



Environment and Natural Resources Trust Fund

2024 Request for Proposal

General Information

Proposal ID: 2024-147

Proposal Title: Cleaning Minnesota's Air with Plant-Based Proteins

Project Manager Information

Name: Jason Hill

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

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Project Basic Information

Project Summary: Agriculture contributes to poor air quality and climate change. This project explores the potential for plant-based protein production to clean Minnesota's air while supporting its rural economic base.

Funds Requested: \$145,000

Proposed Project Completion: June 30, 2026

LCCMR Funding Category: Small Projects (H)

Secondary Category: Air Quality, Climate Change, and Renewable Energy (E)

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 and In the Future

Narrative

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

Agriculture is a major contributor to poor air quality and climate change in Minnesota, the United States, and globally. Recent work from my research group at the University of Minnesota showed that fine particulate matter from food production in our state is responsible for approximately 700 deaths annually, and, according to a recent MPCA report, agriculture is the second largest source of greenhouse gases in our state. In each case, the overwhelming source of damaging emissions is conventional protein production from animals. Reducing animal production's environmental impacts has been an intense focus of researchers, industry, and farmers. Efforts have centered on improving efficiency in production and implementing mitigation measures such as capturing methane from manure. There is also growing interest in plant-based proteins as a means of reducing agriculture's environmental effects while diversifying the income base for farmers and providing consumers with additional healthy dietary options. What is needed by those interested in taking advantage of these opportunities is a detailed accounting of Minnesota's potential for plant-based protein production and its ability to improve air quality and reduce greenhouse gas emissions. Such an accounting for informing how stakeholders might grow this industry is greatly does not yet exist.

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.

This project explores the potential for plant-based protein production in Minnesota to reduce agriculture's environmental impacts on air quality and climate change. Our first goal is to provide an accounting of our state's potential for plant-based protein production, relying upon publicly-accessible sources of data for crop yields and cropland availability. Our second goal is to quantify how increased plant-based protein production might reduce emissions of pollution that contributes to reduced air quality and climate change. Here, we will use computer models developed here at the University of Minnesota in collaboration with researchers at other institutions to quantify how increasing plant-based protein production in Minnesota might reduce levels of fine particulate matter and greenhouse gases in the air. In our assessment of potential air quality benefits, we will also estimate the health benefits and economic benefits of this cleaner air. The greenhouse gas accounting we will perform will take a life cycle approach in which we estimate changes in pollution emissions along the supply chain of plant-based protein production, including fossil fuel and fertilizer use. Our scenario-based approach will consider both near- and long-term growth of plant-based protein production and its potential environmental effects.

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?

The specific outcome of this project is greater public understanding of the potential for plant-based proteins to contribute to improved environmental performance of Minnesota agriculture, and its economic and health co-benefits. This project will provide actionable information for farmers, agribusiness, investors, environmental non-governmental organizations, policymakers, regulators, and consumers. Our Initial work in this area suggests that actions taken by these stakeholders to increase plant-based protein production may provide a win-win-win for food producers, consumers, and the public as a whole, keeping Minnesota competitive in this emerging industry while benefitting the health of its citizens.

Activities and Milestones

Activity 1: Accounting of Production Potential of Plant-Based Protein

Activity Budget: \$72,500

Activity Description:

The objective of this activity is to determine the potential plant-based protein production in Minnesota. This will be accomplished by compiling data on plant-based protein options and their important production parameters (e.g., yield, range, and processing capabilities), and then using computer GIS modeling to place these options on the Minnesota landscape. Data will be sourced from publicly-available state and federal resources, communications with producers, and communications with experts. The outcome, a report and accompanying database, can be used directly by stakeholders to understand Minnesota's potential for plant-based protein production. They will also serve as a starting point for the second activity of this project, which is understanding the potential environmental benefits they may provide.

Activity Milestones:

Description	Approximate Completion Date
Compilation of plant-based protein options	December 31, 2024
Landscape-level assessment of production	June 30, 2025

Activity 2: Accounting of Potential Environmental Benefits of Plant-Based Protein

Activity Budget: \$48,334

Activity Description:

The objective of this activity is to determine the potential for plant-based protein production in Minnesota to improve air quality and mitigate climate change. This will be accomplished by using the database developed in Activity 1 as an input to existing modeling platforms that estimate the potential air quality and life cycle climate change benefits of agricultural production scenarios. The outcome, a report and accompanying database, can be used directly by stakeholders to understand Minnesota's potential for plant-based protein production to reduce environmental impacts.

Activity Milestones:

Description	Approximate Completion Date
Quantification of climate change benefits of plant-based protein production	October 31, 2025
Quantification of air quality benefits of plant-based protein production	February 28, 2026

Activity 3: Preparation and Presentation of Final Report

Activity Budget: \$24,166

Activity Description:

The objective of this activity is to prepare the final report and public presentation. This will be accomplished by writing the final product and submitting it for peer comment and review. The outcome, a final report and accompanying database, can be used directly by stakeholders to understand Minnesota's potential for plant-based protein production and its potential to benefit air quality and state greenhouse gas reduction targets.

Activity Milestones:

Description	Approximate Completion Date
Final report prepared and public release	June 30, 2026

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 results will be published in a report and in the peer-reviewed scientific literature. This report and its underlying data will be open access and distributed widely to Minnesota stakeholders. Public presentations on the findings of the report will also be held. No additional work will be needed, but opportunities to leverage this project to secure additional funding from federal sources (e.g., USDA and US-EPA) to expand upon it will be explored.

Project Manager and Organization Qualifications

Project Manager Name: Jason Hill

Job Title: Professor

Provide description of the project manager's qualifications to manage the proposed project.

Jason Hill is Professor in the Department of Bioproducts and Biosystems Engineering at the University of Minnesota. He also serves as a Resident Fellow of the University's Institute on the Environment. His research focuses on the consequences of food, energy, agriculture, and natural resources from a life-cycle perspective. Dr. Hill has testified before U.S. House and Senate Committees on the environmental effects of biofuels. His work has been published in the journals *Science* and the *Proceedings of the National Academy of Sciences*. He served on the National Research Council's (NRC) Committee on the Economic and Environmental Impacts of Increasing Biofuels Production, the National Academies of Sciences, Engineering, and Medicine (NASEM) Committee on Current Methods for Life Cycle Analyses of Low-Carbon Transportation Fuels in the United States, and on the US-EPA's Science Advisory Board's Biogenic Carbon Advisory Panel. He is a co-author of the Mitigation Chapter of the Fifth National Climate Assessment (NCA5). He has managed numerous sustainability related projects from funding sources that include the US-EPA, U.S. Dept. of Energy, USDA, U.S. Dept. of State, and USAID. Dr. Hill received his AB in Biology from Harvard College and his PhD in Plant Biological Sciences from the University of Minnesota.

Organization: U of MN - College of Food, Agricultural and Natural Resource Sciences

Organization Description:

In the College of Food, Agricultural and Natural Resources Sciences (CFANS) at the University of Minnesota, we look at the bigger picture. When we envision a better tomorrow, it includes disease-resistant crops, products that protect our health, lakes free from invasive species, and so much more. We use science to find answers to Minnesota and the world's grand challenges and solve tomorrow's problems. Almost 93 percent of students who earn CFANS undergraduate degrees find jobs in their career field or enter graduate school within six months of graduation.

The Department of Bioproducts and Biosystems Engineering, in CFANS, discovers and teaches solutions for the sustainable use of renewable resources and the enhancement of the environment. We discover innovative solutions to address challenges in the sustainable production and consumption of food, feed, fiber, materials, and chemicals by integrating engineering, science, technology, and management into all degree programs.

We have a public impact through community engagement and extension efforts. We develop and deliver high quality, regionally and nationally-recognized research-based programs to meet current and emerging needs of industry and communities. We also have a long-standing tradition of close

partnerships with alumni, industry professionals, organizations, government agencies, donors, and community members.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Professor Jason Hill/Project Lead		Direct, oversee, and manage all aspects of the project			36.8%	0.16		\$37,182
Graduate Student Researchers (2 positions)		Conduct research and analysis under direction of the Lead, education			86%	2		\$106,837
							Sub Total	\$144,019
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
	Tools and Supplies	external hard drive, tablet, software	upgrade computing and storage capacity					\$981
							Sub Total	\$981
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
							Sub Total	-

Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$145,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
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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: [ff765ffc-39e.pdf](#)

Alternate Text for Visual Component

A graphic of a word cloud of terms commonly used in plant-based protein marketing and a map of Minnesota's current agricultural landscape...

Optional Attachments

Support Letter, Photos, Media, Other

Title	File
Authorization	d2c96866-ded.pdf
2022 Audit	ad979513-49c.pdf

Administrative Use

Does your project include restoration or acquisition of land rights?

No

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

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 design, construction, or renovation of a building, trail, campground, or other capital asset costing \$10,000 or more?

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?

No

