



2014-17 Site Review

March 19-21, 2019

Burlington, VT



**Resilient
Communities and
Economies**



**Environmental
Literacy and
Workforce
Development**



**Healthy Coastal
Ecosystems**

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Background, overview, and context relevant to 2014-17

Vision: To be a recognized leader and source of knowledge about the natural resources and health of Lake Champlain and its watershed through scientific research, outreach services, and providing educational opportunities to the general public, managers, and decision makers, with the goal of obtaining institutional status within the four-year omnibus period.

Mission: Lake Champlain Sea Grant is dedicated to improving the understanding and management of Lake Champlain, Lake George, and their watersheds for long-term environmental health and sustainable economic development.

Background

The Lake Champlain Special Designation Act, part of the Great Lakes Critical Programs Act of 1990, led New York Sea Grant (NYSG) to offer limited outreach support and education programming to residents of the Lake Champlain basin. Subsequently, the 1998 Sea Grant Reauthorization Act provided the opportunity to create a Lake Champlain Sea Grant (LCSG) outreach project. This new initiative was “for a basin wide coordinated effort.” We have adhered to this multijurisdictional model as we have grown our program. Through our primary collaboration between the University of Vermont (UVM) and the State University of New York at Plattsburgh (SUNY-P), plus partnerships with other organizations in the basin, we actively operate in a lake catchment that includes two states (New York and Vermont) as well as the Province of Quebec in Canada. The Lake Champlain basin lies within the Laurentian-Great Lakes drainage. We share close environmental, social, and economic ties with the Great Lakes region and the Great Lakes Sea Grant programs, with whom we associate. Geographically, we also closely associate with the New England Sea Grant programs on topics of mutual interest.

The LCSG was designated as a Sea Grant Coherent Area Program (CAP) in 2012, just prior to this assessment period. In September 2017 – the end of this assessment period – the National Sea Grant Advisory Board recommended to elevate the LCSG to Sea Grant Institute status, which was completed in September 2018. There was a considerable effort during the assessment period by the LCSG staff and our partners to position the LCSG for this important promotion.

Context

Outside of the Great Lakes, Lake Champlain is one of the largest freshwater bodies in the United States and is a highly valued international resource. The Vermont and New York portions of the Lake Champlain basin are home to nearly 500,000 people, with another 100,000 people in the Canadian portions of the watershed (EPA). At least 45% of the population relies on Lake Champlain for drinking water (LCBP 2018). Lake Champlain’s shoreline is 587 miles long and the lake is centered within a watershed that is 19 times larger than the lake itself. This watershed-to-lake area ratio is 3-4 times larger than the Great Lakes and amplifies the impacts – good or bad – of land use management on water quality. Many people who live in the Lake Champlain basin are dependent on the lake for jobs, recreation and quality of life. People from around the world visit the lake and basin to enjoy its cultural and military history, abundant biological resources, and opportunities for recreation.

LCSG supports and offers education, outreach and applied research activities to enhance the sustainable use, restoration, and development of the Lake Champlain ecosystem. Maintaining and improving the economic and environmental vitality of the Lake Champlain basin by building stronger partnerships with communities, businesses and schools has been a focus of LCSG since its inception. LCSG activities inform and educate the watershed’s inhabitants and visitors about actions needed to protect the quality of Lake Champlain waters, the basin’s coastal region, and other natural and cultural resources. LCSG also offers research-based education and outreach programs for sustainable business development, which generates

income and support for important resource protection goals.

Over the 2014-17 period, and beyond, we have demonstrated the ability to identify needs, work with partners, develop projects, run RFPs, seek matching funds, and deliver products that have meaningful outcomes for our partners and stakeholders. We

have been good stewards of funds entrusted to us and have proven our ability to grow the LCSG program. In the sections that follow, we document how LCSG efforts between 2014-17 address the specific Standards of Excellence identified by the National Sea Grant College Program.

A. Program Management and Organization

“The Sea Grant program under review must have created the management organization to carry on a viable and productive Sea Grant program and must have the backing of its administration at a sufficiently high level to fulfill its multidisciplinary and multifaceted mandate.”

Organization

Management Team

The LCSG Director (Dr. William “Breck” Bowden) is a faculty member of the Rubenstein School of Environment and Natural Resources (RSENR) at UVM. The LCSG Co-Director (Dr. Tim Mihuc) is a faculty member of the College of Arts and Sciences at SUNY-P. The Sea Grant Extension activities of the LCSG program are developed and coordinated by the Extension Leader (Dr. Kris Stepenuck) who, like the Director, is a faculty member of RSENR. The LCSG research program and communications are directed by a senior staff member in RSENR (Elissa Schuett). This leadership team ensures overall programmatic fiscal responsibility, programmatic direction and coordination, staffing, and staff support.

Reporting Structure

In addition to the management and leadership team, during 2014-17, four full time staff, and one part-time staff person facilitated outreach programming across the Lake Champlain basin. A cadre of graduate and undergraduate students and interns supported these efforts. The organizational structure of the LCSG is presented in Figure 1.

Steering Committee

In recognition of the bi-state partnership that defines the LCSG program, the LCSG Steering Committee was established to include the Vice President for Research at UVM (Dr. Richard Galbraith) on behalf of the UVM Provost, the Dean of the Rubenstein School of Environment and Natural Resources at UVM (Dr. Nancy Mathews), the State Director of Extension at UVM on behalf of the Dean of the College of Arts and Sciences (Mr. Charles Ross), and the Dean of the College of Arts and Sciences at SUNY-P on behalf of the Provost at SUNY-P (Dr. Andrew Buckser). Director Bowden maintains personal contact with each of these Steering Committee members, consulting them regularly for high-level guidance and approval of programmatic direction. This team meets at least annually. In addition, the committee promotes the mission, vision and values of LCSG, aids in negotiation of matching funds, and identifies new opportunities and resources to help grow capacity of the program. Full responsibilities of this Steering Committee are defined through an MOU.

Program Advisory Committee

Our Program Advisory Committee (PAC) provides regular public input and guidance to LCSG. PAC members represent stakeholder groups from New York and Vermont, including business, agriculture,

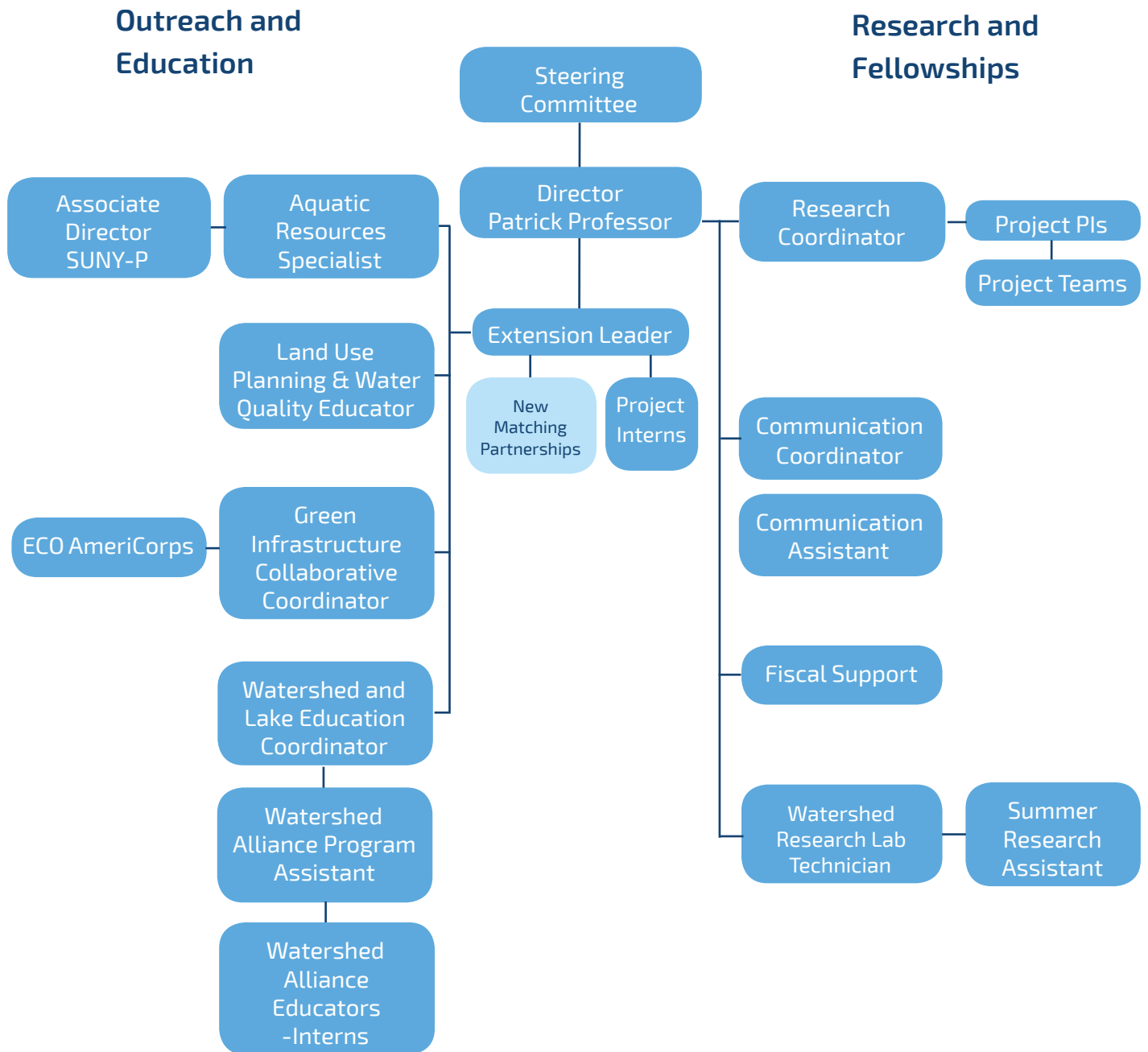


Figure 1. Lake Champlain Sea Grant organizational structure

watershed organizations, state and federal government, research, and education. The PAC helps to ensure that LCSG research, extension, outreach and education programs address the needs and priorities of communities, businesses, and policymakers in the Lake Champlain basin of Vermont and New York. Committee members meet at least bi-annually to help set program priorities, review activities and accomplishments, and advise on program development. LCSG staff maintain ongoing relationships with PAC members who work in their focus area of interest.

In this reporting period, the PAC was integral in development of our 2018-22 strategic plan. They helped to refine focus areas and audiences (e.g., urban areas and English as a second language individuals), and to identify partner groups with whom LCSG staff should work (e.g., Tactical Basin Planners, Lake George Low Impact Development certification program, Chittenden County Regional Planning Commission stormwater project team). Recent recommendations of the PAC have helped define internal processes and ensure inclusive practices are followed. Examples include the recommendation to add a conflict of interest section

to our MOU to outline roles and responsibilities of leadership and management teams of the LCSG program, and ensuring PAC members with non-standard schedules are able to participate in meetings and provide input.

Program Setting

Faculty and staff of LCSG are situated in offices throughout the basin, in both New York and Vermont, which facilitates our ability to carry out our work across the basin. UVM offices within RSENR include two locations in Burlington: on the main UVM campus, and adjacent to Lake Champlain in the Rubenstein Ecosystem Science Laboratory. Staff are also situated on UVM's South campus in South Burlington. In addition, our GIC Outreach Professional has offices both at UVM and the Vermont Department of Environmental Conservation (VTDEC) in Montpelier, VT. In New York, faculty and staff have offices at the Lake Champlain Research Institute (LCRI) at SUNY-P in Plattsburgh. We also collaborate with Poultney Mettowee Natural Resource Conservation District, based in Poultney, Vermont, to carry out Watershed Alliance programming in the southern portion of the watershed.



PAC member, affiliation, expertise, and job title

Dan Albrecht; Chittenden County Regional Planning Commission, Municipal planning; flood resiliency, and stormwater education; Senior Planner
Jill Arace; Vermont Association of Conservation Districts; Rural communities; Executive Director
George Burrill; Retired; International Development; Business development
Kari Dolan*; Vermont Legislature; Water quality; Legislator
Fred Dunlap*; NY Department of Environmental Conservation; NY Lake Champlain Basin Coordinator
Vacant; Water Quality Division, VT ANR; Green infrastructure
Lori Fisher; Lake Champlain Committee; Nonprofit environmental stewardship; Executive Director
Phelan Fretz; ECHO Lake Aquarium and Science Center; Science communications; Executive Director
Heather Furman; The Nature Conservancy of Vermont; Nature-based solutions; Director
Eric Howe; Lake Champlain Basin Program; Cross-basin environmental partnerships; Executive Director
Bill Howland*; Lake Champlain Basin Program; Cross-basin environmental partnerships; Executive Director
Jim Jutras; Village of Essex; Municipal interests; Water Quality Superintendent
Kara Lenorovitz; Colchester High School; Formal education; Science teacher
Dan Lerner; UVM Extension; Community outreach; Associate Director and Chair
Jonathan Lilley; National Sea Grant Office (ex officio member of PAC); Sea Grant; Program Officer
Crea Lintilhac; Lintilhac Foundation; Environmental management; Trustee
Chris Navitsky; FUND for Lake George; Lake George area environmental issues; Lake George Waterkeeper
Sonal Patel-Dame; Plattsburgh High School; Formal education; Science Teacher
Brendan Quirion*; Adirondack Park Invasive Plant Program; Invasive species; Program Manager
Elizabeth Rohring*; National Sea Grant Office (ex officio member of PAC); Sea Grant; Program Officer
Brian Slopey*; U-32 High School; Formal education; Science Teacher
Eric Smeltzer*; VTDEC/retired; Water quality; Limnologist
Chief Don Stevens; Nulhegan Abenaki Nation; Indigenous perspective; Chief
Leigh Walrath; NYS Adirondack Park Agency; Freshwater; Associate Adirondack Park Project Analyst
Mike Winlow*; Vermont EPSCoR Center for Workforce Development and Diversity; Water quality; Coordinator

*PAC member during 2014-17, but not on current PAC

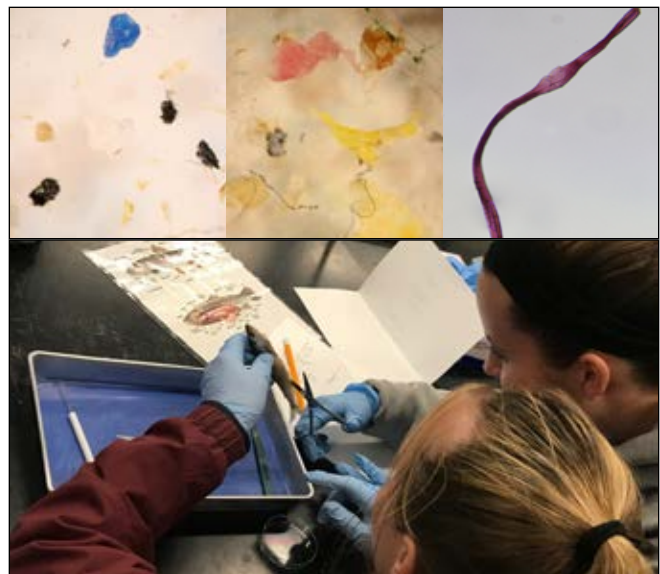
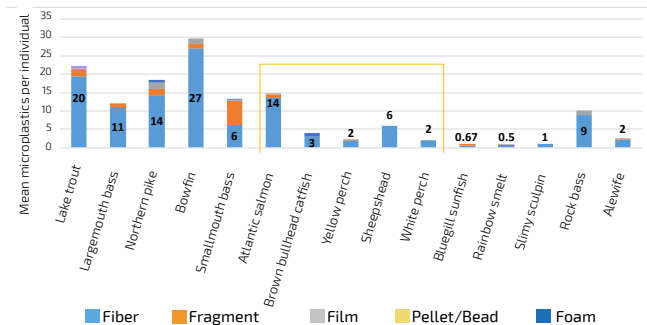
Programmed Team Approach

“The Sea Grant program under review must have a programmed team approach to the solution of ocean/coast/watershed/Great Lakes problems which includes relevant, high quality, multidisciplinary research with associated educational and advisory services capable of producing identifiable results.”

LCSG uses a programmed team approach to address the needs of Lake Champlain basin communities. We fund research that is identified by our partners and stakeholders as critical for the basin. LCSG staff work with researchers and utilize other relevant research literature to provide science-based knowledge that can be used by municipalities, businesses, educational institutions, and citizen-based organizations to make informed decisions. We extract the key lessons from this knowledge base to inform a suite of outreach and education programs that we offer to schools and to adult learning communities.

Research - The Foundation for Advisory Services and Education

The research we facilitate is directly relevant to key issues in the Lake Champlain basin and to the LCSG Strategic Plan. We understand the broad range of research needs in the area because we are deeply involved on numerous local, state, regional, and national committees that develop research priorities (see Section D – Leadership). We further refine our research investments through informal dialog with key partners and formal dialog with our PAC and stakeholders during strategic planning.



Top: Types of microplastics found in different fish species in Lake Champlain (from D. Garneau). Middle: microplastics as seen under a microscope. Bottom: Students dissect fish as part of Watershed Alliance Keeping the Balance to identify gut contents, including microplastics.

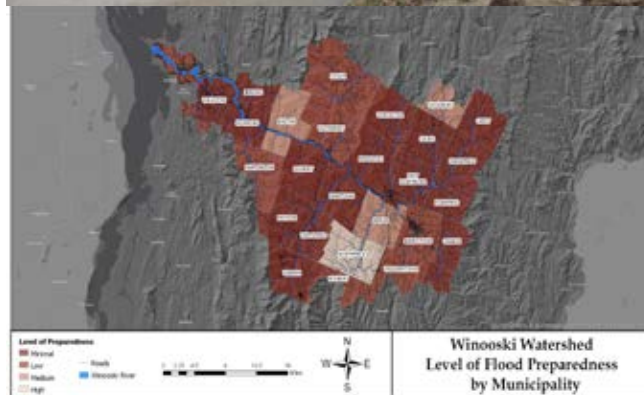
Programmed Team Approach: Research

We support research and leverage partnerships to engage in research that informs our outreach. For instance, we supported research to assess for presence of microplastics in Lake Champlain water and biota. We shared results and action steps to minimize further microplastic pollution through our outreach. We also incorporated this emerging issue into formal education, engaging middle and high school students in stomach content analyses in fish bycatch from other RSENR research. Leveraging our partnerships, we engaged a RSENR-funded graduate student to survey private winter maintenance contractors to understand their current practices and motivations to use less salt as well as barriers that prevent them from using less salt. This research has informed our outreach for this audience, which contributes as much as 50% of the chloride load to surface waters.

Advisory Services - The Foundation for Sound Decision Making

LCSG develops workshops and programs to provide knowledge resources that help community leaders, business leaders, and property owners make informed decisions about important issues facing Lake Champlain and the region. As a consequence of our involvement in numerous committees and through communication with our PAC, we are in close communication with key stakeholders in the region and are able to assess their needs. In some cases, we are able to utilize existing information to develop synthetic resources that can address stakeholder needs.

During this assessment period we have developed a unique new vehicle to provide science-based knowledge to our stakeholders. Many of our stakeholders - especially in state agencies - are scientifically, highly literate. However, they often bemoan the fact that they have little time to keep up with relevant scientific literature. In response to this, the LCSG took the lead to seek partnerships with several other programs to produce a quarterly research digest of recent scientific literature that is relevant to regional environmental management issues. This research digest – ecoNEWS VT – summarizes the key findings of peer-reviewed literature that is either published about or is relevant to the Lake Champlain region.



Top: Gravel wetland planting in Burlington (Photo, G. Taylor). Middle: Streambank erosion (Photo, R. Tharp). Bottom: Winooski Watershed level of flood preparedness.

Programmed Team Approach: Advice

We strive to utilize the best available science to support our outreach efforts. For example, for the past three years, we collaborated with VTDEC to engage ECO AmeriCorps members to serve to support the GIC. The AmeriCorps members researched green stormwater infrastructure practices, their use in cold climates, and maintenance requirements. They regularly shared information and resources that addressed these important management questions with nearly 100 environmental professionals who participate in a Community of Practice known as the Green Infrastructure Roundtable. We were also successful in the Coastal Storms competitive funding process through the NSGO, receiving funding to develop flood maps that describe erosional flooding in watersheds draining to Lake Champlain in both New York and Vermont. In the basin, erosional flooding causes most damage, yet traditional FEMA maps are available only for inundation flooding, thus basin communities lack resources to understand risk or to plan appropriately to protect infrastructure, minimize damages, and be most resilient to flooding.

Education - The Foundation for the Future

The knowledge we develop for Advisory Services is designed to synthesize technical knowledge that will address specific needs of stakeholders. However, there are general principles and useful examples embedded in these technical knowledge bases that are also useful to less technical audiences, including school-aged children. The flagship program for Environmental Literacy in the LCSG is the UVM Extension Watershed Alliance program (see Section B - Education and Training). In addition to UVM Extension Watershed Alliance, LCSG staff partner with other programs that engage school-aged children, to add curriculum that focuses on lake-related issues.



Summer intern measuring lawn health for Raise the Blade campaign. (Photo: K. Stepenuck)

Programmed Team Approach: Education

Our educational efforts reach youth to adults. Through the Champlain Basin Education Initiative, we partner with watershed educational organizations from around the basin to provide comprehensive watershed science professional development training for K-12 teachers through a 6-credit, year-long graduate course. We support undergraduate interns, some who earn credits, to support our Watershed Alliance program and our broader LCSG programming. For instance, during summer 2017 we advised 7 students to complete research internships related to GSI, clean boating, and low input lawn care. In addition, each year, we partner with numerous K-12 schools, one of which is the Edmunds Middle School Science Team. With this team, we provide watershed education science units. Students join us on the R/V Melosira and in local streams, culminating their experience through stewardship projects.



Students learning about Lake Champlain ecology aboard the R/V Melosira

Recruiting Talent

“The Sea Grant program under review must include a brief description of the process used to develop RFP priorities, and of the review process including composition of review panels. Further, they must report the number of institutions represented throughout RFP process, and identify new vs. continuing projects and Principal Investigators.”

RFP Priorities

During the period of this assessment, we made a difficult – but strategic – decision to reduce the resources we allocated to research. Our rationale was that our base funding was relatively low (\$430,000 annually) and there were other local programs – in particular a multi-million dollar NSF-funded EPSCoR program – that were also focused on research needs related to Lake Champlain. In consultation with our Steering Committee and our PAC, we determined that our strengths lay in outreach and education and so we invested more heavily in those areas. However, we also focused considerable efforts during this period to achieve Sea Grant Institute status and a higher level of base funding (\$1,000,000 annually) so that we could reinvigorate our research program. While not the subject of this assessment, we are pleased to report that we did achieve Institute status and have substantially increased our allocation to Sea Grant-related research.

Research priorities for this assessment period were developed in consultation with the PAC, using the 2013-17 LCSG Strategic Plan as guidance. We further refined our research investments by considering the research investments by other, important, collaborating programs and organizations. These included in particular the Vermont EPSCoR program noted above and the Lake Champlain Basin Program.

RFP Process

During the 2014-17 period, we issued two calls for research proposals for award periods of 2014-16 and 2016-18. We required project PIs to include an outreach component and it recommended that PIs contact LCSG staff when developing their proposal. The RFP was distributed via social media and email lists to researchers at all 13 institutes of higher education located in the basin. All proposals were reviewed by external peer experts. Additionally, an internal panel composed of a subset of members from the PAC discussed the peer reviews and the relevance of each proposal to the LCSG Strategic Plan. The NSGO Program Officer for LCSG attended the internal panel meetings via phone. Director Bowden made the final funding decisions based on the recommendations of the reviewers and the panel. Proposals were submitted from researchers at UVM, SUNY-P, and Rensselaer Polytechnic Institute. Proposals were only accepted from researchers at institutes of higher education located in the Lake Champlain basin. During this time period, pre-proposals were not required as part of the process. During the 2014-18 award period, LCSG funded one continuing, and two new research projects.



Support

“The Sea Grant program under review must have the ability to obtain matching funds from non-Federal sources, such as state legislatures, university management, state agencies, business, and industry. A diversity of matching fund sources is encouraged as a sign of program vitality and the ability to meet the Sea Grant requirement that funds for the general programs be matched with at least one non-Federal dollar for every two Federal dollars.”

The LCSG meets its matching obligations through a combination of institutional, state, and private collaborations. Core matching funds are provided by RSENR to support the Director (Bowden), through the Robert and Genevieve Patrick Chair for Watershed Science and Planning. RSENR also provides partial support for the LCSG Extension Leader (Stepenuck) and provides a range of business services (e.g., budget summaries and human resources support) and office space. UVM Extension fully supports the Coordinator for the UVM Extension Watershed Alliance program (Eaton) and also provides substantial support for the Extension Leader (Stepenuck). SUNY-P provides matching support for the Aquatic Resource Specialist (Malchoff) and Associate Director (Mihuc) in New York.

We also developed a shared position with the VTDEC that is focused on the Green Infrastructure for stormwater management. This 50:50 shared position provides an important match for the LCSG program and is a model that we expect to replicate in the future. Collaborator, Poultney Mettowee Natural Resource Conservation District contributes substantial match on its subaward to facilitate the UVM Extension Watershed Alliance program in the southern part of the watershed, and for its shoreline outreach and restoration efforts. Additionally, all research projects that we fund provide 50% match. Finally, private gifts are an irregular but important part of our match portfolio.

B. Stakeholder Engagement

“The Sea Grant program should list its key partnerships and how the program involves its partners, including showing examples. It should also list important stakeholders and how the Program involves its stakeholders.”

LCSG works closely with partners in local, state, regional, and Federal organizations. LCSG has worked with more than 150 organizations between 2014 and 2017. Some of these relationships have developed into long-term, key collaborations and partnerships. We highlight only a select few collaborations and partnerships below.



Key Collaborators

The State University of New York at Plattsburgh

SUNY-P is the secondary host for the LCSG. It offers baccalaureate and Master's degrees in Arts and Sciences, Business and Economics, and Education, Health, and Human Services. It also hosts the Lake Champlain Research Institute (LCRI), which is housed in the College of Arts and Sciences. The LCRI provides students with research experiences as part of their career preparation. LCRI involves qualified students as research assistants on funded projects. The LCRI has a state-of-the-art analytical instrumentation lab and maintains research vessels that complement facilities in Vermont.

University of Vermont Extension

UVM Extension “integrates higher education, research and outreach to help Vermonters put knowledge to work in their families and homes, farms and businesses, and the natural environment.” UVM Extension has been a key partner since LCSG was established. UVM Extension supports Watershed Alliance, which educated more than 5,300 students between 2014 and 2017, helping them learn about watersheds and impacts of human land uses, and engaging them in stewardship projects to protect and improve environmental conditions. UVM Extension also supports the Extension Program Leader position to coordinate and implement outreach efforts.

Vermont Department of Environmental Conservation

VTDEC collaborates with LCSG to implement the Green Infrastructure Collaborative (GIC), which bridges the gap between research, extension, and application of green stormwater infrastructure (GSI) and natural asset management in Vermont. The GIC Outreach Professional promotes the use of Low Impact Development, GSI, and natural assets management as the prioritized

tools to manage stormwater runoff. They provide outreach programming and technical assistance to professional, school, and community audiences, and contribute to state standard revisions to reflect the current state of knowledge in these fields.

In addition, LCSG regularly partners with VTDEC on other types of outreach and education. This includes providing workshops and webinars for local decision makers, real estate professionals, contractors and municipalities focused on such topics as flood resiliency, river corridor protection, septic maintenance, shoreline protection and road salt reduction. VTDEC is also a key partner on a healthy soils education initiative in collaboration with multiple organizations.

Key Partners

Lake Champlain Basin Program

The LCBP mission is to “work in partnership with government agencies from New York, Vermont, and Québec, private organizations, local communities, and individuals to coordinate and fund efforts that benefit the Lake Champlain basin’s water quality, fisheries, wetlands, wildlife, recreation, and cultural resources.” LCSG collaborates on a multitude of programs with LCBP. Key educational programs on which we partner include Watershed for Every Classroom, a year-long professional development course for in-service Kindergarten to 12th grade teachers. This is offered through the Champlain Basin Education Initiative (CBEI), a consortium of environmental and place-based education groups in the basin, which provides workshops to increase understanding of climate change, water quality, cultural heritage and natural resources. We also partner with LCBP and other organizations to bring the science of developing healthy soils to individuals, communities, and businesses by promoting use of recommended lawn care practices. With LCBP and the Vermont Boat and Marine Association, we offer clean boating training and educational materials to marina operators. LCBP also supported the first Lake Champlain Basin Deicing Conference, and we recently partnered to develop a high school stewardship program.

Vermont Association of Conservation Districts

The Vermont Association of Conservation Districts is a non-profit organization that represents the 14 natural resource conservation districts in Vermont. These districts focus their scientific and educational endeavors in the areas of conservation, maintenance, land use, soil health, water resources, forests and other natural resources. LCSG partners with many of these districts on a variety of projects. One long-term partner is the Poultney Mettowee District (PMNRCD). For more than 14 years, we have partnered to implement UVM Extension Watershed Alliance in the southern part of the watershed. Additionally, we support PMNRCD to coordinate a summer outreach and stewardship program that encourages and facilitates stream/shoreline habitat restoration or protection by landowners. This has resulted in more than 1500 feet of shoreline being protected or restored. In addition, we have partnered with the Rutland District, the Lamoyille District, the Franklin District and the Winooski District on outreach focused on river corridor protection for local municipalities. Further, with the Winooski District, we co-hosted a road salt conference, worked collaboratively on stormwater education through an incentive program for homeowner installation of green infrastructure practices, and are developing septic system outreach.

ECHO, The Leahy Center for Lake Champlain

LCSG collaborates with ECHO, the Leahy Center for Lake Champlain, on a variety of educational endeavors. We offer public educational trips on Lake Champlain aboard the UVM research vessel, the Melosira. Staff collaboratively designed an exhibit at ECHO that helps visitors to understand the research happening at the Rubenstein Ecosystem Laboratory. We have collaborated to carry out "Leahy Environmental Summits," named after Vermont's long-time Senator who strongly supports efforts to protect the lake. These bring together individuals representing a variety of perspectives to address and act at the community level on issues such as stormwater management through GSI. Director Bowden and Extension Leader Stepenuck

have served in leadership roles on the ECHO-led Clean Water Network, which has identified a suite of initiatives, which, if addressed, can help to develop a culture of clean water in the basin and the state.

Elementary, Middle, and High Schools

Through our UVM Extension Watershed Alliance program, we partner with dozens of schools. LCSG staff and undergraduate interns visit classrooms, and facilitate field-based learning and stewardship activities in collaboration with teachers. We have schools that have partnered with us since 2002, and others that are just initiating their participation in educational programs.

Other Important Partners

In addition to the partners highlighted above, we partner with numerous environmentally-focused NGOs such as the Lake Champlain Committee, one of the oldest and most effective lake advocacy groups in the basin. We also partner with Regional Planning Commissions and municipalities on projects of mutual interest. Recently, through the generous support of a private donor we have been able to partner with the Abenaki Nation to bring unique educational opportunities to this and other underserved communities.

Important Stakeholders

Our important stakeholders are numerous, and vary based on the issue addressed. These include business owners; local elected officials; elementary; middle and high school students and teachers; undergraduate students; marina and resort owners and operators; recreational boaters and anglers; real estate agents; municipal employees and private contractors; researchers; watershed groups, homeowners and visitor/convention bureaus.

Relevance

“The Sea Grant program under review must be relevant to local, state, regional, or national opportunities and problems in the ocean/coast/watershed/Great Lakes environment.”

Context: Issues faced in the Lake Champlain basin

Non-Point Source Pollution: Like other inland water bodies, Lake Champlain is primarily impacted by nonpoint sources. Phosphorus, suspended sediments and associated harmful algal blooms, chloride, bacteria and other pollutants carried in stormwater are the primary stressors of concern. These stressors have significant economic impacts. For example, property values recently decreased in the northeast arm of the lake, apparently in response to an increase in algal blooms in this area (Milton Independent 2015). Further, a recent study reported that the state would lose \$16.8 million in economic activity and 200 full-time summer jobs for every one-meter loss in water clarity (Voigt et al. 2015). While Vermont passed a state Clean Water Act in 2015, and EPA approved the state’s revised Total Maximum Daily Load (TMDL) pollution reduction strategy for phosphorus in 2016, multiple actions are needed to improve water quality across land use sectors in the basin. Highest priority projects have been identified in Vermont’s TMDL phase I implementation plan. Agricultural and forested lands dominate the basin, but multiple studies show that developed lands contribute the second highest load of phosphorus to the lake despite being the smallest land use by area. Numerous organizations focus their efforts to address agricultural issues, but fewer focus efforts on urban and suburban lands.

Aquatic Invasive Species: With more than 80 marinas and 40 public boat landings on Lake Champlain and Lake George, located in the southern part of the watershed, aquatic invasive species (AIS) and their impact on biodiversity is another notable concern. Lake Champlain has 51 known AIS, the latest arrival, the fishhook water flea (*Cercopagis pengoi*), was identified by LCSG

Aquatic Resource Specialist, Mark Malchoff, and another researcher at the LCRI in September 2018. While this number of invasive species is significantly fewer than the 184 known within the Great Lakes, Lake Champlain’s beauty and fisheries draw boaters and anglers from across North America. It is also connected via the Champlain Canal to the Hudson River and lies within southern Quebec, both of which increase risk of introduction of AIS. This threatens the sustainability of native fisheries and associated economic benefits. Lake warming due to climate change is likely to increase the risk of invasion and may favor non-native species that are already present.

THE LAKE CHAMPLAIN BASIN ATLAS

Landforms of the Basin

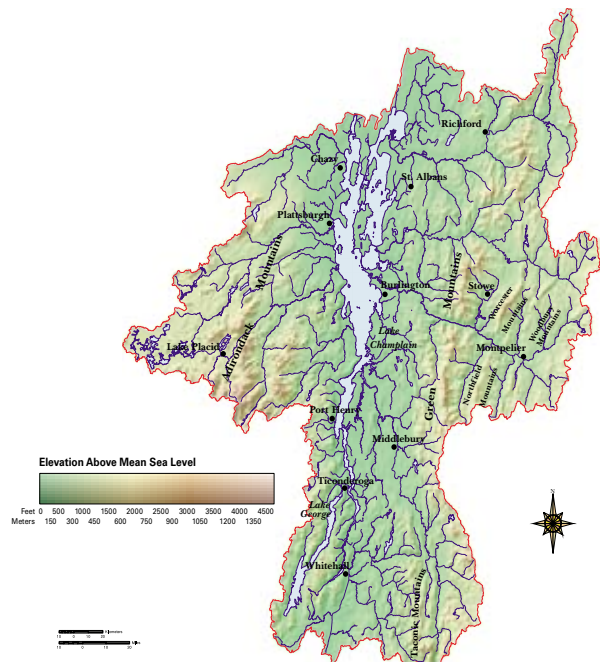


Figure 2. The Lake Champlain basin lies within portions of Vermont (east of the lake), New York (west of the lake), and Quebec, Canada (north of the lake). Source: Lake Champlain Basin Program.

Climate Change: There has been a significant increase in the frequency of extreme precipitation events within the basin which has resulted in damaging shoreline inundation and erosion. Shoreline erosion threatens homes and infrastructure and may reduce spawning areas which could impact the health of the lake's fisheries. It can also increase the risk of encroachment by invasive plant species along shorelines. In spring of 2011 record high water levels caused inundation flooding, shoreline erosion, and widespread physical and economic damage to coastal homes and businesses in New York, Vermont, and Quebec. Later that year, Tropical Storm Irene brought as much as 11 inches of rain to areas of the basin within 24 hours. More than \$730 million in flood damage occurred in Vermont alone. Models predict that events such as these will be more common in the future. While the Federal Emergency Management Agency (FEMA) produces inundation maps, 60-70% of flood-related damage in Vermont is due to fluvial erosion that occurs outside FEMA flood hazard areas. Consequently, development within river corridors, and stream channel alterations have resulted in property and infrastructure damage and loss due to flooding. Without additional guidance and investment, these damages are likely to continue.

Emerging Threats: Microplastics have garnered attention across the world. Wastewater treatment plants are not able to effectively filter microplastics, which are less than 5mm in size. Microplastics themselves can leach harmful chemicals into the environment and adhere to heavy metals. Fish and birds often consume the microplastics, which can then carry the toxins up the food chain. Transport of crude oil and other potentially harmful industrial products forcefully came to the attention of local communities after the Lac Mégantic derailment disaster of 2013. In the case of Lake Champlain, a rail line runs along the entire western edge of the lake, sometimes within a few feet of the shore; 3.6 million gallons of Bakken crude oil is transported along this line each week (McKinstry, 2015). A spill could wreak havoc on the aquatic ecosystems and would put thousands of people's drinking water at risk of contamination. Emergency management planning and preparation training for lakeshore communities and businesses is essential to ensure quick action can be taken in the event of a spill.

Response: What the LCSG does

LCSG is involved in a combination of research, training, and/or outreach associated with the issues noted above. Everything we do is focused on the environment and economy of local communities. For example, our workshops on flood hazard resilience help municipal leaders and homeowners better understand how to retrofit existing development and plan for new development that will be resilient to the changes in precipitation and flooding that are likely to occur in the future. Our workshops for real estate agents help them to understand the connections between environment and property value and ways in which better development practices can benefit both. Our outreach to marinas and to the hosts and participants in fishing derbies raises awareness of clean and safe boating practices that lower pollution and reduce the risk of spreading aquatic invasive species.

The LCSG works closely with the state agencies to define priority research needs and identify opportunities for outreach. One of our strongest relationships has been with the VTDEC. Key executive staff in the VTDEC serve on our PAC, helping to define our research RFPs and to evaluate proposals. As previously noted, one of our most important collaborations is a 50:50 shared position with VTDEC to manage the GIC. This includes coordination of the Green Infrastructure Roundtable, a multi-agency effort to coordinate adoption of green infrastructure approaches across all of the state's activities.

LCSG staff are deeply involved with a number of regional initiatives. For example, the LCBP is a Congressionally-designated, EPA-funded initiative to restore and protect Lake Champlain and its surrounding watershed. Director Bowden previously served on and Chaired the Technical Advisory Committee (TAC) for the LCBP and also has a seat on the LCBP Steering Committee. Extension Director Stepenuck serves on the Education and Outreach Committee of the LCBP. Within Sea Grant, Director Bowden is currently the rotating Chair of the GLSG Committee of Directors and Stepenuck served as Chair of the GLSG Assembly from 2015-7. We also helped develop five, and co-led two, NSGO visioning efforts in 2017-18.

All of the issues that we face in the Lake Champlain basin are national and even international issues. In particular, our work on nutrient enrichment, road salt, harmful algal blooms, and AIS relate to national priorities for water resources management. Our work on the emerging issues of microplastics and crude oil transport also relate to national and

international priorities. An example of our national efforts includes efforts of staff members Malchoff and Schuett, who have helped lead the crude oil transport working group and develop its website, respectively. In Section D - Leadership, we identify ways in which we have been involved at the national level to address these “wicked problems.”

Extension/Advisory Services

“The Sea Grant program under review must have a strong program through which information, techniques, and research results from any reliable source, domestic or international, may be communicated to and utilized by user communities.”

LCSG provides advisory services to municipalities, educators and schools, businesses, and the general public and NGOs across the Lake Champlain basin. LCSG and external research is used to develop the science-based information. We conduct frequent surveys to gauge the need for the programs we offer and to quantify knowledge gained by the stakeholders. In the following sections we describe selected Advisory Services that we have provided to key groups of stakeholders. We discuss educators and schools in greater detail in below – in Education and Training.

Municipalities/State Government

Green Stormwater Infrastructure

LCSG has emerged as a leader in GSI research and extension throughout the Lake Champlain basin. Stormwater management is one of the most pressing issues for resource managers in our cold climate and with our particular challenges of nutrient runoff from developed lands. LCSG supported research directed by Dr. Stephanie Hurley, where bioretention options were studied for their pollutant removal performance. Researchers focused on evaluating how design attributes like soil media and vegetation influenced sediment and nutrient removal, as well as potential capture and/or release of greenhouse gases. The research led to the data-driven updates to the Vermont Stormwater Manual where GSI practices are featured as preferred

methods for managing runoff from developed lands.

Another element of the robust programmatic leadership by LCSG includes partnership with VTDEC to lead a statewide Green Infrastructure Roundtable. Professionals from academia, design consulting firms, non-profit organizations, state agencies, and municipalities gather to discuss persistent stormwater management concerns and new green infrastructural methodologies to address them. Consistent communication via a GSI listserv serves to educate and inform hundreds of associates of the newest information on GSI practice performance for water quality.



Green infrastructure research site at UVM (Photo, A. Cording)

Road Salt

LCSG supported the 2016 Salt Summit organized by NGO, FUND for Lake George, and co-sponsored two subsequent deicing conferences with the Winooski Natural Resources Conservation District, LCBP, and the City of South Burlington. These addressed chloride accumulation in surface and ground waters in the region via winter maintenance practices, and focused on best practices to minimize the use of sodium chloride while maintaining public safety. This science-based information was shared through presentations and demonstrations for public maintenance personnel and private contractors. Results of a survey informed an outreach campaign to allow private contractors to manage impervious surfaces using less salt. As a result of these efforts, one multi-community effort reduced use of salt on 566 lane miles on local, county and state roads, while another community implemented recommended best practices across all of its roads. Other outcomes included communities initiating tracking salt use over time and calibrating equipment. A year after training, attendees reported time savings, increased number of customers, and increased credibility in their winter maintenance efforts.



Participants at the De-Icing conference (Photo, H. Sparacino)

ecoNEWS VT

The results from academic and government-agency research can be difficult to access and requires time and effort to understand. In 2014 we launched ecoNEWS VT to highlight and translate ecological research relevant to the Lake Champlain Basin. An online archive hosts the 49 research digests to date, and quarterly emails are now sent to a list of 330 subscribers with the latest featured scientific reports.

The target audience is users who want to keep up with relevant research, such as state and municipal employees, conservation commissioners, and local watershed organizations. Partners include RSENR, Northeastern States Research Cooperative, Vermont Water Resources and Lake Studies Center, Vermont Monitoring Cooperative and the Vermont Center for Ecostudies.

Flood Resiliency

Municipal decision makers often lack expertise and technical capacity to protect floodplains/ river corridors from development. Such protection can afford communities increased resilience and reduced infrastructure damage during extreme precipitation events or snowmelt. To address this need, we partnered with numerous local and state agencies and provided workshops and a webinar for planning and conservation commissions and the general public to help them understand what actions they can take, and what technical assistance is available to them. As part of this effort, we initially surveyed local decision makers and planners to identify barriers and motivations of towns to adopting protective bylaws, and tailored our outreach accordingly. One aspect of this effort was to develop erosional resilience scorecards that serve as an educational entry point for local decision makers to understand the importance of protecting river corridors and incentives for their communities to implement such protections. Part of this effort was funded through Wisconsin Sea Grant Coastal Storms program.

Environmental Professionals

Workforce Development Training

To support workforce development of environmental professionals in the Lake Champlain basin, we have sponsored a variety of professional development trainings. Through our GIC, we brought a group to the University of New Hampshire's Stormwater Center to learn about innovative practices in this field, particularly as related to cold climates. We also sponsored a community-based social marketing workshop, which provided environmental outreach professionals with skills and knowledge to develop and implement effective outreach programs that result in behavior change. Another training we co-sponsored with the VTDEC is for consultants

and those who implement shoreline erosion control projects. Yet another we held in partnership with the NOAA Office for Coastal Management, engaging professionals in learning best practices for effective meetings.

Businesses

Real Estate Agent Training

LCSG works with business leaders to provide resources and education materials for their particular needs. Over the last several years, we identified real estate agents as an important audience sensitive to environmental issues that affect their business interests. Programs we have developed for them include those focused on the function and values of floodplains and shorelines, how to use online mapping tools, septic design and maintenance, and shoreland regulations. These programs all provide the participants with state-certified professional education credits. These trainings help protect valuable shoreline resources by educating a business community with potential to influence homeowner actions.



Attendees at Realtor workshop. (Photo, L. Patterson)

Marina and Resort Owners

Marinas have significant concerns about the impact of fuel spills to the environment. They requested assistance of LCSG for a product to help minimize spills during the fueling process as commercial devices are no longer available. LCSG partnered with UVM's Seniors in the Electrical Engineering and Mechanical Engineering programs to engage students in a capstone design project to address this need. With LCSG guidance, a team of students developed a prototype device. In the next phase of the project, we will test samples of the device with marinas in partnership with the Institute for Advanced Manufacturing at Clinton Community College in Plattsburgh, NY.



Engineering student learning about boat fueling spill prevention. (Photo, K. Stepenuck)

Fish Tournaments

Research led by LCSG staff to understand the impact of bass tournaments on the bass fishery has informed advice that we have given to tournament organizers to reduce stress on transported fish. The research also led to the adoption of a bass tournament management plan signed by the City of Plattsburgh and the Adirondack Visitors Bureau in 2015. The plan calls for use of LCSG-compiled tournament bag weights, to gauge bass population conditions when deciding how many tournaments to schedule in Plattsburgh each year.

General Public and NGOs

Clean Boating

Marina-based recreational boaters on Lake Champlain do not regularly have access to educational materials that help build awareness or promote implementation of clean boating best practices. To address this gap, marinas were surveyed of their willingness to provide educational materials. As a result, more than 25 marinas now display educational materials for recreational boaters about AIS spread prevention, display signs to prevent fuel spills and trash contamination, and/or host monofilament recycling stations.

Low Input Lawn Care

With partner organizations, LCSG is implementing an outreach campaign to encourage homeowners and commercial property owners to use low input lawn care practices to reduce runoff. In 2017, an undergraduate fellow, supported by the Simon Family Foundation, initiated 10 research demonstration sites at local businesses. Plots are managed according to the recommended

practices and infiltration rates, soil organic matter, and other grass characteristics are compared with grass cut to two inches, representing 52% of Lake Champlain basin homeowners. Other businesses and municipalities have committed to using recommended lawn care practices to serve as demonstration sites for the public. In addition, staff conduct outreach at community events, and have developed rack cards and signs, which are displayed at participating businesses.

Agriculturally Productive Buffers

Agricultural fields abutting rivers lead to bank instability and flooding from fluvial erosion. The TMDL for phosphorus for Lake Champlain recently re-approved by EPA identified erosion by agriculture and urban streambanks as the second largest source of phosphorus to the lake.

Therefore, protecting riparian buffers can reduce phosphorus loading and well as improve flood resilience. However, current state and federal buffer programs do not appeal to some land owners because the contracts are highly restrictive and for many financially struggling small farms, the loss of income-producing property is too great. LCSG, in partnership with the Vermont River Conservancy, demonstrated the technical and financial feasibility of Agriculturally Productive Buffers (APB). APB promotes the planting of zoned river buffers that allow for the production of fruit, nut and forest products while stabilizing vulnerable river banks. The success of the effort is nationally recognized and has been expanded by UVM Extension, the River Conservancy and the National Organic Farmers Association.



Education and Training

“Education and training must be clearly relevant to national, regional, state and local needs in fields related to ocean, Great Lakes, and coastal resources.”

LCSG offers numerous educational opportunities, targeted to age-specific audiences. Our flagship education program is UVM Extension Watershed Alliance, which increases student knowledge and actions to address the challenges of land and water management in the Lake Champlain basin with sound science. We also work with state agencies, NGOs, watershed groups and business associations to build environmental literacy for all basin citizens.

UVM Extension Watershed Alliance

UVM Extension Watershed Alliance (WA) provides K-12 students in Vermont and the Lake Champlain basin with hands-on watershed education and water quality monitoring programs. WA provides curriculum, equipment, and instructors to schools and youth groups participating in programs. WA also provides internship opportunities to UVM undergraduate students who wish to gain valuable, hands-on experience and training in environmental education.



Students learning about stream monitoring from Watershed Educator. (Photo, B. McDonald)

During the years 2014-2017, the Stream Monitoring and Stewardship program reached over 5,300 K-12 students, and 241 K-12 teachers were trained to facilitate place-based stream ecology labs. The Stream Monitoring and Stewardship program led to at least 25 outreach and stewardship projects that engaged students to address local water quality issues and improve the health of the Lake Champlain basin. Additionally, through the Lake Champlain Live program over 1,100 K-12 students collected lake data aboard the UVM Research Vessel the Melosira, improving their understanding of watershed stressors and actions they can take to protect and improve water quality. Lessons are led by program staff and undergraduate interns who are hired to support the program through our Watershed Educator Program. This year-long paid undergraduate internship provides students with hands-on training in best education practices and watershed science, and affords younger students an opportunity to explore college majors and pathways.

UVM Extension Watershed Alliance also trains educators and provides curriculum for teachers to incorporate into their classrooms. This includes leading sessions for the Watershed for Every Classroom year-long graduate level teacher training program, a cooperative effort with LCBP.

Real Estate Agent Continuing Education Workshops

Real estate agents are in a unique position to influence development decisions that impact water quality. Over 400 Vermont realtors have attended workshops and received resources that inform their work in guiding property owners towards responsible stewardship choices. Workshops span a variety of topics. Session titles include: Vermont Use Appraisal Program, Demystifying FEMA and Floodplain Maps, Vermont Shoreland Protection Act, Water Resources, Web-Based Mapping, and Septic Systems.

Public Educational Workshops

Place-based education promotes people to act to protect the environment. LCSG, UVM Extension, the Rubenstein Ecosystem Science Lab, and ECHO began offering educational trips on the lake for the public in 2017. Participants learn firsthand how our uses of the land impact water quality, and identify personal actions to minimize impacts. Nearly 300 people, including Abenaki students, farm migrant workers, Boys & Girls Club members, and community leaders participated in these hands-on educational trips to date.

Another type of educational workshop we offer is a series of tours to introduce the public to water management at numerous facilities. To date, these have included tours at drinking, wastewater, and hydro plants, a waste wood-chip burning power station, a green roof, and our Burlington green stormwater bike tour (which is now also supported with a podcast and online StoryMap for those unable to take the tour in person).



Public boat tour on Lake Champlain. (Photo, K. Stepenuck)

C. Collaborative Network/NOAA Activities

Collaboration and Relationships

“The Sea Grant program under review must have close ties and provide leadership in ocean/coast/watershed/Great Lakes activities including coordinated planning and cooperative work with local, state, regional, and Federal agencies, other Sea Grant programs, and non-Sea Grant universities and educational institutions, and business and industry.”

Federal Agencies

LCSG works with several federal partners. For example, LCSG works closely with the LCBP on a variety of projects that address resilient communities and economies, healthy coastal ecosystems, and environmental literacy and workforce development. LCBP is an organization administered cooperatively by EPA, the NYDEC, Vermont Agency of Natural Resources, Québec Ministry of Sustainable Development, Environment, Fauna and Parks, and New England Interstate Water Pollution Control Commission. LCBP is a Congressionally-designated initiative to restore and protect Lake Champlain and its surrounding watershed. LCBP also provides funding to support LCSG initiatives, such as our winter maintenance outreach to private contractors. The LCSG Director (Bowden) has a designated seat on the LCBP Steering Committee and federal partners working group. Both he and Aquatic Resource Specialist, Mark Malchoff sit on (and Bowden previously Chaired) the LCBP Technical Advisory Committee. The LCSG Extension Leader (Stepenuck) is a member of the LCBP Education and Outreach committee. From these positions we are able to align our resources to most effectively address the issues noted above, which are all of common interest. Also, through these roles, LCSG contributes to the LCBP Opportunities for Action document that defines the work LCBP supports and engages in over time.

The Vermont Water Resources and Lake Studies Center (VWRLSC) is supported by the United State Geological Survey (USGS) and is a member of the National Institutes of Water Resources (NIWR). The

mission of the VWRLSC is to fund research on major water resource issues of concern to the state, to disseminate results from that research, and to help educate students about the nature and value of water resources. An annual RFP is held, typically funding 3-5 projects each year, including graduate-student led projects. Directorship and management of VWRLSC are led by LCSG Director Bowden and Research Coordinator Elissa Schuett. At the national level, the NIWR program and National Sea Grant College Program are in the process of developing stronger connections as a reflection of the overlapping missions of each program.

Regional Networks

LCSG is an active member of the Sea Grant Association, including regional and topical networks and Communities of Practice. LCSG is most closely aligned with the issues of the Great Lakes Sea Grant Network (GLSGN). LCSG participates in regional network meetings, including hosting the biannual meeting in 2015. Leadership among LCSG staff in the GLSG network is achieved through holding positions on the Directors and Extension Program Leaders networks. Staff are also part of regional Communities of Practice and special topic networks. A high priority regional project has focused on Crude Oil Transport. In support of this project, the LCSG has led workshops and webinars, and developed the main website for the project. In cooperation with Land Grant and Sea Grant programs, during 2014-17, LCSG co-led a GSI national community of practice. This led to our co-leadership of the NSGO Community Response to Flooding visioning effort.

In total, LCSG staff engaged in NSGO five visioning efforts, co-leading two of them. Additionally, the LCSG Research Coordinator has worked with other Sea Grant network Research Coordinators to identify ways to more closely align priority research topics when developing RFPs and to possibly sponsor a joint RFP in the future. The LCSG also cooperates regularly with the New England Sea Grant network on topics of collective interest. A series of educational webinars were conducted for the network. Finally, staff participate in a variety of other regional and national Communities of Practice, including those focused on Great Lakes clean marinas, environmental literacy, community science, and diversity, equity and inclusion.

The Director of the LCSG (Bowden) is also Director of the Theme 1 (Socioeconomics) of the Northeastern States Research Cooperative (NSRC). The NSRC is a competitive grant program funded by the USDA Forest Service and supports cross-disciplinary, collaborative research in the Northern Forest -- a 26-million acre working landscape that is home to more than one million residents and stretches from eastern Maine through New Hampshire and Vermont and into northern New York. The NSRC addresses the importance of the Northern Forest to society and the need for research to have relevance and benefit to the people who live there, work with its resources, use its products, visit it, and care about it. The interests of the NSRC Theme 1 and the LCSG overlap in areas of lake and shoreline management in the Northern Forest region.

Coastal Storms Projects

We were awarded two competitive grant awards from NSGO, and one subaward through Wisconsin Sea Grant through the Coastal Storms program in this reporting period. These allowed us to focus efforts to quantify flood damage costs and to calculate costs savings if zoning regulations were updated in selected subwatersheds within the Lake Champlain basin, and to develop erosional flooding maps in those areas. We ultimately aligned these efforts with VTDEC efforts to identify river corridor areas that, if protected, will help communities minimize future impacts from flooding. As described previously, we held a series of workshops and developed a variety of outreach materials to support

this education. In another of these projects, LCSG staff facilitated efforts of three multi-stakeholder community efforts to increase knowledge of actions individuals and communities can take to become more flood resilient, and to implement initiatives that would lead to such outcomes. These projects were all part of a Great Lakes Coastal Storms initiative; thus, we were able to share our outcomes with, and hear progress and outcomes of a multitude of funded-stakeholder projects across the Great Lakes Network over time.



Sharing healthy lawn tips at public event (Photo, K. Stepenuck)

Severe Weather Forum

LCSG aided in the development of a Severe Weather Forum to better inform emergency management, planning, and infrastructure-related communities of recent severe weather trends in New York. This forum was developed and carried out in partnership with SUNY Albany's Department of Atmospheric and Environmental Sciences. A local panel of experts from the Clinton County Office of Emergency Services, NOAA National Weather Service, and local TV stations shared expertise about climate trends and riverine flood patterns.

State Agencies and Administrations

The work of LCSG crosses state lines with work falling in both New York and Vermont. LCSG has working relationships with both states and offers programs to communities and stakeholders throughout the Lake Champlain basin. For example, the LCSG collaborated with the Vermont DEC to develop the GIC and a shared position to manage

the GIC. This collaboration was founded on an already strong relationship with this agency. Since its creation, the program has worked to support the state's clean water goals through development of evaluation tools and building a stronger connection to the scientific community. The program has proven successful and a model for possible future shared positions with other key partners (e.g., see Criterion 10 - Continued High Performance).

LCSG has been a long-term partner of New York State agencies and demonstrated leadership in the development of regulations of non-native species as part of New York State invasive species control and bass tournament organization.

Local Authorities

Like many other US cities, Burlington, Vermont, is managing a legacy of pollution challenges from its past - some related to industrial pollution and others related to aging stormwater and sewer infrastructure. LCSG has worked with the City to educate residents about the impact of combined sewer overflows on water quality and the role of GSI to capture and infiltrate runoff before it enters the City system. LCSG has provided leadership and advisory services on several GSI projects and developed a system for City staff to track and evaluate residential GSI installations.

A relationship with the City of South Burlington has been cultivated over years of partnership on projects that serve the City's needs through the application of scientific principles and findings to improve water quality outcomes. We serve as a primary partner when South Burlington endeavors to learn about, measure impact upon, or discover ways to improve the health of their aquatic resources.



Floating treatment wetland in stormwater pond (Photo: R. Tharp)

LCSG has a long-running relationship with the City of Plattsburgh, NY. Since 2009, LCSG provided advisory services regarding bass tournament impacts hosted by the City. The efforts ultimately led to the City adopting regulations to limit the number of tournaments each year. Recently, a NYSG-LCSG lecture series on underwater cultural resources and limnology was held at City Hall, along with a special exhibit displaying NYSG's "Great Shipwrecks of NY's Great Lakes" educational panels.



Smallmouth bass (Photo, M. Malchoff).

Academic Institutions

LCSG substantially enhances the academic and training opportunities of our host institutions, the University of Vermont and the State University of New York at Plattsburgh. In addition, we are strengthening or relationships with other academic institutions in the Lake Champlain basin, including Norwich University, Vermont Law School, and Middlebury College.

In addition to higher education, LCSG has a strong partnership with numerous K-12 institutions through the UVM Extension Watershed Alliance program. For example, Edmunds Middle School, near the UVM campus in Burlington, has been a strong partner for many years, reaching 300 students annually as part of a stream monitoring program. LCSG also supports the Poultney-Mettowee Natural Resources Conservation District to provide educational programs to schools in southern Vermont.

Businesses

Bass tournament organizations such as FLW Outdoors and NY B.A.S.S. Chapter Federation assisted LCSG staff with research on dispersal and mortality of fish caught during tournaments. Tournaments provided researchers access to

thousands of live fish, without the need for fisheries sampling gear. Results of the research led to recommendations to reduce bass mortality following catch-and-release tournaments.

Realtor boards in Vermont have enthusiastically assisted LCSG in the development of continuing education workshops. Real estate agents learn about the impact of water quality on property values, up-to-date regulations and permitting processes, and flood-risk factors on property location and

professional credits by attending the workshops.

LCSG has established partnerships with commercial businesses to adopt low input grounds care practices. Through the Raise the Blade outreach effort, 6 businesses have committed to adopting lawn care best practices that reduce stormwater runoff. Additionally, 10 local businesses are partnering with LCSG to serve as research demonstration sites.

D. Performance

Leadership

Recognition as a Leader

The Lake Champlain Sea Grant (LCSG) is recognized as a leader in the region and beyond. From modest beginnings as an outreach project of the New York Sea Grant program in the late 1990s, LCSG has grown into a mature program that offers a diverse array of knowledge, services, and opportunities. We operate in a vibrant landscape that offers numerous opportunities for work, entrepreneurship, and recreation, which also create a complex array of interacting challenges for land and water management. LCSG funds research, offers services, and provides educational opportunities designed to meet these challenges.

Staff Leadership on Boards and Committees

The leadership capabilities of LCSG are most clearly expressed in the experience and capabilities of our staff who are actively involved a diverse array of committees and working groups that relate directly to the strategic interests of our program. State agencies, local community leaders, and regional NGOs regularly seek the involvement of LCSG staff on initiatives of mutual interest.

Staff serve on a multitude of committees, boards, and teams, often in leadership roles. These range

from institutional level teams (e.g., the UVM Communicators Network, Rubenstein Ecosystems Lab Strategic Planning team), to state (e.g., leader of Vermont Green Infrastructure Roundtable, board member of Vermont State-Wide Environmental Education programs group), regional (e.g., Lake Champlain Basin Program Technical Advisory Committee, and Education and Outreach Committee; leaders of Great Lakes Sea Grant Directors and Extension Leader Networks), and national and international level boards and networks (e.g., United States Geological Survey National Institute for Water Resources; International Joint Commission Lake Champlain-Richelieu River Flood Study; NSGO Communicators, Educators, Fiscal Officers, Directors, and Assembly Networks; multiple NSGO visioning teams). Staff participation in these groups allows each person to focus in their specialty areas, and affords LCSG strong interactions among professionals within the National Sea Grant Network and beyond.



Flooded road during Richelieu River flooding, 2011.

Productivity

“The Sea Grant program under review must have demonstrated a degree of productivity (of research results, reports, employed students, service to State agencies and industry, etc.) commensurate with the length of its Sea Grant operations and the level of funding under which it has worked.”

Research Products from LCSG

Investments in research by LCSG have resulted in a number of products that enrich our programs and inform stakeholders. A direct product of our research includes a total of 43 publications, reports, fact sheets, and handbooks that have been entered in the National Sea Grant Library. Our research also informs the workshops and presentations that we create for our audiences. Finally, research and outreach create important undergraduate and graduate student training opportunities that provide valuable experiences for the next generation of environmental researchers, educators, and stewards.



Water temperature and meteorological research buoy
(Photo, E. Leibensperger)

Response to the 2015 and 2017 Site Reviews

Our 2015 site review assessed our readiness to propose Institutional status, and concluded that “the LCSG Coherent Area Program partnership [met] the standards of NOAA’s Sea Grant program and has demonstrated the potential to begin the process of becoming an institutional program.” That review resulted in four recommendations and one suggestion, all of which we addressed in full. Our most recent Site Review, in 2017, was held not to assess our progress over four years, but to determine if LCSG should be granted institutional

status. While no official recommendations or suggestions were made in that report, the final report transmitted to Director Bowden following that Site Review indicated one area of concern. That is, while the review committee recognized that UVM is the only large research university in the immediate region, they “expressed some concern that the number of academic programs with which Lake Champlain Sea Grant interacts is limited.” As such, we were “encouraged to continue to actively seek other academic partners in the larger region.”

Some of our activities to engage with other academic institutions in the basin were not well portrayed during our 2017 site review. Specifically, throughout this reporting period, we have directed outreach about available fellowships and research opportunities to contacts in the environmental programs at each of the 13 colleges within the basin. Further, during our 2018-22 strategic planning process, we invited participation from stakeholders at each of these colleges, resulting in participation of eight of these institutions. We have also hired interns from both Green Mountain College and Champlain College to assist with implementation of UVM Extension Watershed Alliance. Since receiving the 2017 report, we are in the process of identifying potential candidates from Paul Smith’s College in Paul Smiths, NY, to serve on our PAC. If successful in our invitation, we will not only build our academic relationships, but strengthen New York representation on the PAC. In addition, we have a newly developing partnership with Clinton County Community College in Plattsburgh, NY, for development and testing of a fuel catching device for recreational boaters.