



Environment and Natural Resources Trust Fund

M.L. 2022 Approved Work Plan

General Information

ID Number: 2022-251

Staff Lead: Mike Campana

Date this document submitted to LCCMR: June 22, 2022

Project Title: Mitigation Strategies for Agroplastic PFAS and Microplastic Contamination

Project Budget: \$169,000

Project Manager Information

Name: Joel Tallaksen

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Project Reporting

Date Work Plan Approved by LCCMR: June 27, 2022

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

Project Completion: June 30, 2024

Final Report Due Date: August 14, 2024

Legal Information

Legal Citation: M.L. 2022, Chp. 94, Art. , Sec. 2, Subd. 04j

Appropriation Language: \$169,000 the second year is from the trust fund to the Board of Regents of the University of Minnesota for the West Central Research and Outreach Center, Morris, to study plastic use in the agricultural supply chain and to research and communicate strategies to reduce impacts of this plastic use, including water and land contamination from microplastics, PFAS, and related compounds.

Appropriation End Date: June 30, 2025

Narrative

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

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? 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 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.

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

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	Approximate 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	Approximate 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	Approximate 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

Dissemination

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

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.

This project is a semi-technical project, with our audiences' with knowledge basis ranging from research scientists to high school students. The toolbox will include a technical report for the more research orientated sector of the audience, newspaper/newsletter/popular for those with a general interest, and a set of policy and practices briefings that will discuss best practices in agroplastic disposal and mitigation measures for farmers and policy makers. We will also create multi-media content to visually highlight the issue and potential solutions. The University of Minnesota, West Central Research and Outreach Center website (<https://wcroc.cfans.umn.edu/>) will be used as the central hub to store the information. However, we intend work with local media, commodity groups, local farmer groups, and our research colleagues to spread our project's information throughout the state.

Project staff will verify that Environment and Natural Resources Trust Fund is acknowledged through use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications per the ENTRF Acknowledgment 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 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.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Joel Tallaksen- Technical staff		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. Depending on Dr Tallaksen's time commitments, funds will be split with a part-time research assistant.			36.5%	0.76		\$70,000
Student Interns		Assist with data collection & outreach- 4 summer students @ 540 hours			0%	1		\$28,080
Research Assistant		Depending on Joel Tallaksen's availability, a part-time research assistant will be used to organize information and collect data. Time and funds allocated for this position are approximate.			36%	0.74		\$66,217
							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
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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 feed by wrapping with plastic. Other uses include ground cover, containers, and pots....

Optional Attachments

Support Letter or Other

Title	File
University of Minnesota Approval Letter	79edffb6-f7b.pdf
Background Check Certification	6449ef0e-c2b.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

On the budget, added text to indicate that a research assistant may help with some of the work using a portion of the salary/time dedicated to the project manager.

Added a description of dissemination work for 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 UMN Policy.

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



