Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-251

Proposal Title: Mitigations Strategies for Agroplastic PFAS and Microplastic Contamination

Project Manager Information

Name: Joel Tallaksen

Organization: U of MN - WCROC

Office Telephone: (320) 589-1711

Email: tall0007@umn.edu

Project Basic Information

Project Summary: This project examines strategies to reduce water and land contamination from microplastics, PFASs, and other contaminants due to plastics use in agriculture (agroplastics) and their limited recycling options

Funds Requested: $169,000

Proposed Project Completion: June 30 2024

LCCMR Funding Category: Small Projects (H)

Secondary Category: Water Resources (B)

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.

Plastics use in the agricultural supply chain (agroplastics) has been increasing significantly. As a result, the risks of these plastics and their components, such as poly-fluoroalkyl substances (PFAS) and microplastics, ending up contaminating water and soils has grown dramatically. This project's objectives are to identify the scope and scale of agroplastics use, model potential environmental impacts, examine opportunities for mitigating problems, and finally, develop information for farmers, policy makers, and recyclers to establish a system for reducing impacts.

The environmental impacts of microplastics, PFAS, and other agroplastic related compounds are now better understood. PFAS are a particular concern as they are water soluble, long-lasting, and bioaccumulate; meaning that crops will accumulate PFAS from groundwater, and then livestock or people eating the plants will further concentrate the PFAS in their bodies. Microplastics particles from the breakdown of agroplastics have been shown to impact plant growth, and can be moved from soil to water during erosion.

Agroplastics are indispensable in modern agriculture; often being used for containers, in greenhouse construction, plastic mulches, and forage covering. Developing strategies to mitigate the long-term environmental impacts from these agroplastics is important, but very little organized data currently exists on agroplastics or potential environmental impacts.

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

This project quantifies Minnesota's agroplastic use and potential impacts in order to foster the informed discussions between farmers, commercial recyclers, and policy makers needed to develop mitigation strategies to reduce agroplastic impacts. Recycling this material has been difficult because of contamination with dirt or livestock feed, manufacturing chemicals like PFAS, remnant fertilizers, or pesticides.

First, we will work with farmers and farm suppliers to understand the types and volumes of agroplastics in use, where they are being used, and how they are being disposed of.

The next phase of work examines how the contaminants and microplastic particles impact the environment. Already, a handful of farms nationwide have had milk contaminated by non-agricultural PFAS from PFAS contaminated well water. However, are the current quantities in Minnesota's water and soil sufficient to cause health or other problems? Which problems? And what is the result of not attempting mitigation?

A final area of investigation is the current, past, and potential recycling efforts to reduce the likelihood of contaminants entering the environment; and, the factors influencing the success or failure of these efforts. Recently, agroplastic recycling systems have experienced economic challenges related to international plastic prices and their large, dispersed collection territories.

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 main outcome from this project is an informational 'toolbox' that covers the use of and impacts from agroplastic contaminants entering our water and soil systems, and potential mitigations strategies. It will establish a baseline of information so that key participants in the agroplastic issue can develop policies and systems to protect Minnesota's waterways and other natural resources from contamination by the components of agroplastics. Additionally, we intend that this information be more widely disseminated in the agricultural community so that farmers understand why there are growing concerns about the plastics they have been using for decades.

Activities and Milestones

Activity 1: Identifying the Use of Agricultural Plastics

Activity Budget: $65,000

Activity Description:
Estimating total agroplastic use and the types of plastic will be conducted using a number of data sources to overcome the lack of specific data collection on agroplastics. In person/phone call Interviews with willing farm stakeholders will examine their opinions and suggestions on plastics in agriculture. This initial feedback will aid in the development of an online farmer survey. The farmer survey will focus on the plastic use of different farm types and sizes. Disposal methods for plastics will also be a part of the survey. A similar survey will target agricultural chemical and supply vendors. To scale this data up to represent the full volume of agroplastic use in the state, existing data from the USDA-NASS and USDA-ARMS databases on the number and types of farms in each region of the state be combined with data from the farm surveys.

The findings from the survey work will help identify particular problem areas in current recycling efforts. Overcoming these barriers would provide important opportunities for reducing the contaminants from agroplastics that are entering the environment. These opportunities will then be further explored in Activity 3.

Activity Milestones:

Description	Completion Date
Initial Interviews with Farm Stakeholders	March 31 2023
Finish Survey and Data Collection	June 30 2023
Final Report on Agroplastic Use	June 30 2024

Activity 2: Investigate Potential Agroplastic Environmental Impacts

Activity Budget: $65,000

Activity Description:
Potential environmental impacts will be modeled using the farm survey agroplastic type and quantity data from Activity 1. The persistence and movement of agroplastic contaminants in the water and soil will be modeled. The modeling will also rely on existing scientific literature on plastics. Several scenarios will be modeled by looking at the different farm systems (plastic types) and disposal methods identified in Activity 1. Mitigation measures will be modeled based on best management practices of recycling or incineration at regulated facilities.

A further component of the environmental impacts will include data on current contamination of agricultural areas with PFAS and microplastics from the application of biosolid fertilizers and irrigation water from urban and rural wastewater treatment plants. Improper incineration, a potential concentrating source of PFAS for airborne contamination, will also be studied for impacts on agricultural areas. Another emerging issue that will be examined is the potential impact of PFAS that have been reported to be leeching from landfills throughout the state, many of which are in rural areas.

Activity Milestones:

Description	Completion Date
Collect MN-based Contamination Data and Review Technical Literature on Environmental Issues	March 31 2023
Model Typical Minnesota Agroplastic Contamination Scenarios	December 31 2023
Final Report on Potential Impacts of Agroplastics	June 30 2024

Activity 3: Explore Previous, Existing, and Potential Agroplastics Mitigation Strategies

Activity Budget: $39,000

Activity Description:

This activity examines existing and potential options for mitigating likely problems with agroplastic use including recycling, landfilling, and incineration. Interviews will be conducted with willing recycling services that are or have recycled agroplastics, retailers required to accept plastic container returns, and counties working to meet farmer needs. Questions will include, 'what factors are/have limited agroplastic recycling?', 'what opportunities do they see for recycling a broader range of plastics?', and 'what would help stabilize the agroplastics recycling sector for long-term viability?'. We also will contact the leaders of agroplastic collection/mitigation efforts in other states to identify whether these efforts may work in Minnesota or can be modified to meet Minnesota's needs. A major focus of these strategies will be to foster areas for cooperation involving farmers, those in the recycling/mitigation sector, and policy makers/citizens. Strategies will be evaluated based on economics, logistics, and environmental impacts. Outreach literature, videos, and web pages will be established to introduce the agroplastics issues to agricultural and non-agricultural audiences. Developed in a farmer-friendly tone, this outreach information will likely be needed to overcome reluctance of farmers and farm organizations to engage in discussion and actions to reduce potential agroplastic impacts.

Activity Milestones:

Description	Completion Date
Investigate Current Agroplastic Mitigation Strategies and Barriers	December 31 2022
Identify and Examine Alternative Agroplastic Potential Mitigation Strategies	September 30 2023
Final Report on Agroplastic Mitigation Strategies, with Outreach Materials	June 30 2024

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 be funded?

The long-term goal of this work is development of an economically self-sustaining system that meets the convenience needs of participating farmers and the environmental needs of the citizens of Minnesota. The farmers, recycling businesses, and policy makers interested in keeping contaminants such as PFAS and microplastics out of our waterways and soils will be the ones whose efforts will be required to agree to and implement changes to mitigate agroplastic contamination. It is not expected that funds beyond those requested for this proposed data collection effort would be needed to provide data to these core audiences.

Project Manager and Organization Qualifications

Project Manager Name: Joel Tallaksen

Job Title: Research Manager

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

Dr. Tallaksen's current efforts examine a wide array of strategies for improving the resiliency of farming, with a primary focus on environmental and energy issues in agriculture. His goal is to reduce or optimize farm inputs, such as energy or fertilizer, in ways that create productive systems that use less resources and have less environmental impacts. These are core topics of agricultural resilience, which looks at the long-term viability of agriculture in the context of soil and environmental health, economic well-being, and human capital of our farming communities. Making improvements to farm systems often involves working in combination with farmers, policy makers, businesses, and the public to balance the competing interests and responsibilities. Working with a diverse team of animal and crop farmers, researchers, Extension staff, and students, Dr. Tallaksen is able to examine complex agriculture problems and disseminate the results to the diverse audiences he works with. Much of his research uses modeling techniques to evaluate the environmental, energy, and economic aspects of the system he studies. One of the important research tools he uses is life-cycle analysis (LCA), which examines the amount of energy needed and greenhouse gases emitted in a variety of livestock and cropping systems. But the diverse nature of his work relies on data and methods from a number of fields.

Recent Projects involving Dr. Tallaksen:

- Improving alfalfa-based livestock forage production systems using life cycle assessment.
- Breaking barriers to organic swine transition: Utilizing cover crops as feed ingredients to reduce feed cost.
- Evaluate different energy sources for renewable ammonia fertilizer production using life cycle methods.
- Integration of renewable and efficient energy technologies to green energy consumed in agricultural production system
- Environmental Footprints for Regional Swine Production Systems Now and in the Future – A Demonstration Pilot Project
- Optimizing Renewable Electric Generation on Minnesota Dairy Farms

Organization: U of MN - WCROC

Organization Description:

The University of Minnesota is a world class educational and research institution with campuses and research centers throughout the state. The combination of exceptional faculty and staff knowledge with the latest in research facilities and equipment gives the University of Minnesota the ability to consistently conduct ground-breaking research.
The West Central Research and Outreach Center is one of the Universities' living laboratory where agricultural research

can be demonstrated at scale and it serves as a regional center for agricultural stakeholders to discuss current issues in agriculture with a variety of field experts. The decades of farm research that WCROC has conducted has built working relationships with farmers and stakeholders that allows us to work on their farms and get honest feedback from them. Recently, the resiliency of Minnesota farms has been tested as farmers are asked to provide food, feed, and fuel for the nation at the same time they are being asked to do it at a low cost, with a small environmental footprint. WCROC and its research partners have been developing a number of tools and strategies to increase the economic and environmental resilience of the states' farm communities to meet these challenges.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Joel Tallaksen		Principle Investigator-This position is a soft-funded position and is reliant on external research dollars (i.e. the University of Minnesota does not support the position with recurring funds			36.5%	1.5		$136,217
Student Interns		Assist with data collection & outreach- 4 summer students @ 540 hours			0%	1		$28,080
							Sub Total	**$164,297**
Contracts and Services								
							Sub Total	**-**
Equipment, Tools, and Supplies								
	Tools and Supplies	Data collections supplies	Supplies for collection, storage, and organization of research data					$859
							Sub Total	**$859**
Capital Expenditures								
							Sub Total	**-**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	2 yrs x 4 trips per year X 300 miles X $0.56/mile	Travel to meet with stakeholders and professionals within state					$1,344
							Sub Total	**$1,344**

Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	Printing of project report and surveys	Printing of surveys, project outreach literature, and final report.					$2,500
							Sub Total	**$2,500**
Other Expenses								
							Sub Total	**-**
							Grand Total	**$169,000**

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				
			State Sub Total	**-**
Non-State				
In-Kind	University of Minnesota In-kind funds	In kind: The University of Minnesota is forgoing the typical 54.5% federally negotiated indirect cost recovery normally associated with research grants. This funding covers facilities, support staff, and other University activities that are not directly part of the research, but must be present to support research activities.	Pending	$92,045
			Non State Sub Total	**$92,045**
			Funds Total	**$92,045**

Attachments

Required Attachments

Visual Component

File: 1e6dec28-5dc.pdf

Alternate Text for Visual Component

The increasing use of plastics in agriculture. The images below show some of the most important uses of agroplastics in modern agriculture in Minnesota. The Largest use of agroplastics is for preserving forage for livestock by encasing it in air-tight plastic sheeting. Clear plastic sheeting is also used to cover traditional greenhouses and, high and low tunnels greenhouses. Plastic Mulch is used with many fruits and vegetables to prevent soil contact, suppress weeds and reduce evaporatio...

Optional Attachments

Support Letter or Other

Title	File
University of Minnesota Approval Letter	79edffb6-f7b.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?

No

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

The increasing use of plastics in agriculture. The images below show some of the most important uses of agroplastics in modern agriculture in Minnesota. The Largest use of agroplastics is for preserving forage for livestock by encasing it in air-tight plastic sheeting. Clear plastic sheeting is also used to cover traditional greenhouses and, high and low tunnels greenhouses. Plastic Mulch is used with many fruits and vegetables to prevent soil contact, suppress weeds and reduce evaporation of irrigation water. The horticulture sector uses a number of plastic plant containers and trays. Almost all farm and horticultural chemicals come in plastic jugs or barrels. In all cases, the plastic is considered disposable and designed to last no more than one or two seasons. The increased use of these products has driven the worldwide use of agroplastics to around 30 million tons per year based on estimates that 7% of worldwide plastic is used for agriculture. Recent estimates place US agroplastic use at around 7 million tons. While a fraction of the plastic is recycled, most of the plastic ends up in landfills. During this end-of-life landfill phase, agroplastics have the potential to breakdown and release chemicals such as PFAS, Phthalates, BPA, pesticides, and microplastic particles.

Photo credit: Delta Plastics

Photo credit: Rimol Greenhouses

Photo credit: Wikipedia

Photo credit: Freepik.com

Photo credit: State of South Dakota