



Environment and Natural Resources Trust Fund (ENRTF)

M.L. 2019 ENRTF Work Plan (Main Document)

Today's Date: 1/31/19

Date of Next Status Update Report: January 31, 2020

Date of Work Plan Approval: June 5, 2019

Project Completion Date: June 30, 2021

Does this submission include an amendment request? N

PROJECT TITLE: Mapping Unprofitable Cropland For Water and Wildlife

Project Manager: Jason Ulrich

Organization: Science Museum of Minnesota

College/Department/Division: St. Croix Watershed Research Station

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Location: Agricultural areas in the southern 1/3 of Minnesota; includes all of Southwest and Southeast regions, and portions of the Central region (Chippewa, Kandiyohi, McCleod, Meeker, Nicollet, Renville, Sibley, Swift Counties) and Metro region (Carver, Dakota, Scott, Washington, Wright Counties).

Total Project Budget: \$100,000

Amount Spent: \$0

Balance: \$100,000

Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04n

Appropriation Language: \$100,000 the first year is from the trust fund to the Science Museum of Minnesota for the St. Croix Watershed Research Station to conduct the first statewide analysis that maps the extent of Minnesota's unprofitable cropland and estimates both the water-quality and habitat benefits of converting these lands to perennial crops and vegetation. This appropriation is available until June 30, 2021, by which time the project must be completed and final products delivered.

I. PROJECT STATEMENT:

What is the statewide potential of converting unprofitable cropland to perennial vegetation? Could this approach be the silver bullet for improving Minnesota's water-quality and habitats?

- **Our current conservation approaches have not met Minnesota's water-quality or habitat goals.**
Despite investing millions of dollars in best management practices, water-quality has not improved demonstrably. At the same time, increases in corn and soybean acres and changes in agricultural practices have resulted in dramatic declines in grassland habitat critical for migratory birds and pollinators.
- **Perennial vegetation is a very effective way to improve water-quality and habitat but is too expensive.**
It has been estimated that meeting our water-quality goals using existing best management practices will cost over a billion dollars per year. However, despite this investment, habitat will not be significantly improved. Alternatively, perennial vegetation -- defined here as either perennial cash-crops (such as alfalfa), or permanent vegetation (such as wetlands or restored prairie) -- is a very effective means of improving both water-quality and habitat but thus far has been economically impractical because it requires taking profitable cropland out of production.
- **It is estimated that at least 1 million acres of Minnesota's cropland is unprofitable.**
Based on Midwestern studies, it is likely that 1 million acres or more of cropland in Minnesota has been unprofitable (i.e., lost farmers money) in some or all of the last 5 years. Moreover, in 2017, Minnesota's cropland was unprofitable on approximately of 2/3 of its 8 million total corn acres.
- **Targeting unprofitable cropland is the cheapest way to increase perennial vegetation in Minnesota.**
Prioritizing unprofitable cropland for perennial vegetation makes sense because this land costs the least to take out of production and can even increase whole farm profits. These unprofitable areas are generally very wet or very dry portions of otherwise profitable fields. This concept of targeting unprofitable land is not new, and in fact, organizations such as Pheasants Forever are currently implementing it on a number of demonstration farms in Minnesota.
- **However, we do not know the statewide extent of unprofitable cropland in Minnesota, nor the water-quality and habitat benefits of converting some or all of it to perennial vegetation.**
Presently, there is no information on the probable statewide locations and extent of unprofitable cropland, and the cumulative water-quality and habitat benefits from converting some or all of these areas to perennial vegetation. If the extent of unprofitable cropland as well as the water-quality and habitat benefits from converting these areas are significant, targeting unprofitable cropland needs to become a major focus of water and wildlife management and policy efforts.

Our project will conduct the first analysis in Minnesota to map the probable extent of unprofitable croplands, and quantify both the water-quality and habitat benefits of converting these areas to perennial vegetation. The project's study area will be composed of agricultural areas in the southern one-third of Minnesota.

II. OVERALL PROJECT STATUS UPDATES:

First Update January 31, 2020

Second Update June 30, 2020

Third Update January 31, 2021

Final Report between project end (June 30) and August 15, 2021

III. PROJECT ACTIVITIES AND OUTCOMES:

ACTIVITY 1 Title: Estimate the probable extent of unprofitable croplands in Minnesota.

Description: We propose building upon previous work of researchers at Iowa State (*Subfield profitability analysis reveals an economic case for cropland diversification*, Brandes et al. 2016) to estimate at a sub-field scale the profitability of row-crop agriculture in the study area during the last 5 years; this period will reflect representative fluctuations in commodity prices, input costs, and climate. The probable extent of unprofitable croplands will be determined using a GIS (geographic information systems) approach that utilizes soils, topography, cropping history, crop prices, input costs, and crop yield data. An important and unique component of our approach will be to also evaluate the size, position and shape of the estimated unprofitable areas to ensure that conversion of these areas is practical given current farming practices, equipment sizing, etc. These profitability estimates will be validated using precision-based farm profit data from the ongoing LCCMR Pheasants Forever *Growing Green Together* project.

ACTIVITY 1 ENRTF BUDGET: \$ 50,000

Outcome	Completion Date
1. Compile GIS, input cost, pricing and yield data necessary for profitability analyses.	January 31, 2020
2. Generate and validate GIS maps of the probable extent of unprofitable croplands.	June 30, 2020

First Update January 31, 2020

Second Update June 30, 2020

Third Update January 31, 2021

Final Report between project end (June 30) and August 15, 2021

ACTIVITY 2 Title: Quantify water-quality and habitat benefits of converting unprofitable cropland to perennial vegetation.

Description: We propose quantifying the water-quality benefits of repurposing unprofitable croplands in the study area by predicting and comparing nutrient and sediment loads under row-crops and three perennial vegetation scenarios (alfalfa, prairie, wetland vegetation) using the GIS based hydrologic, water-quality and agronomic model SWAT. Our approach entails selecting 6-8 regionally representative subwatersheds (e.g., USGS HUC-12) distributed across the study area in which to model scenarios. Model results will be validated using existing field scale monitoring sites and current literature. In addition, we will utilize existing models, data and analyses from efforts such as TMDL, WRAPS and One Water, One Plan projects whenever possible. The results from modeling these representative subwatersheds will be scaled up to entire study area thereby providing water-quality benefits from the field-scale up to the watershed-scales consistent with established water-quality goals. Habitat benefits will be determined by applying an existing scoring system based on habitat size, geometry, vegetation type and hydrologic regime.

The resulting maps of water and habitat benefits will be intersected with the mapped extent of unprofitable land from Activity 1 to create maps of croplands that present the most cost-effective opportunities for conversion to perennial vegetation. These deliverables are intended for watershed and conservation managers

and will also be summarized in fact sheets describing watershed scale and statewide benefits, and presented to watershed management organizations, state agencies and at state agricultural and water resources conferences.

ACTIVITY 2 ENRTF BUDGET: \$ 50,000

Outcome	Completion Date
1. Construct and validate models predicting water-quality benefits.	January 31, 2021
2. Apply habitat scoring system and estimate habitat benefits.	January 31, 2021
3. Create maps and datasets with areas of highest cost-effective conversion opportunities.	June 30, 2021
4. Create and disseminate fact-sheets and presentations.	June 30, 2021
5. Create manuscript for submittal to peer-reviewed journal	June 30, 2021

First Update January 31, 2020

Second Update June 30, 2020

Third Update January 31, 2021

Final Report between project end (June 30) and August 15, 2021

IV. DISSEMINATION:

Description: Results from this project will be summarized in a final report, a concise four-page fact sheet and digital (GIS) maps. These materials will be made available on the following website: <https://www.smm.org/scwrs>. The fact sheet will illustrate the concept of the project and will highlight cost-effective locations within the study area for converting unprofitable land to perennial vegetation and their water-quality and habitat benefits. In addition, the concept, objectives and results of the project will be presented orally at over five venues throughout the State over the duration of the project. Venues will include professional conferences and statewide meeting to audiences of state and federal natural resource managers, policy makers, non-profit advocacy groups, and agricultural producers.

The Minnesota Environment and Natural Resources Trust Fund (ENRTF) will be acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the [ENRTF Acknowledgement Guidelines](#).

First Update January 31, 2020

Second Update June 30, 2020

Third Update January 31, 2021

Final Report between project end (June 30) and August 15, 2021

V. ADDITIONAL BUDGET INFORMATION:

A. Personnel and Capital Expenditures

Explanation of Capital Expenditures Greater Than \$5,000: NA

Explanation of Use of Classified Staff: NA

Total Number of Full-time Equivalents (FTE) Directly Funded with this ENRTF Appropriation:

Enter Total Estimated Personnel Hours for entire duration of project: 2,662	Divide total personnel hours by 2,080 hours in 1 yr = TOTAL FTE: 1.28
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Total Number of Full-time Equivalents (FTE) Estimated to Be Funded through Contracts with this ENRTF Appropriation:

Enter Total Estimated Contract Personnel Hours for entire duration of project: 0	Divide total contract hours by 2,080 hours in 1 yr = TOTAL FTE: 0
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VI. PROJECT PARTNERS:

A. Partners outside of project manager’s organization receiving ENRTF funding: NA

B. Partners outside of project manager’s organization NOT receiving ENRTF funding: NA

VII. LONG-TERM- IMPLEMENTATION AND FUNDING:

This project is the first of its kind in Minnesota to analyze the extent of unprofitable cropland and the potential water-quality and habitat benefits of converting this land to perennial vegetation at a large scale. Therefore, it has the potential to be an exceptionally effective and economically practical approach for significantly improving the quality of Minnesota’s waters and grassland habitats. Results of this project are intended to be of immediate value to restoration projects such as BWSR One Watershed, One Plan, and can serve as a model for all of the Midwest’s agricultural regions.

VIII. REPORTING REQUIREMENTS:

- Project status update reports will be submitted January 31 and June 30 each year of the project
- A final report and associated products will be submitted between June 30 and August 15, 2021

IX. SEE ADDITIONAL WORK PLAN COMPONENTS:

- A. Budget Spreadsheet**
- B. Visual Component or Map**
- C. Parcel List Spreadsheet:** NA
- D. Acquisition, Easements, and Restoration Requirements:** NA
- E. Research Addendum**

Attachment A:

Environment and Natural Resources Trust Fund

M.L. 2019 Budget Spreadsheet

Legal Citation: M.L. 2019, First Special Session, Chp. 4, Art. 2, Sec. 2, Subd. 04n

Project Manager: Jason Ulrich

Project Title: ENRTF ID: 100-BH - Repurposing Unprofitable Cropland: Water and Wildlife's Silver Bullet?

Organization: Science Museum of Minnesota, St. Croix Watershed Research Station

Project Budget: \$100,000

Project Length and Completion Date: 2 years, June 30, 2021

Today's Date: 8/27/18



ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET	Budget	Amount Spent	Balance
BUDGET ITEM			
Personnel (Wages and Benefits)	\$ 98,440	\$ -	\$ 98,440
Ulrich, Assistant Scientist, Science Museum of MN: Project coordination, estimating extent of unprofitable cropland, quantifying water quality benefits, watershed modeling: 43% FTE for 2 years; Salary =70%, Benefits=30% (\$64,867)			
Schottler, Senior Scientist, Science Museum of MN: Calculate habitat scores, cost effectiveness analysis: 21% FTE for 2 years; Salary =70%, Benefits=30% (\$33,573)			
Equipment/Tools/Supplies			
Printing Supplies, modeling software licenses	\$ 500	\$ -	\$ 500
Travel expenses in Minnesota			
Travel to present and disseminate results (2000 miles x \$0.53/mile = \$1060)	\$ 1,060	\$ -	\$ 1,060
Other			
	\$ -	\$ -	\$ -
COLUMN TOTAL	\$ 100,000	\$ -	\$ 100,000

OTHER FUNDS CONTRIBUTED TO THE PROJECT	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind: Support services from Science Museum of Minnesota: 40.83% of direct costs	Secured	\$ 40,830	\$ -	\$ 40,830

PAST AND CURRENT ENRTF APPROPRIATIONS	Amount legally obligated but not yet spent	Budget	Spent	Balance
Current appropriation:		\$ -	\$ -	\$ -
ENRTF M.L. 2018, Chp. 214, Art. 4, Sec. 02, Subd. 08c. Develop Market-Based Alternatives for Perennial Crops to Benefit Water Quality and Wildlife.	\$ 150,000	\$ 150,000	\$ -	\$ 150,000
Past appropriations:		\$ -	\$ -	\$ -
ENRTF M.L. 2016, Chp. 186, Sec. 2, Subd. 08c. Establishment of permanent habitat strips with row crops.	\$ 78,261	\$ 179,000	\$ 100,739	\$ 78,261
ENRTF M.L. 2014, Chp. 226, Sec. 2, Subd. 03g. Watershed-Scale Monitoring of Long-Term Best Management Practices	\$ -	\$ 900,000	\$ 900,000	\$ -