



Environment and Natural Resources Trust Fund

M.L. 2024 Approved Work Plan

General Information

ID Number: 2024-269

Staff Lead: Lisa Bigaouette

Date this document submitted to LCCMR: June 14, 2024

Project Title: Are Stream Restoration Efforts Effective? An Evidence-Based Assessment

Project Budget: \$200,000

Project Manager Information

Name: Andrew Robertson

Organization: Saint Mary's University

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Project Reporting

Date Work Plan Approved by LCCMR: June 20, 2024

Reporting Schedule: June 1 / December 1 of each year.

Project Completion: June 30, 2026

Final Report Due Date: August 14, 2026

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 04I

Appropriation Language: \$200,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Saint Mary's University of Minnesota to assess stream habitat improvement projects to improve trout populations and stream health in Minnesota's Driftless Area.

Appropriation End Date: June 30, 2027

Narrative

Project Summary: Assessing stream habitat improvement projects to improve trout populations and stream health in the Driftless Area.

Describe the opportunity or problem your proposal seeks to address. Include any relevant background information.

Trout populations in the Driftless Area are in poor condition; > 80% of streams in southeastern Minnesota have been classified as impaired for nutrients, sediments, and other factors. Poor stream health results from many environmental and human influences (changes) often requiring restoration efforts which seek to reverse negative impacts and improve stream condition. More than US\$18 million have been invested in Habitat Improvement projects undertaken by Minnesota Trout Unlimited, Trout Unlimited Driftless Area Restoration Effort, and Minnesota Department of Natural Resources since 2008 to address stream health and improve trout populations. Restoration efforts do not always achieve their objectives, and many are unsuccessful. Why are projects failing and are streams recovering? The solution is to investigate how rivers are responding to changes by 1) comprehensive stream habitat surveys (land and stream) to detect improvements; 2) characterize stream networks by specific types of river zones which respond differently to changes instream or on adjacent land; 3) use food webs to detect, from carbon and nitrogen inputs (stable isotope analysis), shorter or longer food chain lengths as a measure of condition. This three-step approach, when brought together, is effective in determining if restoration is meeting its intended goal of improving stream health.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

To enhance stream health and thus trout populations in the southeastern Minnesota, this project proposes the following.

1. We will measure physical instream habitat, geomorphology of the landscape, and relate to habitat improvement activities to describe how rivers are responding to changes.
2. We will use a geographic information system approach to characterize specific stream zones (tracts of streams with similar biological communities, habitat, and restoration features) and match to restoration activities.
3. We will use an in-depth analysis using food webs (stable isotopes), specifically food chain length, as a measure of stream improvement based on carbon and nitrogen signatures.

Future work will use these metrics to calibrate a tool that can be used across the Driftless Area in southeast Minnesota to assess and take action on any impaired streams.

What are the specific project outcomes as they relate to the public purpose of protection, conservation, preservation, and enhancement of the state's natural resources?

1. Identify watershed, riparian and stream features that contribute to successful habitat improvement.
2. Increase stream health in southeast Minnesota via targeted habitat improvements and the development of next generation tools leading to sustainable trout populations.
3. Using food webs as a response tool, via stable isotope analysis to identify impairments.
4. Establish foundational collaborations with partners (industry, private, or academic), focused on habitat improvements, and long-term increases in stream health.
5. Increase awareness of issues revolving around sensitive stream ecosystems and the value of trout fishing in the Driftless Area of southeastern Minnesota through education, dissemination, and partner collaborations.

Project Location

What is the best scale for describing where your work will take place?

Region(s): SE

What is the best scale to describe the area impacted by your work?

Statewide

When will the work impact occur?

During the Project and In the Future

Activities and Milestones

Activity 1: Comprehensive stream and habitat improvement assessments.

Activity Budget: \$75,180

Activity Description:

The Driftless Area is a unique ecoregion affected by human activities. Habitat improvement data will be collected to identify study sites and features to assess, in addition, sites will have to be verified with field visits. To begin assessing stream health, data will be collected from various sites starting in summer of 2024. Selecting sites with habitat improvements and different structures will allow for comparisons to less impacted streams. At study sites and comparison sites, physical instream habitat will be measured, geomorphology of the river will be measured for certain features, and biological communities will be sampled (fish, macroinvertebrates (stream insects), and plants and algae). During this time, we will train and develop interns to assist in the field and lab work, acquire all the necessary equipment for successful sampling events, and report on findings. This effort will require multiple field visits and overnight stays throughout southeastern Minnesota which will be necessary to gather data across 35, or more, sites for comprehensive analysis. Results from activity one, two, and three, will then be used as inputs to develop a predictive model for restoration success after completion of activities.

Activity Milestones:

| Description | Approximate Completion Date |
|---|-----------------------------|
| Gather data on habitat improvement projects from various agencies, private organizations and commence site selection. | July 31, 2024 |
| Results will be published in a peer review journal as a chapter for PhD thesis. | January 31, 2025 |
| Conduct comprehensive assessments at study sites throughout southeastern Minnesota (i.e., fish, bugs, plants, habitat). | August 31, 2025 |
| Resulting database of all assessments and characteristics will populate predictive model for restoration success. | December 31, 2025 |

Activity 2: Characterization of streams in southeastern Minnesota.

Activity Budget: \$76,120

Activity Description:

Approximately US\$1.8 billion is generated from trout angling supporting the southeastern Minnesota economy. There are over 700 miles of trout streams in southeastern Minnesota and a high demand for their improvement. To maximize efficiency of streams targeted for habitat improvements and stream health, streams will be characterized by zone following comprehensive spatial analysis and mapping of streams and habitat improvement data. Delineation of different river zones (tracts of rivers with similar structure and function, and habitat improvement character) is a major component to effective assessments. River zones are specific in structure and function, sensitive to change, and respond differently to those physical changes (e.g., habitat improvement projects). Characterization is a complex, time intensive process and will be completed using geographic information systems. This will be a stepwise approach to extract geomorphological variables using software that will then create specific zones based on 15 variables extracted (verified with site visits). Sites selected for assessment will be combined with the delineated stream zones; this will allow for an accurate detailing of how rivers are responding based on specific stream zones and associated features.

Activity Milestones:

| Description | Approximate Completion Date |
|--|-----------------------------|
| Spatial analysis and comprehensive mapping of restoration data to be completed for analysis. | December 31, 2024 |

| | |
|--|-------------------|
| Characterization of river zones (all metrics) will be the second component to predictive model. | December 31, 2024 |
| Analyze data, publish findings at ESRI storymap hosted at Saint Mary's University and publicly accessible. | March 31, 2025 |
| Results will be published in a peer reviewed journal as a chapter in PhD thesis. | March 31, 2025 |

Activity 3: Food webs and analysis

Activity Budget: \$48,700

Activity Description:

During on-going field visits, at each site, biological sampling will occur. Fish tissue will be collected from separate feeding groups, macroinvertebrates (streams insects) will be sampled from separate feeding groups, and primary producers (algae and plants). Samples will be sent to the University of Southern California, Davis, on an on-going basis, where samples will be analyzed for carbon and nitrogen signatures (isotopes) and data returned. Stable isotope data will be an instrumental tool in the final step of comprehensive assessments. Stable isotopes will be used in relation to river zones and complete site measurements to describe whether streams are improving by analyzing food chain length associated with stable isotope ratios. We will develop a predictive model, that will have a predicted outcome of restoration success, using all metrics described to aid in prioritizing targeted stream health improvements through habitat improvement projects. Additional work will ensue as steps are completed. Upon completion of each step, results will be disseminated through publications, various scientific conferences throughout the state, and at universities. Data will be made available via an educational platform for enhanced, continued learning, after completion of project and dissemination.

Activity Milestones:

| Description | Approximate Completion Date |
|---|-----------------------------|
| Food Web analysis describing restoration success and or improved stream health. Publicly available through storymap. | December 31, 2025 |
| Develop and test predictive model for restoration success for Minnesota Driftless Area. | March 31, 2026 |
| Predictive model tested across all sites for validation. Findings publicly available through sotrymap. | June 30, 2026 |
| Predictive model published in peer reviewed journal and shared with partners and ENRTF. | June 30, 2026 |
| Education platform/dashboard available to public through university web page containing all data and models. | June 30, 2026 |
| Disseminate findings: Publications (peer-reviewed journals), Seminars, Workshops, Final report submitted to partners and ENRTF. | June 30, 2026 |

Project Partners and Collaborators

| Name | Organization | Role | Receiving Funds |
|-------------------|--|--|-----------------|
| Martin Thoms | University of New England, Armidale, Australia | Collaborator - will assist and oversee PhD student Varela's progress. Thoms is Varela's Supervisor as he attends UNE to obtain a PhD. Thom's provides many years of river science knowledge including resilience thinking and restoration ecology. | No |
| Douglas Dieterman | Minnesota Department of Natural Resources - Fisheries Division | Supervisory member of Varela. Will help oversee progress as it pertains to this research project. Dieterman will guide, train, and assist in data collection, analyzing data, and progress reporting. Dieterman will contribute funding for Stable Isotope Analysis. | No |
| Justin Watkins | Minnesota Pollution Control Agency | Supervisory member of Varela. Will aid in progress reporting, data collection, field visits, site selection, and general input into project implementation. Watkins will contribute funding for Stable Isotope Analysis. | No |
| Michael Knudson | GeoSpatial Services - SMU | Project Manager. Knudson will fund interns to assist in physical site sampling, data collection, GIS analysis and support for Varela to project completion. Students engaged in this research project will develop their own capstone projects under the guidance of Varela. | Yes |

Dissemination

Describe your plans for dissemination, presentation, documentation, or sharing of data, results, samples, physical collections, and other products and how they will follow ENRTF Acknowledgement Requirements and Guidelines.

Results from this project research will be disseminated in a variety of ways. As a Minnesota Private College, students will be directly involved in the execution of research (both field and lab) associated with this project. They will share information about the project work and findings through formal classroom reporting and direct classroom activities utilizing project data. Lab exercise that utilize field collected data and project related analyses will be designed and incorporate into existing curriculum. Project progress and results will be shared through investigator presentations at the Saint Mary's Annual Science Symposium throughout the course of the project (2 years). Project researches will attend and present the project at the annual Minnesota Water Resources conference and at a national fisheries habitat conference to be determined. Researches will also present methods and results at the Annual Meeting of the National Association of Floodplain Managers. Finally, this project will result in at least one peer-reviewed and published journal article (BioScience, Fisheries Management etc.) upon completion.

Long-Term Implementation and Funding

Describe how the results will be implemented and how any ongoing effort will be funded. If not already addressed as part of the project, how will findings, results, and products developed be implemented after project completion? If additional work is needed, how will this work be funded?

Long-term implementation will be in the form of an online Education Platform. This platform will facilitate the sharing of data, information, and learnings of habitat improvement among a community focused on improving trout populations in the Driftless Area. This platform will allow stream health across the Driftless Area to be monitored. Our community of partners will contribute to the dashboard development and the data set. Future projects can be identified and improved with funding strings from outside sources. This will be an ongoing effort to show results of the 'fit for purpose' scientific approach into stream rehabilitation.

Budget Summary

| Category / Name | Subcategory or Type | Description | Purpose | Gen. Ineligible | % Benefits | # FTE | Classified Staff? | \$ Amount |
|---------------------------------------|--|---|--|-----------------|------------|-------|-------------------|------------------|
| Personnel | | | | | | | | |
| Andrew Robertson | | Primary Investigator | | | 32% | 0.5 | | \$52,273 |
| William Varela | | Project designer and Implementor | | | 7.65% | 2 | | \$75,355 |
| Ecology Intern | | Assist with field work, lab work, and general project analysis. | | | 0% | 2 | | \$38,038 |
| | | | | | | | Sub Total | \$165,666 |
| Contracts and Services | | | | | | | | |
| University of California, Davis | Professional or Technical Service Contract | Stable Isotope Analysis | | | | 0.6 | | \$15,973 |
| | | | | | | | Sub Total | \$15,973 |
| Equipment, Tools, and Supplies | | | | | | | | |
| | Equipment | Surber Sampler | Collection of benthic macroinvertebrates for food web characterization (stable isotope analysis) | | | | | \$800 |
| | Equipment | Field supplies | Data recorder, waders, rubber gloves and similar supplies for field visits, tissue plug sampler, specimen bags, envelopes etc. | | | | | \$2,800 |
| | | | | | | | Sub Total | \$3,600 |
| Capital Expenditures | | | | | | | | |
| | | | | | | | Sub Total | - |
| Acquisitions and Stewardship | | | | | | | | |

| | | | | | | | | |
|---------------------------------|---|--|---|--|--|--|--------------------|------------------|
| | | | | | | | Sub Total | - |
| Travel In Minnesota | | | | | | | | |
| | Miles/ Meals/ Lodging | Mileage car rental fees for travel to 30-40 sites across two field seasons in southeastern, MN (1 PhD Candidate, 1 GSS SMU interns). | Travel to stream sites approx. 223 mi/site x 35 sites = 7,800 mi x \$0.42/mi = \$ 6,552, Meals \$25 x 60 = \$3,000, lodging ~ 40 overnight stays = \$4,000. | | | | | \$13,552 |
| | Conference Registration Miles/ Meals/ Lodging | Multiple Conferences for PhD student and the student intern from GSS | Disseminate findings and other research related to this project. | | | | | \$1,209 |
| | | | | | | | Sub Total | \$14,761 |
| Travel Outside Minnesota | | | | | | | | |
| | | | | | | | Sub Total | - |
| Printing and Publication | | | | | | | | |
| | | | | | | | Sub Total | - |
| Other Expenses | | | | | | | | |
| | | | | | | | Sub Total | - |
| | | | | | | | Grand Total | \$200,000 |

Classified Staff or Generally Ineligible Expenses

| Category/Name | Subcategory or Type | Description | Justification Ineligible Expense or Classified Staff Request |
|---------------|---------------------|-------------|--|
|---------------|---------------------|-------------|--|

Non ENRTF Funds

| Category | Specific Source | Use | Status | \$ Amount |
|------------------|--|---|----------------------------|------------------|
| State | | | | |
| In-Kind | Justin Watkins - Minnesota Pollution Control Agency | Support for Stable Isotope Analysis. | Secured | \$25,000 |
| In-Kind | Doug Dieterman - Minnesota Department of Natural Resource - Fisheries | Support for Stable Isotope Analysis. | Secured | \$29,000 |
| | | | State Sub Total | \$54,000 |
| Non-State | | | | |
| In-Kind | Michael Knudson - GeoSpatial Services SMU | Provide support in the form of student interns to assist with physical field work and sampling. | Secured | \$42,000 |
| In-Kind | Martin Thoms - University of New England, Department of Geography and Planning | Aid in overall project design, management, guidance for data analysis, GIS work, training, and general support to Varela. | Secured | \$220,000 |
| | | | Non State Sub Total | \$262,000 |
| | | | Funds Total | \$316,000 |

Attachments

Required Attachments

Visual Component

File: [ec71969e-985.pdf](#)

Alternate Text for Visual Component

This is a map shows the location of our project area within the SE Minnesota Driftless area. It also documents many of the sample sites that will be visited and characterized as part of project sampling....

Financial Capacity

File: [7aab1d8c-f74.pdf](#)

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

| Title | File |
|------------------------------------|----------------------------------|
| Letter of authorization | 917146f9-b30.pdf |
| Research Addendum revised 2024-269 | 0a3e51ec-cd5.pdf |

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Updated project collaborators, reviewed and confirmed project narrative, updated project budget to reduce administrative costs, defined dissemination plan, adjusted timeline of project, adjusted expected outcomes/milestones, altered stable isotope analysis budget, increased salary, and added a student intern/s to the project.

Additional Acknowledgements and Conditions:

The following are acknowledgements and conditions beyond those already included in the above workplan:

Do you understand and acknowledge the ENRTF repayment requirements if the use of capital equipment changes?

N/A

Do you agree travel expenses must follow the "Commissioner's Plan" promulgated by the Commissioner of Management of Budget or, for University of Minnesota projects, the University of Minnesota plan?

Yes, I agree to the Commissioner's Plan.

Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?

No

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

N/A

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?

N/A

Does your project include original, hypothesis-driven research?

Yes

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing \$10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No