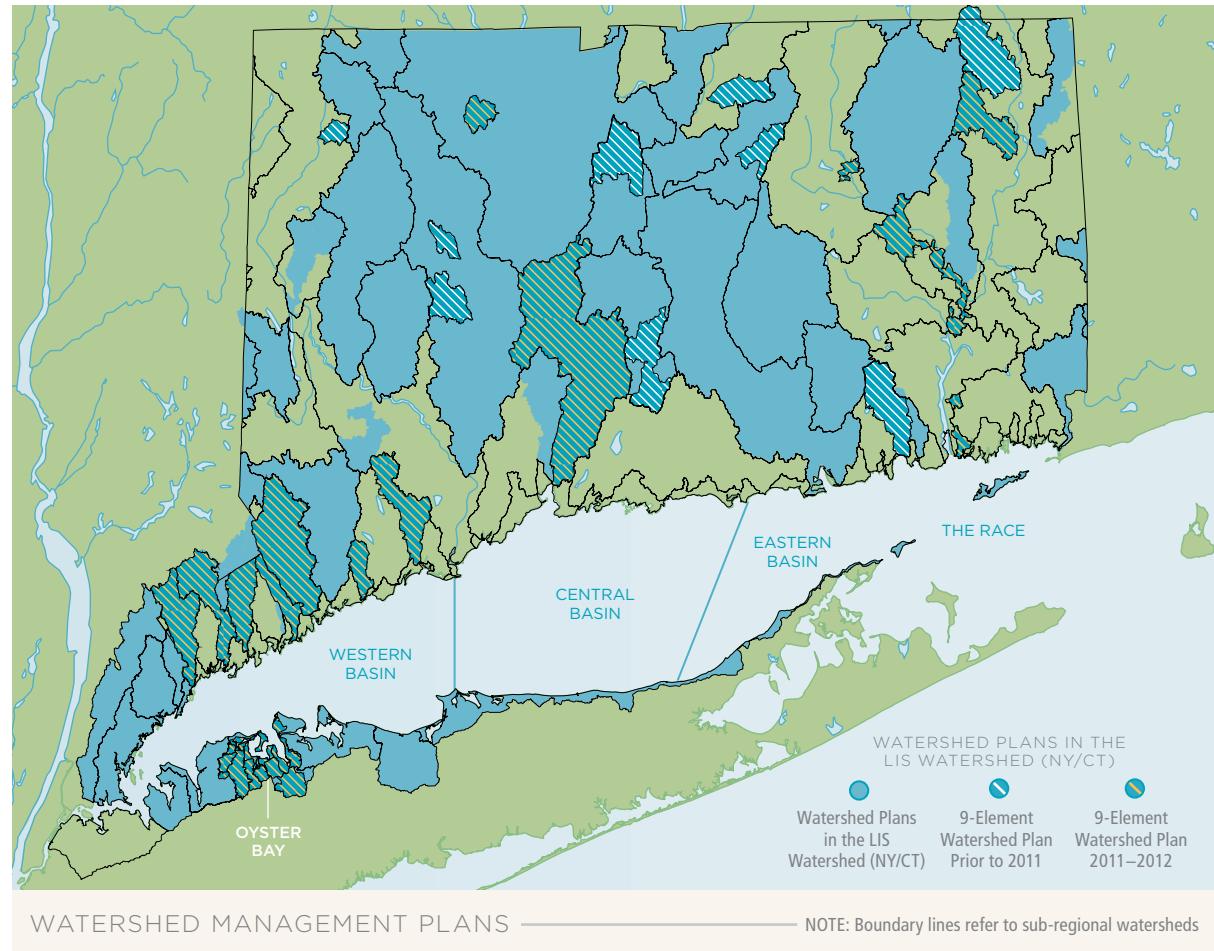
WATERSHED MANAGEMENT

A watershed is an area of land where water drains to the same place such as a river, lake, or coastal body of water. The Sound's watershed is massive, consisting of 465 smaller, interconnected watersheds (or drainage basins) covering more than 16,000 square miles in six states. In the watershed, rain can carry pollutants and nutrients from impervious surfaces and agricultural lands to storm drains and tributaries that flow into the Sound. Land-based pollution can lead to impairments in the Sound such as low levels of oxygen and high counts of pathogens that lead to closed beaches and shellfish beds.

To help communities identify their impact on water quality, LISS funded UConn's Center for Land Use Education and Research (CLEAR) to use satellite imagery to map the types of land cover and areas of impervious surface in each of the 198 drainage basins in New York and Connecticut (see highlight, page 14). The Study, through the Futures Fund, has also provided assistance to 24 municipalities and watershed groups since 2005 to develop watershed plans that focus on regional approaches to reduce the impact of development and agricultural use on water quality. The Study's 2011 Action Agenda proposes specific watershed management actions to improve water quality, including developing and/or promoting guidance for fertilizer and pesticide use, improving the performance of on-site wastewater treatment systems, such as cesspools and septic tanks, and promoting efforts to implement Best Management Practices (BMPs) and Low Impact Development (LID) to reduce polluted runoff from existing and new development.

2,800+ SQUARE MILES

The area of the watershed in NY and CT where communities have participated in developing or implementing a local watershed plan.



PROJECT HIGHLIGHTS 2011–2012

- In August 2012, 14 local governments on Long Island that had been meeting since 2010 established the Oyster Bay/Cold Spring Harbor Protection Committee, one of the top priorities in an intermunicipal Watershed Action Plan. Its creation was supported by a \$60,000 grant from the Futures Fund in 2010. The watershed spans 40 square miles.
- In 2011, the Futures Fund awarded a \$60,000 grant to the Regional Plan Association to prepare a plan to install two bioretention basins (vegetated areas that treat pollutants) under the Long Island Expressway to detain and filter about 320,000 gallons of polluted stormwater runoff annually flowing into the Sound.
- In 2011, the Futures Fund awarded a \$150,000 grant to the Connecticut River Coastal Conservation District and two other conservation districts to develop voluntary projects designed to assist 15 or more horse farm owners, operators, and managers to implement best management practices to reduce manure runoff.
- In 2012, the Study awarded a \$66,603 grant to the CT NEMO program to build a bioretention basin filled with plants on the UConn/Storrs campus. The project treats runoff from 10,000 square feet of pavement. Monitoring will assess how much nitrogen the treatment basin removes from the runoff.

THE DATA

WATERSHED PLANS

IN 2011-2012, the CT Department of Energy and Environmental Protection (CTDEEP) identified 15 communities (an area totaling 528 square miles) that drafted or completed EPA 9-element watershed plans. In 2011, the 40-square mile Oyster Bay/Cold Spring Harbor watershed in NY completed a plan that also used the guidance. EPA developed the 9-element guidance to help watershed managers address some of the most common pitfalls seen in watershed plans.

In prior years LISS tracked communities conducting all watershed planning efforts, including the EPA-based plans. By 2010, more than half of watersheds in NY and CT had watershed strategies, fulfilling a goal set by the LISS Policy Committee in 2003. An increase in implementing watershed projects (see below) reflects progress in managing water pollution that originates on land.

STORMWATER CONTROL AND LID PROJECTS SUPPORTED BY THE FUTURES FUND

- | | |
|---|---|
| 1. 2006 McKook Pt Park, E. Lyme, CT | 10. 2008/9 Randalls Island, NY |
| 2. 2011 Middletown, CT | 11. 2011 LIE, Queens, NY |
| 3. 2010 O'Sullivan's Peninsula, Derby, CT | 12. 2010 Queensborough CC, Queens, NY |
| 4. 2005 Norwalk Harbor, Norwalk, CT | 13. 2006 West Shore Road, Mill Neck, NY |
| 5. 2010 Mill River St Park, Stamford, CT | 14. 2010/12 Old Field, NY |
| 6. 2005 Rye, NY | 15. 2008 Mattituck Creek, NY |
| 7. 2010 Town of Mamaroneck, NY | 16. 2012 UConn Campus/Storrs, CT |
| 8. 2006 Bronx River, Bronx, NY | (Not shown on map) |
| 9. 2010 The Point, Bronx, NY | |



SUCCESS STORY

FARMERS PILOT PROJECT TO REDUCE NITROGEN

SCIENTISTS AND RESOURCE managers know that slow or controlled-release nitrogen fertilizer (CRNF) can reduce the amount of nitrogen used on farms without affecting yields. A two-year project conducted by Cornell Cooperative Extension (CCE) of Suffolk County, with funding support from the Futures Fund and American Farmland Trust, is now looking to encourage farmers on the east end of Long Island to give it a try.

The project is important because excess nitrogen can leach into groundwater, affecting the region's sole-source aquifer and draining to the surrounding bays and estuaries.

Working with sweet corn farmers, CCE created eight demonstration sites along Long Island's North Fork, some of the most valuable farmland in the state. It used a side-by-side comparison of CRNF with conventional fertilizer programs. Unlike conventional fertilizer, which is often applied twice, once at planting and a second ("sidedress") application when plants are around 10 inches tall to account for potential nitrogen loss, CRNF is only applied at planting, ultimately reducing fertilizer use, tractor time, and effort. Because CRNF does not break down during early spring rains, like conventional fertilizers do, less nitrate (a nitrogen compound) is available in the soil profile to be leached early in the season.

CCE's Agricultural Stewardship team worked directly with farmers throughout the growing season on nine plantings. In four plantings, CRNF produced yields equal or greater than the standard and reduced nitrogen application rates by an average of 30 pounds per acre. The other five plantings had similar results between the two practices,



with some yield losses in the CRNF fields that were minimal and would not be a limiting factor. There was no noticeable difference in the quality of the sweet corn and farmers were supportive of this technique being further adopted. On average, farmers using CRNF saved \$46 per acre in 2012, but this figure will change from year-to-year depending on market value and other variables. It is expected that cost savings would be higher in wetter years.



SIDE-BY-SIDE plots of corn grown using conventional fertilizer (red flags) and controlled-release nitrogen fertilizer (yellow flags) look the same (above). Ashley Schmitt of Phillip A. Schmitt and Son Farm inspects corn grown in the program (below).

This project demonstrated that CRNF is a viable growing option that will also protect water quality. Farmers that participated in this and other demonstration projects also have helped persuade other farmers to participate, further expanding the scope of the program. In addition, CCE's Agricultural Stewardship team discussed the program at various grower meetings to encourage more farmers to participate. Farmers have the option of signing up for calibration assistance, nitrogen-load reduction, and other practices in the hopes of ultimately getting them to try CRNF. By March 2013, CCE had 27 commercial sweet corn and potato farmers who signed up for the 2013 growing season. Since only a few growers have adopted the practice on all of their acreage, further reductions in nitrogen applications can be achieved.

PROTECTION & PROGRESS

HABITAT RESTORATION

In 1998, LISS, through the Habitat Restoration Work Group, established restoration targets (see p. 11) to restore 12 priority habitats in order to protect the natural resources of Long Island Sound. Since then, nearly 200 projects have been completed, from restoring access for fish to river spawning areas previously blocked by dams to restoring tidal wetlands. A key part of successful restoration is collaboration between federal, state, and local agencies as well as environmental organizations and local groups. For example, the Long Beach West dune restoration project (see highlight), led by USFWS, involved more than a dozen partners.

Restoration can be technically challenging as well as expensive. To help municipalities and environmental groups restore habitat, LISS-funded habitat coordinators in CT and NY have been providing communities with technical assistance and advice on where and how to apply for grants, including the Futures Fund, which has provided more than 40 grants for restoration projects since 2005. The coordinators have also assisted in the permit process needed to authorize work on the projects.

In 2012, the LISS Habitat Restoration Work Group also took a broader approach to better understand the balance of the priority habitats in the Sound's ecosystem and how it has changed over time by working with a multiagency subcommittee to gather historic and present-day acreage information.

Descriptions of the 12 priority habitats as well as all restoration projects are available on the Study's website.

1,000,000+ ALEWIVES

The number of alewives passing through the upgraded channel at Brides Brook since 2010, a threefold increase in annual run size and a strong indication of the project's success.



HABITAT RESTORATION PROJECTS

- 1a. Anguilla Brook Fish Passage Restoration (2 sites), Stonington, CT
- 1b. Anguilla Brook Fish Passage Restoration (2 sites), Stonington, CT
2. Groton Long Point Tidal Marsh Restoration, Groton, CT
3. Londregan Tidal Marsh Restoration, New London, CT
4. Harkness Memorial State Park Dune Restoration, Waterford, CT
5. Brides Brook Dune Restoration, Stratford, CT
6. Lyman Viaduct Fish Passage Restoration, Colchester, CT
7. Spoonville Dam Removal, Bloomfield & East Granby, CT
8. Guilford Point/Seaside Ave TW Restoration, Guilford, CT
9. Harry O. Haakensen Fishway at Wallace Dam, Wallingford, CT

10. Little River Tidal Marsh Restoration, New & North Haven, CT
11. West River Tidal Flow & Fish Passage Restoration, New & West Haven, CT
12. Club Creek Tidal Marsh Restoration, West Haven, CT
13. West River Tidal Flow & Fish Passage Restoration, New & West Haven, CT
14. Long Beach West Dune Restoration, Stratford, CT
15. Mamaroneck River, Saxon Woods Park, Mamaroneck, NY
16. Bronx R. Streambank Stabilization and Wetland Restoration, White Plains, NY
17. Soundview Park, Tidal Marsh Restoration Bronx, NY
18. Betty Allen Twin Ponds Nature Park, Fishway, Centerport, NY
19. Sunken Meadow Creek, Tidal Flow and Wetland Restoration, Smithtown, NY

PROJECT HIGHLIGHTS 2011-2012

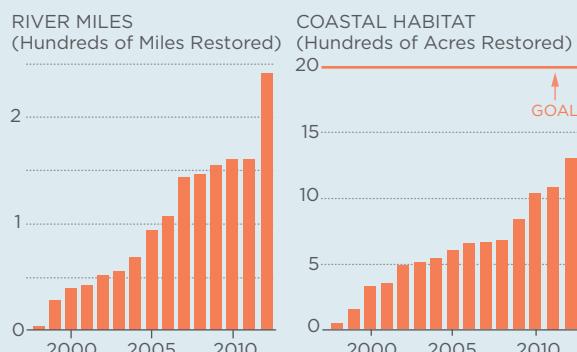
- In 2012, the USFWS Northeast Region and its partners received a Coastal America Partnership Award for a 35-acre beach and dune restoration project at Long Beach West. The 2010-2011 project removed 37 abandoned houses and 25 outbuildings that were an eyesore and, if left standing, would have most likely resulted in the scattering of tons of toxic debris from the impacts of Tropical Storm Irene and Superstorm Sandy. The project received \$909,000 through the 2009 American Recovery and Reinvestment Act, and an additional \$233,000 from multiple sources, including the Futures Fund.
- In 2012, the Futures Fund awarded a \$100,000 grant to NYC Dept. of Parks and Recreation to restore and enhance about 31 acres of coastal forest at Rodman's Neck in Pelham Bay Park in the Bronx, adding to 65 acres already restored under a previous Futures Fund grant.
- The Futures Fund provided \$125,800 to the Farmington River Watershed Association in 2011 and 2012 to help fund the removal of a breached dam in summer 2012. Thanks to the removal of the Spoonville Dam, there is now upstream access to 50 miles of historic spawning habitat for American eel, American shad, Atlantic salmon, and river herring.

THE DATA

RESTORING HABITATS

FISH PASSAGE PROJECTS remove the barriers (such as dams and narrow culverts) that prevent migratory fish from finding suitable freshwater spawning habitat. In 2012, five completed projects reopened 86 miles of river for fish passage, the most recorded since the Study first set targets for river restoration in 1998. Available funds to finance the Spoonville Dam project (see highlight) and other large projects were largely responsible for the success. A goal to restore 100 miles by 2008 was surpassed in 2006, and a second goal to restore an additional 43 miles by 2011 was surpassed in 2008. Most projects are in CT, but NY completed its first project in 2010 and a second in 2011.

By 2012, LISS partners restored 1,267 coastal acres, falling short of a goal launched in 1998 to restore 2,000 acres of coastal habitat in 10 years. The goal has since been extended to 2020. For several years, after initial success restoring larger, relatively less expensive sites, LISS partners tackled smaller, sensitive sites that were difficult to restore. But the number of restored acres increased in 2009-2010 and again in 2012, with projects that had the potential to quickly restore wetland vegetation in large areas. For example, in 2012, the installation of three tidal gates in the West River in New Haven restored 80 acres of wetlands. While it doesn't count as part of the restoration target, the breach of a berm in Sunken Meadow State Park following Superstorm Sandy reestablished 132 acres of tidal wetlands (see p. 2).



FOOTNOTE: Both charts show cumulative totals

SUCCESS STORY

RESTORATION PROJECTS IN NY AND CT

ALLEY POND

Alley Pond Park, a 657-acre coastal treasure in densely-populated Queens, is in the midst of a major restoration. By project end, more than 145 acres of forest, salt marsh, and grassland habitat will be restored. In 2007, the Futures Fund contributed to the effort by awarding a \$150,000 grant to the NYC Department of Parks and Recreation's Natural Resources Group (NRG) to help restore 23 acres of forests at the headwaters of Alley Creek. The project included installing erosion control fabric, and planting 15,300 native trees, shrubs, and herbaceous plants to stabilize and restore the degraded environment. In 2012, the Futures Fund helped again by providing a \$100,000 grant to NRG to restore an additional 26 acres of forest. The project will begin in 2013, and will remove invasive plants, replacing them with 6,000 trees and shrub seedlings.

Alley Pond Park, a LIS Stewardship Area, offers one of the largest, unfragmented watersheds in urban New York City. Because of its glacial formed moraine, the park has numerous unique natural features like freshwater and saltwater wetlands, tidal flats, meadows, and forests that create a diverse ecosystem and support abundant bird life.

Each September, on National Estuary Day, the Alley Pond Environmental Center holds a festival to celebrate Long Island Sound. The festivals have received support from Futures Fund mini-grants.

RUTAN DAM

The Anguilla Brook in Stonington, CT gets its name from the Latin genus of the American eel, *Anguilla rostrata*. Now eels will have



THE LISS HABITAT Restoration Team in a newly created meadow at Alley Pond during a site visit to view tidal wetland and grassland restoration projects (above). The Rutan Dam being demolished in 2012 (below).

opportunity to once again migrate up the Anguilla Brook thanks to two projects funded in part by the Futures Fund.

At the lower end of the Anguilla Brook two dams a mile apart had blocked 13 miles of river passage for fish, including eels, for hundreds of years. Following heavy rain events in 2009 and 2010, downstream residents became increasingly concerned about the integrity of the Rutan Dam, and the possibility of its failure. As a result, The Nature Conservancy and the Avalonia Land Conservancy teamed up to apply for grants to remove the Rutan Dam, restore its natural floodplain, and create a fishway at the Wequetequock Pond Dam. In 2010, the Futures Fund awarded a \$122,400 grant to the Avalonia Land Conservancy as part of the \$150,000 project. The funds paid for the design of the fishway, permits, engineering oversight during construction, and removal of the dam. With help from volunteers, stone from the Rutan Dam demolition was used to create a pool and weir fishway, like a series



PROTECTION & PROGRESS

STEWARDSHIP

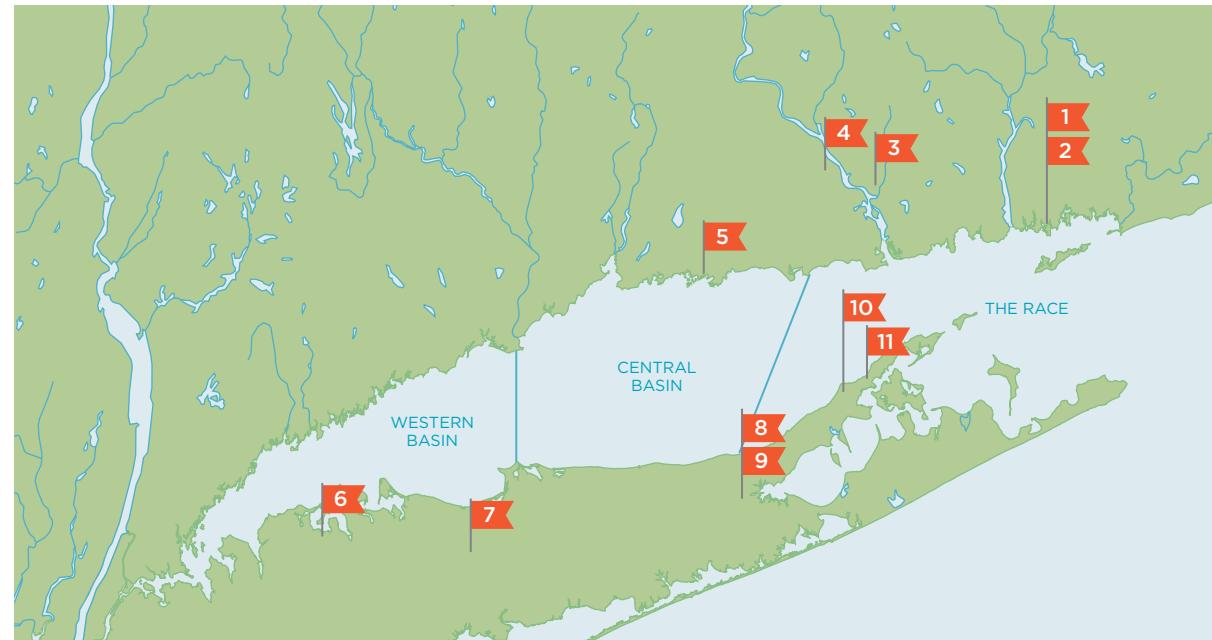
The LISS Stewardship Initiative works with partners throughout the region to protect the special, natural places around the Sound. In 2006, this effort culminated in 33 areas with unique ecological and recreational value being designated as Stewardship Areas. Since then, the Study has been active in assisting states and municipalities with acquiring lands near Stewardship Areas to protect wildlife and habitats from encroaching development, and providing grants through the Futures Fund to help managers develop conservation plans and implement stewardship projects.

EPA, through LISS, has provided \$1,220,000 since 2008 to help in the purchase of four separate sites totaling 83 acres at a total cost of \$6,520,000. The Futures Fund also provided \$260,000 to help acquire a 17-acre parcel in Madison, CT that cost \$1.7 million. The financial support is welcomed by state and local partners because of the high real estate values in New York and Connecticut coastal communities. The Stewardship Initiative Work Group also is helping to support more strategic prioritization of land protection and acquisitions by working with local, state, and federal partners to develop a geo-referencing site selection tool that provides information on habitat, species, and recreational value of parcels.

In 2012, the work group began assessing ways that the ecological value of private lands surrounding stewardship sites can be improved through sensible development or protection. Private lands in Stewardship Areas can provide migratory stopover habitat, ecological buffer zones, water pollution filters, and space for the habitats to migrate if sea level rises. The work group also worked with outreach staff to develop an online Stewardship Atlas and organized public outreach events to encourage greater appreciation of the Sound's resources.

100 ACRES

The total area of coastal properties protected with financial support from LISS and the Futures Fund since 2008.



COASTAL LANDS PROTECTED

1. Crowley Parcel/Matson, Stonington, CT
2. Crowley Parcel 2, Stonington, CT
3. Talcott property/Chestnut Hill preserve, Lyme, CT
4. Feldman property, Chester, CT
5. Pieper property, Branford CT
6. Oyster Bay Cove conservation easement, Oyster Bay, NY

7. Hauppauge Springs acquisition, (Kasper), Hauppauge, NY
8. Harbes Farm development rights, Riverhead, NY
9. North Fork Preserve Inc., Riverhead, NY
10. Flora Nursery development rights, Mattituck, NY
11. Conway Farm, Southold, NY

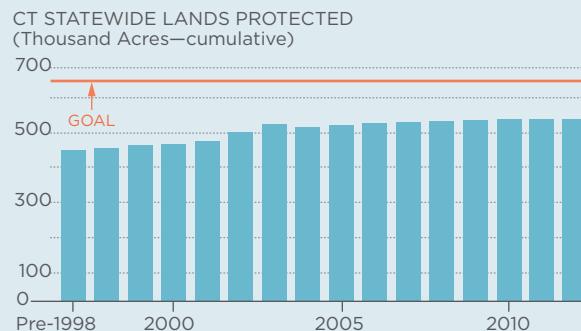
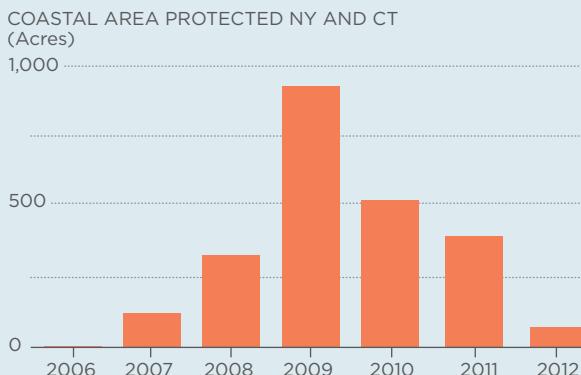
PROJECT HIGHLIGHTS 2011-2012

- In 2011, the Study provided a \$300,000 grant to CTDEEP to help purchase 6.2 acres known as the Matson property to extend the Barn Island Wildlife Management Area, a Stewardship Area and the state's largest, most diverse, and ecologically significant coastal wildlife preserve. In 2012, the Futures Fund also awarded a \$24,000 grant to CTDEEP to develop a Comprehensive Management Plan for Barn Island. Earlier, in 2009, the Study provided a \$650,000 grant to help purchase 48 acres of forests and wetlands adjacent to Barn Island to expand habitat for 25 plant and animal species on state or federal protection lists.
- In 2012, New York State Parks, with LISS staff, held volunteer "Stewardship Days" events. Activities included invasive plant pulls at Sunken Meadow State Park and Brookhaven State Park, native tree planting at Orient Point State Park, and native seed collection at Caumsett State Park and Preserve. More than 50 volunteers participated in these events.
- In 2012, the Futures Fund provided a \$39,865 grant to UConn to develop a management plan and engage 50 volunteers to remove invasive plants from seven acres of Great Gull Island, a Stewardship Area, to improve and increase common and roseate tern nesting habitat. There are an estimated 1,300 nesting pairs of roseate terns (one of the largest concentrations in the Western Hemisphere) and 9,500 nesting pairs of common terns (one of the largest concentrations in the world) on the island.

THE DATA

PROTECTING OPEN SPACE

THE STUDY ESTIMATES that in 2011 and 2012 non-profit organizations and local, state, and federal agencies acquired or purchased easements for at least 21 properties in the LIS watershed. These actions protected 500 acres of undeveloped lands as natural open space. The research was compiled by LISS's habitat restoration coordinators from press releases, newspaper articles, and websites. The list does not account for all transactions, but shows that the region far exceeded a goal established by the LISS Policy Committee in 2006 to restore and protect 300 acres of land by 2011. The acquisitions and easements also help to fulfill Open Space Protection Plans established by CT and NY.



FOOTNOTE: CT is more than 70% toward the state goal of protecting 673,210 acres of land for the entire state.

SUCCESS STORY

PROTECTING THE HABITATS OF EAST RIVER PRESERVE

THE EAST RIVER PRESERVE, acquired by the town of Guilford, CT in 2009, buffers the beautiful East River to the west and serves as an ecological bridge connecting two protected parcels that lie to the property's north.

The preserve is an area of exceptional ecological value. Spanning 583 acres, this property is one of the only areas in Connecticut that was never clear cut for farming. Along with soil that remains untilled and some of the oldest coastal forest in the state, the preserve contains an extensive network of vernal pools, streams, freshwater and tidal wetlands, rocky outcroppings, and 40 acres of grassland fields that support an abundance of pollinators and bird species including the eastern meadowlark, a state species of concern.

In addition to a rich diversity of habitat types, the preserve serves as an upland buffer for the East River, shading its banks, protecting the river from runoff, and contributing to its status as one of the state's healthiest rivers. This benefit flows beyond the river itself, into the extensive tidal wetlands systems downstream and to the Sound.

This area contains a level of ecological intactness that is rare in the region's highly urbanized coastline. Guilford was proactive in recognizing the value of the land and the need to protect it, not only by protecting it in 2009, but by creating a management plan in 2011 that will guide its sustainable use and enjoyment for years to come.

The management plan committee included Guilford residents, the town planner, local conservation organizations, CTDEEP, Audubon Connecticut, FWS, and others. Dave Kozak,



the LISS Stewardship Work Group co-chair and a senior coastal planner with CTDEEP, and Suzanne Paton, a USFWS biologist, provided technical assistance on the management plan development. The group hired a consulting firm to do an ecological assessment that identified the outstanding quality of the vernal pools, and noted that the site was highly unique because it was never disturbed by agriculture.

The committee also worked with the public to design ways to enhance recreational use of the site while maintaining its high



LISS HAS A NEW WEBSITE that highlights the ecological and recreational significance of the 33 Stewardship Areas. It's available at LISStewardshipatlas.net.

A VIEW OF the East River Preserve from the Clapboard Hill Road Bridge. The preserve serves as a buffer to the East River and is an area of exceptional ecological value.

level of ecological integrity. The committee re-routed trails to locations with the most beautiful vantage points, considered recreation options, and decided on the best ways to both enjoy and protect this valuable resource. Once the plan was approved in 2011, it was submitted to NOAA, one of the entities that had a lead role in funding the acquisition of this site. Impressed with its quality, NOAA requested to use the plan as a template for future grant recipients.

The East River Preserve Management Plan is a noteworthy example of a community working to ensure the future protection and enjoyment of their local environment. The future of open space in urban landscapes depends on this sort of community-driven initiative and foresight.

MONITORING + ASSESSMENT

Monitoring environmental conditions over time provides crucial information to assess the progress made in achieving the goals of the Study's CCMP and to identify emerging trends.

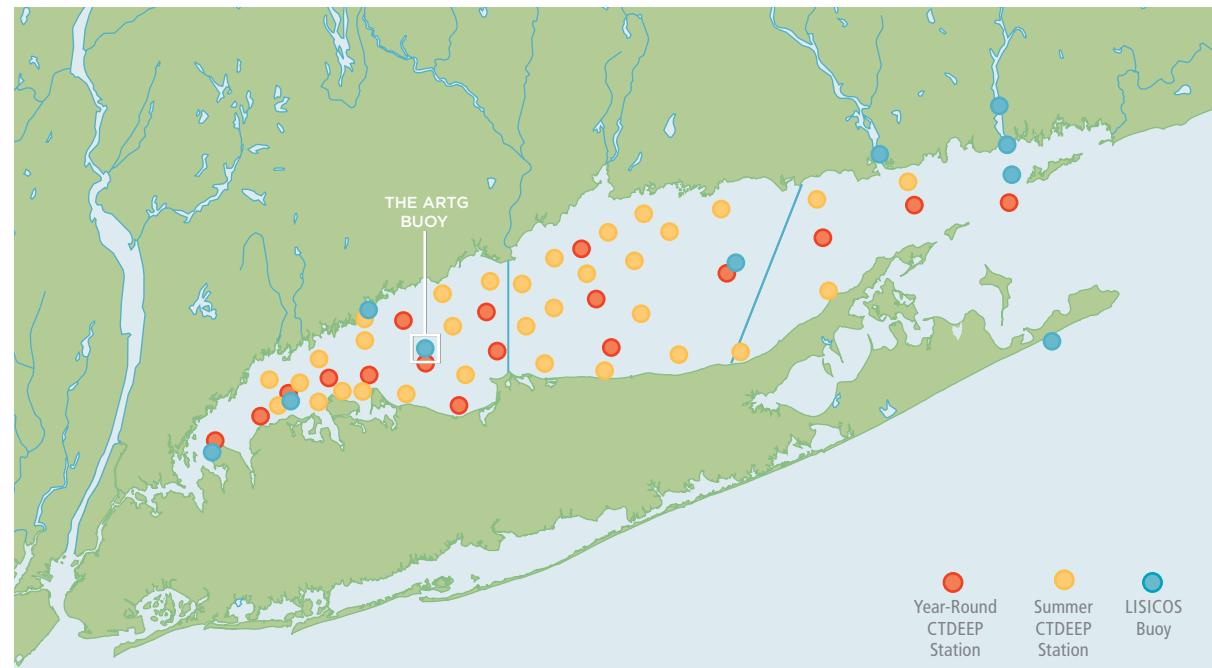
The Study has played an important role in funding monitoring programs. Since 1991, for example, LISS has funded CTDEEP to monitor water quality year-round throughout the Sound. Among the parameters measured are dissolved oxygen, chlorophyll *a*, and water clarity. Scientists also use the data to support basic research on the causes of hypoxia (low concentrations of dissolved oxygen) and other water quality issues. In 2011 and 2012, the Study also funded an additional real-time water quality monitoring buoy in the Western Sound (see spotlight). The Sound's buoy network began in 1998 with the help of the Study, which leveraged EPA's Empact Grant Program to provide \$1 million to install the first buoy stations.

LISS also helps monitoring programs through the Futures Fund, which has provided grants to citizen monitoring programs to sample in harbors and nearshore areas. In 2012, the Study, through NEIWPCC, also provided a grant to the Maritime Aquarium of Norwalk to study the viability of expanding and coordinating citizen embayment monitoring programs.

Besides water quality, LISS funding contributes to monitoring programs that track other CCMP challenges, including protecting habitats and assessing the impact of development on habitats and water quality. For example, LISS funds USFWS to survey the extent of eelgrass meadows, and UConn CLEAR to track changes in land use and impervious surfaces that can impact the Sound and its tributaries.

1,000,000+ SAMPLES

The number of water quality samples collected by the LIS Water Quality monitoring program from 1991 to June 2013 to measure parameters such as temperature, dissolved oxygen, and nutrients.



WATER QUALITY MONITORING STATIONS

FOOTNOTES: Summer boat stations collect samples from mid-June to September. The buoy sensors are operated by UConn's Long Island Sound Integrated Coastal Observing System. The newest buoy station, the ArtG, was named for Art Glowka, a long-time environmental advocate for the Long Island Sound and Hudson River, who died in 2013.

PROJECT HIGHLIGHTS 2011-2012

- In 2011, LISS partners collected blue mussels from reference sites around the Sound to assist in NOAA's Mussel Watch Program. By collecting the samples, which was requested by NOAA due to budget cutbacks, LIS partners prevented a gap in a data series that goes back to 1986. Mussel Watch tracks chemical contaminants in coastal sites across the US.
- In August 2012, USFWS performed aircraft photographic overflights of eelgrass beds, its fourth since 2003, to survey eelgrass abundance. Eelgrass beds, found in the shallow-subtidal zone, serve as food, nursery, and forage areas for shellfish, fish, and birds. They also reduce turbidity and recycle nutrients.
- In 2011, the Study updated its online indicators presentation to make it easier for resource managers and the public to search for data tracking environmental conditions and management efforts to protect the Sound.
- In 2012, the Futures Fund awarded a \$24,730 grant to Sacred Heart University to conduct an outreach, education, and data collection program about American horseshoe crabs in 12 communities involving 600 volunteers and 20 K-12 schools.
- In 2012, the UConn CLEAR program unveiled the updated and expanded version of its Changing Landscape Project, which uses remote sensing imagery to document where and how much development occurred between 1985 and 2010. The project update was funded with a \$108,956 grant from the Study and for the first time included the NY portion of the LIS watershed.
- In 2011 and 2012, the Futures Fund provided \$120,000 in grants to help citizen groups conduct water quality monitoring programs in Oyster Bay, Hempstead Harbor, Stonington Harbor, and the mouth of the Thames River.

DATA SPOTLIGHT

MONITORING AIDS OPENING OF SHELLFISH BEDS

IN JUNE 2011, citing the positive results of sanitary surveys, water quality monitoring, and shellfish tissue testing, NYSDEC reclassified approximately 2,500 acres of underwater lands in outer Hempstead Harbor from uncertified to certified year-round for shellfish harvesting. Activities that have contributed to the water quality improvement in the harbor include: UV disinfection at the Glen Cove sewage treatment plant, stormwater control projects implemented around the harbor, the cleanup of multiple inactive hazardous waste sites, and water quality monitoring conducted by the Coalition to Save Hempstead Harbor through funding from the Hempstead Harbor Protection Committee. In 2011, the Futures Fund provided a \$40,000 grant to the protection committee to collect data at 18 locations and to track 13 different sources of pollution. The committee uses the data to gauge progress, pinpoint sources of pollution, and monitor water quality at the newly opened shellfish beds. From 2007 to 2009, LISS provided an additional \$105,500 to help fund citizen monitoring efforts. The day of reopening saw a large turnout of shell fishermen in an area that hadn't been harvested in 35 years.

CLAMS HARVESTED ON the first day shellfish beds were reopened in a section of outer Hempstead Harbor.



PROJECT SPOTLIGHT

Q&A: WHY BUOY MONITORING MATTERS FOR LIS

JIM O'DONNELL, a marine scientist at UConn/Avery Point, is co-chair of the Study's Science and Technical Advisory Committee. In this Q&A, he discusses the effort by the Long Island Sound Integrated Coastal Observing System (LISICOS) to expand real-time monitoring using buoys equipped with scientific instrumentation.



How did you first become involved in developing the LISICOS Buoy Network?

(UConn scientist) Hans Dam and I were interested in trying to better understand the processes that controlled dissolved oxygen (DO) decline in the Western Sound. So we got together with (UConn scientist) Frank Bohlen to develop a proposal to NOAA for a large interdisciplinary experiment funded for three years that added three buoys to the existing network (see intro, p. 14). The new insights from these data have allowed us to secure additional NOAA funding to sustain the program. We now have ten years of data.

The use of moored buoys to measure water quality is becoming increasingly popular in many estuaries. How does a buoy network enhance a water quality monitoring program?

It is clear that there are rapid variations in DO each day and that ship samples (such as the LIS monitoring program) can't resolve them properly. On the other hand, ships support spatial surveys that buoys can't deliver and can collect water samples for lab analyses that can't be done automatically. The two approaches are complementary and data

DEPLOYING a monitoring buoy in the Western Sound.

analysis approaches are being developed that can combine the measurements in a manner that optimizes the advantages of both.

Recently LISICOS was funded by the LISS to augment existing buoys and add a new one. How will this help us to better understand and manage our estuary?

The sites of the existing buoys were chosen to observe the areas where hypoxia is the most extreme. To the east of the WLIS buoy the near bottom DO is depressed, but does not typically fall below the threshold for hypoxia. We believe that this region will be the first to show the expected improvements from management efforts to limit nitrogen discharge and this buoy will help us detect them.

What do you think are the key challenges facing the buoy program in the future?

Since decade-long cycles in global weather patterns likely influence the extent and duration of hypoxia, we must sustain the infrastructure for another 20 years to separate the expected change due to management actions from natural variations. The greatest challenge to all long-term observation programs is sustaining the recognition of their importance as a priority for financial support.

How can the buoys help us understand and be prepared for climate change?

The only way to detect change unambiguously is through sustained, consistent, and well-calibrated measurements. The buoys we have deployed can be exploited to measure water quality and meteorology parameters such as oxygen, temperature, salinity, wave height, and wind speed



and direction. From measurements over land we know that there are cycles in global weather patterns in wind and temperature that have five- to ten-year periods (like El Niño and the North Atlantic Oscillation), so long data records are needed to separate oscillations from trends. Data records from LIS are shorter, so trends are more uncertain. In the future, the data records from buoys will be invaluable to the task of separating the impact of local management decisions from global scale patterns.

What are the next steps for this program moving forward?

The technology to remotely measure nutrient concentrations in the ocean (as opposed to collecting water and returning it to a lab for processing) is becoming more cost effective and reliable. Given the amount of management effort devoted to nutrient reductions, we hope to add nutrient sensors to the buoys in the near future and to sustain them indefinitely. This also has potential for long-term cost savings because laboratory analysis of nutrient samples is time consuming and expensive.

PROTECTION & PROGRESS

CLIMATE MONITORING

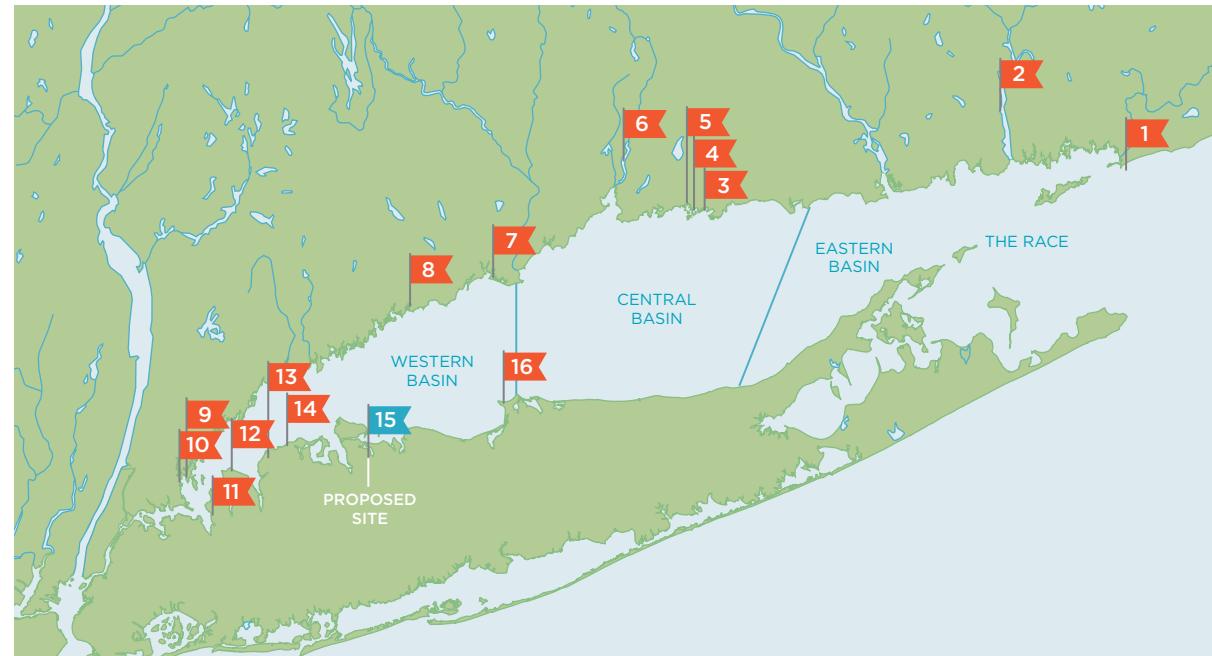
Since the Study's CCMP was approved in 1994, global climate change impacts have come to the forefront in science and in managing environmental resources. The complexities of a changing climate and the subsequent impacts on ecosystems have caused many estuary programs to revisit their management plans to take into consideration regional climate change. The LISS Management Committee also saw the need to address the localized effects of climate change and created a work group in 2009 to develop a Sentinel Monitoring for Climate Change Strategy.

The strategy, released in June 2011, is a multidisciplinary approach to provide early warnings of climate change impacts to the Sound's estuarine and coastal ecosystems, plant and animal species, and processes. The information can facilitate appropriate and timely management and adaptation responses based on assessments of climate-related changes to the "sentinels" (climate change indicators). Through this program and others, resource managers will be able to identify which Long Island Sound resources are most vulnerable to climate change and which are the most critical to protect. In 2011 and 2012, the strategy led directly to projects to collect and synthesize existing data on climate change (see highlights) in the Sound and research to develop new sentinels (see p. 17).

The Sentinel Monitoring for Climate Change Work Group has been leading this program since its inception, and includes staff from the EPA Long Island Sound Office, NOAA, NYSDEC, CTDEEP, and Connecticut Sea Grant. Two state technical advisory groups include more than 60 federal, state, non-governmental, and university partners who contributed to strategic plan development.

133 SENTINEL ENTRIES

The number of climate change related research projects identified in the LIS Climate Change Data Citation Clearinghouse.



SURFACE ELEVATION TABLE (SET) LOCATIONS

- | | |
|---|--|
| 1. Barn Island, Stonington, CT (Connecticut College/NRCS) | 9. Pelham Bay Park A (LIS side of park), Bronx, NY (NYC Parks) |
| 2. Mamakoke Marsh, Waterford, CT (Connecticut College) | 10. Pelham Bay Park B (Hutchinson River side), Bronx, NY (NYC Parks) |
| 3. Leetes Island Tidal Marsh, Guilford, CT (Yale) | 11. Udalls Cove Park Preserve, Queens, NY (NYC Parks) |
| 4. Hoadley Creek east, Guilford, CT (Yale University) | 12. East Creek, Sands Point, NY (NYSDEC) |
| 5. Jarvis Creek, Branford, CT (Yale University) | 13. West Pond, Glen Cove, NY (NYSDEC) |
| 6. Quinnipiac River Marsh, North Haven, CT (Yale University) | 14. Frost Creek, Lattingtown, NY (NYSDEC) |
| 7. Great Meadows, Stratford, CT (FWS/CTDEEP) | 15. Crab Meadow Marsh, Northport, NY (CUNY) (proposed site) |
| 8. Sherwood Island State Park, Westport, CT (Yale University) | 16. Flax Pond, Old Field, NY (NYSDEC) |

PROJECT HIGHLIGHTS 2011-2012

- With support from a LISS grant, CT Sea Grant and UConn completed a web-based LIS Climate Change Data Citation Clearinghouse to provide access to information about climate change-related data collected in LIS. The clearinghouse will help scientists and resource managers facilitate synthesis of LIS-related data through an easily searchable on-line interactive database of historic, current, and emerging research.
- In 2012, with LISS funding, NEIWPCC issued a request for proposals to provide a grant for a project to assemble and synthesize existing Long Island Sound data to look for climate-related trends. An enhancement grant was awarded to Coastal Analytics of Noank, CT in 2013.
- In 2012, LISS outreach staff worked with the Sentinel Monitoring work group to develop a climate change section in LISS's online indicators presentation.
- In 2012, LISS awarded a \$170,000 grant to NYSDEC to assist in the creation of Coastal Erosion Hazard Area (CEHA) maps. These maps will aid in the regulation of CEHAs along 82 miles of shoreline in the towns of Huntington and Southold. The CEHA program's goal is to protect human life and to minimize or prevent damage to man-made property, natural protective features (nearshore areas, dunes, bluffs, and beaches), and other natural resources.

SURFACE ELEVATION TABLES

WITH SEA LEVEL RISING at a local rate of approximately 0.1 inch per year, the capacity of marshes to keep pace depends to a large degree on whether sufficient sediments flowing from rivers and coastal embayments are depositing on the marsh surfaces. One way to monitor the stability of marshes in surviving the long-term impacts of climate change is through the use of a mechanical measuring device known as the Surface Elevation Table (SET). SETs measure the relative elevation change of wetland sediments, and were first installed in the early 2000s to try to determine why several wetland complexes were losing vegetation, including the possibility of subsidence, the gradual sinking of peat that supports plants. How the marshes respond to sea level rise is an important secondary issue. There are 16 SET stations around the Sound. The stations on Long Island were installed by NYSDEC through a \$26,000 grant from the Study in 2003. Three SET stations in CT (Branford, Guilford, and Westport) were installed by Yale University in the early 2000s as part of a research grant funded by the Study. Three other SET stations were installed by the Natural Resources Group of the NYC Department of Parks and Recreation in the Bronx and Queens. Brooklyn College is also installing a SET station in Northport.

MARY SCHROEDER of the NYC Parks and Recreation Natural Resources Group positions SET pins at the marsh surface at Pelham Bay Park in the Bronx. Pelham Bay Park is a LIS Stewardship Area.



PROJECT SPOTLIGHT

SENTINELS OF CLIMATE CHANGE

IN 2012, THE STUDY funded UConn scientists Chris S. Elphick and Min T. Huang to investigate climate change impacts on key wildlife and ecosystem resources in Long Island Sound. Their project, **Sentinels of Climate Change: Coastal Indicators of Wildlife and Ecosystem Change in Long Island Sound**, is ideally suited for a climate change pilot program.

Elphick and Huang's research addresses several of the key sentinels identified in the sentinel monitoring strategy, including the responses of critical and sensitive habitats to climate change. The project will also identify how changes in these habitats, including salt marshes and tidal flats, impact the population and behavior patterns of key bird species. The project effectively makes use of existing data and resources, while supplementing those efforts with the collection of additional monitoring data.

"Long Island Sound is likely to see substantial changes over the coming decades," said Elphick, whose expertise includes the study of the endangered saltmarsh sparrow, a species likely to be affected by sea level rise. "This project will provide a detailed baseline against which to judge future changes. Most importantly, this knowledge will facilitate better, more cost-effective planning for the protection of natural resources."

As defined in the LISS sentinel monitoring strategy a 'sentinel' is "a measurable variable (physical, biological, or chemical environmental indicator) that is susceptible to some key aspect of climate change." The study of these sentinels will facilitate



CHRIS ELPHICK OF UCONN at Barn Island Wildlife Management Area (left). Saltmarsh sparrow nestlings (above).

climate change impacts to Long Island Sound. Funding for this project, \$193,000, was provided by EPA through the Study, and is being administered by CTDEEP, which ran a single grant competition on behalf of both states. This project is slated to be completed in 2014.

For more information about the sentinel monitoring program, including the sentinel monitoring strategy, visit <http://longislandsoundstudy.net/research-monitoring/sentinel-monitoring/>.

appropriate and timely management decisions for the long term health of the Long Island Sound ecosystem. This pilot project is the first of several planned projects that will address

RESEARCH

Since 2000, LISS has supported a biennial research grant program, administered since 2008 by the New York and Connecticut Sea Grant Programs. The objective of the program is to investigate the complex ecological issues facing the Sound and to apply this research to help improve environmental conditions.

The 2008 cycle of five grant projects, which was completed in 2012, focused on the biological and physical factors that result in hypoxic (low oxygen) conditions in the Sound as well as the impact climate change might have on local food webs. The 2010 cycle of six grant projects began in 2011. Four of the grants focus on the effects of nitrogen pollution on harbors and embayments as well as on assessing best management practices to remove nitrogen. The other two focus on examining how changes in nutrient discharges, carbon dioxide, and temperature impacted phytoplankton at the base of the food web. The application process for the most recent cycle began in 2012, although the formal announcement was made in 2013. This cycle emphasizes multidisciplinary collaborative research (see descriptions in the highlights section). Descriptions of all projects are available at: www.longislandsoundstudy.net/research.

LISS also has a Science and Technical Advisory Committee (STAC), consisting of engineers and scientists from government agencies, academia, industry, and private organizations. The committee meets three times a year to provide the LISS Management Committee with overall direction and advice on science and technical issues, including recommending the topics for the research grant program.

33 RESEARCH PROJECTS

The number of research projects since 2000 funded through the LISS Research Grant Program.



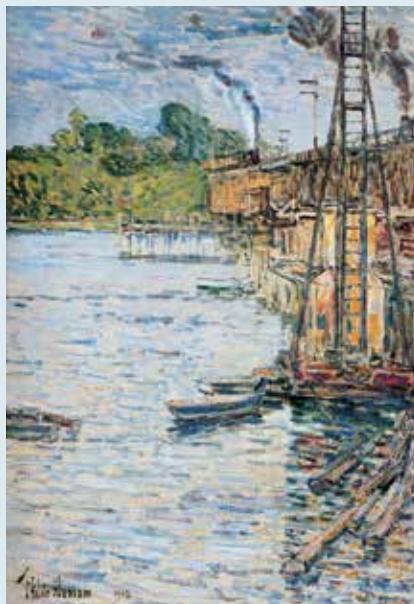
UCONN STUDENTS Adam Chlus and Marissa Mackewicz take a grab sample of macroalgae and sediment from Stony Brook Harbor (left). A sediment core collected with an Eckman box core sampler from Cold Spring Harbor, NY (right).

PROJECT HIGHLIGHTS 2011–2012

- In its most recent grant cycle (2012) the Study awarded two research grants totaling \$708,000.
- 1. **Embayment Water Quality Research:** Researchers will estimate the risk of eutrophication, which is often characterized by hypoxia and algal blooms, for 50 embayments in the Long Island Sound region. Jamie Vaudrey, Charles Yarish, and Jang Kim from UConn and Christopher Pickerell and Lorne Brousseau from Cornell Cooperative Extension of Suffolk County will use computer models to calculate dissolved nitrogen concentrations and freshwater flushing times for a subset of 50 embayments. They will also sample 10 embayments at dawn and slack tide during the summer hypoxia season to compare the results with the main stem of Long Island Sound. An assessment of the potential risk of eutrophication in the embayments will be prepared and distributed to coastal managers.
- 2. **Climate Change Historical Trends:** Researchers will develop a computer model to analyze historical trends back to the 1970s to project the environmental conditions of Long Island Sound into the future. Nickitas Georgas of Stevens Institute of Technology (working with colleagues Alan Blumberg and Philip Orton) will synthesize physical data collected for LIS and global climate change indices. The computer model will first model backward in time, a process called "hindcasting," and will be compared to historic marine resources data provided by CTDEEP and a high-resolution global climate model from NOAA's Geophysical Fluid Dynamics Laboratory. The computer model will then look forward to simulate the effects of climate on Long Island Sound's physical environment and living marine resources up to the year 2100.
- In summer 2012, NOAA deployed the research vessel *Thomas Jefferson* to begin mapping the different habitats on the seafloor of Long Island Sound. The project, directed by the LISS Sound Cable Steering Committee, will take several years to complete, providing valuable information to help protect the benthos, or bottom environment, of Long Island Sound.

PROSPECTS FOR
THE URBAN SEA

IN 2013, the much anticipated book *Long Island Sound: Prospects for the Urban Sea* will be published. The book has been several years in the making, and is a direct product of the Study's Science and Technical Advisory Committee. This volume, which will be published as part of the highly-acclaimed and globally-circulated Springer Series on Environmental Management, synthesizes the past and present chemical, physical, geological, and biological trends of Long Island Sound. The book also provides a history of the development of the Sound over the past 400 years. It includes contributions from more than 30 experts representing academic institutions, government agencies, and non-profits. The book includes an in-depth synthesis chapter that examines the cross-disciplinary implications of the state of the science on future research and management of Long Island Sound, and will serve as an example for other estuaries around the world. For up-to-date information on availability and release date or to pre-order, visit: www.springer.com and search *Long Island Sound* or *Prospects for the Urban Sea*.



THE MILL POND by early 20th century American Impressionist Childe Hassam shows approaching trains on a bridge over the Mianus River in Cos Cob, CT. The image will appear in *Prospects for the Urban Sea*.

PROJECT SPOTLIGHT

TESTING GREEN TECH TO REDUCE URBAN RUNOFF

THE REDUCTION OF NITROGEN to the Sound is a major focus of management efforts to improve water quality. Over the last decade, most of these efforts have gone to regulating inputs from point sources such as wastewater treatment plants that result in the biggest 'bang for your buck' in terms of pounds of nitrogen removed per dollar spent. As wastewater treatment plant upgrades approach the limit of technology, however, each incremental pound of nitrogen becomes more and more expensive to remove. Even before communities began the upgrades, WWTPs constituted less than half of the total loading of nitrogen to Long Island Sound. Much of the remainder comes from diffuse, or nonpoint, sources (lawn and agricultural runoff, stormwater, etc.), which are much more difficult to manage.

One potential management strategy to reduce nitrogen from nonpoint sources is building constructed wetlands. In pre-industrial conditions, rainwater falling on the Long Island Sound watershed trickled through the soils, wetlands (swamps, bogs, and marshes), and streams. This process cleans the water, settling out particulates and removing nitrogen along the way by biological, physical, and chemical processes. In developed areas, stormwater is channeled into storm drains, culverts, and concrete spillways. These systems reduce the risk of flooding, but they also cut out natural biological and chemical processes, thus increasing the amount of nitrogen from runoff that reaches Long Island Sound.

Shimon Anisfeld and Gaboury Benoit from the Yale University School of Forestry

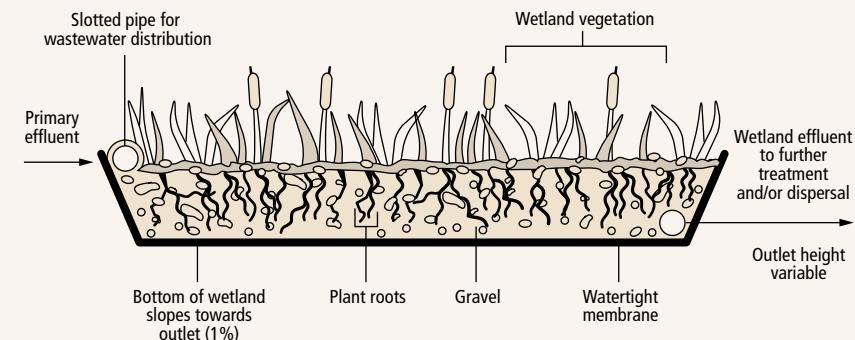


and Environmental Studies are working on a research grant from the Long Island Sound Study to investigate the effectiveness of using constructed wetlands and retention basins to reduce nitrogen from stormwater. Constructed wetlands allow specific plant species and bacteria to break down the nitrogen, thus reducing the nitrogen runoff to Long Island Sound.

So far, Anisfeld and Benoit and their students have focused primarily on one stormwater treatment site in Hamden, owned by the South Central Connecticut Regional Water Authority. The site, which intercepts runoff from a residential neighborhood before it reaches Lake Whitney, consists of a sediment forebay (a small pool near the inlet designed to allow coarse sediments like road sand to settle out), an open water pond, and a wet-

GABOURY BENOIT OF YALE University and graduate student Lisa Webber collect data from a designed wetland in Hamden, CT (above). A conceptual diagram for construction of a designed wetland project (below).

land. Over the course of some 50 sampled storm events, the system has removed, on average, about half of the nitrogen that has entered it. This is comparable to the removal rate of a modern wastewater treatment plant. Because research from other systems has shown that the performance of these wetlands is highly variable from site to site, and from storm to storm, they are now working on trying to understand the variability around this average and on extending their work to additional sites.



CITIZEN INVOLVEMENT

In the 1980s, a public outcry over fish kills and the washing up of waste on beaches propelled interest in the health of the Sound and the newly-created Long Island Sound Study. Maintaining that interest and providing information and tools on how to contribute to a healthy Sound is the task of LISS's Public Involvement and Education (PIE) program.

With its information products, the PIE program is making adjustments to reach out to citizens in the digital age. In 2010 and 2011, for example, LISS completely redesigned its website to allow for more content and to make it easier to search for reports, photos, maps, charts, and videos. The website was recognized with three design awards, including one from the Connecticut Art Directors Club.

Another vital part of the program is LISS's Citizens Advisory Committee (CAC), consisting of around 40 people who represent some of the region's environmental groups, coastal towns, and marine trade groups. These members advise the Management Committee on local issues. They also reach out to their communities to promote the Sound and the objectives of the CCMP. In 2011, through the leadership of Save the Sound, the CAC drafted *Sound Vision*, a series of short, medium, and long-term actions (through 2020) to prepare for climate change, improve water quality, protect habitats, and sustain economically strong coastal communities. The CAC developed *Sound Vision* to provide a citizens' agenda for revising the Study's Comprehensive Conservation and Management Plan. *Sound Vision* was promoted aboard the *SoundWaters* schooner, which made stops in seven LIS harbors.

See the rest of this section for projects that highlight other Public Involvement programs—educating students, encouraging volunteerism, and promoting behavior change to reduce pollution and improve water quality.

600,000 PEOPLE

The number of Long Island Sound residents who have participated in Futures Fund projects since 2005.



EDUCATING YOUTH: Captain Living Sound (top left) shares his passion for the Sound and for being a Sound steward at The Maritime Aquarium; students participate in a Stamford schoolyard habitat project (right); Hauppauge High School students learn about beach and dune habitats at Sunken Meadow State Park (left).

PROJECT HIGHLIGHTS 2011–2012

TEACHING THE NEXT GENERATION about the wonders of Long Island Sound and how to protect it is an important goal of the Study.

- Educational Sails:** Kids get a unique perspective of the Sound on board historic and replica sailboats. In 2011, *SoundWaters*, with support from a \$35,000 Futures Fund grant, engaged 1,050 children (and parents) on 30 hands-on educational sails, stopping in 10 ports aboard its 17th-century replica schooner. During the sails, students learned about the impacts of floatable debris such as plastic bags on the Sound. Also in 2011, a \$35,000 Futures Fund grant helped Cornell Cooperative Extension of Suffolk County fund 24 sails that provided educational experiences to 575 students (grades 4-8) from underserved communities aboard the *Christeen*. The 40-foot gaff-rigged sloop, built in 1883, is the oldest oyster sloop in America and a National Historic Landmark.

- Mentor Teachers Program:** In 2011, NY Sea Grant expanded CT Sea Grant's Long Island Sound Mentor Teachers Program into New York, recruiting high-quality, creative, and respected teachers to assist their peers in incorporating Long Island Sound content into curricula. The 28 workshops since 2002 have trained mentor teachers to reach 359 K-12 educators and, through them, a self-reported 17,253 students in school districts across the Sound.

- Sound Stewards:** Since 2008, the *Sound Stewards* program, developed by NY Sea Grant, has involved more than 900 middle and high school students in research projects in Stewardship Areas. For example, long-term monitoring of fish abundance and water quality at Sunken Meadow State Park by Hauppauge High School students has helped to provide data to track the impact of the breach of a berm following Superstorm Sandy in 2012 (see p. 2).

THE DATA

CITIZENS MAKING A DIFFERENCE

ORDINARY CITIZENS volunteering their time can make vital contributions to a clean, healthy Sound.

Volunteers, for example, collect beach debris at the annual International Coastal Cleanup in September. Since 1998, nearly 50,000 volunteers have collected 967,000 pounds of bottles, cigarette butts, balloons, and other debris on Sound beaches. In recent years, the Futures Fund has provided mini-grants to Save the Sound and the American Littoral Society to coordinate volunteer efforts for the coastal cleanup.

Volunteers participated in many other projects supported by the Futures Fund in 2011-2012, including:

- Up to 400 volunteers prepared eelgrass shoots into specially designed burlap planting units that will be used to restore (under-water) eelgrass meadows at four sites.
- More than 200 volunteers removed invasive species to help restore coastal forests at Alley Pond Park in Queens and Pelham Bay Park in the Bronx.
- About 600 volunteers collected data on American horseshoe crabs in their beach habitats as part of the Project *Limulus* horseshoe crab monitoring project.

VOLUNTEERS PICKING UP TRASH at a beach cleanup at Lighthouse Point in New Haven.



SUCCESS STORY

PROMOTING POSITIVE BEHAVIOR CHANGE

FROM 2008 TO 2012, the Futures Fund has awarded \$575,000 in grants for 10 projects that involved campaigns to change the types of behaviors that harm the Sound and its shoreline.

In each of these projects, the grantee used community-based social marketing strategies that LISS is encouraging to complement more conventional methods of reaching out to the public. Social marketing campaigns identify the barriers that prevent people from doing the right thing and use marketing tools such as incentives or establishing new social norms to try to change habits.

In 2011-2012, the following projects were funded:

KEEPING THE SOUND HEALTHY

Since 2009, The Maritime Aquarium has worked to both understand and change negative environmental behaviors. It's all part of **Keeping the Sound Healthy**, a series of staffed exhibit stations on the Aquarium floor. Using audience research, Aquarium educators have employed social marketing principles to influence behavior. At the Water Quality and Marine Debris stations, families are treated to fun activities including encounters with a live terrapin turtle, an interactive 3-D version of the local watershed, and a chance to make a reusable shopping bag out of old IMAX movie banners. During these stops, visitors also were asked to make a pledge to wash their cars at a commercial facility (to avoid runoff from a car washed in a driveway), use organic slow-release fertilizer on lawns, and employ reusable bags, bottles, and mugs. They were also given prompts to remind them to

MAUREEN DOLAN Murphy of CCE at a Bring Your Own Bag booth (right).

Maritime Aquarium educator Nicki Fallon holds a pledge card (below).

follow through on their pledges, including loyalty cards, free soil testing, and informative hand-outs. In 2012, 45,000 visitors participated in Keeping the Sound Healthy activities. A follow-up survey concluded that about half of those visitors who participated had adopted improved behaviors. For example, 42 percent reported that they now wash their cars in a commercial facility either "a lot more" or "a little more" than before.

BRING YOUR OWN BAG

Plastic bags washed into waterways harm marine life. That prompted Citizens Campaign for the Environment (CCE) in 2011 to launch a social marketing **Bring Your Own Bag (BYOB) campaign** in Huntington, Northport, and Port Jefferson, NY. The first step was conducting research in the three downtown target areas. About 320 residents were surveyed to establish baseline data that laid the framework to create and distribute informational materials in the communities. Retailers were educated on reusable bag benefits and helpful store policies such as providing reusable bags, educating employees to ask consumers if they want or need a bag, charging for or eliminating plastic bags in their stores, and posting signs encouraging reusable bag use. Fifty stores signed pledges to "kick the plastic bag habit." Through community events, festivals, and tabling events at supermarkets, thousands of residents were educated on the importance of bringing their own bag and over 500 individuals signed pledges to stop using plastic bags. Every individual that pledged to "BYOB" received a free reusable bag.



ESTABLISH ORGANIC LAND CARE

With 2012 support from the Futures Fund, the Northeast Organic Farming Association of Connecticut (CTNOFA) established an **Organic Land Care Training Program**. This pilot project educated landscapers about alternative, non-chemical lawn care services, through a low-cost short course on the cultural methods of organic lawn care, the ecological benefits of organic lawn care services, and how to market these services to clients while increasing profits. Through follow-up surveys, CTNOFA will see if landscapers met the program's goal of reducing fertilizer use by 35 percent as well as identify the barriers and catalysts for change to adopt and implement organic lawn care practices.

BUDGET

Section 119 of the federal Clean Water Act authorizes Congress to provide up to \$40 million per year to the Long Island Sound Study, through the EPA Long Island Sound Office, to implement the CCMP. Each year, the Study develops a work plan to implement projects based on appropriations approved by Congress. This page lists these appropriations for the fiscal years 2010–2012 for projects that took place in fiscal years 2011–2013. LISS partners who receive grants under these appropriations must meet matching fund requirements—50 percent for implementation projects and five percent for education and out-

reach projects. Not shown in the budget below are the additional funds provided by New York and Connecticut, and their municipalities for projects to implement the CCMP. From 2006 to 2012, for every federal dollar EPA appropriated on projects, an additional \$70 was leveraged in projects by LISS's partners to restore and protect the Sound.

Electronic versions of annual CCMP Implementation Tracking and Monitoring reports, which provide a comprehensive list of projects undertaken by the Study and its partners, are available at www.longislandsoundstudy.net in the Reports section.

LISS BUDGET

	FY 2010 (Oct 09– Sept 10)	FY 2011 (Oct 10– Sept 11)	FY 2012 (Oct 11– Sept 12)
Coordination/Reporting	\$358,162	\$420,507	\$312,552
Public Involvement and Education	\$560,917	\$656,033	\$467,589
Monitoring, Modeling and Research	\$1,193,891	\$2,073,831	\$1,659,525
Implementation Support and Technical Assistance*	\$1,019,847	\$2,597,216	\$86,1534
Habitat and Water Quality Improvements**	\$450,000	\$2,013,500	\$1,250,000
TOTAL	\$3,582,817	\$7,761,087	\$4,551,200

* includes habitat restoration and watershed management planning, and Stewardship Initiative.

** includes EPA grants to the Sound Futures Fund grant program.

LISS BIENNIAL REPORT 2011–2012

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