Environment and Natural Resources Trust Fund

M.L. 2021 Approved Work Plan

General Information

ID Number: 2021-212

Staff Lead: Corrie Layfield

Date this document submitted to LCCMR: July 21, 2021

Project Title: Reducing Plastic Pollution With Biodegradable Erosion Control Products

Project Budget: $200,000

Project Manager Information

Name: Riley Gordon

Organization: Agricultural Utilization Research Institute

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Project Reporting

Date Work Plan Approved by LCCMR: July 20, 2021

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

Project Completion: June 30, 2024

Final Report Due Date: August 14, 2024

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 08i

Appropriation Language: $200,000 the first year is from the trust fund to the Agricultural Utilization Research Institute in partnership with the Departments of Transportation, Agriculture, and Natural Resources to demonstrate use of regionally grown industrial hemp to create biodegradable alternatives to plastic-based erosion and sediment control products used in transportation construction projects.

Appropriation End Date: June 30, 2024

Narrative

Project Summary: Utilization of Industrial Hemp to create biodegradable alternatives to plastic-based erosion and sediment control products.

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

Erosion and sediment control are required on construction projects to protect surface waters from pollution and resulting eutrophication. The Minnesota Department of Transportation (MnDOT) installs enough erosion and sediment control products to protect 1,100 acres from erosion and prevent 125,000 tons of sediment from entering surface waters each year. These significant water quality benefits are tainted by the fact that many of these products are made of plastic, a pollutant of emerging concern. Since these products are intended for temporary use, MnDOT construction projects cause over 30 tons of plastic to be landfilled or remain on the landscape, inevitably degrading into micro-plastics. One of MnDOT's sustainability goals is to reduce the use of plastic by requiring biodegradable erosion and sediment controls. However, the state cannot specify products that do not exist and manufacturers cannot be expected to develop products that are not specified. Seed money is needed to demonstrate that biodegradable alternatives can be produced so that the state can start specifying them and manufacturers can start producing them. This project looks to provide a clear path to long-term public-private industry partnerships to ensure without additional grant dollars there are ongoing environmental benefits for decades to come.

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 proposal will establish a unique public-public-private partnership between AURI, MnDOT and regional private industry to develop methods to produce biodegradable erosion control products made from regionally grown feedstocks such as hemp. The project will receive technical support from the Minnesota Department of Agriculture and Minnesota Department of Natural Resources. Project partners will seek input from regional biomass growers (including tribal hemp producers), manufacturers, and installation contractors to guide the effort. The team will then develop methods of processing hemp fibers into biodegradable prototypes of erosion control blankets, hydraulic mulch, sediment control logs, and silt fence. These prototypes will be evaluated through laboratory and field testing. After demonstrating that biodegradable erosion control products are possible, MnDOT can phase in specifications to allow their use. The environmental benefits will be amplified in several ways. The use of these products will extend far beyond state construction projects because MnDOT specifications are also used by local government and private construction projects. Such widespread use will expand opportunities for local hemp production, which is more sustainable than other row crop production. Strong interest by other state DOT's, who face similar obstacles, indicates that what is developed in Minnesota will eventually become adopted nationwide.

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?

- Eliminating a significant source of microplastics in soil and water by replacing single use plastic materials with locally grown biodegradable products
- Proof of concept that biodegradable alternatives to plastic erosion and sediment control products can meet or exceed current specifications
- Development and sharing of methods for processing industrial hemp into functional erosion and sediment control products
- Expanded opportunities for hemp production, which offers significantly greater water quality, soil erosion and C02 sequestration benefits than other crops
- Facilitation of partnerships with growers and manufacturers to encourage ongoing product development and further innovation which will support both the environment and economy

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: Develop Methods of Processing Hemp Stalks into Prototype Erosion and Sediment control products

Activity Budget: $101,959

Activity Description:
AURI will collaborate with manufacturers of erosion control blankets, hydraulic mulch (hydroseeding), sediment control logs and silt fence in order to identify the technical specifications of fibers and yarns necessary to meet state and manufacturer specifications. AURI will then network with textile/fabric experts and manufacturers in order to understand the steps and specifications necessary to achieve a hemp yarn that can be spun or woven into a prototype product. With key variables identified, AURI will source hemp stalks from Minnesota growers and/or tribes and conduct separation work at the Waseca lab and selected private partner sites. Stalks will be processed using AURI's new decorticator and the resulting fiber and hurd will be analyzed for cleanliness and quality. The research and purchase of a fiber cleaning device under this activity will be used to achieve fiber quality necessary for yarn spinning. AURI will then work with selected manufacturer partners in order to transform decorticated and cleaned hemp fibers and hurds into end-product prototypes. Product blends with other agricultural fibers will be explored throughout.

Activity Milestones:

Description	Completion Date
Identify Process for decorticating hemp fiber of necessary quality for use in Erosion Control Products	March 31, 2022
Identify process for twisting yarns of sufficient quantity and quality to create woven materials	June 30, 2022
Prototypes of Hydraulic Erosion Spray and Erosion Control Blanket	December 31, 2022
Sediment Control Log and Silt Fence Prototypes	June 30, 2023
Estimation of Material and Processing Costs to Understand Economic Feasibility	June 30, 2023

Activity 2: Testing yarns, fabrics, and fill materials (loose and blanket materials) in laboratory and field demonstrations to evaluate against performance standards

Activity Budget: $66,958

Activity Description:
MnDOT will coordinate testing of the prototype fabrics, erosion control and sediment control products which are produced through AURI's decortication and identified manufacturer partners. The products will be tested using standardized ASTM testing methods. MnDOT will coordinate and manage the field demonstrations of the prototypes compared to the current standard product, in a standardized setting.

Activity Milestones:

Description	Completion Date
ASTM standards lab testing of yarns, fabrics and fill materials to evaluate performance	December 31, 2023
Field demonstrations of prototype products to evaluate installation, performance, and estimation of service life/biodegradation	March 31, 2024
Report of lab and field-testing results	June 30, 2024

Activity 3: Collaboration with growers, manufacturers, and contractors to inform product and business development and disseminate findings to the public

Activity Budget: $31,083

Activity Description:

AURI and MnDOT will work with product manufacturers, hemp growers and applicators to support the development and commercialization of these bio-based products. Through AURI and MnDOT driven networking and events, the findings will be shared and disseminated with various industry groups. Another dissemination effort will include the development of a one-page fact sheet which highlights the project and product specs developed. MDA will support the efforts of MnDOT and AURI to promote the use of hemp as an alternative to plastic materials in roadside restoration materials. MDA will also provide regular updates on project development and results to hemp licensees, hemp organizations, and agricultural commodity groups throughout Minnesota.

Activity Milestones:

Description	Completion Date
Field Day to promote project findings to public audience	June 30, 2024
Development of 1-page fact sheet summarizing various product specifications, manufacturing process and key benefits	June 30, 2024
Presentation of project findings at specific team selected events	June 30, 2024
Ongoing manufacturer and grower collaboration and networking to inform product and business development	June 30, 2024

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Ken Graeve	Minnesota Department of Transportation	Ken will oversee all of MnDOT's activities on this project. Ken will plan and coordinate all lab and field testing of the prototype products, and also guide the development of products, to ensure that MnDOT's standards are being considered throughout. MnDOT is providing In-Kind support to project for Kens time.	No
Anthony Cortilet	Minnesota Department of Agriculture	Anthony will be the primary contact at the MDA providing industry and grower connections, as well as overall advocacy of the project. Having a primary involvement in the industrial hemp program at the MDA, Tony will provide a valuable resource to this projects third activity, surrounding dissemination and state collaborations	No
Peter Leete	Department of Natural Resources (MnDOT Liason)	Peter is a Transportation Hydrologist for the DNR. Peter will provide any technical support needed along the way from the DNR. He will be the contact for the DNR providing industry connections and overall advocacy for the project.	No
Erik Evans	AURI	Erik is AURI's communications director. Erik will serve the project by aiding in the development of one page fact sheets and presentation materials. Erik will also be the primary editer and packager of any final reporting documents back to the LCCMR.	Yes
Matthew Leiphon	AURI	Matthew will be the lead project manager. He will ensure all project tasks and deliverables are completed in a timely manner, and on budget. He will coordinate team meetings periodically throughout the project in order to maintain oversight and keep everyone connected and focused on the milestones.	Yes
Abel Tekeste	AURI	Abel is a laboratory technician at the Coproducts lab in Waseca. Abel will provide laboratory assistance in producing the decorticated, cleaned and carded hemp fiber. The decortication equipment requires several people to operate at any given time and Abel's role in operation of this equipment will be critical	Yes
Alan Doering	AURI	Alan is AURI senior Coproduct scientist, and operates the lab in Waseca where the fiber decortication equipment is housed. Alan will be a primary operator of the equipment and will be supporting the project by producing decorticated, cleaned and carded hemp fibers.	Yes
Harold Stanislawski	AURI	Harold will be the co-lead on the project for AURI. Harold is a project development director at AURI and has significant connections in the hemp industry. Harold will serve as the lead on the business development and networking components of the project.	Yes
Riley Gordon	AURI	Riley will serve as the lead Principal Investigator. He will be the primary contact for the project. Riley will oversee all technical project tasks including decortication of fiber to meet specs, prototype development, lab and field testing as well as the presentation and dissemination of results through multiple channels.	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.
The dissemination strategy, as discussed under Phase three of the results and deliverables section, will have AURI and MnDOT working with product manufacturers, hemp growers and applicators to support the development and commercialization of these bio-based products. Through AURI and MnDOT driven networking and events, the findings will be shared and disseminated with various industry groups. Another dissemination effort will include the development of a one-page fact sheet which highlights the project and product specs developed. MDA will support the

efforts of MnDOT and AURI to promote the use of hemp as an alternative to plastic materials in roadside restoration materials. MDA will also provide regular updates on project development and results to hemp licensees, hemp organizations, and agricultural commodity groups throughout Minnesota. The Environment and Natural Resources Trust Fund will be acknowledged through use of the trust fund logo or attribution language on any project print and electronic media, publications, signage, or other communication pieces that result from the work per the ENTRF Acknowledgment Guidelines.

Early conversations surrounding this project have indicated a high interest level in the outcomes of this research and the team has had requests to provide presentation updates on outcomes to various groups nationwide, including tribal nations, departments of agriculture and departments of transportation.

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?

This project will develop prototype products to demonstrate how industrial hemp can be processed to create biodegradable erosion and sediment control products. The testing will evaluate the various prototype products abilities to meet or exceed current specifications. This will enable MnDOT to update specifications for biodegradable erosion and sediment control products. Growers and manufacturers will be able to use the processing methods developed by this project to produce products that meet or exceed the updated specifications. The long-term implementation will be sustained by market mechanisms.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
AURI Outreach and AURI Connects Team		Plan, organize and execute a field day showcasing the developed processes and prototype products developed			27.27%	0.06		$6,875
AURI Communications Director		Aid in the development of one page fact sheet and presentation materials. Lead editer and packager of final report			27.27%	0.02		$3,300
AURI Project Manager		Continually track project progress and oversee that completion of deliverables meet timelines and project stays on budget			27.27%	0.06		$6,600
AURI Senior Coproduct Scientist and Coproduct Lab Technician		Primary Operation of AURI Decorticator and Cleaning and Carding of Fibers			27.27%	0.08		$8,800
AURI Project Development Director		Co-lead of project and head of business development, networking and project collaboration efforts			27.27%	0.15		$17,325
AURI Engineer		Principal Investigator			27.27%	0.21		$24,750
							Sub Total	**$67,650**
Contracts and Services								
TBD	Professional or Technical Service Contract	Initial Lab Testing of Prototype Products. Pricing obtained from MnDOT. -Hydraulic Mulch: $500/prototype product * 2 Products -Erosion Control Blanket: $3,500/prototype product * 2 Products -Silt Fence: $2,500/ prototype product * 2 Products -Sediment Control Log: $4,500/ prototype product * 2 Products				0.19		$22,000
TBD	Professional or Technical	Full-scale field testing to meet specifications and prototype product installation in-field by				0.23		$26,000

	Service Contract	contractors --Erosion Control Blanket - $11,500 (breakdown of testing can be provided upon request) --Sediment Control Log - $4,500 (breakdown of testing can be provided upon request) Prototype product installations by contractors - $10,000						
TBD	Professional or Technical Service Contract	Erosion Control Product Prototype Development (based on quotes gathered from private contacts) - Mat Development: $450/hour *10 hours = $4,500 - Hydraulic Mulch Development: $150/hour (100 sy of 3 different hemp fiber inclusions) * 6 hours = $900 - Sediment Control log and silt fencing development = $350/hr * 10hrs = $3500				0.08		$8,900
TBD	Professional or Technical Service Contract	Hemp yarn Development (based on quotes gathered from private industry contacts) 200lb of yarn at $25/lb				0.04		$5,000
							Sub Total	**$61,900**
Equipment, Tools, and Supplies								
	Tools and Supplies	Hemp Bales	Various Hemp Stalk Bales for Processing					$400
	Tools and Supplies	Miscellaneous Supplies	Miscellaneous Supplies throughout project- Shipping containers, wearable lab supplies, Dust masks, gloves, goggles, etc.					$500
							Sub Total	**$900**
Capital Expenditures								

		Carding Device	Carding equipment to clean and align hemp fibers into a roving quality necessary for yarn production					$55,000
		Stationary Bale Unroller	A bale unroller will be purchased in order to safely and efficiently prepare biomass to be fed into the decorticator. Stalks will be delivered in large round bales, which will need to disassembled and properly aligned before feeding into the decorticator. This equipment will streamline this process, saving significant man hours and increasing the safety of the operation.					$5,000
							Sub Total	**$60,000**
Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Travel to prototype development and product testing sites for AURI Engineer (from Lakeville) and Project Development Director (from Fergus Falls) - (2X trip to yarn development site, 4X trips to erosion and sediment product manufacturer, 2X trips to MNRoad site in Albertville) 460 miles x 2; 460 miles x 4; 460 miles x 2 @ $0.575/mile = $2150; Lodging (4 nights hotel stays) - $700; Meals and Incidentals ($50/day for standard areas) - $400	Oversee yarn and prototype development efforts, develop personal relationships with key partners and gather pertinent information and pictures for reporting out					$3,250
	Miles/ Meals/ Lodging	2 trips per year for AURI Engineer (from Lakeville) and Project Development Director (from Fergus Falls) - 460 miles x 2 total trips per year x $.575/mile = $550; 2 hotel stays/year = $350; 2 people x 2 days of meals of incidentals (one in twin cities and one standard areas) =$250	Travel for networking with collaborators to inform business and product development					$3,450
	Miles/ Meals/ Lodging	Meals and Incidentals - 3 x $71/day (rounded)= $225; Lodging - 3 hotel stays - $525; Mileage - 350 miles x 3 events x $.575/mile = $600	Travel to two in-state related industry conferences to disseminate					$1,000

			project findings and grow interest and collaborations					
	Miles/ Meals/ Lodging	AURI Staff Field Day Travel - 3 AURI Staff to travel to field day in Waseca. 2 from Twin Cities, 1 from Fergus Falls. Mileage = 800 miles x $.575/mile = $475. 1 nights hotel ($175). 3 x standard Meals and Incidentals ($50/day) = $150	AURI communications, event planning and business development staff attendance at field day					$800
							Sub Total	**$8,500**
Travel Outside Minnesota								
							Sub Total	**-**
Printing and Publication								
	Printing	fact sheets + other handout materials	Printing of one page fact sheets and presentation materials for field day					$200
							Sub Total	**$200**
Other Expenses								
		Product Shipments	Hemp Fiber shipping to yarn spinners and prototype development groups					$400
		Field day associated costs	Field day resources					$450
							Sub Total	**$850**
							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	MnDOT In-kind cost share of unrecovered ICR (100hrs/yr at $60/hr - ($45/hr salary + $15/hr fringe)	MnDOT will supply in-kind hours for lab and field testing of prototype products as well as reporting out of the results. In addition, they will provide ongoing support and guidance of product development	Secured	$18,000
			State Sub Total	**$18,000**
Non-State				
			Non State Sub Total	**-**
			Funds Total	**$18,000**

Attachments

Required Attachments

Visual Component

File: a2a37497-36a.pdf

Alternate Text for Visual Component

The visual showcases the project opportunity to be explored, which is replacing plastics in soil and erosion control products with biodegradable materials, such as industrial hemp.
Project Partners include the Agricultural Utilization Research Institute, Minnesota Department of Transportation, Minnesota Department of Agriculture and the Minnesota Department of Transportation. Several contracted partners that currently produce erosion and sediment control products will also be key participants...

Financial Capacity

File: cd950332-0ae.pdf

Board Resolution or Letter

Title	File
AURI Board Resolution	a9a4062a-f7d.pdf

Optional Attachments

Support Letter or Other

Title	File
Research Addendum	4e0a3387-cf2.docx
Background Check Form	508b6c84-6ef.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Reduced overall budget from $227,000 to $200,000 through a combination of a reduction of AURI internal hours, reduction of capitol equipment, reduction of supplies, reduction of out-state and in-state travel for dissemination of results and removing the expanded lab and field testing of 1 prototype product from each of the four product categories (previously 3 for each category, now planning for 2 from each category). Also added language to further define the dissemination strategy, and filled out all other '(new)' workplan fields accordingly.

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?

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

Research Partners And Supporters:

auri Agricultural Utilization Research Institute

DEPARTMENT OF NATURAL RESOURCES

DEPARTMENT OF AGRICULTURE

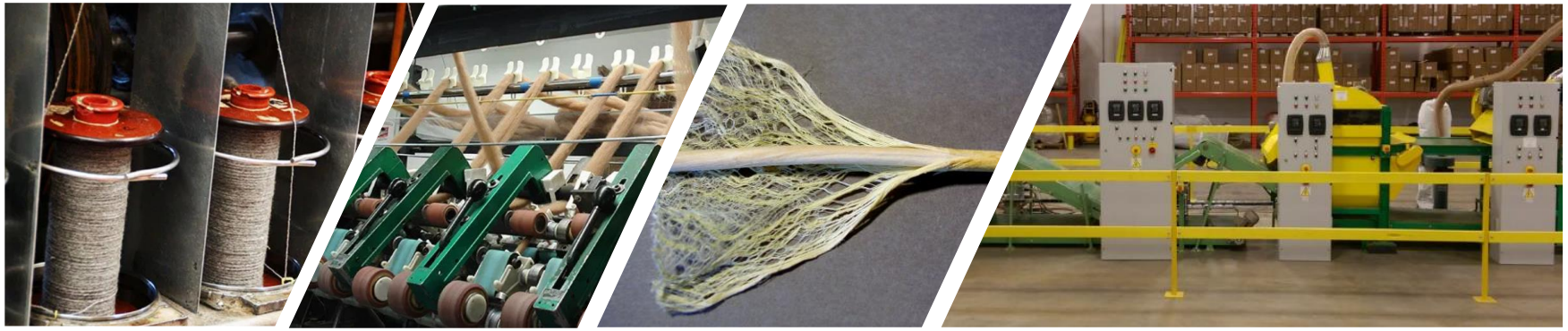
DEPARTMENT OF TRANSPORTATION

MnROAD
Safer, Smarter, Sustainable Pavements Through Innovative Research

Reducing Plastic Pollution with Biodegradable Erosion Control Products

Soil and Erosion Control Product Opportunity Space in MN

- **Erosion control blanket (all types): 1,558,000 square yards/year (State roads)**
- **Hydraulic Erosion control applications (all types): 1,180,000 pounds/year (State roads)**
- **Silt fence (all types): 287,000 linear feet/year (State roads)**
- **Sediment control logs (all types): 441,000 linear feet/year (State roads)**
- **Estimated $30.1 million spent each year on erosion control products on local and state roads in Minnesota**



Outcomes:

- Technical Development of Erosion Control Product prototypes utilizing Industrial Hemp as a replacement for plastic components
- Complete lab and field testing required to evaluate that various prototype products meet or exceed current specifications, allowing MnDOT and other agencies the option to source these biodegradable products for wide scale adoption in MN