Environment and Natural Resources Trust Fund

M.L. 2024 Approved Work Plan

General Information

ID Number: 2024-224

Staff Lead: Tom Dietrich

Date this document submitted to LCCMR: June 17, 2024

Project Title: Remote Sensing for Pollinator Habitat

Project Budget: $180,000

Project Manager Information

Name: Wendy Caldwell

Organization: Monarch Joint Venture

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Project Reporting

Date Work Plan Approved by LCCMR: June 20, 2024

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

Project Completion: June 30, 2026

Final Report Due Date: August 14, 2026

Legal Information

Legal Citation: M.L. 2024, Chp. 83, Sec. 2, Subd. 03x

Appropriation Language: $180,000 the second year is from the trust fund to the commissioner of natural resources for an agreement with Monarch Joint Venture to use remote sensing technology to evaluate pollinator habitat on energy and transportation corridors across Minnesota and to host field-day training workshops.

Appropriation End Date: June 30, 2027

Narrative

Project Summary: This project uses remote sensing technology (UAVs) to evaluate pollinator habitat on energy and transportation lands across Minnesota.

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

The Monarch Joint Venture (MJV) facilitates a network of stakeholders to achieve widespread conservation action for multi-species benefits nationwide. To address community information needs and inform future strategies and priorities, we must evaluate the availability and quality of grassland habitats across land use sectors and the monarch range. A critical component in measuring monarch conservation progress is quantifying milkweed host plants and nectar resources. These key metrics inform assessment and associated decision making surrounding species conservation. In particular, these include the potential listing for monarchs under the Endangered Species Act and an associated mechanism, the Monarch Candidate Conservation Agreement with Assurances (CCAA) for Energy and Transportation Lands.

To achieve a meaningful inventory of monarch habitat, we need to establish current baseline conditions and track progress towards the community goal of 1.8 billion milkweed stems added to the landscape throughout the range of the eastern North American population. Current tracking and monitoring efforts are costly and not operating at the scale required. To overcome these barriers, we have developed and implemented remote sensing tools that are cost-effective, scientifically valid, provide significant opportunities for expanded applications, and are easy to deploy at a much grander scale than current realities.

What is your proposed solution to the problem or opportunity discussed above? Introduce us to the work you are seeking funding to do. You will be asked to expand on this proposed solution in Activities & Milestones.

MJV and their technology partner, Simple Business Automation (SBA), completed a process to identify common milkweed (Asclepias syriaca) from UAV images. SBA's software platform and tool allows commercial drone operators to program flights, collect data (images) via standard procedures, and process those images to produce milkweed density reports, with a nectar resource analytic available by summer 2024. The milkweed algorithm can recall 80% of the milkweed plants in an image with a precision of nearly 93%. We are proposing to utilize and expand this technology.

Building upon datasets being gathered during 2023-2024 on public and private lands in Minnesota, this project will evaluate energy and transportation rights of way across the state using the remote sensing platform, and produce reports compatible with their requirements for enrollment in the Monarch CCAA. Data generated through this project will inform stakeholder reporting and decision making, feed into state and national models for monarch conservation, and provide a more comprehensive landscape assessment across Minnesota's land uses. Additionally, we will collect machine learning training data and develop at least one algorithm to detect targeted invasive species prioritized by project stakeholders. Finally, we will host workshops and create training resources for continued use of this technology.

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?

A robust assessment of pollinator habitat on Minnesota's energy and transportation lands quantifying both common milkweed and nectar resource availability, complementing a dataset covering public and private lands in Minnesota.

At least one invasive species detection and mapping model added to the remote sensing platform.

Training for project stakeholders for expanded use of remote sensing technology for monitoring pollinator habitat and invasive species, made available through MJV's online learning management system.

A quantitative and qualitative review of the measured attributes prepared and made available for use in the state pollinator report/other uses informed by the Interagency Pollinator Protection Team.

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: Remote sensing field work on statewide energy and transportation rights of way.

Activity Budget: $138,838

Activity Description:
The project manager and remote sensing specialist will work with the project's stakeholders to select sites and receive appropriate permissions and access. At least 70 sites will be selected representing a mix of roadsides, energy ROW, and solar arrays across the state. The remote sensing specialist will then travel throughout the state of MN to complete two field seasons of data collection (July-August 2024 and May-August 2025) using cameras mounted on UAVs. Incidental observations made during surveys, including the existence of pollinators and other species of interest to the land manager, will be documented through various community science databases as appropriate (e.g., BumbleBee Watch, iNaturalist, Journey North, Monarch Larva Monitoring Project, Integrated Monarch Monitoring Program).

Data processing, analyses, and report writing will be conducted between field seasons and at project completion. Data summaries will be provided to landowners for each individual site surveyed, and will be aggregated into a summary report for broader consumption. Data privacy considerations and restrictions will be documented and honored. Site reports will include measures of common milkweed (Asclepias syriaca), including the number of stems per acre, total number, and the percent coverage of blooming nectar resources.

Activity Milestones:

Description	Approximate Completion Date
Stakeholders engaged and field season established	July 31, 2024
20 energy and transportation sites surveyed using remote sensing technology during the 2024 field season.	September 30, 2024
Individual and summary reports for 2024 field season prepared	December 31, 2024
Stakeholders engaged and 2025 field season is organized.	April 30, 2025
50 energy and transportation sites surveyed using remote sensing technology during the 2025 field season.	September 30, 2025
Final reports made available to individual landowners/site managers.	December 31, 2025
Summary report for project is generated and made publicly available.	January 31, 2026

Activity 2: Develop a new machine learning model for detecting the presence of a targeted invasive species.

Activity Budget: $13,600

Activity Description:
The Project Manager and Remote Sensing Specialist will work with project stakeholders (MnDOT, East Central Energy, Enel Green Power, Connexus and others) to create a prioritized list of desired machine learning algorithms to develop for invasive species detection, mapping, and management. The highest priority species will be targeted for this project, while the remaining species will be prioritized for future projects.

The MJV maintains a research development team through its staff and partners to guide the scientific design of model development and ground truthing and works with machine learning engineers on technology development. We will work with this team to design and implement the new invasive species model development. The remote sensing platform will also facilitate a self-propelled model development platform where we can upload images and produce the annotations necessary to advance machine learning.

After collecting training and ground truthing data and annotating images collected during each field season, we will have a well functioning algorithm for a common invasive species that can be used to map and quantify problem areas on the landscapes. Finally, we will reprocess the images collected during each field season to evaluate them according to the invasive species model (vs. milkweed and nectar models).

Activity Milestones:

Description	Approximate Completion Date
Stakeholders engaged and priority list of invasive species developed.	September 30, 2024
Initial training and ground truthing data for invasive species model gathered.	September 30, 2024
Training data annotations complete.	January 31, 2025
Machine learning model developed and incorporated into remote sensing software platform.	May 31, 2025

Activity 3: Live and asynchronous training for expanded, long-term adoption of remote sensing technology by state stakeholders.

Activity Budget: $27,562

Activity Description:
The Remote Sensing Specialist will host in-person field-day workshops as they conduct their statewide surveys, inviting local and regional stakeholders and interested conservation staff to shadow and participate in pollinator habitat monitoring with UAVs. In the off season, the Specialist will develop asynchronous, virtual training for use of the remote sensing platform. A syllabus will be created for training needs based on stakeholder input and engagement and may include videos, presentations, FAQs, research articles, and guides for UAV and software application. Virtual training and online learning modules will be available via MJV's online learning management system to ensure continued opportunity for increased engagement. Through these in person and virtual trainings we anticipate an additional 5-20 trained UAV operators implementing data collection on ROW in MN in subsequent years. To disseminate this information more broadly, our work with remote sensing on energy and transportation ROW will be included as a topic in MJV's monthly Monarch Conservation Webinar Series.

Activity Milestones:

Description	Approximate Completion Date
One in-person stakeholder training completed during the 2024 field season.	September 30, 2024
Two to three in-person stakeholder trainings completed during the 2025 field season.	September 30, 2025
Asynchronous learning modules available through MJV's online learning management system.	June 30, 2026
Webinar held to disseminate project results.	June 30, 2026

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Rob Davis	Connexus Energy	Representing the solar and energy sector, Rob has been a leading partner at engaging the solar industry in pollinator conservation in Minnesota. Rob would serve as a connector and innovator to help us select and access habitat sites on solar arrays and encourage additional participation from the energy sector.	No
Chris Smith	Minnesota Department of Transportation	MnDOT has been a valued partner in MJV's efforts to develop tools for roadside managers to assess and prioritize habitat. MnDOT has also developed targets for pollinator habitat conservation efforts in MN and would help us select appropriate roadside habitat for remote sensing surveys.	No
Alicia Kroll	East Central Energy	As East Central Energy's manager of their Monarch CCAA agreement, Alicia would help ensure access to habitat sites for evaluation on ECE's rights of way throughout the state.	No
Jesse Puckett	Enel Green Power	Jesse would serve as our contact at Enel North America to help us select and access solar sites for remote sensing surveys in Minnesota, and encourage broader adoption of this habitat and evaluation technique across Enel's national projects in the future.	No
Greg Emerick	Simple Business Automation	Simple Business Automation is the MJV's technology partner who has developed the software platform used in this project. SBA will help process field data (project funds) and facilitate development of a new software to detect a selected invasive species (financed through match).	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.
Data collection efforts will produce reports of findings and raw data that will be made available to each respective landowner or land manager where MJV surveys for their own use in reporting and adaptive management of their habitats. Data will be aggregated into a statewide dataset for use by state and national stakeholders in monarch and pollinator conservation (respecting data privacy considerations encountered with project stakeholders). Unless restricted by landowner, all data will be made available for broader research efforts upon request. A project report will be provided to ENRTF and other stakeholders for use in promotional materials as deemed appropriate, including for inclusion in the interagency pollinator team's annual reporting of pollinator conservation status and trends. The MJV will also post relevant project updates and a summary of results/findings on our website, www.monarchjointventure.org, including in print or online materials, and at least one webinar.

Acknowledgement of the ENRTF will be included in all project communications and outreach, including press releases, media interactions, signs, publications, event advertisements & invitations, websites, newsletters, printed materials, presentations, and social media. We will use the ENRTF logo where appropriate, include verbal or written acknowledgement language, and when relevant, will tag ENRTF on social media when disseminating project results or activities.

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 work be funded?
Unless restricted by the landowner, data will be available to researchers and conservation stakeholders. Minimally, a summary report presenting scientific findings of the project will be published on the MJV website. We'll ensure project

stakeholders have the resources and knowledge to continue habitat surveys, with training videos available on MJV's online learning system for long-term access. The common milkweed, nectar availability, and invasive species algorithms will be available for future use by energy/transportation companies, government agencies, and the public. As functionality expands, the remote sensing platform will be used more broadly by commercial stakeholders increasing sustainable revenue generation.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Project Manager (technical science)		Manages Remote Sensing Specialists and provides technical science support, including site selection criteria, data analysis, and report writing.		X	26%	0.5		$39,375
Remote Sensing Specialist		Organizes and conducts remote sensing field work, facilitates in-person workshops for project stakeholders, develops online training materials on the use of remote sensing technology, and organizes and annotates data (images) for new machine learning algorithm.			26%	1.5		$118,125
							Sub Total	**$157,500**
Contracts and Services								
Simple Business Automation	Professional or Technical Service Contract	Data processing of the data (images) collected during two remote sensing field seasons.				0.05		$4,000
							Sub Total	**$4,000**
Equipment, Tools, and Supplies								
	Tools and Supplies	Extra UAV battery (2), UAV battery charger (1), UAV screen shade (1), Fireproof battery case (2), Micro SD card (4), Fuel for charging station (6), vehicle field magnets (2), paracord for field validation plots (1), whiteboard for validation plots (1), 3-ring binders (2), pencils (5), first aid kit (1)	For use during remote sensing field surveys.					$490
							Sub Total	**$490**
Capital Expenditures								
							Sub Total	**-**

Acquisitions and Stewardship								
							Sub Total	**-**
Travel In Minnesota								
	Miles/ Meals/ Lodging	Mileage reimbursement at the current IRS rate of $0.655/mile and anticipating 4,500 miles of travel in 2024 and 8,500 miles of travel in 2025.	For the Remote Sensing Specialist to drive throughout the state to conduct field surveys.					$8,515
	Miles/ Meals/ Lodging	30 nights of lodging at $140/nights	Lodging for Remote Sensing Specialist while traveling long distances for field surveys.					$4,200
	Miles/ Meals/ Lodging	($11 breakfast, $13 lunch, $19 dinner)	82 breakfasts, 83 lunches, 82 dinners while traveling for field work					$3,540
	Miles/ Meals/ Lodging	4 nights of lodging at $140/night.	Lodging for Project Manager during field season check-in.					$560
	Miles/ Meals/ Lodging	Mileage reimbursement at the current IRS rate of $0.655/mile and anticipating 305 miles of travel, rounded to the nearest dollar.	For Project Manager to travel to survey sites during field season check-in.					$200
	Miles/ Meals/ Lodging	($11 breakfast, $13 lunch, $19 dinner)	7 breakfasts, 8 lunches, and 6 dinners for Project Manager while traveling to field sites & providing training for the technician					$295
							Sub Total	**$17,310**
Travel Outside Minnesota								
	Other	1 round trip flight between Michigan and Minnesota.	Travel (flight) for the Project Manager (based in MI) to conduct a field season check-in on site in MN.	X				$500
							Sub Total	**$500**
Printing and Publication								
	Printing	250 double-sided and hole punched paper datasheets over two field seasons, at $0.40/page, 'survey in progress' printed signs (2)	For use by the Remote Sensing Specialist while conducing field surveys.					$200
							Sub Total	**$200**

Other Expenses								
							Sub Total	**-**
							Grand Total	**$180,000**

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
Personnel - Project Manager (technical science)		Manages Remote Sensing Specialists and provides technical science support, including site selection criteria, data analysis, and report writing.	While our remote sensing specialists are based in Minnesota, our long-standing science program manager who leads the overarching program is remotely based in Michigan. She manages staff remotely through standing weekly check-ins and additional as needed meetings. She provides in-person training in Minnesota from time to time, and leverages additional Minnesota based leadership team to provide secondary support and oversight where needed. The Project Manager is the primary staff person qualified for data managaement and analysis activities relating to the program, and her involvement there is key to supporting the locally based MN team in presenting their results. The only work conducted by the project manager for this project will either be MN based training, or remote-based computer work directly relating to the project's MN footprint (project staff supervision, data analysis, etc.). It is infeasible to relocate existing management staff to Minnesota for their role in the project.
Travel Outside Minnesota	Other	1 round trip flight between Michigan and Minnesota.	The Project Manager is MJV's Science Manager, who works remotely from Michian. This staff member has been with MJV for 6 years and will travel to Minnesota once to provide in-field training & support to the Remote Sensing Specialist and project collaborators. She provides expertise in program history and implementation and will provide necessary in-person training to MN based field staff.

Non ENRTF Funds

Category	Specific Source	Use	Status	$ Amount
State				
			State Sub Total	**-**
Non-State				
Cash	Mixed corporate and family foundation support	Machine learning algorithm/software development for targeted invasive species.	Potential	$120,000
			Non State Sub Total	**$120,000**
			Funds Total	**$120,000**

Attachments

Required Attachments

Visual Component

File: 86a2d775-a9c.pdf

Alternate Text for Visual Component

UAV hovering over a flowering field demonstrating how we will evaluate pollinator habitat; solar panels behind common milkweed demonstrating how we will engage the energy and transportation sector; aerial image with red boxes drawn around the species the algorithm is being trained to detect demonstrating our machine learning process....

Financial Capacity

File: 364fce39-3bb.pdf

Board Resolution or Letter

Title	File
MJV Board Resolution Letter	b29b3982-37b.pdf

Supplemental Attachments

Capital Project Questionnaire, Budget Supplements, Support Letter, Photos, Media, Other

Title	File
East Central Energy Letter of Support	77465294-aa8.pdf
Enel North America Letter of Support	6814fc64-2aa.pdf
MN Dept. of Transportation Letter of Support	1ab4c0a0-7e3.pdf
University of Illinois Chicago, Energy Resource Center Letter of Support	ad4cfb9b-7ae.pdf
US Geological Survey Letter of Support	b78febc1-e92.pdf

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

Added some additional supplies and printing items to include within budget line (cost did not change). Reviewer comments implemented.

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?

N/A

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, sale of products and assets, or revenue generation?

Yes

Do you understand and acknowledge IP and revenue-return and sharing requirements in 116P.10?

Yes

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF? If so, describe here (1) the source and estimated amounts of any revenue and (2) how you propose to use those revenues:

Yes, MJV understands that LCCMR approval of the following is contingent on future legislative approval.

There may be the potential for future revenue resulting from the development of a new remote sensing tool to detect a targeted invasive species (Activity 2). The funding for the software development will come from other sources, but some staff time will be spent developing the machine learning technology that will be housed in the commercially licensed software owned and managed by our technology partner Simple Business Automation. Any revenue that MJV would potentially receive in the future from commercial use of this software would be reinvested in continuing to grow and support our remote sensing program for monarch and pollinator conservation.

Does your project include original, hypothesis-driven research?

No

Does the organization have a fiscal agent for this project?

No

Does your project include the pre-design, design, construction, or renovation of a building, trail, campground, or other fixed capital asset costing $10,000 or more or large-scale stream or wetland restoration?

No

Do you propose using an appropriation from the Environment and Natural Resources Trust Fund to conduct a project that provides children's services (as defined in Minnesota Statutes section 299C.61 Subd.7 as "the provision of care, treatment, education, training, instruction, or recreation to children")?

No