Environment and Natural Resources Trust Fund 2018 Request for Proposals (RFP)

Project Title: ENRTF ID: 021-A
Smart Mapping St. Louis River Estuary Habitats
Category: A. Foundational Natural Resource Data and Information
Total Project Budget: \$ _301,000
Proposed Project Time Period for the Funding Requested: <u>3 years, July 2018 to June 2021</u>
Summary:
Produce web-accessible smart maps of St. Louis River Estuary habitats to efficiently display summary information from thousands of biological records for use by resource managers working to restore impaired habitats.
Name: Carol Reschke
Sponsoring Organization: U of MN - Duluth NRRI
Address: 5013 Miller Trunk Highway
Duluth MN 55811
Telephone Number: (218) 788-2738
Email creschke@nrri.umn.edu
Web Address www.nrri.umn.edu
Location
Region: Northeast
County Name: St. Louis

City / Township: Duluth

Alternate Text for Visual:

Г

Map 1 shows the location of the St. Louis River Area of Concern in northeast Minnesota in Duluth MN. Map 2 of the St. Louis River Estuary shows locations of 1086 aquatic vegetation sample points collected by Carol Reschke and NRRI staff from 2013 through 2016.

Funding Priorities	_ Multiple Benefits	Outcomes	Knowledge Base	
Extent of Impact	Innovation	Scientific/Tech Basis	Urgency	
Capacity Readiness	Leverage		TOTAL	_%



PROJECT TITLE: Smart Mapping St. Louis River Estuary Habitats

I. PROJECT STATEMENT

The goal of this project is to produce web-accessible smart maps of St. Louis River Estuary habitats for use by resource managers working to restore impaired habitats. Smart maps are an innovative way to display complex data in an efficient and easy to understand format. Since 2010 we've conducted field surveys yielding thousands of records on aquatic vegetation, birds, fishes, benthic macroinvertebrates, and invasive species in the estuary. These surveys are part of the multi-agency St. Louis River Area of Concern Remedial Action Plan to restore fish and wildlife habitats and remove impairments that led to listing the St. Louis River as a Great Lakes Area of Concern. This 12,000 acre freshwater estuary at the west end of Lake Superior in Duluth MN and Superior WI was designated an Area of Concern in the 1980's because legacy contaminants and disturbances led to nine key impairments, including loss of fish and wildlife habitat. Currently resource managers have access to extensive biological monitoring data from the estuary, without an efficient means to display or share data summaries in a consistent manner; as a result some errors and omissions have been made in interpreting massive data sets. We propose creating a **smart mapping system** as a tool to provide resource managers:

- 1) an easy way to access biological data summaries at a habitat scale,
- 2) an efficient way to consider and weigh benefits and impacts of restoration activities across multiple habitat values for aquatic plants and animals,
- 3) a way to quickly review ecosystem services provided by specific habitats, and
- 4) a tally of recreation opportunities to be considered for habitats located within an urban environment.

Combining multiple resource values via smart mapping will make it easier for managers to evaluate and coordinate restoration and management activities so they maximize benefits and minimize impacts.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Prepare summaries and analysis of biological data by habitat types

Compile recent St. Louis River Estuary biological data and run analyses to refine plant community and aquatic habitat types. Revise community and aquatic habitat maps from the 2002 Lower St. Louis River Habitat Plan to reflect recent data. Prepare data summaries for plant communities and aquatic habitats, and add information on ecosystem services and recreation opportunities to mapped habitat areas.

Outcome	Completion Date
1. Compile existing biological datasets sampled since spring 2010 (vegetation, fishes, birds,	January 2019
macroinvertebrates, invasive species), and data on ecosystem services & recreational uses.	
2. Run initial statistical analyses of biological and GIS data to classify plant communities and	May 2019
aquatic habitats, and prepare community summaries for review by resource managers.	
3. Refine maps to reflect plant community and habitat classes; identify data gaps.	August 2019
Prepare draft maps, legends, and associated data tables for review with resource managers.	

Activity 2: Meet with resource managers to review maps and assess needs

Meet with resource managers (site restoration managers, landowners, tribal resource managers, and city planners) to review map products and assess their information needs. We intend to make sure our smart mapping system and the data displayed will support resource managers' work evaluating restoration progress, and planning long-term site management within the St. Louis River Estuary in Duluth.

Budget: \$ 31,750

Budget: \$ 104,000

1



Outcome **Completion Date** October 2020 1. Organize meetings and workshops in 2019 and 2020 with resource managers to review draft maps, legends, and associated data tables, and assess information needs. November 2019 2. Identify key data gaps where new imagery or field confirmation is needed for planning restoration or management efforts; and set priorities for acquiring additional data. Activity 3: Refine maps, data summaries, models; produce smart mapping system Budget: \$ 165,250 Acquire high-resolution imagery where needed with an Unmanned Aerial Vehicle. Conduct field surveys in summers of 2019 and 2020 to confirm map accuracy in key sites. Revise data summaries, analyses, and maps using acquired data. Refine models that predict aquatic vegetation occurrence for use in mapping, and for planning restoration. Produce smart maps, legends, data tables, and descriptive summaries; write final report. Outcome **Completion Date** 1. Collect high-resolution imagery as needed with an Unmanned Aerial Vehicle; conduct October 2020 field surveys to confirm plant community or habitat types as needed to fill key data gaps. January 2021 2. Revise data summaries and statistical analyses in response to needs identified in meetings with resource managers. Refine models that predict aquatic vegetation based on physical habitat conditions. Incorporate any new data acquired to fill key data gaps. 3. Revise maps to reflect refined plant community and habitat classes, update associated April 2021 data tables with any new data acquired (biological or ecosystem service data). 4. Prepare both printed and online versions of smart maps, legends, and associated data tables, graphs, and images. Write instructions for use and maintenance of smart maps. June 2021 Distribute final report and links to online smart mapping system to resource managers.

III. PROJECT STRATEGY

A. Project Team/Partners: Our project team includes ecologists Carol Reschke (PI), Dr. George Host (Co-PI), and Annie Bracey (Co-PI) at the University of Minnesota Duluth. Carol Reschke's expertise is Community Ecology, she has worked on sampling and mapping vegetation in the St. Louis River estuary since 1999. Dr. Host will share his expertise in Landscape Ecology and GIS. Annie Bracey's expertise is Avian Ecology and she has sampled birds in the St. Louis River estuary since 2010. Non-funded partners include John Lindgren (MN DNR, Area of Concern Coordinator) and Melissa Sjolund (MN DNR, Habitat Coordinator). Potential collaborators include Tom Hollenhorst at the U.S. Environmental Protection Agency's Mid-Continent Ecology Division Laboratory in Duluth.

B. Project Impact and Long-Term Strategy: The completed smart mapping system will make it easier for resource managers to plan restoration and management activities so that they maximize benefits across multiple resources (vegetation, birds, fishes, benthic macroinvertebrates, and control of invasive species), while also considering multiple ecosystem services, human values, and recreational uses. During the project period we will identify partners best suited for long-term maintenance of the completed smart mapping system. We discussed this project with Garono et al. (who are submitting "Safeguarding Our St. Louis River Restoration Investment" to LCCMR); although their proposal addresses related goals for the estuary, our approaches differ and results would complement each other, if funded. Both proposals aim to provide essential information for resource managers. We invited Minnesota Land Trust to collaborate on this project, and they acknowledged that our maps would complement their proposed LCCMR project; however they chose to submit a separate proposal.

C. Timeline Requirements: This is a three-year project to allow adequate time for summarizing complex data by habitat and community types, holding meetings and workshops with resource managers, acquiring new data to fill key data gaps, and preparing a smart mapping system that will meet needs identified by resource managers.

2018 Detailed Project Budget

Project Title: Smart Mapping St. Louis River Estuary Habitats

IV. TOTAL ENRTF REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	
Carol Reschke, Principal Investigator (72.8% salary, 27.2% benefits), 55% FTE yrs 1-3	\$ 128,403
George Host, Co-Investigator, (66.5% salary, 33.5% benefits), 0.5% FTE yrs 1-3	\$ 2,399
Annie Bracey, Co-Investigator, (66.5% salary, 33.5% benefits), 15% FTE yrs 1-3	\$ 37,425
Josh Dumke, Fish ecologist, (66.5% salary, 33.5% benefits), 3% FTE yrs 1-3	\$ 7,482
Valerie Brady, Aquatic ecologist, (66.5% salary, 33.5% benefits), 0.5% FTE yrs 1-3	\$ 1,582
Kristina Nixon, GIS mapping, (72.8% salary, 27.2% benefits), 4% FTE yrs 1-3	\$ 8,340
Paul Meysembourg, GIS analyst, (66.5% salary, 33.5% benefits), 5% FTE yrs 1-3	\$ 14,133
Graduate assistant, (75% salary, 15% benefits), 50% FTE academic yrs 1&2 and summer yrs 2&3	\$ 81,240
Undergraduate field assistant, (100% salary), 10% FTE summer yr 2; 9% FTE summer yr 3	\$ 2,126
Service Contract: TBD, consultant to facilitate meetings with stakeholders, and review map	\$ 14,000
products, \$2k yr 1, \$8k yr 2, \$4k yr 3	
Equipment/Tools/Supplies:	
Garmin GPSMAP 64st, \$360 yr 1 to provide accurate GPS coordinates for field checking polygon	\$ 360
data, includes batteries and case	
Olympus Tough waterproof digital camera for photos of habitat types for illustrations in final report,	\$ 410
Waders for field crew doing field checks of polygons, yrs 1&2	\$ 240
Field crew supplies: sunscreen, bug spray, write in rain paper/pencils, \$20 yr 1, \$40 yrs 2&3	\$ 100
Travel:	
Transportation to check uncertain habitat classifications, or to collect low elevation aerial imagery	\$ 570
using a small Unmanned Aerial Vehicle (UAV) with a digital camera, \$190 yr for 3 yrs	
Local transport to meetings with collaborators, \$60 per year for 3 yrs	\$ 180
Additional Budget Items:	
NRRI/UMD ISO: GIS lab fees for use of GIS software and computers: \$250 each year for 3 yrs	\$ 750
NRRI/UMD ISO: UAV fees for use of Unmanned Aerial Vehicle for collecting high-resolution imagery	\$ 600
where needed to complete mapping or fill data gaps, \$200 yr for 3 yrs	
HyperNiche software site license yr 1, for refining models to predict aquatic vegetation patterns	\$ 250
PCORD 7 software upgrade yr 1, to a site license, for multivariate analysis of community data	\$ 200
Printing expenses for draft and final maps, \$30 yr 1&2, \$150 yr 3	\$ 210
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 301,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	<u>Status</u>
Other Non-State \$ To Be Applied To Project During Project Period:	N/A	
Other State \$ To Be Applied To Project During Project Period:	N/A	
In-kind Services To Be Applied To Project During Project Period: MNDNR: 400 hours staff time (200 hrs John Lindgren, SLR AOC coordinator = \$10,400, 200 hrs Melissa Sjolund, Habitat Coordinator = \$9,600)	\$ 20,000	Secured
In-kind Services To Be Applied To Project During Project Period: Unrecovered indirect (54% of MTDC)	\$ 159,093	Secured
Past and Current ENRTF Appropriation:	N/A	
Other Funding History:	N/A	

Environment and Natural Resources Trust Fund (ENRTF) PROJECT TITLE: Smart Mapping St. Louis River Estuary Habitats

Map 1 showing location of St. Louis River Area of Concern in northeast Minnesota:





Map 2 of St. Louis River Estuary showing locations of aquatic vegetation samples collected by Carol Reschke and NRRI staff from 2013 through 2016.

Over 100,000 records of vegetation, birds, fishes, macroinvertebrates, and invasive species from more than 2000 sample points in the Estuary have been collected by NRRI biologists and partners since 2010. These complex data are challenging for resource managers to accurately summarize for site restoration and management planning.

The proposed smart mapping of habitats would provide resource managers easy access to accurate biological summary information organized by habitat type.

07/28/2017

Environment and Natural Resources Trust Fund (ENRTF) PROJECT TITLE: Smart Mapping St. Louis River Estuary Habitats

Project Manager Qualifications

Carol Reschke will have primary responsibility for overseeing the proposed project, and coordinating with Co-Investigators George Host and Annie Bracey and project partners to ensure that project goals and timelines are met. Carol Reschke is a Community Ecologist and her recent research has focused on the ecology of plant communities in the St. Louis River estuary. She has conducted aquatic and wetland vegetation studies comparing restoration sites to reference sites within the St. Louis River Area of Concern for the U.S. Fish and Wildlife Service and the Minnesota Pollution Control Agency. She has conducted experiments comparing growth of aquatic plants in sediments from both unvegetated restoration sites and vegetated reference sites to evaluate factors limiting growth of aquatic plants in a barren restoration site in the estuary. Carol is a former employee of the MN DNR's County Biological Survey (now called the Minnesota Biological Survey); while in that position she worked on mapping plant communities for the 2002 Lower St. Louis River Habitat Plan. In early 2003 Carol received a Willard Munger Sr. Environmental Stewardship Award in recognition of her work with the team that produced the maps for the Habitat Plan.

Carol Reschke is an active member of the St. Louis River Habitat Committee. She has been invited to serve on two teams currently involved with St. Louis River restoration projects: the Kingsbury Bay - Grassy Point Site Restoration Team, and the Kingsbury Bay - Grassy Point Health Impact Assessment Advisory Committee. Carol has a Masters Degree in Botany from the University of Wisconsin Madison, and over 30 years professional experience as a Community Ecologist. She has worked at the University of Minnesota Duluth's Natural Resources Research Institute since 2004 as a fieldwork coordinator, senior scientist, and research program manager.

Organization Description

The University of Minnesota is a non-profit, state-funded educational institution of the State of Minnesota. Carol Reschke, George Host, and Annie Bracey work at the Natural Resources Research Institute (NRRI) at the University of Minnesota Duluth. NRRI's mission is to deliver research solutions to balance our economy, resources and environment for resilient communities. NRRI has a state-of-the-art Geographic Information Systems (GIS) laboratory.

Co-Investigators

Dr. George Host is a Landscape Ecologist at NRRI and Director of the NRRI Geographic Information Systems Laboratory. His research focuses on watershed-scale assessments of human stressors to aquatic and terrestrial ecosystems, particularly those related to urban development and agricultural land use. He is currently working on a project to develop remote sensing techniques for early detection of aquatic invasive plant species in lakes and stream systems of northern Minnesota.

Annie Bracey is an Avian Ecologist and PhD candidate at the University of Minnesota. Her research interests include ecology and conservation biology specifically related to issues concerning birds in the Great Lakes region. Annie has been involved in monitoring projects targeting Great Lakes coastal wetland bird and amphibian communities since 2010. She is also interested in how human activities affect bird populations. Annie is an active member of the St. Louis River Habitat Committee.