

**Environment and Natural Resources Trust Fund
2017 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 018-A

NE Minnesota Environmental Atlas: Turning Data into Information

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 617,632

Proposed Project Time Period for the Funding Requested: 3 years, July 2017 - June 2020

Summary:

NRRI will develop an on-line environmental atlas and database for NE Minnesota with data summary, visualization, and analysis tools tailored to the needs of decision makers and natural resource managers.

Name: Richard Axler

Sponsoring Organization: U of MN - Duluth NRRI

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Web Address www.nrri.umn.edu

Location

Region: Northeast

County Name: Aitkin, Carlton, Cook, Itasca, Kanabec, Koochiching, Lake, Pine, St. Louis

City / Township:

Alternate Text for Visual:

Samples of three websites demonstrating online tools: www.bwsr.state.mn.us/ecological_ranking;
www.lakesuperiorduluthstreams.org; <http://nrri.umn.edu>

<input type="checkbox"/>	Funding Priorities	<input type="checkbox"/>	Multiple Benefits	<input type="checkbox"/>	Outcomes	<input type="checkbox"/>	Knowledge Base
<input type="checkbox"/>	Extent of Impact	<input type="checkbox"/>	Innovation	<input type="checkbox"/>	Scientific/Tech Basis	<input type="checkbox"/>	Urgency
<input type="checkbox"/>	Capacity Readiness	<input type="checkbox"/>	Leverage	<input type="checkbox"/>		TOTAL	<input type="checkbox"/> %



Environment and Natural Resources Trust Fund (ENRTF)

2017 Main Proposal

Project Title: NE Minnesota Environmental Atlas: Turning Data into Information

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I. PROJECT STATEMENT

In one sense Minnesota is awash in data. Everywhere we turn data are being collected from individuals and organized programs designed to inform management and policy decisions. However, data are usually hard to access, difficult to visualize and associate with data collected for other programs (e.g. fish, water quality, land use, and cover, and weather), and therefore, underutilized by decision makers. One solution is to create data clearinghouses to make data readily available, scalable to end user needs, with graphing tools that facilitate analyzing multiple datasets for interpreting cause-effect relationships. We propose to develop such a comprehensive environmental atlas for NE Minnesota that includes natural and human-influenced features as well as a range of environmental data.

Decision makers need *data* that is transformed into *information* that is 1) discoverable, 2) provides appropriate context, and 3) is in a form that is useful and interpretable. The proposed project addresses this need to provide decision makers, managers, and the public with information about the environment for NE Minnesota. This is a region on the cusp of an industrial renaissance as a result of the discovery of high-value minerals (e.g., ilmenite, copper), the evolving forest products bioeconomy with multiple end users that compete for a finite resource, and increased urban and rural development. These new endeavors require consideration of multiple, interacting factors by any industry seeking to locate to the region, and the public and decision makers have specific needs for data and information in order to fulfill their responsibilities as stewards of the land.

There are >500 data sets publicly available through the MN Geospatial Information Office program alone, not including the new data management system for storing and disseminating site specific environmental data. *Data*, however, just represent unorganized facts that only become *Information* useful for decision making once they are processed, organized, and given context in a useful form. Examples of useful *information* are the Statewide Conservation and Preservation Plan (2008), which consulted multiple stakeholders and summarized a large body of data to create information critical for managing the state's natural resources, and the Minnesota Water Sustainability Framework (2011) that developed a long-range plan to frame major water sustainability issues and provide strategies and recommendations for addressing them.

The data "supply chain" involves multiple steps and processes including collection, quality control, storage, analysis, dissemination, and finally making the data discoverable and relevant to the end users. While many of these functions are performed well and efficiently, the individuals and programs that generate data may not [be able to] consider the diverse array of potential end users of the information. As a result, valuable data remains undiscoverable, inaccessible, and unusable to all but a few. Our proposed comprehensive environmental atlas and database would present a solution to this problem.

Goal: We propose to develop a comprehensive environmental atlas and database for NE Minnesota that will provide information in a form guided by the specific needs of a set of decision makers and end users. While the framework for this project is specific to NE MN, it can subsequently be expanded to other regions of Minnesota. The atlas will contain information that will facilitate informed communication and decision making by industry, agencies, non-profits, and the general public. Potential uses of this database are envisioned to: help identify potential mitigation wetlands; help prioritize wetlands and key wildlife habitats for restoration or protection; guide land reclamation to enhance wildlife, and pollinator habitat; provide unbiased data for use by industry, agencies and the public to ensure transparency over the life cycle of current and proposed development projects. Components of the system will involve a) a process to identify key data and information needs for different policy and management decisions; b) developing links to current data dissemination tools, c) development of a menu of data summaries; d) trend analysis, e) visualization and data delivery tools, f) peer review by panels of independent decision makers and scientists; and g) creation of online tutorial help tools, and training workshops to ensure products get used for decision-making. The outcome of this effort will be a better-informed citizenry that can engage in an informed discussion about the merits and costs of new development.



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II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Convene panels of decision makers and end data users

Budget: \$ 190,671

Panels of decision makers and managers will help identify key information needs and a peer review panel will help develop policies, guidelines, and best practices to ensure ongoing accurate and unbiased data delivery.

Outcome	Completion Date
1. Determine list of key data and information needs for decision making and communication	June 2018
2. Identify key data gaps; work with agencies and collaborators to find ways to fill gaps	June 2020

Activity 2: Create a Digital Environmental Atlas for NE Minnesota

Budget: \$ 209,350

Outcome	Completion Date
1. Assemble existing map-based data or establish mechanisms to link with current data dissemination systems encompassing human and natural features for NE Minnesota	June 2019
2. Acquire existing environmental (land, water, and air) and weather data from agencies	June 2019
3. Calculate summary metrics and indicators identified by Activity 1 panels; conduct statistical trend analyses using historic and current data in user-friendly formats	June 2019

Activity 3: Create a Map-Based User-Interface for Atlas Data

Budget: \$ 217,611

A Map Based User-Interface for Atlas Data will display and download data for user-defined areas (i.e. watersheds, townships; e.g., www.mnbeaches.org/gmap/trends/; www.mnwetlandrestore.org/, www.lakesuperiorstreams.org/streams/data/map/index.html).

Outcome	Completion Date
1. Create map-based visualization tools and a web-based user-interface	June 2018
2. Develop instructional materials to assist with data interpretation, inquiry-based learning, and improved environmental decision making	June 2020
3. Conduct two training workshops in NE Minnesota to familiarize local decision makers, natural resource managers, and other potential end-users with the tools and interface	June 2020

III. PROJECT STRATEGY

A. Project Team/Partners Lead PIs: Richard Axler (Natural Resources Research Institute Project Manager, Aquatic Ecologist). Team members: Lucinda Johnson (NRRI: Aquatic Biologist, Landscape Ecologist), George Host (NRRI: GIS/Data Visualization), Mei Cai (NRRI: Environmental Statistics), George Hudak (NRRI: Geology, Air), Cynthia Hagley (MN Sea Grant & Center for Great Lakes Literacy: Outreach/Education/Facilitation). NRRI staff (GIS, Web, Database programmers). Team members will receive partial compensation; some matching funds will be contributed. Collaborators: MPCA, MDNR, BWSR, MDH, IRRRB/Laurentian Vision, BWSR/SWCDs, NRCS, L.Superior Nat. Estuarine Research Reserve, USGS, USFWS, USFS, Fond du Lac Tribe, 1854 Authority, et al.

B. Project Impact and Long-Term Strategy The project builds on a previously funded LCCMR project (2005, 2007, PI Lucinda Johnson) to assemble historic water quality, fish, and environmental data for lakes across the state to assess climate change impacts on surface waters; data visualization and decision support tools and outreach/education methods we previously developed (e.g., www.lakesuperiorstreams.org, www.mnwetlandrestore.org, www.stlouisriverestuary.org, www.lakeaccess.org, www.nrri.umn.edu/coastalGIS, www.mnbeaches.org, www.parkpointbeach.org, www.globalgreatlakes.org) will be refined. Where feasible, we will take advantage of existing data portals for this digital atlas. The Atlas will be provided to the appropriate local units of government and agencies; at least initially, the digital database will be accessible to the general public via NRRI hosted web site, which could then be shared or transferred to agency partners.

C. Timeline Requirements This request is for three years.

2017 Detailed Project Budget

Project Title: NE Minnesota Environmental Atlas: Turning Data into Information

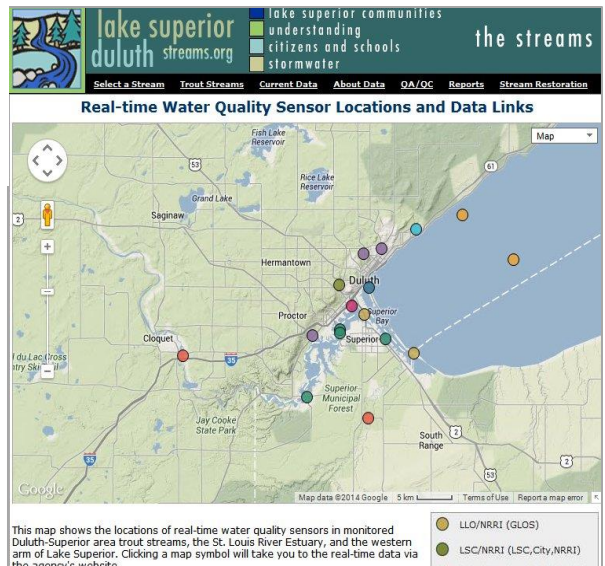
IV. TOTAL ENRTF REQUEST BUDGET: 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Richard Axler, project manager (66.3% salary, 33.7% benefits); 7% /7%/4% FTE each year, 3 yrs	\$ 30,027
George Host, co manager (66.3% salary, 33.7% benefits); 7% FTE each year, 3 yrs	\$ 31,854
Lucinda Johnson, co manager (66.3% salary, 33.7% benefits); 3% FTE per year, 3 yrs	\$ 18,286
C. Hagley, co manager, extension professor, (66.3% salary, 33.7% benefits); 10% FTE each year, 3 yrs	\$ 25,425
G. Hudak, geological data lead (66.3% salary, 33.7% benefits); 4% FTE each year, 3 yrs	\$ 20,429
E. Ruzycki, water quality data (66.3% salary, 33.7% benefits); 10% FTE each year, 3 yrs	\$ 23,892
M. Cai, statistician (66.3% salary, 33.7% benefits); 10% FTE each year, 3 yrs	\$ 26,677
Project manager (TBD), daily activities mgt related to data identification, compilation, and overall QAQC (66.3% salary, 33.7% benefits); 40% FTE each year, 3 yrs	\$ 85,139
3 I.T. ppl (66.3% salary, 33.7% benefits); GIS mapping and analysis, 30/25/25% FTE for yrs 1/2/3; database/programming/metadata development, 50% FTE each year, 3 yrs; website programming/data visualization, 50% FTE each year, 3 yrs	\$ 326,434
Professional/Technical/Service Contracts:	
Red Pebble, Inc. website designer, Duluth MN 300 hrs @ \$40/hr (\$6,000 yr 1; \$4,000 yr 2; \$2000 yr 3)	\$ 12,000
Equipment/Tools/Supplies:	
Software, project specific software license fees \$750 each year, 3 yrs	\$ 2,250
Computer hardware (project server; backup hard drives; accessories: \$750 each year, 3 yrs	\$ 2,250
Travel:	
Present results at October annual Water Resources Meeting, MSP; \$1445 each year, yrs 2 and 3 (2 ppl*2 days*2 rooms: mileage \$189 (350 mi * \$0.54) + lodging \$560 (2 nights* \$140/night*2 rooms) + per diem \$296 (\$74/day*2 days*2 ppl assume some meals provided) + registration \$400 (\$200 *2 ppl))	\$ 2,890
Minneapolis-St. Paul project meetings with agency collaborators: Year 1: \$352 (2 trips @ \$176 ea (326 mi*\$0.54); Years 2 and 3: \$176 ea (326 mi* \$0.54)	\$ 704
Additional Budget Items:	
GIS lab fees, \$4.10/hr for 350 hrs each year, 3 yrs	\$ 3,150
3 Panel meetings: A) \$585 yr one for decision makers and natural resource management members, one- day, 30 decision makers + 9 project staff, lunch @ \$15*39; B) \$585 yr one for natural resource managers, one- day, 30 decision makers + 9 project staff, lunch @ \$15*39; C) \$585 yr two for peer review panel, one-day, 30 panel members + 9 project staff, lunch @ \$15 x39	\$ 1,755
User training workshops \$585 per year, yrs 2 and 3; one-day each at NRRI, 30 trainees + 9 project staff, lunch @\$15 ea)	\$ 1,170
Data license and website domain fee	\$ 3,300
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 617,632

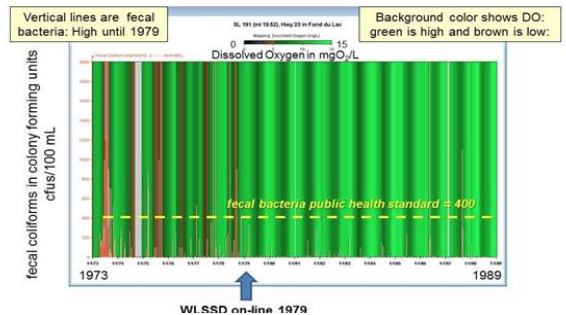
V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<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: Foregone by UMN ICR funding (53% MTDC 7/1/17-6/30/18; 54% MTDC 7/1/18-6/30/20, excluding equipment)	\$ 331,441	Secured
Funding History	N/A	
Remaining \$ From Current ENRTF Appropriation	N/A	

Environmental Benefits Index- an online tool using data from the LCCMR-funded Statewide Conservation and Preservation Plan and other sources and converts it to information about risks to habitat, soils, and water quality. Slider bars allow end users to weights risk factors, allowing prioritizations of particular environmental values. funding: LCCMR /BWSR www.bwsr.state.mn.us/ecological_ranking/



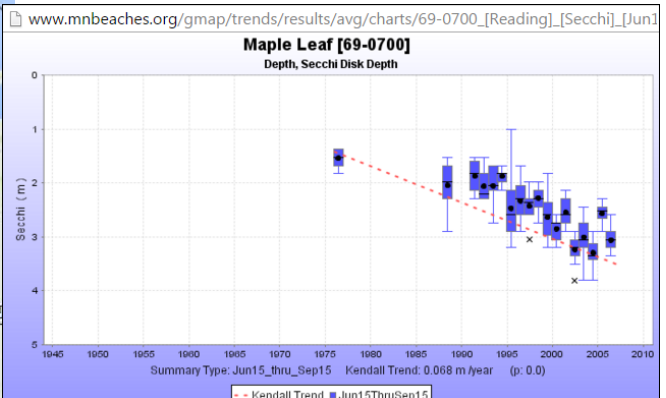
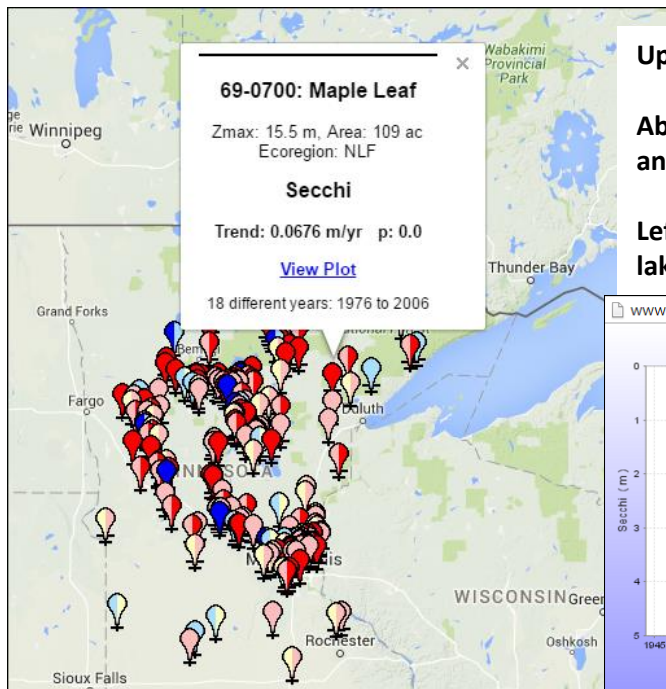
How did WLSSD affect dissolved oxygen (DO) and fecal coliform bacteria



Upper Left: Environmental Benefits Index (LCCMR)

Above: Lakesuperiorstreams.org w/ map retrieval and historic St. Louis River data visualization

Left and Below: MN Lake Trends tool for >600 lakes with time trends (LCCMR)



LCCMR 2016 LCCMR Project Manager Qualifications and Organization Description

Richard Axler, Natural Resources Research Institute, University of Minnesota-Duluth

Key Qualifications

Dr. Axler is a Senior Research Associate and aquatic ecologist with expertise in lake and stream water quality management and restoration; aquatic ecosystem responses to pollutants; nutrient cycling and food web dynamics; web-based environmental education using real-time data; constructed treatment wetlands. He directs NRRRI's certified Central Analytical Water Quality Laboratory and has collaborated closely with local, state, federal, tribal, and academic water resource scientists and managers in Northeastern Minnesota for more than 25 years on projects relevant to this LCCMR proposal

Education: Ph.D., Ecology/Limnology, University of California-Davis, 1979
B.A. Physics, Temple University, 1970

Selected Grants (total >\$21M)

LakeSuperiorStreams/DuluthStreams.org Project: Community partnerships for understanding urban stormwater and water quality issues at the head of the Great Lakes. **PI R.Axler** w/G.Host, C.Hagley, J.Scomberg, and C.Kleist. NRRRI, MN Sea Grant, Duluth, WLSSD, MPCA, MDNR, 16 others. 2002-present. \$1,121,362 cumulative funding from EPA, NOAA, MPCA, City of Duluth.

Duluth Streams Urban Watershed Restoration & Protection (WRAP): Phase 1. **co-PI R. Axler** w/ PI J.Schomberg. MPCA. \$154,038. 2014-2016.

Amity Creek Restoration Project. **PI R. Axler** w/ B.Story (MPCA); D.Breneman, G.Host, V. Brady (NRRRI-UMD), J.Schomberg (Sea Grant-UMD), K.Gran (UMD-Geology), and R.Boheim (S.St. Louis SWCD). EPA-GLRI (via MPCA). \$843,616 total (\$488,493 to NRRRI). 2010-2014.

Center for Global Great Lakes Data Analysis, Synthesis and Modeling. **co-PI R. Axler** w/R. Hecky, S. Colman, N.Dobiesz, and G. Host U. of MN Institute on the Environment. \$600,000. 2009 -2014.

Minnesota's Water Resources: Impacts of Climate Change- Phase II. LCCMR. **co-PI R. Axler** w/ PI L. Johnson, R. Newman, H. Stefan, R. Skaggs, V. Card. 2007-2010. \$300,000.

Impacts on Minnesota's aquatic resources from climate change. LCCMR. **co-PI R. Axler** w/PI L. Johnson, V. Card, R. Newman, R. Skaggs, H. Stefan. 2006-2009. \$250,000.

Selected Publications (164 total):

Silbernagel, J., Host, G., Hagley, C., Hart, D., **Axler, R.**, Fortner, R., Drewes, A., Axler, M., Mathews, J., Bartsch, W., Smith, V., Wagler, M., Danz, N. Linking place-based science to people through spatial narratives of coastal stewardship. Coastal Conservation. Published on-line 2 April 2015

Ruzycki, E.R., **R.P. Axler**, J.R. Henneck, N. Will, and G.Host. 2014. Estimating sediment and nutrient loads in three Western Lake Superior streams: Continuous turbidity monitoring versus spot sampling and modeling. J.Amer. Water Resources Assoc. (JAWRA) 50(5): 1081–1364.

Bartsch, W., **R.Axler**, and G.Host. Anthropogenic stressor predictions of water quality in the St. Louis River Estuary. 2015. J. Great Lakes Res. 41: 99-110.

Axler, R., N. Will, E. Ruzycki, J. Henneck, J. Olker, J. Swintek. 2009. Minnesota lake water quality on-line database and visualization tools for exploratory trend analyses. Technical report NRRRI/TR-2009/28, Natural Resources Research Institute, University of Minnesota Duluth.

The Natural Resources Research Institute is a part of the U. of Minnesota-Duluth. Its mission is to promote private sector employment based on natural resources, in an environmentally sensitive manner. NRRRI scientists are experienced in managing large, interdisciplinary applied ecological research projects on terrestrial and aquatic systems that integrate cutting edge tools for web-based data management, analysis, and visualization of geospatial, remote sensing, and real-time water quality data.