



Environment and Natural Resources Trust Fund

2021 Request for Proposal

General Information

Proposal ID: 2021-205

Proposal Title: Scaling A Market-Driven Water-Quality Solution for Row-Crop Farming

Project Manager Information

Name: Nicholas Jordan

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

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Project Basic Information

Project Summary: Adding a year of grain/winter camelina production to Minnesota crop rotations provides a market-driven clean-water solution; our watershed-scale pilot supply/value chains will accelerate wide adoption of this solution.

Funds Requested: \$909,000

Proposed Project Completion: 2024-06-30

LCCMR Funding Category: Water Resources (B)

Project Location

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

Region(s): SE

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

Region(s): SW, SE, NW, Central,

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.

A new option is emerging for improving water conservation in Minnesota row-crop agriculture: integrated production of cool-season and winter grains (such as hybrid winter rye, oat, or pea), followed by the winter-hardy crop camelina. These pairs of crops (a grain, and camelina) can be grown between corn and soybean years of the common corn/soybean crop rotation, adding a third year to these crop rotations and enhancing conservation on Minnesota farms. The grain/camelina system safeguards water by providing continuous living cover of soil for most of the year, thereby substantially reducing soil erosion, runoff of precipitation, and losses of nutrients. In addition to safeguarding water, grain/camelina systems can produce abundant yields of high-value commodities, for which large markets are beginning to emerge. Therefore, enabling Minnesota farmers to add a grain/camelina rotation year to corn/soybean crop production systems will create a new market-driven pathway to clean water. The grain/camelina system also provides other important benefits, such as habitat for pollinators and wildlife, and produces additional value for farmers by improving soil health and management of crop pests (including herbicide-resistant weeds). Therefore, there is high potential to realize many environmental benefits from wide adoption of grain/camelina.

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.

To realize the potential of grain/camelina systems as a market-driven water-conservation strategy for row-crop farms, research, demonstration, and outreach activities are needed to eliminate remaining barriers to wide deployment across Minnesota. We will focus on implementing camelina/grain systems at significant pilot scales in watersheds featuring valuable water resources, building on promising results from a current LCCMR project that is testing camelina in much smaller plots (2 acres), and on other proof-of-concept efforts that have set the stage for pilot implementation in watersheds. Pilot implementation is now critically needed to activate market forces that can drive wide adoption of grain/camelina systems. Specifically, pilot implementation will enable all stakeholders in supply/value chains for these crops—from farmers to food manufacturers—to test and refine systems needed to profitably produce and market these crops. In addition, emerging markets for environmental benefits produced on farms can pay farmers for benefits produced by adding grain/camelina systems to current row-crop farms. Pilot implementation will also enable these markets to develop. The centerpiece of the project is extensive watershed-scale adoption of grain/camelina systems in row-crop farms in several watersheds with highly-valued water resources, including source water protection areas and trout streams.

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?

Our key outcome is to scale up a market-driven water-quality solution for row-crop farming by producing prototype supply/value chains, built on watershed-scale implementation of the grain/camelina system in watersheds with valued water resources. Watershed-scale implementation will enable documentation of water protection and conservation benefits created by implementation at watershed scale, and advances in development of supply/value chains, end-use markets, and markets for environmental benefits produced by the grain/camelina system. Additionally, we will leverage watershed-scale implementation in education, outreach, and engagement activities, increasing awareness of this market-driven water-quality solution among agricultural and conservation stakeholders.

Activities and Milestones

Activity 1: Pilot Extended Rotation on Watershed Scale: Planning and Implementation.

Activity Budget: \$294,120

Activity Description:

Support core groups of farmers in two significant watersheds to design and test an extended crop rotation that adds a grain/camelina year to corn/soybean crop rotation. Working in a source-water protection area for the City of St. Peter (Rogers Creek), and a trout stream in Rice County (Rice Creek), we will engage watershed farmers to explore options for adding this rotation to their farming operation, planning and implementing pilot testing of the rotation on their farms, evaluating results of pilot grain/camelina plantings, and planning and implementing additional pilot plantings as warranted. In both watersheds, farmers are strongly interested in working together for clean water, as a result of previous efforts, creating ideal settings for our ambitious project. The project watershed coordinators (CRWP and GRG in Rice Creek and Rogers Creek, respectively) will organize these activities; technical assistance will be provided by UMN personnel. Coordinator staff will hold up to two individual meetings with each farmer, to explain and discuss options for implementing the rotation. These pilots will collaborate with interested farmers to develop a plan for implementing strategically-placed implementation of the rotation in these watershed, to efficiently protect water while also enhancing farm revenue.

Activity Milestones:

Description	Completion Date
Develop watershed-scale protection plan featuring grain/camelina in row-crop rotations	2022-11-30
Develop on-farm implementation plans for grain/camelina in up to 20 farm operations in watersheds	2023-02-28
Implement production plans for up to 20 farm operations, with production risk and ecosystem-service payments	2024-06-30

Activity 2: . Supply-chain Co-Design with Supply-chain and End-use Partners

Activity Budget: \$86,520

Activity Description:

We will form and facilitate a cross-sector network of end-use and intermediary firms, water-management agencies, watershed groups, the Forever Green Partnership, and others. Our private-sector partners will participate in this network. Participants will identify opportunities for production of the grain/camelina system in crop rotations in the project region, considering production opportunities, potential markets, and potential environmental and social benefits. Similarly, opportunities and requirements for establishing supply chains for these crops will be systematically explored, using structured supply-chain assessment tools developed by the Forever Green Partnership. In these dialogues, participants will share information and perspectives and explore market-driven scenarios for extensive production of these crops in the project region (Southeast and South Central Minnesota). These discussions will enable interested private-sector partners to advance feasibility assessments and planning for supply-chain infrastructure for these crops. Similarly, public and private clients for environmental benefits and public agencies can advance planning of programs to target public resources to support these crops. Finally, the network will collaborate produce a plan for scaling up production of these crops in the project region, projecting crop production and environmental benefits and explore terms (e.g., crop prices, and payments for environmental benefits) needed to implement production at scale.

Activity Milestones:

Description	Completion Date
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Develop regional scenarios for implementation of grain/camelina systems in row-crop rotations extended rotation	2022-06-30
Feasibility assessments for private- and public-sector development and support for grain/camelina and supply chains	2023-01-31
Identify terms needed to implement grain/camelina at scale in regional row-crop farms	2024-06-30

Activity 3: Ecosystem Service Market Development

Activity Budget: \$378,390

Activity Description:

The project will collaborate with the Ecosystem Service Market Consortium (ESMC), extending current piloting in a separate location (the Sauk River Watershed). The ESMC (represented by in Minnesota by project partner The Nature Conservancy in Minnesota) is a major national project prototyping scalable methods for paying farmers for producing environmental benefits (i.e., ecosystem services). The ESMC protocols for establishing marketable water-quality and flow credits for farmers will be adapted for cool-season grains and camelina in the cropping system, and then administered on the acreage in the grain/camelina system in Roger’s and Rice Creeks. To monitor water-quality and flow effects of the grain-camelina system, we will use intensive water sampling, assessing nitrate concentration and flow (water discharge) by sampling at tile outlets and other suitable sampling areas with and without the grain/camelina system. Water quality and flow data from field/watershed monitoring will be compared to estimates from ESMC protocols, enabling verification of the protocols or identification of weaknesses needing refinement. If the ESMC protocols are accurate, the ESMC marketplace will provide a scalable pathway for farmers to capitalize on the increase in ecosystem services provided by their cropping systems.

Activity Milestones:

Description	Completion Date
Install and calibrate water-sampling systems in project watersheds	2022-03-31
Complete verification test of ESMC protocols for grain/camelina system in row-crop rotations	2024-06-30
Assess water quality benefits produced by grain/camelina by water-sampling system and ESMC Protocols	2024-06-30

Activity 4: Support End-Use Entrepreneurs

Activity Budget: \$149,970

Activity Description:

Work on this activity will support the development of sustainable supply chains for camelina through technical assistance, commercialization, and stakeholder engagement. Milestones include a focus on expanding uses and markets for camelina, including the advancement of ecosystems services models that will improve the economic viability of camelina production and provide an additional return to growers. Technical work will focus on assessment of camelina for use in bioproducts and support for businesses in development of camelina-based food products. Results from this work will guide the development of pilot scale projects with private businesses to commercialize camelina-based products. AURI’s outreach component will include organizing an annual field day and inclusion of camelina at annual AURI “Fields of Innovation” events to further awareness, knowledge-sharing, and action planning and building stronger commercialization and supply chain networks for camelina. Outreach efforts will leverage previous efforts in the project region, which is one of three implementation clusters of the Forever Green initiative, creating an increasing level of awareness in regional private, public, and non-profit groups about opportunities to protect water and increase agricultural opportunities by implementing continuous living cover agriculture at scale.

Activity Milestones:

Description	Completion Date
Identify and assess potential uses of camelina in bioproducts including composites and plastics	2022-03-31
Provide technical assistance to Minnesota businesses in the development of camelina based food products	2023-12-31
Build network connections to support the continued development of supply chains for camelina and grains	2024-03-31
Disseminate information developed during project through forums, publications, and other targeted outreach activities	2024-06-30
Engage with end-use firms to advance ecosystem-service markets for Minnesota grain and camelina producers	2024-06-30

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Brad Gordon, Program Manager – Southern MN	Great River Greening	Watershed planning and coordination in Rogers Creek, via individual and group meetings with interested farmers, and support for watershed planning in Rogers Creek and Rice Creek, by modeling agricultural practice impacts in the target watersheds with PTMApp and ACPF.	Yes
Kristi Pursell, Executive Director	Cannon River Watershed Partnership	Watershed planning and coordination in Rice Creek, via individual and group meetings with interested farmers, and water-quality and flow monitoring in Rice Creek.	Yes
Tom Raymond, Director of Environmental Sustainability	Hormel Foods Corporation	Participate in supply/value chain co-design for grain/camelina systems.	No
Erin Heitkamp, Senior Vice President – Agriculture and Public Affairs	Pipeline Foods, LLC	Participate in supply/value chain co-design for grain/camelina systems.	No
Jack Brodshaug, Sustainability Field Manager	Nutrien Ag Solutions	Participate in supply/value chain co-design for grain/camelina systems.	No
Tai Ullmann, Sustainability Manager, Global Edible Oilseeds	Cargill, Inc.	Participate in supply/value chain co-design for grain/camelina systems.	No
David Mulla, Professor, Soil, Water and Climate Department	University of Minnesota	Lead water quality monitoring design, implementation, and analysis.	Yes
Leif Fixen, Agriculture Strategy Manager	The Nature Conservancy	Integrate grain/camelina pilots into Ecosystem Service Market Consortium's Minnesota pilot project.	No
Ryan Anderson, Supply Development Lead	Nori, LLC	Participate in supply/value chain co-design for grain/camelina systems.	No
Michael Stutelberg, Scientist, Chemistry	Agricultural Research and Utilization Institute	Support end-use entrepreneurs developing products from grain/camelina system, through a range of activities as detailed in Activity 4	Yes
Pete Moulton, Director of Public Works	City of St Peter	Participate in supply/value chain co-design for grain/camelina systems.	No
Stefani Millie Grant, Senior Manager, External	Unilever North America	Participate in supply/value chain co-design for grain/camelina systems.	No

Affairs & Sustainability			
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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?

If we are successful, our key outcome—a grain/camelina option for Minnesota row-crop farms—will be rapidly adopted in row-crop farming across Minnesota. There is very strong market interest in sustainably-sourced grains, oils, and protein produced from the grain/camelina system, as reflected by our many private-sector partners. By building prototype supply/value chains, project partners—from farmers to corporations such as Cargill, Unilever, and Hormel—will “work out the kinks” in their systems, setting the stage for major investments that will drive wide adoption of this market-driven water-quality solution, resulting in major benefits for water, soil, and wildlife.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Farmer-Led Expansion of Alfalfa Production to Increase Water Protection	M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 04i	\$500,000

Project Manager and Organization Qualifications

Project Manager Name: Nicholas Jordan

Job Title: Professor of Agronomy and Plant Genetics

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

The Project Manager is Dr. Nick Jordan. He is an agricultural scientist and is co-director of the Forever Green Initiative, a project based at the University of Minnesota. The Forever Green Project is developing a set of new crops that grow during times when summer crops do not grow, while also producing valuable agricultural commodities and marketable environmental benefits. Forever Green's goal is to provide crops that enable market-based solutions to conservation of soil, water and wildlife through agriculture. Dr. Jordan, as Forever Green co-director, has led development of Forever Green's strategy to implement this market-based strategy. This strategy is based on developing pilot supply/value chains that coordinate growth of both supply (crop production) and market demand for these crops, thus surmounting the "chicken or egg" problem that can block adoption of these crops by both farmers and end-use markets (the problem is: which comes first, supply or demand?). More broadly, he has many years of project management experience, including complex, large-budget projects. He will provide project direction, management, and fiscal oversight. The University of Minnesota is the project organization; it is capable of fulfilling all project activities through its research and outreach capacities.

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

Organization Description:

The University of Minnesota’s College of Food, Agricultural and Natural Resources Sciences (CFANS) works to provide comprehensive sustainability solutions by novel solutions to today’s pressing challenges related to food, water, wildlife, and communities. We use science, education, and engage with communities, companies, and organizations to find answers to the world’s grand challenges and solve tomorrow’s problems. Every single day, our students, faculty and staff use science, education, and partnership to create a world that will feed our growing population while sustaining the natural resources upon which we depend. Few public universities come close to the breadth of our expertise, allowing

us to tackle challenges in novel ways. Most importantly, we work with young people to develop leaders that see more possibilities and produce solutions that work for real people.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Technical assistance support for farmers		Develop, coordinate, and deliver custom learning opportunities for individual farmers, groups, and others engaged in integrated grain/camelina in pilot-project region.			31.8%	0.75		\$75,000
Support supply/value chain co-design process and activities.		Serve as liaison between project watersheds (Rogers Creek and Rice Creek) in engaging supply-chain partners for commodities and ecosystem services from grain/camelina system in corn/soybean farms.			36.5%	0.6		\$81,600
Water quality monitoring analysis		Data management, analysis, and report preparation of water quality and flow data from project watersheds.			36.5%	1.2		\$114,660
							Sub Total	\$271,260
Contracts and Services								
Great River Greening	Sub award	Support farmers in Roger's Creek watershed (Nicollet Co.) to design and test an extended crop rotation using the grain/camelina system in corn/soybean farms, engaging at least 12 watershed farms; outreach, connect growers/buyers; support watershed-scale planning for for grain/camelina production with modeling tools PTMApp and ACPF.				0.78		\$87,551
Cannon River Watershed Partnership	Sub award	Support farmers in Rice Creek watershed (Rice Co.) to design and test an extended crop rotation using the grain/camelina system in corn/soybean farms, engaging at least 12 watershed farms; conduct grab-sampling and chemistry tests of tile drainage stream water, and stream invertebrate sampling; provide results to partners.				0.93		\$135,408
Agricultural Resources	Sub award	Establish opportunities and investigate new camelina markets with private businesses; pilot-scale R&D projects for food and non-food uses (e.g.				1.05		\$118,470

Utilization Institute		protein isolate, resins, margarine, etc); organize annual educational field days; organize AURI Connects: Fields of Innovation events for dissemination of market and supply-chain opportunities for grain/camelina system.						
AURI-designated Contractor, TBD	Professional or Technical Service Contract	Contracted technical and analytical services supporting AURI R&D activities.				-		\$15,000
Rice County SWCD	Professional or Technical Service Contract	Collaborate with Cannon River Watershed Partnership in outreach, engagement, and planning activities related to extended rotation with grain/camelina system in corn/soybean farms in the watershed.				-		\$15,000
Contractor TBD	Professional or Technical Service Contract	Ecosystem Service Market Consortium (ESMC) Pilot Auditor will adjust ESMC protocols and algorithms to encompass the addition of cool-season grains and winter camelina into a crop rotation; integrate data from field remote sensing, modeling, and in-field protocol implementation; in-field protocol implementation and soil testing.				-		\$30,000
							Sub Total	\$401,429
Equipment, Tools, and Supplies								
	Tools and Supplies	Water sampling supplies	Roger's Creek: Water-quality monitoring supplies and sample analysis; \$227.76 per sampling week x 34 sampling weeks/yr x 3 years). CRWP Rice Creek: Water Chemistry Tests \$4,000 per year x 3 years; ISCO sampler supplies \$10,000 per year x 3 years; Total water quality sampling supplies and analysis: \$65,232					\$65,232
	Tools and Supplies	Supplies required for Activity 4	Activity 4: Product R&D: Reagent and consumable supplies/chemicals for all years (\$6,000). Activity 4: Field Day budget for all years (e.g. food, flyers, etc) (\$3,000).	X				\$9,000

	Tools and Supplies	Expenses for meetings associated with Activity 1	Costs of printed materials (\$800) and refreshments (\$200) at meetings for participating farmers	X				\$1,000
							Sub Total	\$75,232
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Great River Greening Travel for related to work in project watersheds.	Travel to project watersheds in Nicollet and Rice Counties, involving individual and group meetings with participants in and near those watersheds. Projected travel: 840 miles per year, x 3 years, at 0.575/mile					\$1,449
	Miles/ Meals/ Lodging	Water sample collection	Travel for collection of water samples ((yr 1: 25 Minneapolis-St. Peter round trips x \$94/trip for mileage, per diem; yr 2: 25 Minneapolis-St. Peter round trips x \$95/trip for mileage, per diem; yr 3: 25 Minneapolis-St. Peter round trips x \$96/trip for mileage, per diem: \$7125 total					\$7,125
	Miles/ Meals/ Lodging	Technical assistance to participating farmers.	Technical support (10 Minneapolis-St. Peter round trips/yr, all years x \$95 trip for mileage, per diem). (10 Minneapolis-Dundas round trips/yr, all years x \$69 trip for mileage, per diem). 2850 + 2070. \$4920 total					\$4,920
	Miles/ Meals/ Lodging	Travel related to supply-chain organization	Supply-chain organizer: (10 Minneapolis-St. Peter round trips/yr, all years x \$95 trip for mileage, per diem). (10 Minneapolis-Dundas round trips/yr,					\$4,920

			all years x \$69 trip for mileage, per diem). \$4920 total					
	Miles/ Meals/ Lodging	Travel associated with Activity Four	Travel by technical team, business development team, and outreach team. Pilot scale project sites are unknown currently. Annual field day in Waseca (Mileage: 3 trips to Waseca from various locations @ \$0.575/mile. Travel by Business Development Team to private businesses and investors, various MN locations (\$0.575 per mile; M&IE@ \$71 per day in Minneapolis/St. Paul, outside metro area M&IE@ \$50/day); Travel by the Outreach and AURI Connects team to Field Days (@ \$0.575/mile; M&EI @ \$50 per day), \$2,500/year, \$7,500 all years.					\$7,500
							Sub Total	\$25,914
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
		Risk-share/ecosystem service payments to growers for grain/camelina production	Risk-share/ecosystem service payments to growers of grain/camelina (projected maximum scope: 1500 acres), in partial compensation for risk of lost income in participating in pilot project, and for production of ecosystem services. Note that these payments will only cover losses relative to corn/soybean production alternative.					\$135,165

							Sub Total	\$135,165
							Grand Total	\$909,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Equipment, Tools, and Supplies		Supplies required for Activity 4	Budget is requested to provide refreshments at educational events associated with Activity 4.
Equipment, Tools, and Supplies		Expenses for meetings associated with Activity 1	We request funding (\$200) for refreshments at meetings for participating farmers

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: [e2db33f8-f33.pdf](#)

Alternate Text for Visual Component

Map illustrating the project region for watershed-scale pilot implementation of the grain/camelina system for safeguarding water in Minnesota row-crop farming, indicating that the project area contains many highly-valued water resources such as drinking-water source management areas and trout streams, and indicating the future work will expand to other Minnesota regions containing such water resources.

Administrative Use

Does your project include restoration or acquisition of land rights?

No

Does your project have patent, royalties, or revenue potential?

No

Does your project include research?

Yes

Does the organization have a fiscal agent for this project?

Yes, Sponsored Projects Administration

Project Region & Future Goals

Watershed-scale pilot implementation of the grain/camelina system for Minnesota row-crop farms will demonstrate its value to protect drinking-water source areas and other valued water resources, such as trout streams. We will focus on watersheds in the Southeast-South Central implementation area of the Forever Green Initiative, leveraging implementation efforts for other water-conservation crops such as Kernza® in that area by private-sector and public-sector partners. Future work will expand to protect other key watersheds and water resources, as shown.

COOL-SEASON GRAINS | **WINTER CAMELINA**



