

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

Project Title:

ENRTF ID: 236-F

Phase II: Economic Assessment of Precision Conservation and Agriculture

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

Sub-Category:

Total Project Budget: \$ 789,648

Proposed Project Time Period for the Funding Requested: June 30, 2023 (3 yrs)

Summary:

Utilizing technology through precision agriculture, precision conservation and drones/remote sensing to improve farmers bottom line, provide additive conservation acres and monitor habitat using drones/sensors to support monarchs, pollinators and wildlife.

Name: Tanner Bruse

Sponsoring Organization: Pheasants Forever

Job Title: Aq & Conservation Programs Manager (MN)

Department: _____

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Location:

Region: Statewide

County Name: Statewide

City / Township:

Alternate Text for Visual:

Full-farm technology approach using drone, remote sensing, machine learning and precision ag data to make conservation decisions, improve farmer profitability and provide effective monitoring efforts for monarchs and habitat availability.

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



PROJECT TITLE: Phase II: Economic Assessment of Precision Conservation and Agriculture

I. PROJECT STATEMENT

Our proposed work expands engagement of Minnesota farmers and leverages remote sensing technology in a holistic farm management approach. In this project, we will demonstrate how the same technology that supports farmers in making decisions about the profitability of their production lands can also help them evaluate existing and add habitat on their farm for pollinator and other wildlife benefits. Our objectives are to:

- Improve the farm’s economic bottom line through direct landowner outreach and consultation in using precision ag tools to identify unprofitable acres and find alternative conservation solutions.
- Provide additive conservation for pollinators in areas where dramatic habitat loss has occurred.
- Make advancements in the use of innovative technology to conduct biological monitoring, which will improve our current understanding of monarch and pollinator habitat in Minnesota, improve data collection efficiency, and model an approach that will drive state and national habitat goals forward.

Agricultural lands are critical in our economy and are also critical for supporting pollinators. Attention on pollinators is growing, especially as species like the once abundant monarch butterfly are petitioned for protection under the Endangered Species Act. To reverse declines and ensure pollinators are here for future generations, we need “All Hands-on Deck”. To succeed, we must pursue traditional and non-traditional conservation methods and partners. Through outreach and technology, this project opens doors for collaboration between farmers and conservationists and uses economics as a driver in the decision-making process to increase farm profitability while increasing conservation benefits for pollinators and other wildlife.

In Phase I of this effort, we had tremendous success cultivating cooperation between farming and conservation professionals by applying cutting-edge precision technology and acre-by-acre data profitability analyses. By focusing on the economic returns of applying alternative conservation practices on acres where it financially made sense, conversations with farmers began to take shape about how to maximize conservation benefits throughout their farms. To foster these conversations and continue to engage more producers and new partners across the state in farm and conservation planning, we have identified additional conservation and technology partners to build on our achievements from Phase I and grow an even greater impact in Phase II.

Phase II brings in two new Minnesota based partners, the Monarch Joint Venture (MJV), a nationally renowned collection of organizations dedicated to increasing pollinator habitat across the U.S., and Sentera, a remote sensing company specializing in small, affordable, and dual-purpose technology. Partners will help us build on Phase I by demonstrating how to use the same tools and technology to measure grassland habitat characteristics on the farm and within the rural landscape. To validate the approach, we will utilize a field crew for both drone operation and field data collection. Density of common milkweed stems will be the primary attribute measured by the drones/sensors and machine learning because a) preliminary feasibility testing has been conducted by partners, b) number of milkweed stems is a primary metric driving state and national monarch conservation targets, and c) the time-efficient approach will allow us to generate more data. The field crew will collect additional, pollinator-relevant habitat measures, like seasonal nectar resource availability. This presents a unique opportunity for broad scale habitat quality evaluation that can improve the tracking and evaluation of our collective efforts and inform conservation approaches.

II. PROJECT ACTIVITIES AND OUTCOMES

**Activity 1 Title: Precision Ag/Conservation for ROI: Sourcing New Acres for Conservation
ENRTF Budget: \$ 492,898**

Two Pheasants Forever precision planning specialists will work throughout Minnesota for three years to engage farmers and retail ag businesses in implementing conservation while maintaining farm profitability. They will leverage expertise of the MJV and Sentera to expand the use of precision ag technology in a more



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

holistic approach to pollinator and wildlife conservation on their farms.

Interpretation and Outreach: Pheasants Forever and the MJV will conduct outreach, including one-on-one consultations with farmers and field workshops to learn about farmer motivations to do conservation, present realistic conservation opportunities and showcase an innovative approach for producers to be both environmentally and economically sustainable. Data gathered will be leveraged to improve national monarch habitat models (which drive conservation targets) and to explore expansions of using this technology for biological monitoring.

Outcome	Completion Date
1. ~5000 new or enhanced conservation acres sourced from precision and direct conservation planning with ~100 Minnesota farmers.	<i>June 30, 2023</i>
2. Endorsement from agribusiness, farmers and technical assistance providers to expand the use of precision ag technology and promote pollinator conservation	<i>June 30, 2023</i>
3. 300 landowners or professionals reached through 6 farmer engagement events/workshops held and presentations to at least 4 local meetings (i.e. SWCD)	<i>June 30, 2023</i>

**Activity 2: Pollinator Habitat Evaluation Using Field Crews and Aerial Surveys
ENRTF Budget: \$296,750**

Field Survey: Two survey teams will assess pollinator habitat at 100 grassland or other potential habitat sites on Phase I and Phase II farms. Up to 3 times throughout the growing season, they will deploy drones equipped with sensors to collect data about common milkweed density and will conduct a field survey to gain additional information, including nectar plant availability, monarch presence, and overall site characteristics. While not a deliverable of this project, drones will simultaneously collect exploratory images to determine future expansions of using this technology for biological monitoring.

Imagery Interpretation and Technology Development: Sentera will train crews to gather information using the drones and sensors (Phantom 4 Pro Drone with Double 4K Multispectral Conservation Kit). They will fly drones/sensors across transects at different altitudes at different stages of plant development to determine the best ground sample distance for future application. Both RGB and NDVI information will be collected. MJV will facilitate volunteer support in training algorithms to identify and count milkweeds.

Outcome	Completion Date
1. Monarch and pollinator habitat evaluation on 100 sites in Minnesota using a combination of field surveying and aerial drone surveys.	<i>September 2022</i>
2. Proven approach for using remote sensing technology to detect monarch habitat in a variety of conditions. Assessment of potential future applications.	<i>June 2023</i>
3. A framework for how to use remote sensing technology to advance local, regional and national scientific monitoring objectives and conservation strategies.	<i>June 2023</i>
4. Expanded information about grassland habitat quality and availability across MN.	<i>September 2022</i>

III. PROJECT PARTNERS AND COLLABORATORS: Pheasants Forever, Monarch Joint Venture, Sentera

IV. LONG-TERM IMPLEMENTATION AND FUNDING:

This work is an important step in fostering long-term partnerships between conservation and agricultural stakeholders by identifying opportunities to advance both conservation and production objectives and leveraging innovative technology. We see great potential in the efficiency of this approach to strengthen biological datasets for pollinator habitat across Minnesota, which leads to a more targeted and efficient approach to conserving pollinators in the state. Technology is already a major part of advancing today’s agriculture practices, so we see this as an opportunity to bring together farm profitability analyses and conservation implementation and monitoring to maximize the effectiveness of limited conservation dollars.

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



Legal Citation:
 Project Manager: Tanner Bruse
 Project Title: Phase II: Economic Assessment of Precision Conservation and Agriculture
 Organization: Pheasants Forever
 Project Budget: \$789,648
 Project Length and Completion Date: 3 years ; June 30, 2023
 Today's Date: 4/11/2019

ENVIRONMENT AND NATURAL RESOURCES TRUST FUND BUDGET		Budget	Amount Spent	Balance
BUDGET ITEM				
Personnel (Wages and Benefits)				
2 Precision Ag and Conservation Specialists (70% Salary, 30% benefits) 2 FTES per year over 3 years		\$ 406,228		\$ 406,228
4 technicians for drone and survey collection of data (100% salary) total of 2 FTE's per year over 3 years		\$ 180,080		\$ 180,080
Project Manager (70% salary 30% benefits) 25% FTE per year over 3 years		\$ 57,240		\$ 57,240
Professional/Technical/Service Contracts				
Sentera, a Minnesota company has been selected as the sole source supplier of sensor and drone technology - Designers and builders of the smallest and most lightweight sensors available for precision agronomy. The sensors are dual-purpose in that they can be used for precision agriculture and conservation. Additionally, Sentera performed preliminary research to realize an ability to discern Common Milkweed with their sensors, reducing the cost and development to scale the technology for broad scale use.				
Software, operational training, non-recurring engineering services, algorithm testing and refinement, data processing and report formatting and production		\$ 19,404		\$ 19,404
Equipment/Tools/Supplies				
Drones to conduct reaserch for milkweed monitoring and habitat components		\$ 3,600		\$ 3,600
Sensors to attach to drone for monitoring and habitat components		\$ 4,400		\$ 4,400
Supporting Hardware such as chargers, cases, batteries etc.		\$ 2,596		\$ 2,596
Printing				
		\$ -		\$ -
Travel expenses in Minnesota				
Travel, meals and overnight stay related to travel for specialists meeting with farmers and technicians on research work				
Travel: 45,000 miles per year over all positions @ \$0.58 per mile (or government rate at the time) = \$78,300 plus meals and lodging for in-state travel over all positions over 3 years = \$25,000 plus 5,000 miles per year for project manager x \$0.58 (or current state rate at the time) = \$7,800		\$ 111,100		\$ 111,100
Other				
Outreach and outreach events		\$ 5,000		\$ 5,000
COLUMN TOTAL		\$ 789,648	\$ -	\$ 789,648
SOURCE AND USE OF OTHER FUNDS CONTRIBUTED TO THE PROJECT				
	Status (secured or pending)	Budget	Spent	Balance
Non-State:		\$ -	\$ -	\$ -
State:		\$ -	\$ -	\$ -
In kind:		\$ -	\$ -	\$ -
Other ENRTF APPROPRIATIONS AWARDED IN THE LAST SIX YEARS				
	Amount legally obligated but not yet spent	Budget	Spent	Balance
ML 2014, Minnesota Pollinator Partnership		\$ 100,000	\$ 100,000	\$ -
ML 2017, Minnesota Bee and Beneficial Species Habitat Restoration		\$ 732,000	\$ 222,809	\$ 509,191
ML 2017, Economic Assessment of Precision Conservation and Agriculture		\$ 400,000	\$ 88,541	\$ 311,459

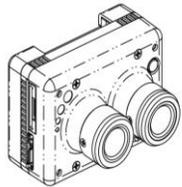
Full-Farm Approach Using Innovative Technology to Generate Monarch, Pollinator and Wildlife Habitat with Better Financial Outcomes for Farmers



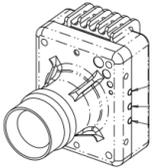
Using sensor and software tools to identify potential changes to production practices will identify opportunities for different income streams through conservation while reducing operational costs of poor-performing acres. Using the same tool across an entire farm will facilitate a host of benefits for soil, water, wildlife and pollinators.

These scalable, cost-effective, and efficient solutions support the identification and census of common milkweed and demonstrate how remote sensing can increase efficiencies, reduce error and bias, and provide valuable decision-making data to inform conservation and land management practices.

How the technology works:



Appropriate Sentera cameras and sensors.

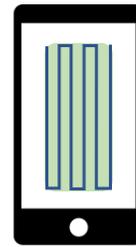


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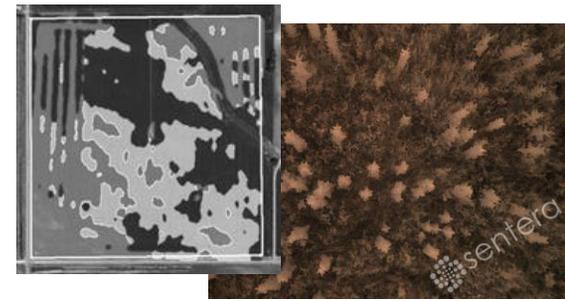
Drone integrated with appropriate cameras and sensors.

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Mobile app flies drone autonomously to acquire scientific data.

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Position and high resolution data are collected for training and machine learning for milkweed and conservation opportunity.

Applying the data for whole-farm and conservation benefit:



Machine learning identification and count of Milkweed plants. (Note: Light colors indicate Milkweed in sea of green grasses)



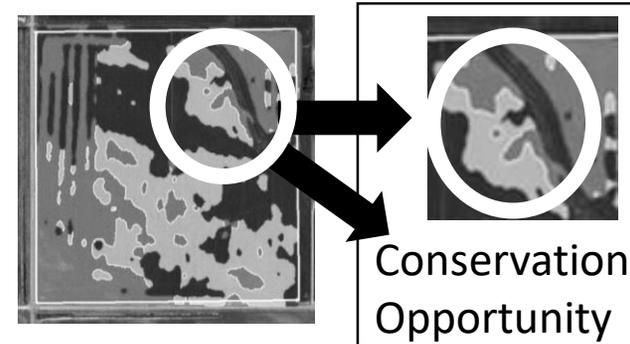
Testing and Quality Assurance

Compare researcher observations with sensor data to confirm accuracy.



Data-driven Reporting

GPS location of plant. Which can be used to count, report trends, identify values, etc.



Conservation Results and Grower Profitability

Zone maps are used to visualize, measure and manage collected data faster for conservation opportunity and farmer return on investment.

Project Manager Qualifications:

Tanner Bruse, Ag & Conservation Programs Manager (MN)

Pheasants Forever, Inc.

A.A. General Education – South Central College, Mankato, MN. 2007

B.S. Wildlife & Fisheries Science - South Dakota State University, Brookings, SD. 2012

Tanner has experience working directly with landowners, as a Farm Bill Biologist, helping them with habitat management and enrolling them in voluntary conservation programs. As the Ag & Conservation Programs Manager (MN) he supervises a talented team of 19 employees including Farm Bill Biologists and Precision Ag and Conservation Specialists. Tanner will be responsible for all required reports for LCCMR.

Organization Description:

Pheasants Forever (PF) is a non-profit 501(c)3 conservation Pheasants Forever is dedicated to the conservation of pheasants, quail and other wildlife through habitat improvements, public awareness, education and land management policies and programs. Pheasants Forever has over 145,000 members and 700 chapters nationwide doing grassroots conservation. Historically PF has impacted 18 million acres, completed 540,000 habitat projects and acquired 197,498 acres with 1,565 land acquisitions since 1982. PF has invested \$867 million dollars on habitat projects and education programs. Pheasants Forever is a 4 star charity navigator for over 5 consecutive years showing the efficiency of the organization and vested interest in mission delivery.