Environment and Natural Resources Trust Fund

2022 Request for Proposal

General Information

Proposal ID: 2022-048

Proposal Title: Enhancing Natural Resource Conservation Through Species Distribution Modeling

Project Manager Information

Name: Fred Harris

Organization: MN DNR - Ecological and Water Resources Division

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Project Basic Information

Project Summary: Create Species Distribution Models (SDMs) for rare species in Minnesota to provide new tools for natural areas conservation and rare species surveys.

Funds Requested: $200,000

Proposed Project Completion: June 30 2025

LCCMR Funding Category: Small Projects (H)
        Secondary Category: Foundational Natural Resource Data and Information (A)

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

Narrative

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

To help conserve Minnesota's native flora and fauna, conservation planners, environmental impact reviewers, land managers and landowners have to know where the plants and animals are—especially rare species that are in danger of vanishing from the state.

DNR biologists have been conducting field surveys to document where rare species remain in Minnesota. Yet, our information is incomplete. First, we cannot get to all potential locations for every species, and second, we do not have good information for many species on the extent of other unsearched locations where those species also likely reside. As a result:

1. For sites where rare species have not been surveyed, environmental review and conservation planners have no way of predicting the likelihood of a rare species being present, or of identifying other suitable habitat for a given rare species for mitigating environmental impacts.

2. Rare species field surveys can be hit-or-miss when surveyors are uncertain about how likely a species will occur in a given location – this makes surveys expensive and inefficient.

3. Public and private demand for DNR rare species data and expertise exceeds our staff capacities resulting in lost opportunities to protect biodiversity.

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.

This project will address the above issues by developing Species Distribution Models (SDMs) for Minnesota rare species. The project will use: (1) GIS modeling software to integrate known rare species locations with GIS data layers (e.g. LiDAR, climatology, soils, LandSat, and land-use data) to generate predictive habitat suitability maps for a given species, (2) test model predictions by conducting field surveys, and (3) refine the models' predictive success by integrating the new field data back to the model. The final product will include a tested and refined process for modeling species distributions in Minnesota and data-driven maps that identify locations that have the highest likelihood of supporting a specific rare species in Minnesota. For projects undergoing environmental review that lack previous surveys, these maps will become one of the standard tools used for determining the likelihood of a rare species being present and for targeting field surveys.

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?

This project will:
1. Increase our ability to locate suitable habitat in decisions to require field surveys or mitigate environmental impacts in regulatory processes.
2. Increase precision in decisions, such as state listing decisions, by providing data-driven estimates of a species' viability, vulnerability and available suitable habitat.
3. Increase the sharing of knowledge about rare species distributions and habitats by synthesizing an immense amount of subject matter expertise that currently resides inside the heads of a few biologists.
4. Increase the effectiveness of rare species field surveys by identifying and ranking unsurveyed locations where rare species are likely to occur.

Activities and Milestones

Activity 1: Develop Species Distribution Models

Activity Budget: $50,000

Activity Description:

Assemble and meet with a technical team of collaborators within and outside the DNR to develop model applications, data inputs and modeling protocols. Consult with other organizations that have experience with SDM, including NatureServe (an international network of conservation science organizations). Identify target species to model that have at least 10 known locations. Assemble SDM software and other tools. Assemble continuous coverage GIS data layers (LiDAR, climatology, soils, LandSat, land-use). Run SDM models on at least 100 rare plant species (and a similar number of rare animal species with federal funding for which these LCCMR dollars are a match). Convene the technical team to review model outputs. Refine and rerun models.

Activity Milestones:

Description	Completion Date
A technical team identifies target species, model applications, needs, parameters and protocol	September 30 2022
SDM models are completed for at least 100 species	February 28 2023
SDM model outputs are reviewed by technical team and protocol adjustments identified	March 31 2023
Models are refined and rerun based on technical team reviews.	April 30 2023

Activity 2: Test Model Predictions by Conducting Field Surveys

Activity Budget: $120,000

Activity Description:

Field surveys guided by SDM outputs are conducted in the 2023 and 2024 field seasons. For each field season, a minimum of 10 new SDM-generated locations will be surveyed for at least 10 species (i.e.>100 field survey locations). Results are compiled into the DNR's Natural Heritage Information System databases including the Observation Database and the Rare Features Database.

Activity Milestones:

Description	Completion Date
At least 10 SDM-identified locations for at least 10 species are surveyed by field staff in 2023 field season	September 30 2023
2023 field season data are compiled into databases	December 31 2023
At least 10 SDM-identified locations for at least 10 species are surveyed by field staff in 2024 field season	September 30 2024
2024 field season data are compiled into databases	December 31 2024

Activity 3: Refine Models by Integrating New Field Data

Activity Budget: $30,000

Activity Description:

Refine the models' predictive success by integrating new data back in the models and rerunning the models. Apply standard evaluation methods to assess model results. Incorporate validated models in DNR data delivery sites that are available for use by a wide range of people inside and outside the DNR, including environmental review biologists and contractors licensed to access rare species data.

Activity Milestones:

Description	Completion Date
New data are incorporated into models and models are rerun	February 28 2025
Technical team evaluates model results and identifies improvements	March 31 2025
Outputs from validated models are made available for use	June 30 2025

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Regan Smyth	NatureServe	Guidance on tools and procedures developed for species distribution modeling.	No

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?

Once built, tested and refined, SDMs will become one of the standard Natural Heritage Information System (NHIS) data delivery products that are provided by the Minnesota DNR through the same means as rare species data and information. The SDMs will be trained over time to improve their predictions through the input of new field survey data and advancements in the related datasets. Ongoing financial support for SDMs will be covered by program funding.

Project Manager and Organization Qualifications

Project Manager Name: Fred Harris

Job Title: Plant Survey Supervisor (Acting) Minnesota Biological Survey

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

Fred Harris has worked as a plant ecologist, research scientist and supervisor for the DNR's Minnesota Biological Survey (MBS) for 26 years. As an ecologist he surveyed and mapped native plant communities and rare plant species populations in all or portions of 27 counties in Minnesota. As a Research Scientist at the DNR, and as Lead Ecologist at Great River Greening, Fred organized and coordinated numerous research and monitoring projects, including initial project design, budget management, personnel supervision and reporting. Since June 2020, he has supervised a staff of 12 plant ecologists and botanists who survey and monitor Minnesota's native plant communities and native plant populations.

Work Experience:
June 2020-present: Plant Survey Supervisor (Acting), Minnesota Biological Survey (MBS), DNR Division of Ecological and Water Resources
2011-2020   Research Scientist, MBS, DNR Division of Ecological and Water Resources
2006-2011   Plant Ecologist/Botanist, MBS, DNR Division of Ecological and Water Resources
2003-2006   Lead Ecologist, Great River Greening, St. Paul, MN
1992-2003   Plant Ecologist/Botanist, MCBS, DNR Division of Ecological and Water Resources
1991-1992   Preserve Ecologist, The Nature Conservancy, MN Chapter, Minneapolis
1980-1983   Peace Corps Volunteer and Trainer, U.S. Peace Corps, Kenya

Education:
1991   Ph.D. Botany, The University of Kansas
1980   B.A. Biology, Carleton College

Organization: MN DNR - Ecological and Water Resources Division

Organization Description:
The DNR's Minnesota Biological Survey collects, interprets and delivers data on the distribution and ecology of native animals, plants, plant communities and native landscapes. Delivery of these data helps guide management, conservation and monitoring of critical habitat and ecological functions in Minnesota.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	$ Amount
Personnel								
Natural Resource Specialist/Intermediate - Plant Ecologist		Create and evaluate SDM models; field survey SDM-identified locations			30%	1.5		$151,023
Natural Resource Specialist SR - Plant Ecologist		Create and refine SDM models; conduct field surveys to SDM-identified locations			30%	0.2		$25,000
							Sub Total	**$176,023**
Contracts and Services								
							Sub Total	-
Equipment, Tools, and Supplies								
							Sub Total	-
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Fleet, lodging, meal expenses while in travel status for field surveys.	Fleet, lodging, meal expenses while in travel status for field surveys.					$10,000
							Sub Total	**$10,000**
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-

Other Expenses								
		DNR Direct & Necessary	DNR's direct and necessary costs pay for activities that are directly related to and necessary for accomplishing appropriated projects. HR Support (~$2,829), Safety Support (~$438), Financial Support (~$2,371), Communication Support (~$1,311), IT Support (~$6,019), and Planning Support (~$1,008).					$13,977
							Sub Total	$13,977
							Grand Total	$200,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
In-Kind	State Heritage Enhancement	In kind funds for 0.25 FTE (existing classified NR Specialist SR and Research Scientist 2) for 2 years; DNR GIS/IT professional services.	Pending	$65,000
Cash	State mitigation dollars	Funds earmarked for SDM for goblin fern (Botrychium mormo).	Secured	$50,000
In-Kind	General Fund	0.1 FTE for Project management, supervision, administrative support	Pending	$20,000
			State Sub Total	**$135,000**
Non-State				
In-Kind	Federal State Wildlife Grant	LCCMR dollars would be State match to Federal dollars; Federal dollars used for animal SDMs	Secured	$130,000
			Non State Sub Total	**$130,000**
			Funds Total	**$265,000**

Attachments

Required Attachments
Visual Component
File: 2548c54d-ac0.pdf

Alternate Text for Visual Component
Graphic illustration of a species distribution model for blanket flower....

Administrative Use

Does your project include restoration or acquisition of land rights?
No

Does your project have potential for royalties, copyrights, patents, or sale of products and assets?
No

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

Do you wish to request reinvestment of any revenues into your project instead of returning revenue to the ENRTF?
N/A

Does your project include original, hypothesis-driven research?
Yes

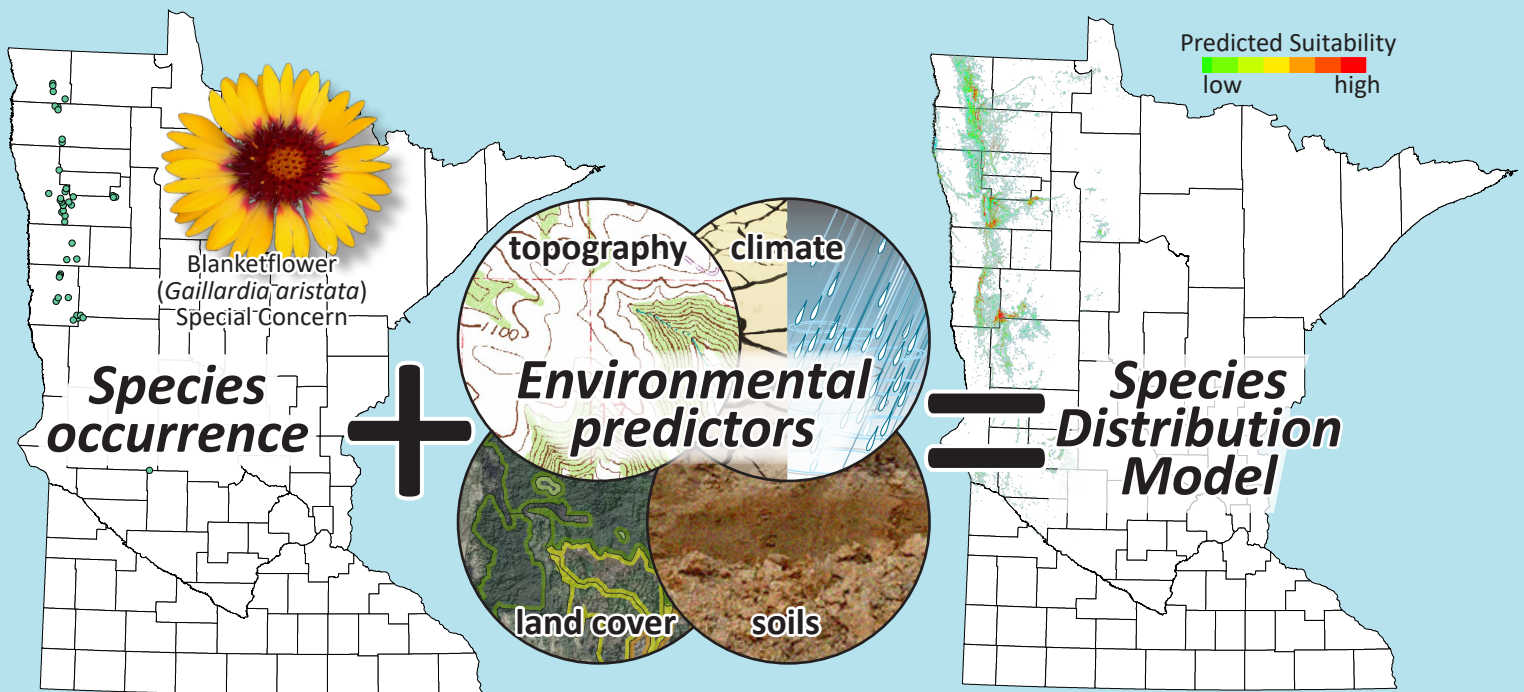**Does the organization have a fiscal agent for this project?**
No

Species Distribution Models (SDMs)
Improving natural resource conservation

The more conservation planners, land managers and environmental impact reviewers know where Minnesota's rare natural features are, the better they can plan the future to conserve them.

- Rare species field surveys can be costly, take time and not all possible habitat can be surveyed.
- SDMs are computer-generated models that build on existing data to identify and prioritize unsurveyed locations where species are likely to occur.

Blanketflower
(*Gaillardia aristata*)
Special Concern

Species occurrence

+

Environmental predictors

topography climate

land cover soils

=

Species Distribution Model

Predicted Suitability
low   high

Tangible*...actionable* results:

✓ **Increase our ability to locate suitable habitat** in decisions to require field surveys or mitigate environmental impacts in planning and regulatory processes.

✓ **Optimize precision in decisions,** such as state and federal listing decisions, by providing data-driven estimates of a species' viability, vulnerability and available suitable habitat.

✓ **Expand the sharing of knowledge about rare species distributions and habitats** by synthesizing an immense amount of subject matter expertise that currently resides inside the heads of a few biologists.

✓ **Improve the effectiveness of rare species field surveys** by identifying and ranking unsurveyed locations where rare species are likely to occur.

DEPARTMENT OF NATURAL RESOURCES
MINNESOTA BIOLOGICAL SURVEY