

**Environment and Natural Resources Trust Fund  
2020 Request for Proposals (RFP)**

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**Project Title:**

**ENRTF ID: 210-F**

Adapting 4R Management for the Red River Basin

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**Category:** F. Methods to Protect, Restore, and Enhance Land, Water, and Habitat

**Sub-Category:**

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**Total Project Budget: \$** 459,218

**Proposed Project Time Period for the Funding Requested:** June 30, 2024 (4 yrs)

**Summary:**

This multi-institutional collaboration proposes adapting 4R Nutrient Stewardship for Northwest Minnesotas Red River Basin to improve -fertilizer use efficiency while maintaining profitability and limiting potential impairment to Minnesotas freshwater - ecosystems.

**Name:** Lindsay Pease

**Sponsoring Organization:** U of MN

**Job Title:** Dr

**Department:** \_\_\_\_\_

**Address:** 450 McNamara Alumni Center, 200 Oak St SE  
Minneapolis MN 55455

**Telephone Number:** (612) 625-4276

**Email** lpease@umn.edu

**Web Address:** \_\_\_\_\_

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**Location:**

**Region:** NW

**County Name:** Becker, B eltrami, Clay, Clearwater, Grant, Kittson, Mahnomen, Marshall, Norman, Otter Tail, Pennington, Polk, Red Lake, Roseau, Traverse, Wilkin

**City / Township:**

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**Alternate Text for Visual:**

Location of proposed and existing research sites to be included in Activity 2

_____ Funding Priorities	_____ Multiple Benefits	_____ Outcomes	_____ Knowledge Base
_____ Extent of Impact	_____ Innovation	_____ Scientific/Tech Basis	_____ Urgency
_____ Capacity	_____ Readiness	_____ Leverage	_____ TOTAL _____%



**Environment and Natural Resources Trust Fund (ENRTF)**  
**2020 Main Proposal Template**

**PROJECT TITLE:** Adapting 4R Management for the Red River Basin

**I. PROJECT STATEMENT**

There is an urgent need for effective strategies to reduce nutrient runoff in Northern Minnesota's Red River Basin. Minnesota's Red River Basin watershed is on the leading edge of the expansion of the Northern Corn Belt. With this expansion comes increases in subsurface (tile) drainage, changes in fertilizer application, and alterations in patterns of nutrient loss. This region is not only undergoing a transformational shift in agricultural practices. It also is also experiencing a transformational threat to public health and aquatic ecosystems: harmful algal blooms (HABs). In Minnesota, HABs have led to serious incidents including human illness and pet deaths. Motivating producers to change production practices based on environmental impact is often difficult. Common middle ground can be found through improvement in nutrient utilization to minimize off-site nutrient loss. The 4R Nutrient Stewardship framework encourages thinking critically about nutrient application. The goal is to apply nutrients at the Right Rate, in the Right Place, at the Right Time, and from the Right Source. Previous research has shown that the 4R framework can help to meet load reduction goals in Ohio's similarly flat Western Lake Erie Basin watershed. While promising, the 4R framework must be tested in the harsh winters, wet springs, and dry summers of Northern Minnesota. Defining and adapting 4R Nutrient Stewardship for the Red River Basin is critical to reducing the extent and severity of nutrient runoff from agricultural land to Minnesota's freshwater lakes. Specific project objectives include:

- Evaluate the dual water quality and production benefits of 4R Nutrient Stewardship in the Red River Basin
- Develop outreach programming and resources to engage with stakeholders on 4R Nutrient Stewardship

**II. PROJECT ACTIVITIES AND OUTCOMES**

**Activity 1: Establish a Research Network North-to-South across the Red River Basin (ENRTF: \$266,665)**

*We propose to form a basin-wide, regional research network. This research network will collaborate with, and build upon four (4) existing research sites from the Minnesota Department of Agriculture Minnesota Agricultural Water Resource Center's Discovery Farms Program, and one (1) existing EOF research site in Manitoba in partnership with Canada's Agricultural Water Futures. Existing EOF data will be analyzed collectively with data from two (2) new EOF sites in Minnesota. Adding two new research sites to this effort will strengthen the reliability of project findings through replication of results over time and broader coverage across landscapes.*

Outcome	Completion Date
1. Install monitoring equipment to establish two new edge-of-field research sites in Northern Minnesota	Spring 2020
2. Collect baseline data on nutrient loss and farmer management practices	Spring 2022
3. Network of nutrient loss results spanning from north to south across the Red River Basin	Spring 2022
4. Publish one peer-reviewed synthesis paper of nutrient loss trends in Red River Basin	Spring 2023

**Activity 2: Quantify nutrient loss reduction when using "Right Placement" on nutrient loss in drained and undrained fields (ENRTF: \$165,565)**

*We propose to conduct a coordinated field experiment on fertilizer placement on four of the field sites included in the Research Network. Activity 2 builds on Activity 1 to quantify the impact of 4R Nutrient Stewardship practices on the productivity, profitability, and environmental sustainability of crop production for the Red River Basin. Three fields will be located on glacial lakebed soils in the northern, central, and southern portions of the Red River Basin. A fourth site will be located in the central basin on the sandy soils of the Lake Agassiz beach ridge. This experiment will evaluate four treatments at each site location:*



## Environment and Natural Resources Trust Fund (ENRTF) 2020 Main Proposal Template

1. *Subsurface Drainage, fertilizer incorporated with tillage*
2. *Subsurface Drainage, fertilizer injected or banded into the root zone (subsurface placement)*
3. *No subsurface drainage, fertilizer incorporated with tillage*
4. *No subsurface drainage, fertilizer injected or banded into the root zone (subsurface placement)*

Outcome	Completion Date
1. <i>Conduct coordinated fertilizer placement experiment</i>	<i>Spring 2024</i>
2. <i>Critical findings on the interactions of fertilizer management and off-site nutrient loss</i>	<i>Spring 2024</i>
2. <i>Publish one peer-reviewed journal article on experimental findings</i>	<i>June 30, 2024</i>

### Activity 3: Develop outreach programming and resources on 4R Nutrient Stewardship (ENRTF BUDGET: \$26,987)

*Engagement with stakeholders is critical to adoption of sustainable nutrient management. Our team will produce outreach materials from the start of the project using data from on-going and current projects. As Activities 1 and 2 progress, we will build on these materials and share with the stakeholder networks of the project partners. Stakeholders include growers, nutrient service providers (including co-op agronomists and crop consultants), research and extension personnel, government staff, and the public. We will present findings through field days, seminars, meetings, extension bulletins, news articles, and peer-reviewed manuscripts. The newly established research site in Crookston, MN will serve as a demonstration site for community engagement. The proposed site would be in a highly visible, easily accessible location adjacent to the UMN Crookston campus and Crookston High School. Educational tours will introduce students and community leaders with the efforts of local producers to improve nutrient utilization and reduce off-site nutrient loss.*

Outcome	Completion Date
1. <i>Establish Crookston Research and Demonstration Site</i>	<i>Spring 2020</i>
2. <i>Host 4R Field Day Events in Northwest Minnesota</i>	<i>Summer 2021, 2022, and 2023</i>
3. <i>Share findings on 4R Nutrient Stewardship with stakeholders</i>	<i>June 30, 2024</i>

### III. PROJECT PARTNERS AND COLLABORATORS:

**Dr. Lindsay Pease**, UMN-Northwest Research and Outreach Center (ENRTF Supported)

**Dr. Jeppe Kjaersgaard**, MN Dept of Agriculture (No ENRTF Funds)

**Dr. Heidi Peterson**, UMN-Adjunct (No ENRTF Funds)

**Warren Formo**, MN Agricultural Water Resources Center (No ENRTF Funds)

**Leif Fixen**, The Nature Conservancy (No ENRTF Funds)

**Dr. Amitava Chatterjee**, North Dakota State University (No ENRTF Funds)

**Dr. David Lobb**, Univ. of Manitoba (No ENRTF Funds)

**Mitchell Timmerman**, Manitoba Agriculture (No ENRTF Funds)

**Dr. Merrin Macrae** Univ. of Waterloo (No ENRTF Funds)

### IV. LONG-TERM IMPLEMENTATION AND FUNDING:

This project has partial funding through 2024. Acquired funding includes \$800,000 from the 4R Research Fund, \$35,000 from the Red River Watershed Management Board, and \$60,000 from the UMN Northwest Research and Outreach Center. Following the conclusion of this experiment, sponsored funding will be sought to continue data collection and conduct additional experiments on plot infrastructure established as part of this project.

### V. SEE ADDITIONAL PROPOSAL COMPONENTS:

**A. Proposal Budget Spreadsheet**

**F. Project Manager Qualifications and Organization Description**

Attachment A: Project Budget Spreadsheet  
 Environment and Natural Resources Trust Fund  
 M.L. 2020 Budget Spreadsheet

Legal Citation:

Project Manager: Dr. Lindsay Pease

Project Title: Defining and Adapting 4R Nutrient Stewardship for the Red River Basin

Organization: University of Minnesota

Project Budget: \$459,218

Project Length and Completion Date: 7/1/2020 - 6/30/2024

Today's Date: 4/15/2019



\$459,218

\$266,665 Activity 1

\$165,565 Activity 2

\$26,987 Activity 3

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
<b>BUDGET ITEM</b>				
<b>Personnel (Wages and Benefits)</b>				
Dr Lindsay Pease, Extension specialist, (11%) \$38,207 salary + Fringe (36%) \$13,755		\$ 51,962	\$ -	\$ 51,962
Heidi Reitmeier, NWROC Lab Technician, (50%) \$88,764 salary + Fringe (29.5%) \$26,186		\$ 114,950	\$ -	\$ 114,950
<b>Graduate Research Assistant</b> , (50%) \$79,135 + Fringe (16.1%) + Fringe (Tuition) \$67,511		\$ 146,646		\$ 146,646
<b>Professional/Technical/Service Contracts</b>				
		\$ -	\$ -	\$ -
<b>Equipment/Tools/Supplies</b>				
12 Automated water samplers @ \$3000 each		\$ 36,000	\$ -	\$ 36,000
8 sonic ranging sensors to monitor surface runoff @ \$1375 each		\$ 11,000	\$ -	\$ 11,000
4 pressure transducers to monitor subsurface discharge @ \$750 each		\$ 3,000	\$ -	\$ 3,000
12 Data loggers with enclosure @ \$2000 each		\$ 24,000	\$ -	\$ 24,000
12 Solar panels with regulator @ 1050 each		\$ 12,600	\$ -	\$ 12,600
Miscellaneous expenses and site maintenance (wiring, tubing, plastic bottles, etc.)		\$ 10,000	\$ -	\$ 10,000
Water Sample Analysis (Approx 220 samples/site/year x 2 sites x 4 years @ \$6/sample)		\$ 10,560	\$ -	\$ 10,560
<b>Capital Expenditures Over \$5,000</b>				
		\$ -	\$ -	\$ -
<b>Fee Title Acquisition</b>				
		\$ -	\$ -	\$ -
<b>Easement Acquisition</b>				
		\$ -	\$ -	\$ -
<b>Professional Services for Acquisition</b>				
		\$ -	\$ -	\$ -
<b>Printing</b>				
		\$ -	\$ -	\$ -
<b>Travel expenses in Minnesota</b>				
Project-related travel to research sites for data collection and maintenance, project meetings, to meet with the graduate research assistant on the University of Minnesota Twin Cities campus, and to present project findings at state outreach events and professional meetings (\$5000/year x 4 years)		\$ 20,000	\$ -	\$ 20,000
<b>Other</b>				
Extension Workshop (Field Day) (Food, Printing, Travel) \$1000 x 3 years		\$ 3,000	\$ -	\$ 3,000
Annual Stakeholder & Project Meetings (Food, room rental, stakeholder and collaborator travel) \$5000 x 3 years		\$ 15,000	\$ -	\$ 15,000
Publication costs (2 peer-reviewed publications @ \$250/each)		\$ 500	\$ -	\$ 500
<b>COLUMN TOTAL</b>		\$ 459,218	\$ -	\$ 459,218
<b>SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT</b>				
	<b>Status (secured or pending)</b>	<b>Budget</b>	<b>Spent</b>	<b>Balance</b>
<b>Non-State:</b> 4R Research Fund	Secured	\$ 800,000	\$ -	\$ 800,000
Red River Watershed Management Board	Secured	\$ 35,000	\$ -	\$ 35,000
University of Minnesota-Northwest Research & Outreach Center	Secured	\$ 60,000	\$ -	\$ 60,000
<b>State:</b> N/A		\$ -	\$ -	\$ -
<b>In kind:</b> Minnesota Department of Agriculture & Minnesota Agricultural Water Resources Center: Data collection on four exisiting sites totalling \$30,000 per site each year for four years	Secured	\$ 480,000	\$ -	\$ 480,000
<b>Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS</b>				
	<b>Amount legally obligated but not yet spent</b>	<b>Budget</b>	<b>Spent</b>	<b>Balance</b>
		\$ -	\$ -	\$ -



● Existing Monitoring Sites

▲ Proposed Monitoring Sites

— Red River Basin Boundary

LINDSAY A. PEASE  
University of Minnesota Northwest Research & Outreach Center  
Crookston, MN 57616 • lpease@umn.edu • 218-281-8608

#### PROFESSIONAL EXPERIENCE

- Assistant Professor and Extension Specialist, University of Minnesota – Northwest Research and Outreach Center, Department of Soils, Water, and Climate, Aug 2018 to Present
- Adjunct Assistant Professor, The Ohio State University, Department of Food, Agricultural & Biological Engineering, Jan 2018 to May 2018
- Postdoctoral Research Agricultural Engineer, USDA Agricultural Research Service, Soil Drainage Research Unit, Jun 2016 to Aug 2018

#### EDUCATION

The Ohio State University, Columbus, OH

- Ph.D., Food, Agricultural & Biological Engineering, May 2016
- M.S., Food, Agricultural & Biological Engineering, Jun 2012
- B.S., Food, Agricultural & Biological Engineering, Dec 2010

#### SELECTED PEER-REVIEWED PUBLICATIONS

- **Pease, L.A.**, K.W. King, M.R. Williams, G.A. LaBarge, E.W. Duncan, and N.R. Fausey. 2018. Phosphorus export from artificially drained fields across the Eastern Corn Belt. *J. of Great Lakes Res.*, 44 (1): 43-53.
- Williams, M.R., K.W. King, E.W. Duncan, **L.A. Pease**, and C.J. Penn. 2018. Fertilizer placement and tillage effects on phosphorus leaching in fine-textured soils. *Soil & Tillage Res.*, 178: 130-138.
- King, K.W., M.R. Williams, D.R. Smith, G.A. LaBarge, J.M. Reutter, E.W. Duncan, and **L.A. Pease**. 2018 Addressing Agricultural Phosphorus Loss in Artificially Drained Landscapes with 4R Nutrient Management Practices. *J. of Soil and Water Conserv.*, 73 (1): 35-47.
- **Pease, L.A.**, N.R. Fausey, J.F. Martin, and L.C. Brown. 2017. Projected climate change effects on subsurface drainage and the performance of controlled drainage in the Western Lake Erie Basin. *J. of Soil and Water Conserv.*, 72 (3): 240-250.
- Duncan, E.W., K.W. King, M.R. Williams, G.A. LaBarge, **L.A. Pease**, D.R. Smith, and N.R. Fausey. 2017. Linking soil phosphorus to dissolved phosphorus losses in the Midwest. *Agric. & Environ. Lett.*, 2: 170004

#### SELECTED PRESENTATIONS

- **Pease, L.A.** 2018. Exploring Phosphorus Management in the Red River Valley (*Invited*), 2018 Drainage Research Forum, Owatonna, MN. Nov 13.
- **Pease, L.A.** and K.W. King. 2018. Effect of Rainfall Patterns and Ground Cover on the Intensity of Surface Runoff and Tile Discharge (*Invited*), Conservation Tillage & Technology Conference, Ada, OH. Mar 6 to 7.
- **Pease, L.A.**, K.W. King, M.R. Williams, G.A. LaBarge, E.W. Duncan, and N.R. Fausey. 2017. Phosphorus export from artificially drained fields across the Eastern Corn Belt. International Interdisciplinary Conference on Land Use and Water Quality: Effect of Agriculture on the Environment, The Hague, the Netherlands. May 29 to Jun 1.
- **Pease, L.A.**, N.R. Fausey, J.F. Martin, and L.C. Brown. 2016. Climate, Landscape, and Management Effects on Nitrate and Soluble Phosphorus Concentrations in the Western Lake Erie Basin,” 10th International Drainage Symposium, Minneapolis, MN. Sep 6 to 9.