

**Environment and Natural Resources Trust Fund
2014 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 141-E

Quality of Life under Climate Change in Minnesota

Category: E. Air Quality, Climate Change, and Renewable Energy

Total Project Budget: \$ 493,784

Proposed Project Time Period for the Funding Requested: 3 Years, July 2014 - June 2017

Summary:

Develop Quality of Life indices sensitive to climate change in communities founded on timber, tourism, mining, and agriculture; work with city and natural resource managers to validate this tool statewide.

Name: George Host

Sponsoring Organization: U of MN - NRRI

Address: 5013 Miller Trunk Hwy
Duluth MN 55811-1442

Telephone Number: (218) 720-4316

Email gghost@d.umn.edu

Web Address <http://www.nrri.umn.edu/staff/gghost.asp>

Location

Region: Statewide

County Name: Carver, Cook, Crow Wing, Itasca, St. Louis

City / Township:

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



PROJECT TITLE: Quality of Life under Climate Change in Minnesota

I. PROJECT STATEMENT

- The natural resources of Minnesota contribute to the economy, health, and well-being of its citizens across all parts of the state. They provide vital products and functions, commonly called ecosystem services, which maintain or improve our quality of life.
- Many studies seek to measure the value that Minnesotans place on the state's natural resources to make resource management decisions or set policies.
- The choices made by Minnesotans can directly impact the state's ecosystems and the services that those ecosystems provide.
- Sometimes the impact to natural resources is not the result of human choice but is due to extreme events, such as storms and floods, which can also affect ecosystem services. Thus, changing climate could have an impact on the well-being of Minnesotans.
- Well-being, or quality of life indicators evaluate: health, family and community life, material well being, job security, and/or political freedom (Figure 1). These can be assessed at a range of scales from individuals in communities to the state, and can be used to measure the success of management and policies.

What is the impact of degraded natural resources and changing climate on the quality of life of Minnesota's citizens? How can the effects of those impacts be assessed and evaluated?

Traditionally, programs which benefit Minnesotans are evaluated one component at time, often relying on input from surveys, interviews, or focus groups. For example, an economic analysis may focus on property values or household income. A more productive approach is the development of quality of life (QoL) indicators. A QoL indicator links the results of subjective 'satisfaction' surveys to the objective determinants of quality of life. Not all QoL indicators contain elements that are suitable for evaluating the impact of changing climate on Minnesota's natural ecosystem services.

We propose to: 1) evaluate existing QoL indices (Fig. 3, 4) to identify indicators that are relevant to natural resources and responsive to climate change. We will draw heavily on available information (e.g., The Millennium Assessment, a widely used document that relates social, environmental, and economic approaches for defining the services provided by ecosystems, and existing QoL indices; 2) assess sensitivity of candidate QoL indicators to climate; and 3) assess how QoL has or might change as a result of changing climate in four regions across Minnesota that reflect reliance on different natural resources (agriculture, forestry, mining, tourism).

The primary result of this study will be a climate-sensitive QoL index that will measure the impact of climate on natural-resource based factors that are part of Minnesotans' sense of well-being. Results from this study will be useful to evaluate public natural resource management or policies' impact on our QoL, determine how changing climate affects our lives in Minnesota; and help to target management and policy decisions regarding climate change adaptation that have the greatest influence on quality of life.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1: Develop a comprehensive survey of existing QoL indicators

Budget: \$ 149,498

We will conduct a comprehensive review of QoL indicators from the literature, as well as interviews with agencies / communities that use QoL indices. We will then evaluate indicators with respect to their suitability (i.e., link to ecosystem services), and sensitivity to climate change. We will focus on identifying indicators related to four natural resource based economic sectors: agriculture, forestry, mining, and tourism. QoL indices from communities in Carver County, MN and Jacksonville, FL will be used as candidate indicators.



Environment and Natural Resources Trust Fund (ENRTF)
2014 Main Proposal
Project Title: Quality of Life under Climate Change in Minnesota

Outcome	Completion Date
1. List of candidate QoL indicators relevant to four economic sectors and geographic regions in Minnesota: Brainerd (tourism), Grand Rapids (forestry), Hibbing/Chisholm (mining), and Carver County (agriculture). 2. Underlying data necessary to calculate candidate metrics.#	6/30/15

Activity 2: Evaluate sensitivity of candidate QoL indicators with respect to climate. **Budget: \$ 173,702**

Candidate QoL indicators will be evaluated to assess their link to ecosystem services and sensitivity to climate change. [E.g., increased frequency of extreme storms leads to reduced capacity of wetlands to absorb flood waters and subsequent reduction in crop productivity due to flooding.] We will assemble underlying environmental and social data and quantify relationships between environmental conditions that lead to the delivery of ecosystem services and key climate variables. Example data include: land use change, shoreline development, water quality, economy, human health, and assess correlations with climate variables.

Outcome	Completion Date
1. QoL indicators linked to ecosystem services and responsive to climate change 2. Application of the QoL indicators in four pilot areas around the state with distinct natural resource sectors	12/31/2016

Activity 3: Disseminate framework for assessing changes in QoL under changing climate. Outreach materials will be disseminated via the MN Extension and Sea Grant network; at least one workshop in each region will be run for regional resource managers **Budget: \$ 170,584**

Outcome	Completion Date
1. A framework that can be applied across Minnesota to evaluate natural resource based policies and management informing climate change adaptation planning.	6/30/2017

III. PROJECT STRATEGY

A. Project Team/Partners:

U of M Duluth Natural Resources Research Institute: Dr. George Host (project manager), Dr. Lucinda Johnson (climate/ecosystem services assessment), Dr. Richard Axler (water quality assessment), Dr. Ralph J. Garono (systems modeling/integration); Dr. Barbara Elliot (QoL and health; UM School Medicine), Dr. Ken Gilbertson (tourism, UMD). All investigators will participate in writing and outreach. **MN Sea Grant:** Ms. Cynthia Hagley (outreach); **UW Superior:** Dr. Shon Schooler (unpaid collaborator, outreach).

B. Timeline Requirements

We are requesting 3 years of funds beginning July 2014, ending June 30, 2017.

C. Long-Term Strategy and Future Funding Needs

This project will build upon and tie together several existing programs/ projects including two prior LCCMR funded climate change projects (Johnson, NRRI/UMD) and fill important data gaps that will ultimately enable resource managers and social scientists to better evaluate the success of their management programs and policies. Quality of life indicators will be used by MN Sea Grant, UMD/NRRI, and UM School of Medicine researchers. Based on the indicators from the four pilot regions, a statewide QoL is envisioned that can be used to gauge progress through time (as per Jacksonville, FL example).

2014 Detailed Project Budget

Project Title: Quality of life under climate change in Minnesota

IV. TOTAL ENRTF REQUEST BUDGET 3 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	
Host, PI; project management, indicator development, publication and outreach 16% fte; 75% salary/25% fringe, 36 mo (\$69,717)	\$ 482,214
Johnson, Co-PI; climate modeling, outreach; 5% fte; 75% salary/25% fringe, 36 mo. (\$29,515)	
Axler, Co-PI; assess climate change water quality impacts; 4% fte; 75% salary/25% fringe, 36 mo. (\$19,538)	
Brown, Co-PI; geospatial data analysis; 5% fte; 75% salary/25% fringe, 36 mo. (\$31,154)	
Elliott, Co-PI; QoL indicator development 33% fte SUMMER; 75% salary/25% fringe, 9 mo. (\$59,686)	
Cai, ResAssoc; statistical analysis; 10% fte; 75% salary/25% fringe, 36 mo. (\$56,380)	
TBD, ResAssoc; integrative analyses, 25% fte; 75% salary/25% fringe, 36 mo. (\$87,617)	
Erickson, Scientist; programming and analysis; 50% fte; 75% salary/25% fringe, 36 mo. (\$98,686)	
Hagley, Extension Professor; outreach coordination, 3.7% fte; 75% salary/25% fringe, 36 mo (\$12,093)	
Undergrad; bibliographic research; 15% fte AY, 24 mo; 75% fte SUM, 24 mo; 100% salary (\$17,828)	
Equipment/Tools/Supplies:	
Data storage and outreach materials (\$750), license fees for software (\$1500)	\$ 2,250
Travel:	
Yr 1-PI and Project Manage travel to Carver Co, MN (\$950) meet with developers of quality of life indices; travel support for attendees of workshop to disseminate results about QoL index (\$1000); year 2 and 3 travel for project personnel to attend instate conference in TC (\$2770).	\$ 4,720
Additional Budget Items:	
GIS lab service - \$3000 (\$4.10/hr, projected 365 hours per year x 2 yrs); publication costs in yr 2 - 3, \$1000; conference calls with collaborators (\$600/yr)	4,600
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 493,784

V. OTHER FUNDS

<u>SOURCE OF FUNDS</u>	<u>AMOUNT</u>	<u>Status</u>
Other Non-State \$ Being Applied to Project During Project Period:	\$ -	
Other State \$ Being Applied to Project During Project Period:		
Salary/fringe for L. Johnson (PI)	\$5,000	
Salary/Fringe for Meysemburg (NRRI GIS Lab Manager)	\$ 5,000	Secured
In-kind Services During Project Period:		
Remaining \$ from Current ENRTF Appropriation (if applicable):		
NA	\$ -	

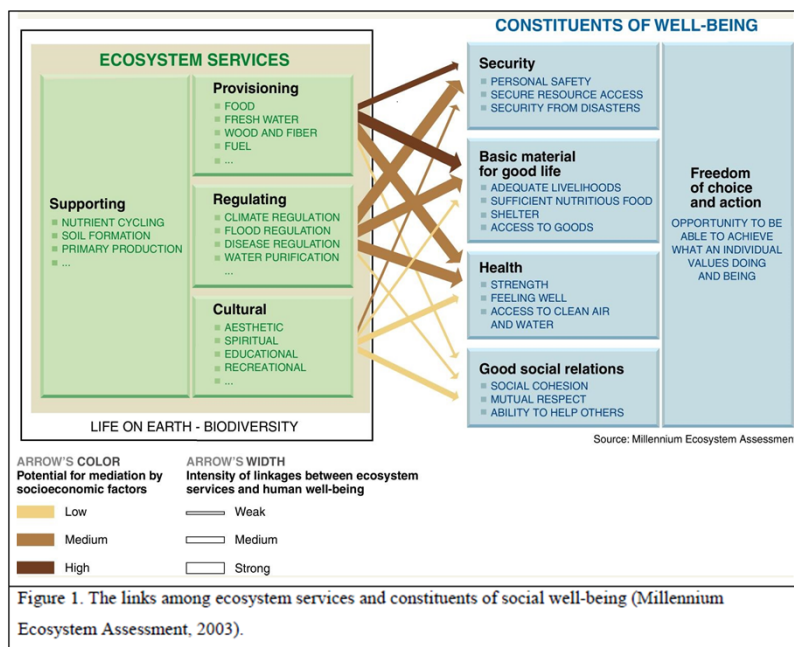


Figure 1. The links among ecosystem services and constituents of social well-being (Millennium Ecosystem Assessment, 2003).

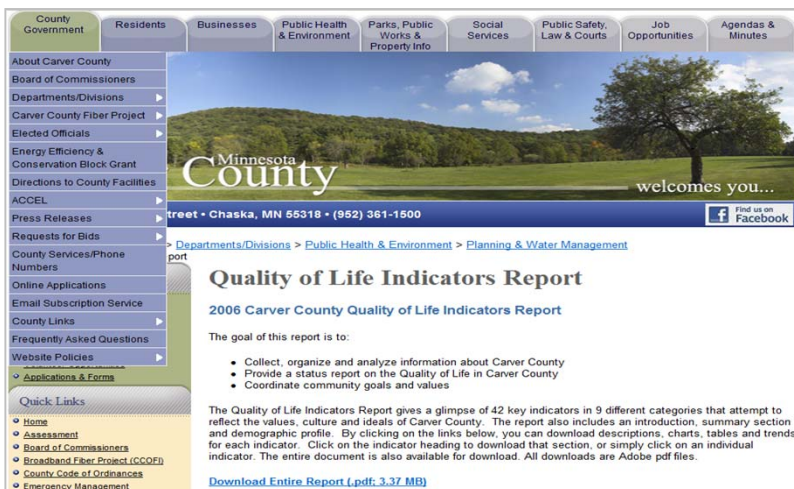


Figure 3. The Carver County, MN Quality of Life Indicators Report includes 42 key indicators in 9 different categories that attempt to reflect the values, culture and ideals of Carver County.

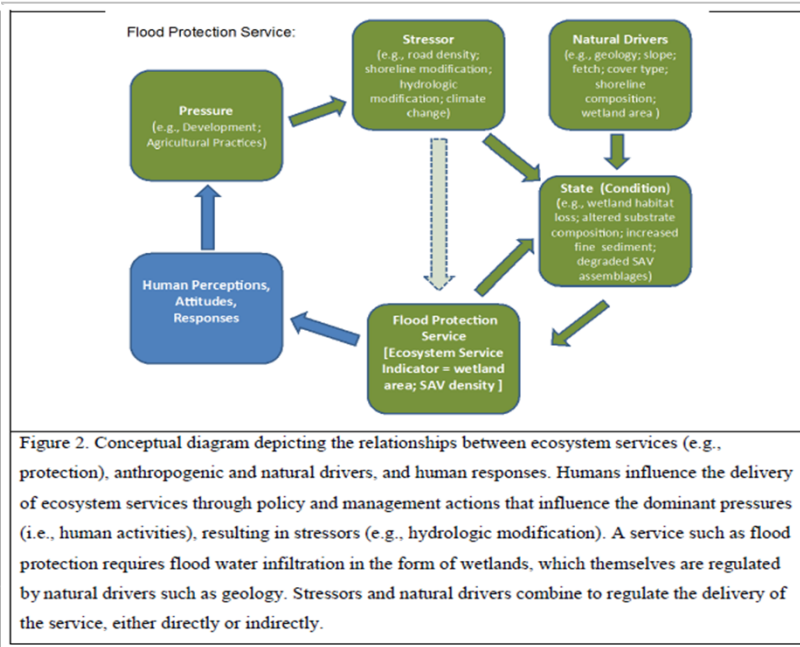


Figure 2. Conceptual diagram depicting the relationships between ecosystem services (e.g., protection), anthropogenic and natural drivers, and human responses. Humans influence the delivery of ecosystem services through policy and management actions that influence the dominant pressures (i.e., human activities), resulting in stressors (e.g., hydrologic modification). A service such as flood protection requires flood water infiltration in the form of wetlands, which themselves are regulated by natural drivers such as geology. Stressors and natural drivers combine to regulate the delivery of the service, either directly or indirectly.

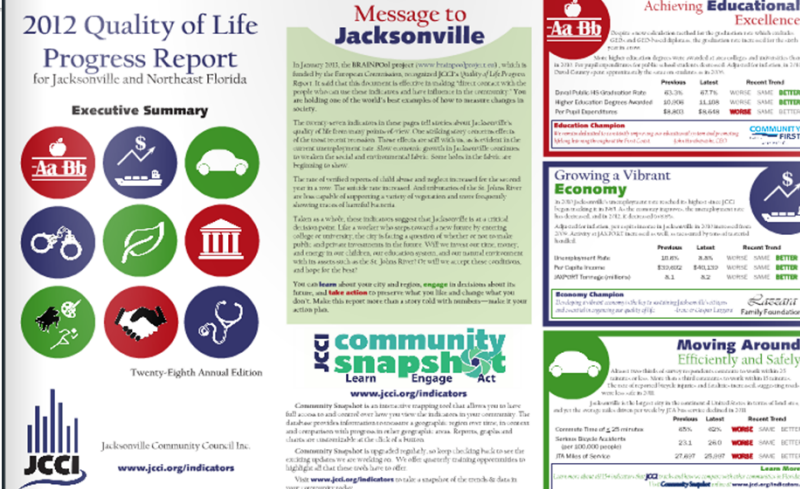


Figure 4. Jacksonville, FL has published QoL reports for 28 years to identify needs, develop programs, allocate funding, target priorities, educate others, evaluate effectiveness, and report on successes.

Quality of Life under Climate Change in Minnesota

2014 LCCMR Project Manager Qualifications and Organization Description

George Host, Senior Research Associate, Natural Resources Research Institute, University of Minnesota Duluth

Key Qualifications

Host managed the Land Resources Program at NRRI, with active projects in ecological design and remediation, environmental stressor assessment, forest and landscape ecology, and invasive species. Project budgets average \$400,000/yr over the past 10-year period. Host was a co-principal investigator on the LCCMR funded Statewide Conservation and Preservation Plan, and subsequent Ecological Ranking of CRP lands project.

Education

PhD Forest Ecology, Michigan State University, East Lansing. 1987
MS Botany, Kent State University, Kent, Ohio. 1982
BS Botany, Miami University, Oxford, Ohio. 1977

Relevant Publications

Niemi, G.J., E.D. Reavie, G.S. Peterson, J.R. Kelly, C.A. Johnston, L.B. Johnson, R.W. Howe, G.E. Host, T.P. Hollenhorst, N.P. Danz, J.J.H. Ciborowski, T.N. Brown, V.B. Brady, and R.P. Axler. 2011. An integrated approach to assessing multiple stressors for coastal Lake Superior. *Aquatic Ecosystem Health and Management Society* 14:356-375.

Hollenhorst, T.P., Brown, T.N., Johnson, L.B., Ciborowski, J.J.H., and Host, G.E. 2007. Methods for generating multi-scale watershed delineations for indicator development in Great Lake Coastal ecosystems. *J. Great Lakes Res.* 33 (Special Issue 3). 13-2.

Host, G.E., T. N. Brown, T.P. Hollenhorst, L.B. Johnson, and J.J.H. Ciborowski. 2011. High-resolution assessment and visualization of environmental stressors in the Lake Superior basin. *Aquatic Ecosystem Health and Management Society* 14:376-385.

Johnson, L.B. and G.E. Host. 2010. Recent developments in landscape approaches for the study of aquatic ecosystems. *J. N. Am. Benthol. Soc.* 29:41-66.

Hutchens, J.J., J.A. Schuldt, C. Richards, L.B. Johnson, G.E. Host, and D.H. Breneman. 2009. Multi-scale mechanistic indicators of Midwestern USA stream macroinvertebrates. *Ecological Indicators* 9:1138-1150.

Selected grants:

Stressor gradients and spatial narratives of the St. Louis River estuary. MN Sea Grant \$110,311

Minnesota's statewide conservation and preservation plan. Legislative-Citizen Commission on Minnesota Resources. 2007-present. Co-principal Investigator \$121,000.

Ecological design for the St. Louis River area of concern. US Fish and Wildlife Service, Principal Investigator \$338,566

A Web 2.0 guide to coastal resources, hazards, and habitats. MN Department of Natural Resources, \$32,058

Statewide ecological ranking of CRP lands, Legislative-Citizen Commission on Minnesota Resources, \$108,000

The **Natural Resources Research Institute** is a part of the University of Minnesota Duluth. NRRI's mission is to promote private sector employment based on natural resources in an environmentally sensitive manner. NRRI scientists have extensive experience in applied ecological research on terrestrial and aquatic systems.