Environment and Natural Resources Trust Fund
2011-2012 Request for Proposals (RFP)

LCCMR ID: 044-B

Project Title: Linking Rural Land Treatment Systems to Healthy Biota

Category: B. Water Resources

Total Project Budget: $ $948,000

Proposed Project Time Period for the Funding Requested: 3 yrs, July 2011 - June 2014

Other Non-State Funds: $ 0

Summary:

This project increases understanding of the linkage between multiple rural land treatment systems and healthy biota through the development of tools [InVEST] that effectively measure response for decision makers.

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Sponsoring Organization: U of MN

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Location

Region: Central, SW, SE

Ecological Section: Paleozoic Plateau (222L), Minnesota and NE Iowa Morainal (222M), North Central Glaciated Plains (251B)

County Name: Big Stone, Blue Earth, Brown, Carver, Chippewa, Dodge, Goodhue, Lac qui Parle, Le Sueur, Martin, Nicollet, Olmsted, Redwood, Renville, Scott, Sibley, Swift, Wabasha, Watonwan, Yellow Medicine

City / Township:

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

LCCMR – 2010 University of Minnesota and Rural Advantage – Priority B- 1, 2 & 3; priority C–1.

I. PROJECT STATEMENT

Minnesota plans to focus on biotic indices to define water quality impairments. Based on past observation, approximately 40% of the waterbodies assessed will not meet standards. The MPCA will be faced with the task of mitigating thousands of water bodies that have impaired biota. Developing the means of improving water quality and aquatic biota is particularly challenging for streams and rivers that have been impaired by non-point source (NPS) pollution in agricultural watersheds. Effective treatment options for addressing NPS pollution are not presently in hand. To date, extensive monitoring and research (with support from CSREES, LCMR, and MPCA funding) have helped determine causes of water quality impairment and have identified practices that have potential to reduce turbidity, sediment and nutrient impairment from agricultural watersheds including BMPs such as riparian buffers. However, none have examined the complementary aspects of multiple land-use practices applied across the landscape to address multiple impairments and that ultimately improve aquatic biota (Meals et al. 2010). Restoring aquatic biota requires new ideas and integrated land management across the landscape to improve water flow, water quality, and aquatic habitat to meet standards for fishable and swimmable conditions. What is needed are: (1) integrated land treatment systems that can cumulatively improve water quality and aquatic biota; and (2) effective user-friendly tools for land managers to identify the type and location of land treatment systems to effectively and efficiently improve impaired waters.

The goals of this research are to (1) determine the cumulative effects of rural land treatment systems to improve aquatic biota and meet water quality goals in the Chippewa, greater Blue Earth and Cannon River basins, (2) develop "effectiveness monitoring" tools that link biotic response to designed treatment systems to limit pollutant impact upon fish and macroinvertebrates, and (3) engage multiple stakeholders through demonstration and training to enable them to apply the tools in their land conservation work. This research takes an integrated watershed management approach and applies a set of decision-support tools (e.g., computer modeling platforms such as InVEST) that will assist agency personnel and other stakeholders in identifying causes of impaired waters and target land use treatments on “working lands”. By addressing working lands, we target the vast majority of agricultural lands recognizing that land retirement programs alone cannot treat sufficient land areas to address impaired waters across the state.

II. DESCRIPTION OF PROJECT ACTIVITIES

Activity 1. Determine the effects of rural land treatment systems to improve aquatic biota $378,000

(1) Based on past and continuing monitoring and research on watersheds in the Chippewa, greater Blue Earth, and Cannon River basins, establish relationships that link each of the following land use treatments for agricultural landscapes with aquatic biota and related water quality constituents.
(a) Two – stage ditches -- applications of newly designed 2-stage ditches coupled together with previously used buffer strips to "tailor fit" a landscape and provide cumulative impacts of improving aquatic biota habitat and reducing sediment, turbidity and nutrient export along large ditches;
(b) Application of cover crops on corn-soybean fields to reduce surface runoff and soil erosion,
(c) Interceptor wetlands (biogeochemical reactors) restored along stream corridors that intercept tile drainage and reduce NO3, TP and organic sources of turbidity, and
(d) Perennial cropping and agroforestry systems located in selected areas that can provide habitat and financial returns to landowners (e.g., bioenergy, forage for livestock, others).

(2) Continue monitoring of existing sites in the greater Blue Earth basin through 2011-2014 to test and validate computer model results.

Outcome	Completion Date
1. Relationships between treatment systems on impaired water impacts	January, 2014
2. Report on monitoring (will include annual summaries)	June, 2014

Activity 2: Develop effectiveness monitoring tools -- $181,500

Develop submodel components for the InVEST modeling platform (Tallis et al., 2010), validate the model with data sets from each of the three watersheds, and apply by examining the cumulative effects of different

combinations of land use treatment practices best suited for the landscapes of the respective watersheds. The InVEST Platform will be used to help answer: (1) which parts of the watershed provide the greatest improvement of aquatic biota (and overall ecosystem services)? (2) how do the individual and cumulative land use treatments affect aquatic biota and other water quality values? (3) how will changes in climate impact the effectiveness of land use treatments? In addition, we will examine the effects of the land treatment practices on land production, biodiversity and other outcomes of interest to stakeholders.

Outcome	Completion Date
1. Model predicting impacts of treatment systems on impaired waters/ecosystems	June, 2014

Activity 3: Implement and monitor new land treatment systems - $60,000

Working with our partners in the Greater Blue Earth, Cannon and Chippewa River basins, we will install and monitor additional land treatment systems to generate data on the impacts of systems on water.

Outcome	Completion Date
1. Establish 600 acres of cover crops; 3 interceptor wetlands and 60 acres of perennial cropping or agroforestry systems in the 3 targeted watersheds.	June, 2014

Activity 4: Stakeholder Engagement - $142,500

Increase stakeholder adoption of rural land treatment systems by establishing demonstrations, develop training and train local natural resource professionals on "effectiveness monitoring" tools and utilize the leadership of local experts to advance, evaluate and increase adoption of these initiatives. A steering committee with representatives from each watershed will be organized and meet semi-annually. Rural Advantage will lead the stakeholder component with assistance from local watershed groups.

Outcome	Completion Date
1. Organize a steering committee (farmer, local government person and others)	October 2011
2. Annual stakeholder training and demonstrations in the 3 targeted watersheds.	March 2014
3. Local coordination, collaboration, marketing, assistance with monitoring	June 2014

Activity 5: Project Management and Economic Analysis - $186,000

Outcome	Completion Date
1. Economic analysis of options for implementing land treatments	June 2014
2. Effective management of project activities (continuous)	June 2014

III. PROJECT STRATEGY

A. Project Team/Partners

The project team includes personnel from the University of Minnesota, Rural Advantage and Watershed groups in the Blue Earth, Cannon and Chippewa Watersheds. UMN - Ken Brooks and Joe Magner (also of MPCA) will work on hydrology/watershed issues, Craig Sheaffer and Don Wyse will work on Agronomic issues in Activity 1, Dean Current will provide overall project management and address economics issues. Rural Advantage – Linda Meschke will coordinate with our watershed partners and Jeff Jensen will work on outreach. We will work with the Natural Capital Project of Stanford University that is developing the InVEST Model which will be used to predict impacts of land treatment systems. We currently have federal and private sector funding that supports data gathering that will contribute to this project.

B. Timeline Requirements

This project is a logical step and continuation of previous and ongoing research. The time proposed is adequate to develop the models for predicting the impacts of land treatment systems. The modeling platform (InVEST) is designed to be improved as new and better data becomes available.

C. Long-Term Strategy and Future Funding Needs

The partners involved in this project have been working together for years and this project represents a continuation and logical next step in the overall strategy to address water quality and ecosystem service issues in Minnesota. The project team has been successful in generating resources to support our work and will continue to search out resources as needed to maintain the research and outreach effort.

2011-2012 Detailed Project Budget

IV. TOTAL TRUST FUND REQUEST BUDGET 3 years

BUDGET ITEM	AMOUNT
Personnel:	$ -
3 Graduate research assistants (50% time for 3 years) to provide assistance with Hydrology, Agronomy and Economics research (51% salary and 49% fringe and tuition)	$315,000
1 post-doc modeler to work with models to predict impacts of land treatments on water quality and ecosystem services 3 years (33.3% fringe)	$165,000
Undergraduate assistants - number undetermined - Approx. 700 hours/year for 3	$21,000
1 Research associate (25% time for 3 years) to manage project and work on economic assessment. (33% fringe)	$75,000
1 technician (50% time for 3 years) (41% fringe)	$75,000
Contracts:	$ -
Rural Advantage; Contract to manage outreach effort, coordination with watershed partners, and implementation of land treatments (This includes $90,000 for partners - $10,000/year for 3 years in 3 watersheds)	$202,500
Equipment/Tools/Supplies:	$ -
	$40,500
Travel:	$ -
Travel to project areas and 3 targeted watersheds by project teams ($8,000/year x 3 years). 24 trips to Elm Creek (major monitoring site) @ $200/trip = $4,800/year. 12 trips/year to the Chippewa Watershed @ $165/trip = $1,980. 12 trips to Cannon River Watershed/year @ $55/trip = $660/year. $560/year for meals and lodging. Chippewa Watershed - 300 miles X $.55/mile=$165/trip. Elm Creek Watershed - 364 miles X $.55/mile= $200/trip. Cannon River Watershed - 100 miles X $.55/mile=$55/trip. All distances are from the UMN St. Paul Campus.	$24,000
Additional Budget Items:	$ -
Water quality analysis to analyze water samples taken from research areas	$30,000
TOTAL ENVIRONMENT & NATURAL RESOURCES TRUST FUND $ REQUEST	$948,000

V. OTHER FUNDS

SOURCE OF FUNDS	AMOUNT	Status
Funding History:	$ -	
Lowering the Cost of Bio-energy Feedstocks while Providing Environmental Services – A Win-Win Opportunity. - Xcel Energy	$993,000	In execution through 2013
Innovative Agoforestry Systems for Bioenergy - USDA Forest Service National Agroforestry Center, Met Council, UMN-IREE, and NRCS.	$165,000,	In execution through 2013
A Decision Support Tool to Restore Impaired Waters - EPA 319 funds. This is a complementary project with a different focus which does not address issues of aquatic biota nor the integration of specific land treatment systems.	$719,000	In execution through 2014
LCMR 2005 – Continuation of the Project: 3rd Crops and Native Perennials for Water Quality (07/01/05)	$500,000	Completed
LCMR 2003 - 3rd Crops and Native Perennials for Water Quality (2003-2005)	$622,000	Completed
Improving Water Quality and Enhancing Hydrologic Stability of the Minnesota River through Agroforestry and Other Perennial Cropping Systems. USDA-CSREES	$556,500	Completed

PROJECT MANAGER QUALIFICATIONS

KENNETH N. BROOKS
Professor of Forest Hydrology
Department of Forest Resources, University of Minnesota, St. Paul, MN.
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Education:

University of Arizona	Ph.D.	Watershed Management	1970
University of Arizona	M.S.	Watershed Management	1969
Utah State University	B.S.	Range & Watershed Science	1966

Professional Hydrologist: Certified by the American Institute of Hydrology, No. 118

Professional Experience:

1985-Present	Professor, Department of Forest Resources, University of Minnesota, St. Paul
1995-Present	Co-Director of the Center for Integrated Natural Resources and Agricultural Management (CINRAM), University of Minnesota
1973-1975	Hydrologist, Training and Methods Branch, Hydrologic Engineering Center, US Army Corps of Engineers, Davis, California

Courses Taught:

- Hydrology and Watershed Management (3 semester credits), Forest and Wetland Hydrology (3 semester credits), and Watershed Management Implications of Agroforestry Practices (3 credits)

Research Activities and Interests:

Forest and Wetland Hydrology; Hydrologic modeling of forested watersheds, wetlands, and land use change; Watershed management -- integrating physical, biological and socio-economic factors.

Current Research:

PI : Decision support tool for restoring impaired waters; $1.3 million; USEPA – MPCA (2010-2014)
Watershed and stream channel modification potential in the Blue Earth River; $285,000; MPCA

Recent Professional Activities:

2009	Advisory and Assistance Service Contract – Hydrologic modeling of wetlands and forested watersheds, Northern Forest Experiment Station, USFS, Grand Rapids, MN (2007-2009)
2008	Lecturer in Graduate Course, Wageningen Graduate Schools, The Netherlands, Titled "Coping with Climate Change in Integrated Watershed Management," 30 June - 9 July, 2008
2007	Member, Committee on Hydrologic Impacts of Forest Management, Water Science and Technology Board, The National Academies, Washington, DC (2005 - 07)

Recent publications: Authored and co-authored over 95 publications, books and chapters in books;

Current, D.A., K.N. Brooks, P.F. Ffolliott and M. Keefe. 2009. Moving agroforestry into the mainstream. *Agroforestry Systems* 75:1-3.

Lenhart, C.F., K.N. Brooks, D. Heneley and J.A. Magner. 2009. Spatial and temporal variation in suspended sediment, organic matter and turbidity in a Minnesota prairie river: implications for TMDLs. *Environmental Monitoring and Assessment DOI 10.1007/s1066-009-0957-y.*

Magner, J.A. and K.N. Brooks. 2008. Integrating sentinel watershed-systems into the monitoring and assessment of Minnesota's (USA) waters quality. *Environmental Monitoring and Assessment 138:149-158.*

Magner, J.A. and K.N. Brooks. 2008. Predicting stream channel erosion in the lacustrine core of the upper Nemadji River, Minnesota (USA) using stream geomorphology metrics. *Environmental Geology 54:1423-1434.*

ORGANIZATION DESCRIPTION

(Center for Integrated Natural Resources and Agricultural Management - CINRAM)

CINRAM is a partner-based organization that catalyzes the development and adoption of integrated land use systems. CINRAM links the expertise of the Univ. of Minnesota with the experience and insights of people and organization who work with and have understanding of, opportunities and issues across the landscape. CINRAM's efforts lead to: 1) A more diversified agricultural and natural resource production base; 2) Increased profitability; 3) An enhanced environment; 4) Strengthened rural communities; and 5) Productive landscapes generating income and environmental/ecosystem services.