**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**

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| **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 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.

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

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| **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.
 | *September 2022* |
| 1. Proven approach for using remote sensing technology to detect monarch habitat in a variety of conditions. Assessment of potential future applications.
 | *June 2023* |
| 1. A framework for how to use remote sensing technology to advance local, regional and national scientific monitoring objectives and conservation strategies.
 | *June 2023* |
| 1. Expanded information about grassland habitat quality and availability across MN.
 | *September 2022* |

**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.