

Lake Superior National Estuarine Research

Reserve

Research Program Strategic Plan



Lake Superior NERR Research Program  
Strategic Plan

Dr. Shon Schooler

Lake Superior National Estuarine Research Reserve

August 9, 2012

LSNERR document number: 2012-R-1003



Duck Bay in the Lake Superior National Estuarine Research Reserve

## Contents

Executive Summary.....	4
Lake Superior NERR Overview .....	5
Lake Superior NERR Goals.....	5
Lake Superior NERR Research Program Mission.....	6
Lake Superior NERR Research Program Goals .....	6
Priority Research Themes .....	6
Research Program Actions.....	8

## Executive Summary

The Lake Superior National Estuarine Research Reserve (NERR) is located near the mouth of the St. Louis River and St. Louis Bay at the confluence of the river and Lake Superior. It is one within a network of 28 Research Reserves across the country identified for long-term research, water-quality monitoring, education and coastal stewardship under the National Oceanic and Atmospheric Administration's (NOAA) National Estuarine Reserve System. The Lake Superior NERR is comprised entirely of public lands and waters owned by four land owners: Wisconsin Department of Natural Resources, City of Superior, Douglas County and the University of Wisconsin. The Reserve is a large, diverse complex that contains a variety of representative terrestrial and aquatic habitats, including riparian and riverine habitat; riverine islands; emergent freshwater marshes, interdunal wetlands and scrub swamp; aspen, dry and hardwood forests; and open sand beach and dunes. The Reserve works with its partners to improve the understanding of Lake Superior freshwater estuaries and coastal resources and to address the issues affecting them through an integrated program of research, education, outreach, and stewardship.

The mission of the Lake Superior NERR Research Program is to provide science-based information through prioritization, coordination, implementation of research projects and dissemination of research results aimed at fostering a better understanding of the biophysical and socio-economic processes of Lake Superior freshwater estuaries. We will support this mission by coordinating and conducting quality research and providing this information to constituents. This will be done by engaging in research activities that: provide a better understanding of the biophysical processes and socio-economic benefits freshwater estuaries; examine the effects of climate change, pollutants, and invasive organisms on freshwater estuary biophysical and socio-economic structure and function; study the progress of environmental restoration projects and the status of species of special interest (rare and threatened species and species of cultural significance); and provide relevant and high quality information for education, stewardship, and management activities and provide citizens with research opportunities.

## **Lake Superior NERR Overview**

The Lake Superior NERR is situated on the freshwater estuary at the confluence of the St. Louis River and Lake Superior, the largest and most pristine of the Great Lakes. The Reserve is a diverse, large complex of representative terrestrial and aquatic habitats allowing for extensive research and educational opportunities. The boundaries of the Lake Superior NERR include land and water areas that are significant to supporting the Reserve's goals and will protect the integrity of core areas for long term research and monitoring. The Reserve will provide opportunities for research and monitoring, experiential learning, and training while continuing to contribute to the protection of the ecological health of the St. Louis River Freshwater Estuary and Lake Superior coastal habitats. The St. Louis River is bordered by Wisconsin and Minnesota for 23 miles and has a largely forested watershed that is 1,872,807 acres in size. The combination of ecosystems within the Lower St. Louis River—estuarine wetlands and aquatic habitats, baymouth bar complex, and surrounding upland forest—are very unusual in Lake Superior, the Upper Midwest, the Great Lakes region, and the world. Many of the ecosystems and native species are rare and/or declining across their ranges. This concentration of such diverse ecosystems, along with the location on the western end of Lake Superior, makes this freshwater estuary a critical migratory stopover and an important breeding area for many species. In spite of human impacts, Duluth-Superior is one of the world's largest freshwater ports, the Lower St. Louis River ecosystem is both regionally and globally significant. Great Lakes wetland systems are unique from a global perspective, and the St. Louis River Freshwater Estuary is one of the largest such complexes on the Lake Superior shore, representing a significant source of productivity for the entire Lake Superior ecosystem. The freshwater estuary and its tributaries are unusual in having such a variety of habitat types supporting a large and diverse assemblage of native fish species.

## **Lake Superior NERR Goals**

The four goals stated below are long-term intentions of the Lake Superior NERR. These goals, focusing on Lake Superior freshwater estuaries and coastal resources and issues, link closely to the NERR program sectors of research, education and stewardship.

- 1) Conduct applied research and monitoring to increase the understanding of Lake Superior freshwater estuaries and coastal ecosystems

- 2) Educate youth, students, community members, and visitors about Lake Superior freshwater estuaries and coastal resources and improve their ability to address coastal issues
- 3) Increase the ability of community leaders and other decision makers to address critical Lake Superior coastal management issues
- 4) Protect and enhance the ecological health of the St. Louis River Watershed and Lake Superior coastal habitats

## **Lake Superior NERR Research Program Mission**

To provide science-based information through prioritization, coordination, implementation, and dissemination of research aimed at better understanding the biophysical and socio-economic processes of Lake Superior freshwater estuaries.

## **Lake Superior NERR Research Program Goals**

To engage in research activities that:

- provide a better understanding of the biophysical processes and socio-economic benefits freshwater estuaries.
- examine the effects of climate change, pollutants, and invasive organisms on freshwater estuary biophysical and socio-economic structure and function.
- study the progress of environmental restoration projects and the status of species of special interest (rare and threatened species and species of cultural significance).
- provide relevant and high quality information for education, stewardship, and management activities and provide citizens with research opportunities.

## **Priority Research Themes**

### *Climate Change*

Climate change is expected to alter the intensity and frequency of precipitation events, affect lake water levels, and increase the length of the growing season, and reduce the number of extreme cold days in northern Wisconsin. All these changes are expected to influence the St Louis River Freshwater Estuary. The LSNERR will set up a NOAA Sentinel Site to measure the changes in physical variables and the associated changes in biophysical processes and biotic communities.

### *Invasive Species*

Invasive species are considered a major impact to wildlife habitat, ecosystem processes, and species diversity around the world. There are a number of invasive plants and animals in the St Louis River Freshwater Estuary. The invasive species theme will focus around the risks, impacts, ecology, and management of invasive species. This may include general assessments of non-native species in order to determine risk and to prioritize management actions.

### *Pollutants*

There is a legacy of pollution, primarily in the harbor of the lower St. Louis River Freshwater Estuary. To a large extent, this is being remediated and restored. However, there are still many unknown issues around pollutants in sediments and the water column that should be addressed. For example, the role of microbial communities in the methylation of elemental mercury. The Lake Superior NERR will work with partners to identify potential research needs related to toxins and contaminants and their impacts on the St. Louis River Freshwater Estuary.

### *Freshwater Estuaries*

The Lake Superior NERR is considered a freshwater estuary (or drowned river mouth). It is the second freshwater estuary NERR site in the Great Lakes. Freshwater estuaries differ in biophysical processes than saltwater estuaries, primarily due to differences in salt concentrations and tidal frequency and intensity, but also in their expected responses to climate change (e.g. it is not known whether lake levels will rise or fall). A primary research theme will be to study the biophysical processes of freshwater estuaries and compare with the processes of salt water estuaries.

### *Species of Special Interest*

We have several state and federal listed rare and threatened species (e.g., grass of Parnassus and piping plover) on the Reserve. In addition, we have culturally important species (e.g., wild rice and lake sturgeon). Knowledge on the locations, habitat requirements and population sizes of these species will help us to direct restoration and management plans. Research on these species will be one of our priorities.

### *Restoration Research*

The St Louis River is a Great Lakes Area of Concern with nine Beneficial Use Impairments, including fish and wildlife populations and habitats. In conjunction with this and other issues, there are a number of ongoing and planned restoration projects in the St Louis River Freshwater Estuary. The Lake Superior NERR will collaborate with partners to identify a group of reference sites that cover a range of conditions and are appropriate for long-term study and comparison to the St. Louis River Freshwater Estuary system. We will assist partners with monitoring, assessing the progress of restoration projects, and act as a centralized data hub. We will also examine the implications of freshwater estuary processes and how these may affect restoration project success.

### *Social Science*

The Lake Superior NERR will partner with scientists to conduct research to improve our understanding of the socio-economic aspects of the St. Louis River Freshwater Estuary. This will include a diversity of topics. For example, we plan to produce a historical cost/benefit analysis of the industry (production benefits vs. environmental and social cost) in the freshwater estuary.

## Research Program Actions

### *Environmental monitoring*

The Lake Superior NERR will implement the NERR System-Wide Monitoring Program (SWMP). This will include four continuous water quality monitoring stations with monthly nutrient and chlorophyll sampling, a meteorological station, and monthly sampling at one site consisting of 12 nutrient and chlorophyll samples collected over a 24 hour period. Data will be archived at the Centralized Data Management Office (CDMO) as per established protocols.

In addition, we will seek funding to become a NOAA Sentinel Site. This will include installing surface elevation tables, establishing permanent vegetation transects, installing water level monitoring wells, and establishing a geodetic framework for all instruments.

To promote information access by the public in a timely manner the Lake Superior NERR will seek to provide real-time water quality and meteorological information using telemetry systems (satellite and cellular). This information will be used in the Coastal Training Program (CTP) and Education programs and made available to the public online and in the Lake Superior NERR Science and Interpretive Center.

### *Linking with other researchers*

The Lake Superior NERR Research staff will actively promote research in the St. Louis River Freshwater Estuary through partnerships and collaboration on projects and providing access to resources. The Lake Superior NERR will work with the NERRS Graduate Research Fellowship program to develop and sponsor graduate research at the Reserve.

### *Information Dissemination*

We will strive to make information gained from Lake Superior NERR research activities available to researchers, managers, and the public. This will include: publishing research results in publically accessible forms (reports, journal papers, book chapters, internet resources); presenting research results at conferences, public meetings, and management meetings; organizing symposia at conferences; and organizing the annual St. Louis River Estuary Science Summit.

Data collected by the Lake Superior NERR will be developed into geospatial datasets. Geographic information systems (GIS) will be used to archive, analyze, and disseminate data collected at the reserve and by partners.

### *Resource to Community*

The Lake Superior NERR will collect data to enable a comprehensive site description and characterization of the St Louis River Freshwater Estuary and will use this information to prepare and publish baseline habitat maps and a Site Profile. We will compile references for existing physical, chemical, biological, social, and cultural information into a bibliographic database for use by Lake Superior NERR staff, researchers, managers and the public. In addition,



we will develop a geographic information system (GIS) and associated geospatial-temporal database for the St. Louis River Freshwater Estuary and contributing watershed that incorporates existing and new data from diverse sources. Information regarding past, current, and potential watershed land use patterns and impacts will be incorporated into a GIS platform for the St. Louis River Freshwater Estuary and used to identify and prioritize watershed management and research needs. Research staff will also serve on relevant local, regional, and national committees.

### *Citizen Science*

We will develop a citizen science program around our priority research themes. The goal will be to have groups of volunteers collect quality data targeted at answering specific questions. This will be linked with the Lake Superior NERR Volunteer and Coastal Training Programs.

### *Education / Capacity Building*

The Lake Superior NERR Research Program will strive to support the Lake Superior NERR Education, Stewardship, and CTP Programs by providing up-to-date highquality information on environmental aspects of the St Louis River Estuary. The Research Program will also be responsive to community needs that are identified by the Lake Superior NERR Educational and Outreach programs. We will also look to build capacity by promoting environmental science careers through the Lake Superior NERR Research Intern Program and participating in the UW Undergraduate Science Initiative.

### *Increasing Scope*

The Lake Superior NERR will explore the feasibility of establishing a formal, connected network of Wisconsin freshwater estuary sites. Partnering sites would be included in coordinated outreach, applied research, and monitoring programs designed to encourage and foster local stewardship of freshwater estuary resources at the community level.