

**Environment and Natural Resources Trust Fund
2016 Request for Proposals (RFP)**

Project Title:

ENRTF ID: 002-A

Minnesota Vegetative Buffer Assessment and Prioritization

Category: A. Foundational Natural Resource Data and Information

Total Project Budget: \$ 170,421

Proposed Project Time Period for the Funding Requested: 2 years, July 2016 to June 2018

Summary:

A GIS assessment of riparian vegetative buffers in 70 agricultural counties in Minnesota using state of the art aerial imagery and prioritization of unprotected waters using LiDAR terrain analysis.

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Sponsoring Organization: U of MN

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Location

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Buffer Assessment and Prioritization Project Area Map

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



PROJECT TITLE: Minnesota Vegetative Buffer Assessment and Prioritization

I. PROJECT STATEMENT

This project aims to work collaboratively with MN DNR via the Governor’s Buffer Initiative data-creation effort to assist in cataloging topographic features on the landscape which may require a buffer. With our group at the U of MN having the longest tenure of experience with LiDAR data and Hydro-Terrain Analysis in the state, we recognize current efforts already underway, yet seek to provide critical advisement, consultation, and Quality Assurance/Quality Control to final products. By utilizing high resolution aerial imagery acquired during the spring non-crop growing period, a more robust analysis of riparian areas will be produced than currently exists. Additionally, once unprotected waterways have been identified, a prioritization will then be employed to rank the vulnerability of each reach to water quality degradation. This will act as a valuable guideline for resource conservation planners and will ultimately result in increased protection for our susceptible surface waters and associated improvements in water quality.

The Governor’s recent proposed buffer initiative has brought much attention to the status of Minnesota’s waterways and the vegetative buffers that are needed to protect them. There is a strong need for not only identifying where surface waters lack proper protection, but also prioritizing these susceptible areas. A large portion of Minnesota waters in the prairie pothole region lack proper vegetative buffers; the Minnesota DNR currently reports that half of the shorelines in this region remain unprotected. Various reports identify buffer locations and areal coverage; however, detailed analysis is limited to the southern portion of the state and is lacking elsewhere. Furthermore, analysis in southern Minnesota is limited to merely buffer presence or absence. A prioritization of currently unprotected waters is needed as the Governor’s buffer initiative evolves and waterway protection is mandated.

State of the art Digital Globe satellite areal imagery (1 m resolution at 1-3 day revisit frequencies) will provide unprecedented spatial and temporal detail for this assessment. The project will be focused in agriculturally important portions of the state and will include regions not analyzed in previous efforts. Once locations of unprotected waterways are identified, a terrain-based approach utilizing LiDAR data will then identify the areas where overland flow paths cross unprotected shorelines and pose an increased threat to waterways.

II. PROJECT ACTIVITIES AND OUTCOMES

Activity 1: Buffer Features Assessment

Budget: \$87399

University of Minnesota and MN DNR staff will work collaboratively to satisfy the data requirements of the Governor’s Buffer Initiative, with each providing crucial yet varied experiences to the process. Regardless of funding mechanism, both entities will work together to ensure a final cohesive product that satisfies all needs. For the University portion, the most recent and highest resolution streams data layer will be acquired from MN DNR to create a 50 - 200 foot riparian corridor layer (using GIS) on either side of ditches, perennial streams and rivers. All definitions of buffers, perennial streams, and any applicable terms will be matched to Buffer Initiative terminology for consistency. Vegetative indices (e.g.. Normalized Difference Vegetative Index) will be applied to high resolution aerial photography to assess the extent of perennial vegetation within the riparian corridor. Digital Globe aerial imagery is available to the University of Minnesota, which will allow a very high level of spatial and temporal detail for this analysis. The analysis will be concentrated in 70 counties where agricultural landuse is 30% or greater. Minnesota’s prairie pothole region covers a majority of these counties, and includes most of the non-buffered waters in the state. More than 20,000 miles of perennial streams and rivers will be assessed in this analysis. Data regarding vegetative buffer coverage will be validated using high resolution aerial photography and field visits.

Outcome	Completion Date
1. Acquire appropriate data layers for riparian corridor assessment (Public Waters Inventory, Aerial Imagery, etc.)	July 2016
2. Develop a methodology for assessing presence or absence of perennial vegetation on 20,000 miles of Minnesota Waterways	October 2016



3. Validate method with aerial photography and field visits	March 2017
4. Create a spatial data layer identifying non-protected waterways in 70 Minnesota counties	June 2017

Activity 2: Prioritization of Unprotected Waterways

Budget: \$83021

Once areas are identified as unprotected, they will be ranked and prioritized based on a LiDAR terrain analysis coupled with the previously developed Ecological Benefits Index (EBI). A new stream corridor layer will be created for unprotected waters that will stretch past the Governor’s proposed 50 foot corridor (e.g. 300 feet) on either side of the stream to properly analyze near stream flow paths; this new corridor width will be determined during analysis based on data processing feasibilities and wildlife restoration goals. A LiDAR-based terrain index that measures erosivity of overland flow (Stream Power Index) will be calculated for this corridor along with other terrain attributes in order to rank the risk of erosion and pollutant (sediment, phosphorus, pesticide) transport near unprotected waters. Categorical risk values will be analyzed at multiple scales, and data can be aggregated to DNR Subwatersheds or HUC 12 hydrologic unit boundaries to guide regional conservation planning. Data can also be made available at a finer-scale, such as individual unprotected stream reaches. Based on slope, soil, SPI, and EBI characteristics, we will use these data to identify what types of practices are needed to best protect riparian areas and provide multiple benefits. These practices could include vegetative buffers of various widths, water and sediment basins, and saturated buffers, for example.

Outcome	Completion Date
1. Determine an appropriate LiDAR corridor width based on the extent of unprotected waters and data processing considerations	July 2017
2. Acquire and calculate appropriate terrain attributes	November 2017
3. Develop a methodology for prioritizing unprotected waters based on terrain analysis	March 2018
4. Create a spatial data layer for vulnerability ranking of unprotected waters in 70 Minnesota counties	June 2018

III. PROJECT STRATEGY

A. Project Team/Partners

This is a partnership between the Minnesota Department of Natural Resources (DNR) and the University of Minnesota. David Mulla is the project manager, and he will oversee the compilation and analysis of data by Jake Galzki and Joel Nelson (University of Minnesota) while Sean Vaughn (MN DNR) acts as a Quality Assurance/Quality Control analyst for the finished products for this proposal. MN DNR has also agreed to provide high-resolution streams data, as well as advice on utilizing the Hydrographic Position Index (HPI) to identify hydrographic areas of interest. The University of Minnesota will also carry out LiDAR data downloading and processing, and develop methodologies used for prioritization. The DNR will maintain an advisory role throughout this analysis, as will Greg Larson, former BWSR State Soil Specialist, retired.

B. Project Impact and Long-Term Strategy

A statewide dataset of vegetative buffer coverage as well as their priority rankings will be hosted on Minnesota Geospatial Commons, a data hosting website supported by the Minnesota DNR. These data will be made available to conservation agencies in order to assess the statewide condition of near-stream vegetative buffers on a scale never before achieved. Vegetative buffer installation will inevitably increase as the Buffer Initiative evolves, and these data can be utilized to target the most effective placement and width of buffers and other practices to achieve multiple water quality and habitat benefits. These data will be used by DNR and BWSR, among other conservation agencies, to develop goals and strategies for protecting riparian areas of the state, and will have positive impacts on the protection of Minnesota’s surface waters for decades to come.

C. Timeline Requirements

The tasks listed in this proposal can be completely in approximately 2 years.

2016 Detailed Project Budget

Project Title: *Minnesota Vegetative Buffer Assessment and Prioritization*

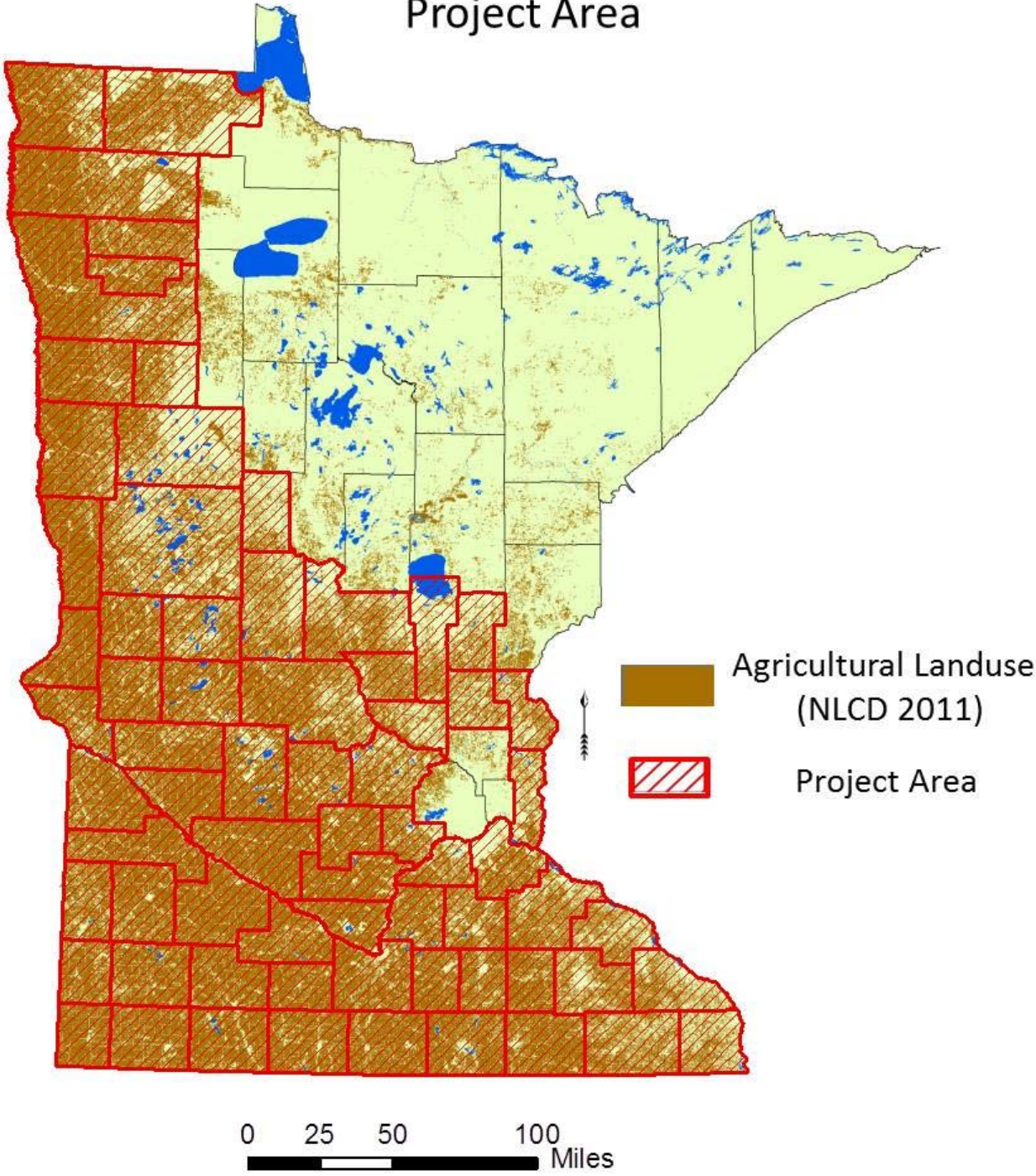
IV. TOTAL ENRTF REQUEST BUDGET: 2 years

<u>BUDGET ITEM</u>	<u>AMOUNT</u>
Personnel:	\$ -
Jake Galzki - Full Time Research Fellow, Remote Sensing and Terrain Analysis, July 2016 to June 2018, 75% Salary, 25% Benefits	\$ 104,411
Joel Nelson - Quarter Time GIS Support, July 2016 to June 2018, 80% Salary, 20% Benefits	\$ 39,210
Equipment/Tools/Supplies:	
Computer Hardware - 2 high memory, high CPU computers with large external storage disks, data requires high processing and storage considerations	\$ 6,500
Computer Software - image analysis software fees	\$ 10,000
Travel:	
Travel @ \$0.575/mile, estimated 200 mile trip approximately 10 trips/year for field verification of features and potential project meetings	\$ 2,300
Additional Budget Items:	
Fees for using GIS facilities at the University of Minnesota	\$ 8,000
TOTAL ENVIRONMENT AND NATURAL RESOURCES TRUST FUND \$ REQUEST =	\$ 170,421

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	n/a
Other State \$ To Be Applied To Project During Project Period:	n/a	n/a
In-kind Services To Be Applied To Project During Project Period:	n/a	n/a
Funding History:	n/a	n/a
Remaining \$ From Current ENRTF Appropriation:	n/a	n/a

Minnesota Vegetative Buffer Assessment Project Area



Project Manager Qualifications and Organization Description

Project Manager: David Mulla

Current Position: Professor and Larson Chair for Soil and Water Resources; Dept. Soil, Water & Climate; University of Minnesota. This department is ranked nationally in the top 5 for research productivity and quality on soil, water and environmental quality issues.

Education:

- Ph.D (1983) Purdue Univ.; W. Lafayette, IN
 - Agronomy with emphasis on Soil Physics
- MS: (1981) Purdue Univ.; W. Lafayette, IN
 - Agronomy with emphasis on Soil Chemistry

Experience:

Thirty two years experience in research on soil and water resources at two Land Grant Universities (Washington State Univ. 1983-1995; Univ. Minnesota 1995-present). Appointed Founding Fellow to Univ. MN Institute on Environment in 2007. Elected Fellow Soil Science Society of America (1997) and Fellow American Society of Agronomy (1999). World Pioneer in research on Precision Agriculture and Precision Conservation. Co-leader of Energy Production and Use Team for LCCMR Statewide Conservation Plan (2008). Member, Scientific Advisory Panel for Lake Pepin TMDL Process, St. Paul, MN. (2005-present). Member, Gulf of Mexico Hypoxia Task Force for White House Committee on Environment and Natural Resources, (1998). Team Leader Environ. Quality Board GEIS Animal Agriculture Water Quality Impacts (1999-2001). Published 160 refereed articles on Soil and Water Resources in scientific journals. Awarded over \$18 million in scientific research grants. Invited to present research findings at conferences and workshops in 25 countries around the world.

--Major projects have included:

- Integrated modeling and management of the Minnesota River Basin. Funded by NSF/EPA for \$813,000 from 1996-1999.
- Sustainable farming systems. Funded by LCCMR for \$910,000 from 1997-2001.
- Generic Environmental Impacts Study of Animal Agriculture. Funded by Environ. Quality Board for \$132,000 from 1999-2001.
- Paired watershed nutrient reduction strategies. Funded by USDA-CSREES for \$539,000 from 2001-2005.
- Minnesota Statewide Conservation and Protection Plan. Funded by ENRTF for \$496,000 from 2007-2008.
- Statewide ecological ranking of CRP and other critical lands. Funded by ENRTF and Emerging Issues Fund for \$275,000 from 2009-2011.
- Strategic planning for MN natural and artificial watersheds. Funded by ENRTF for \$327,000 from 2010-2012.

Organization Description

The University of Minnesota is both the state land-grant university, with a strong tradition of education and public service, and the state's primary research university