



Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-294

Staff Lead: Michael Varien

Date this document submitted to LCCMR: August 19, 2022

Project Title: Chronic Wasting Disease Prion Soil Research

Project Budget: \$732,000

Project Manager Information

Name: Tiffany Wolf

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Project Reporting

Date Work Plan Approved by LCCMR: August 30, 2022

Reporting Schedule: March 1 / September 1 of each year.

Project Completion: June 30, 2025

Final Report Due Date: August 14, 2025

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Sec. 2, Subd. 03n

Appropriation Language: \$732,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota to study chronic wasting disease prions in soils, including the assessment of sites where carcasses with chronic wasting disease have been disposed.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: The goal of this project is to advance research related to the contamination, persistence, detection, and risk of transmission related to CWD prions in soil.

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

Chronic Wasting Disease is a contagious, 100% fatal neurological disease affecting deer. Infected deer shed CWD-causing prions into the environment throughout the duration of illness and through decomposition after death. Research demonstrates that the interactions between prions and soil is a complex system affected by the variable organic and inorganic microenvironment of soil types. Minnesota's diverse ecosystems and associated soils, along with the reality that CWD continues to be detected across the state, demonstrate an opportunity to learn more about the prion/soil interface and how that influences the potential risk for CWD transmission to deer. The variability of soil matrices also complicates consistent and accurate prion detection with current testing schemes. Our Minnesota Center for Prion Research and Outreach (MNPRO) laboratory has RT-QuIC testing functionality, a highly advanced and sensitive prion detection assay that has capability for environmental samples such as soil. Although capability is apparent, further investigation is necessary to optimize RT-QuIC testing of soil for CWD prions.

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.

CWD prions are resistant to degradation and can remain infectious in the environment for years, expanding the risk of CWD spread. Therefore, it is critical that research specific to the interaction of soils and prions continues to make progress. Our team proposes to: 1) develop a Minnesota soils map that will both inform and be updated by ongoing experiments to model and characterize prion risk across the state; 2) form a consortium of prion/soil scientists across UMN and the U.S. to collaboratively strategize, design, and perform prion ecological research; and 3) conduct ongoing research to optimize RT-QuIC for prion detection in soil under different conditions, building on existing LCCMR soil funding, with direct application to the soils of Minnesota. To accomplish the proposed work plan, we will leverage knowledge gleaned from ongoing experiments conducted with previous LCCMR support (2020 CWD Prion Research in Soils) and the growing capacity of MNPRO as a multidisciplinary, collaborative, research center, resulting from 2022 Establishing a Center for Prion Research and Outreach.

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?

Specific outcomes of this project that are critical to advancing future environmental research around CWD prion persistence, degradation, and remediation in Minnesota include: 1) the optimization of methods for prion detection in soils, under different conditions and of different compositions; 2) spatial modeling associated with the soil diversity in Minnesota and the risk of CWD transmission to native cervids; and 3) formation of a scientific prion/soil consortium to develop new avenues of research on CWD ecology in the environment.

Project Location

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

Statewide

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

Statewide

When will the work impact occur?

During the Project

Activities and Milestones

Activity 1: Soil-based spatial modeling of CWD risk in Minnesota

Activity Budget: \$171,286

Activity Description:

Recent research demonstrates that prions bind efficiently to clay particles in soil, which could either promote or inhibit transmission due to conformational changes in prion structure that affects infectivity to cervids. Yet binding of prions to clay also has been suggested as a potential method of environmental mediation, as clay could sequester prions and reduce exposure. Ongoing studies also demonstrate that relationships between clay and CWD incidence in deer in the field are mixed. For example, higher clay content was associated with CWD in Colorado but not Wisconsin. Relevance of other soil properties, such as heavy metal contamination or organic content, are less well understood. As Minnesota is characterized by a diversity of soil types and matrices across the state, we can leverage the knowledge gleaned from these previous studies and utilize the draft map to prioritize soil sampling and testing for Activity 3. Further, over time the draft map will be updated by MNPRO's discoveries and ongoing experimental and field studies emerging from Activity 4. Future efforts would integrate soil, hydrology, and deer movement risk maps to determine what factors best explain the spatial variation of CWD in Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Recruit a new graduate student researcher to the project.	January 31, 2023
Up-to-date comprehensive literature review of science behind prion variation by soil type.	August 31, 2023
A draft Minnesota soil-based prion risk map to model prion risk across the state	June 30, 2024

Activity 2: Formation of a soil/prion research consortium

Activity Budget: \$62,158

Activity Description:

A complex problem such as prion interaction with various environmental compounds is best undertaken by a team of dedicated, experienced, multi-disciplinary scientists. Leveraging MNPRO's capacity as a center for cultivating multi-disciplinary prion research, we will create a structure for successful team science. We will work with UMN's Strategic Partnerships and Research Collaborative (SPARC) to design and host a collaborative workshop, outline a strategy for participant recruitment, and develop a transparent and inclusive approach to research prioritization and support. The workshop will focus on needs, opportunities, and methods to advance research on the prion/soil interface. Participants will include UMN researchers, Minnesota scientists (e.g. from MPCA) and national leaders (joining virtually if needed) in environmental prion research. The workshop will be a launchpad for new ideas and a research consortium that will develop and conduct new avenues of soil/prion research (integrated into Activity 4). The consortium will continue with regular, remote meetings at a frequency that facilitates necessary communications for research development and advancement - biweekly to monthly - with an annual summit.

Activity Milestones:

Description	Approximate Completion Date
Design and planning of workshop and process for research prioritization.	January 31, 2023
Host the prion/soil science workshop with formation of prion/soil science consortium.	February 28, 2023
Prioritization and design of new prion/soil studies (to feed into Activity 4).	June 30, 2023
Host regular consortium meetings (biweekly to monthly) to advance soil prion science.	June 30, 2025

Activity 3: RT-QuIC detection of CWD prions in soil

Activity Budget: \$198,556

Activity Description:

RT-QuIC is a CWD screening test that is capable of detecting prions in live and dead animals (including carcass remains), as well as the environment - samples such as plants, soil, and water. Yet, environmental detection of prions using RT-QuIC technology is still early in its development. Given soil matrix complexity, more work is needed to optimize methods for prion detection across soils with different mineral and organic content. MNPRO began such efforts with LCCMR funding in 2021, and these efforts will continue with this Activity. A variety of RT-QuIC protocols developed with previous funding will continue to be investigated and utilized to optimize detection methods on known CWD positive and negative soils. Based on the detection methods developed across experimental soil conditions, we will screen soil samples collected from areas across Minnesota, as informed by the spatial analysis of Activity 1, including those with known CWD exposures.

Activity Milestones:

Description	Approximate Completion Date
Recruit and hire a new soil/protein scientist to MNPRO.	January 31, 2023
RT-QuIC optimization for the detection of CWD prions in soil.	May 31, 2023
Experimental study of CWD prion binding and detection across different soil types and compositions.	January 31, 2024
Screen soil samples from multiple Minnesota locations for CWD prions using RT-QuIC.	June 30, 2025

Activity 4: The ecology of prions in soil.

Activity Budget: \$300,000

Activity Description:

CWD prions are resistant to degradation and bind to various compounds in soil, allowing them to remain infectious in the environment for years. The goal of this Activity is to leverage the knowledge gained in the 2021 LCCMR soil grant and Activities 1 and 3 of this work plan, as well as the strategy derived by the newly formed soil/prion consortium of Activity 2. We envision that through this Activity, using new protocols for the extraction and detection of prions in soil with RT-QuIC, the consortium will begin new studies that will serve as initial phases of research into prion binding, detection, persistence and degradation under different environmental conditions. In the final 1.5 years of this grant, initial studies will generate new, preliminary data and information that will direct and leverage future funding opportunities for ongoing environmental CWD research. This work will enhance our understanding of the persistence and potential transmission of CWD in the soil environment and add to an overall assessment of ecological risk.

Activity Milestones:

Description	Approximate Completion Date
Peer-reviewed Research Addendums for new research projects identified by prion/soil consortium in Activity 2.	December 31, 2023
Amend work plan budget as needed to support new soil/prion research projects.	January 31, 2024
Complete initial studies of prion-soil ecological projects.	April 30, 2025
New funding opportunities identified by consortium for continuation of prion-soil ecological research.	June 30, 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Stuart Lichtenberg	University of Wisconsin	Collaborator	No
Jason Bartz	Creighton University	Collaborator	No
Rodrigo Morales	University of Texas Houston	Collaborator	No

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.

The environmental dimension of CWD transmission is a critical area for CWD research. This unique project, uniting expertise across disciplines and combining spatial and environmental assessments, is a first of its kind. The methods and approach taken will be of broad interest to those tasked with characterizing the potential risks associated with CWD-positive prions in soils, and the findings critical to the work of our own state and tribal agencies in protecting our wild deer herds and the surrounding ecosystem. Findings will be shared directly with state and tribal agencies through project reports. We will also use the following opportunities to share methods and findings more broadly:

1. dissemination via the MNPRO website: <https://mnpro.umn.edu/>
2. presentation at local, regional, and national scientific, management, and public/stakeholder meetings
3. publication of findings in peer-reviewed scientific (e.g. Science of the Total Environment) and professional journals (e.g. The Wildlife Professional)
4. dissemination to the media via press releases and UMN Research Briefs
5. testimonials to LCCMR and other policy platforms

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.

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?

The environmental dimension of CWD transmission is a critical area for CWD research. The methods and results of this study will be of broad interest and lay a strong foundation for future hypothesis-driven research related to prion contamination, persistence, degradation and remediation. The Beltrami Co. dump site, depending on results produced from this project, has the potential to become a long-term environmental prion research demonstration site. Thus, the results from this project will be leveraged for funding from federal agencies, including USDA, USFWS, and NSF.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
2 Assistant Professors		Two assistant professors will serve in the role of Primary Investigator (Project manager) and Co-PI to manage the project and guide research.			33.5%	0.45		\$77,394
Assistant Professor		An assistant professor specializing in water and soil science will advise a graduate student and guide/partake in field and laboratory research			33.5%	0.15		\$28,302
Researcher		A researcher will be part of the workshop, and integrate the research plan into field and laboratory investigations			33.5%	0.03		\$3,422
Lab technician		A laboratory technician will perform field sampling and lab analyses of soil for prion detection.			28.7%	3		\$216,631
2 graduate students		Two graduate student researchers will facilitate data collection and analysis and focus on prion/soil research			87.9%	2.25		\$233,203
							Sub Total	\$558,952
Contracts and Services								
Laboratory Services	Professional or Technical Service Contract	Analytical testing services				0		\$10,000
UMN-SPARC	Professional or Technical Service Contract	Professional design, planning and facilitation of collaborative workshop and research prioritization process.				0.2		\$16,000
							Sub Total	\$26,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Soil sampling and analysis supplies	Expenses include consumables and other supplies needed for soil sampling, high-throughput laboratory testing using RT-QuIC technology, chemicals and compounds for					\$109,548

			extracting prions from soil, PPE, kits and reagents for protein isolation, etc.					
	Tools and Supplies	Prion detection/research equipment	Equipment for MNPRO lab R/D and analytical testing					\$16,000
							Sub Total	\$125,548
Capital Expenditures								
		Lab Oven/incubator	Drying and processing soil samples	X				\$8,000
							Sub Total	\$8,000
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Lodging and per diem support for 4-5 people x 2-days in Minneapolis/St. Paul.	Support for external participants to travel to the Twin Cities for a 2-day collaborative workshop.					\$1,000
							Sub Total	\$1,000
Travel Outside Minnesota								
	Conference Registration Miles/ Meals/ Lodging	Travel for 1-2 MNPRO staff and students to participate in 1 national scientific conference.	To disseminate project findings, establish new collaborative partners, gain new knowledge in prion and environmental research.	X				\$5,000
							Sub Total	\$5,000
Printing and Publication								
	Publication	Publication costs range \$2-3,000 per manuscript; we anticipate the publication of 2-3 manuscripts from this original research.	Publication will allow broad dissemination of research results to the scientific community to build on our findings.					\$7,500
							Sub Total	\$7,500
Other Expenses								

							Sub Total	-
							Grand Total	\$732,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Capital Expenditures		Lab Oven/incubator	A dedicated drying oven for environmental samples such as soil is necessary for experiments requiring quantification of prion loads. The equipment will be maintained in the MNPRO laboratory and be dedicated to environmental prion research. Additional Explanation : The equipment will be used in future experiments and projects focused on soil/environmental research conducted by the MNPRO laboratory.
Travel Outside Minnesota	Conference Registration Miles/Meals/Lodging	Travel for 1-2 MNPRO staff and students to participate in 1 national scientific conference.	MNPRO is at the forefront of scientific advancement for environmental prion research, which necessitates continuous dialogue with the scientific community to progress using cutting-edge knowledge and techniques.

Non ENRTF Funds

Category	Specific Source	Use	Status	\$ Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

Attachments

Required Attachments

Visual Component

File: [7375fe64-d51.pdf](#)

Alternate Text for Visual Component

Visual summary of project goals, approach, and outcomes....

Optional Attachments

Support Letter or Other

Title	File
UMN SPA Support	0e1159ac-c42.pdf
Background Check Certification Form	1d8ad658-03b.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

NA

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?

Yes

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, or sale of products and assets?

Yes

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

Yes

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

No

Does your project include original, hypothesis-driven research?

Yes

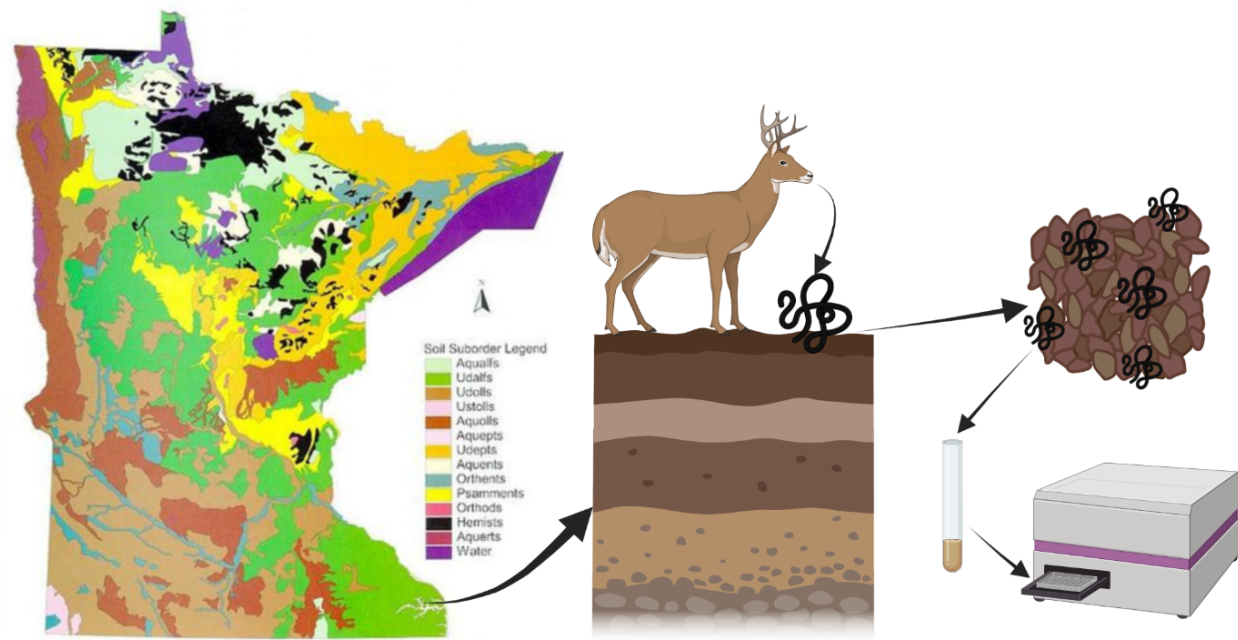
Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

CWD prion soil research

Concerns

Contamination of the environment with chronic wasting disease prions is a complicating factor in the control and spread of the disease. Infected deer deposit prions into the environment, and the prions incorporate into the soil. Minnesota's large scale soil diversity along with the variable organic and inorganic microenvironment of soil at a local level provide a complex matrix for the consistent and accurate detection of prions within the soils from across the state. These factors inform the risk of CWD transmission from soils to wild deer in Minnesota.



Project goals

- Develop soil-based CWD risk models and maps for Minnesota
- Form a consortium of leading soil/prion scientists to inform research
- Advance the understanding of CWD prion interactions in soil and methods of detection

Project outcomes

- Develop and optimize RT-QuIC soil testing protocols and screen study area soil samples
- Characterize study area soil types and understand prion interactions with soil types
- Provide a CWD risk assessment associated with soil types of Minnesota



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