



# Environment and Natural Resources Trust Fund

## 2025 Request for Proposal

### General Information

**Proposal ID:** 2025-225

**Proposal Title:** Understanding Climate Impacts on Common Loons

### Project Manager Information

**Name:** Walter Piper

**Organization:** Chapman University - Schmid College of Science and Technology

**Office Telephone:** (714) 997-6907

**Email:** wpiper@chapman.edu

### Project Basic Information

**Project Summary:** Loss of water clarity hampers loon foraging and has caused population decline in Wisconsin. I propose to build a marked population of loons to determine if Minnesota shares that problem.

**ENRTF Funds Requested:** \$238,000

**Proposed Project Completion:** June 30, 2028

**LCCMR Funding Category:** Small Projects (H)

**Secondary Category:** Air Quality, Climate Change, and Renewable Energy (E)

### Project Location

**What is the best scale for describing where your work will take place?**

Region(s): Central

**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.**

Common loons are iconic and beloved animals in Minnesota. Surprisingly, we have insufficient scientific data to assess the health of Minnesota's loon population robustly and understand environmental factors that might threaten loons in the state.

Our limited knowledge about Minnesota's loon populations is ill-timed. A recent long-term study has shown that loon chicks in Wisconsin are fewer in number, weigh less, and return to breed only 1/3 as often now as they did 30 years ago. Moreover, a second just-published paper shows that decreased water clarity during chick-rearing impairs loon parents' ability to feed young and is a major cause of chick mortality in Wisconsin. Lacking reproductive and population data from marked animals, we cannot tell whether Minnesota loons are on a similar downward trajectory. However, a recent downturn in breeding success reported by the Minnesota Loon Monitoring Program (run by MN-DNR) is a worrisome sign.

No in-state investigator has conducted the kind of quantitative field investigation proposed here. The MLMP estimates numbers of adult loons and chicks each year. But that survey is prone to wide fluctuations in estimates owing to a lack of marked study animals and extensive wandering of adults at the time of data collection.

### **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.**

From 2021 to 2023 we began to capture and mark with colored leg bands 120 breeding pairs of loons in Crow Wing and Cass counties. Here I propose to complete capture and marking of loons in this new study population, measure annual survival and reproductive success of these pairs through intensive field observation, and assess the impact of water clarity and other environmental factors on Minnesota's loons. This research will require a large field team to carry out nocturnal capture efforts and make at least once-weekly visits to assess reproductive success of 120 marked pairs.

We will use generalized linear models to measure impacts of water clarity, land use, and climatic factors on loon survival, breeding success, and population stability.

Our results will provide specific, critical, and timely information to Minnesotans and to federal, state, and local wildlife agencies tasked with conserving the loon population. This information might help such agencies take steps to conserve loons in the state, if necessary. Since we are examining specific causes of potential population decline, our results offer the prospect that loon conservation efforts can be targeted towards specific environmental threats that threaten loons.

### **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?**

- 1) Build upon recent marking of common loon adults and chicks, with the goal of obtaining a nearly complete marked population by 2027 or 2028.
- 2) Intensify our field study of the new population, with particular goals of estimating adult survival and rate of reproductive success. This will require expanding the field team to 4 full-time members, which will be adequate to make weekly visits to loon territories.
- 3) Acquire water clarity data (from satellite images), landcover, and climate data.
- 4) Carry out statistical analyses to isolate impacts of specific environmental factors on loon survival and breeding success.

## Activities and Milestones

### Activity 1: Activity 1: Complete our marking of the new Minnesota study population.

**Activity Budget:** \$76,500

**Activity Description:**

Marking of territorial pairs of loons is essential to calculate annual survival rate and to obtain robust estimates of breeding success of known pairs.

Adults loons and their chicks can be captured safely by spotlighting at night from a small motorboat. The success rate of capture is about 80%. Each adult and each chick of at least four weeks of age is marked with a numbered steel leg band and three colored plastic bands in unique combination so that they can be distinguished from all other loons banded in North America. Families are quickly released together back into their territory after capture, marking and weighing.

Twenty-five to forty percent of all chicks banded return to the breeding ground as 2- to 5-year-old adults, providing a valuable sample of loons of known age and birthplace. Moreover, weight of chicks at time of banding has proved to be a reliable measure of water clarity and the abundance of small bait fish.

We captured and marked a total of 214 adult loons and chicks in Crow Wing and Cass counties in 2021, 2022, and 2023. Marking will continue in all future years, ensuring virtually complete marking of all study animals by 2027.

**Activity Milestones:**

Description	Approximate Completion Date
75% of adults marked	August 31, 2025
85 to 90% of adults marked	August 31, 2026
95 to 100% of adults marked	August 31, 2027

### Activity 2: Initiate intensive field study of the new population, with particular goals of estimating adult survival and rate of reproductive success.

**Activity Budget:** \$82,450

**Activity Description:**

Field observations of marked territorial pairs allow us to measure survival and breeding success, two critical demographic parameters.

Piper has investigated loon ecology in Wisconsin since 1993. He began to employ the same techniques in Minnesota in 2021 with only two observers. Under this proposal, Piper will expand his field team to 4.5 field workers, enough to make weekly hourlong visits to each of 120 territories in the study area. Briefly, Piper and student interns observe loons from solo canoes (in small lakes, which account for 76 territories) or a small motorboat (in large lakes: 44 territories). Observers verify the return or non-return of each breeding pair member in early May, locate and map nests in May and June, count chicks and estimate their size in June and July, or check nests to assess causes of failure. Final visits in August verify fledging or non-fledging of chicks.

Annual return/non-return of marked loons allow us to estimate adult survival rate. Repeated territory visits permit us to determine fledging success, our most important measure of reproduction.

We aim to accumulate many "territory-years" of breeding data (one "territory-year" = a territory covered for a year) to support robust statistical analysis.

**Activity Milestones:**

Description	Approximate Completion Date
Accumulate 515 territory-years of breeding data and 360 records of banded adults' return or non-return.	August 31, 2025
Accumulate 635 territory-years of breeding data and 510 records of return or non-return.	August 31, 2026
Accumulate 755 territory-years of breeding data and 680 records of return or non-return.	August 31, 2027

**Activity 3: Acquire water clarity data, landcover, and climate data. Analyze and publish data on impact of environmental factors on Minnesota loons.**

**Activity Budget:** \$79,050

**Activity Description:**

Environmental data can be obtained from several sources. Landsat satellite data are available from the U.S. Geological Survey dating back as far as the 1970s. These data can be used by my current collaborators at Rensselaer Polytechnic Institute to estimate water clarity accurately for all lakes in Minnesota at the time that the satellite passed overhead. Data on landcover and climate are available free of charge from NOAA, Minnesota DNR, and other sources.

I will use generalized linear models to examine any impacts of water clarity and other environmental variables on fledging success of loons. I will employ Program MARK (suited to marked populations) to investigate possible impacts of environmental factors on adult loon survival and to generate a robust estimate of adult loon survival in Minnesota that can be compared to that published for other loon populations. Survival and reproductive data combined will permit me to construct a preliminary population model to determine whether the loon population is stable, rising, or falling -- as in Wisconsin.

Based on findings from the analyses above, I will publish at least one scientific paper detailing environmental impacts on loons in a high-impact journal such as Ecology, Biological Conservation, or Ornithological Applications.

**Activity Milestones:**

Description	Approximate Completion Date
Work with RPI collaborators, who will estimate water clarity for study lakes across time	August 31, 2025
Acquire landcover and climate data for all study lakes.	December 31, 2025
Analyze predictors of loon mass and water clarity in Minnesota.	August 31, 2026
Complete analysis of water clarity's impact on loons and submit paper for publication in journal.	August 31, 2027

## 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?**

Our project will generate critical foundational data to assess the status of the Minnesota loon population and determine, in particular, whether it is declining like the loon population in neighboring Wisconsin. ENRTF support would come at a critical juncture, because short-term funding from local partners has run out, yet we are still several years short of reaching our goals. In the long term, the link we have established between water clarity and loon breeding success in neighboring Wisconsin will permit us to approach the National Science Foundation for funding in 2028, after funding for this three-year project has run out.

## Project Manager and Organization Qualifications

**Project Manager Name:** Walter Piper

**Job Title:** Professor of Biology

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

Walter Piper received his doctorate in 1987 from the University of North Carolina studying the winter ecology of white-throated sparrows. Since then, he has done postdoctoral research at Indiana University and at the Smithsonian Institution in Washington, DC. In 1999, Piper became a tenure-track assistant professor at Chapman University in Orange, California. He received tenure in 2004, and became a full professor in 2010.

Since 1993, Piper has conducted an intensive mark/recapture study on common loons in 105-110 breeding territories in Oneida, Vilas, and Lincoln counties in Wisconsin. In 2021, Piper initiated a new field project in Minnesota. This nascent study, which incorporates 120 breeding territories in Crow Wing and Cass counties, is the only long-term field study of marked loons ever carried out in Minnesota.

Piper is well qualified to investigate the breeding ecology and survival of common loons, having done so for three decades in Wisconsin. He is accomplished at finding enthusiastic, outdoorsy students with interests in wildlife ecology and training those students to find loons, record leg bands, and examine loon behavior. Part of the training requires exciting students about the study animal, pointing out the importance of the work, and inspiring them to do their best work both independently and as part of the loon team. Piper has safely captured and marked over 2600 loon adults and chicks in Minnesota and Wisconsin since 1993.

Piper has published 32 scientific papers and 3 popular articles on loons based on his work in Wisconsin and Minnesota. Most recently, he and two collaborators published an article (attached) detailing how increased rainfall and warming temperatures in Wisconsin have negatively impacted water clarity, which, in turn, has caused a sharp decline in the masses of loon chicks. That article forms part of the foundation for this proposal.

**Organization:** Chapman University - Schmid College of Science and Technology

**Organization Description:**

Schmid College of Science and Technology is the school of science at a small liberal arts institution that also has a small number of graduate programs. Chapman University is a "research college" in that we qualify as an "R-2" institute based on quality and quantity of scholarship and publications across the University. Chapman provides statistical, technological, and administrative support for faculty doing research. The University attracts students from across the country, including many from Minnesota and other parts of the Upper Midwest.



## Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
<b>Personnel</b>								
Program Coordinator		Coordinate and lead field research activities			11%	0.24		\$44,367
Crew Leader		Senior member of data collection team			0%	0.87		\$32,550
Crew		Data collection			0%	2.25		\$75,600
							<b>Sub Total</b>	<b>\$152,517</b>
<b>Contracts and Services</b>								
							<b>Sub Total</b>	-
<b>Equipment, Tools, and Supplies</b>								
	Equipment	Used kevlar canoe, paddle, pfd, and cartop carriers	Each crew member requires a lightweight canoe.					\$5,075
	Tools and Supplies	Custom color bands (Pro-Touch), banding supplies, capture equipment	Field readable leg bands for marking loons.					\$11,449
	Tools and Supplies	Binoculars (3 @ about \$320 each)	For reading color bands					\$965
	Tools and Supplies	Handheld GPS units (2 @ \$350)	For recording precise locations of loons					\$700
	Tools and Supplies	Boat fuel and maintenance	Motorboat needed for capturing loons.					\$4,600
	Tools and Supplies	Miscellaneous (batteries, cords, lancets, filter papers, etc.)	For use with other items while in the field.					\$654
							<b>Sub Total</b>	<b>\$23,443</b>
<b>Capital Expenditures</b>								
							<b>Sub Total</b>	-
<b>Acquisitions and Stewardship</b>								
							<b>Sub Total</b>	-

<b>Travel In Minnesota</b>								
	Miles/ Meals/ Lodging	Mileage 175 miles/day * 40 days * 3 yrs * \$0.67/mile	Visit each study lake once per week					\$14,070
	Other	Rental vehicle	Visit each study lake once per week					\$4,050
	Miles/ Meals/ Lodging	House or cabin rental (\$4000 per mo x 3 mos x 3 yrs)	House crew in location allowing for access to lakes.					\$36,000
	Other	Airfare to field site	Cost of airfare for coordinator and crew to get to field site					\$4,500
							<b>Sub Total</b>	<b>\$58,620</b>
<b>Travel Outside Minnesota</b>								
							<b>Sub Total</b>	-
<b>Printing and Publication</b>								
	Printing	Data sheets and instructions	To maintain consistency in the field.					\$420
	Publication	Publication in 1 peer-reviewed open-access journal	disseminate information					\$3,000
							<b>Sub Total</b>	<b>\$3,420</b>
<b>Other Expenses</b>								
							<b>Sub Total</b>	-
							<b>Grand Total</b>	<b>\$238,000</b>



Classified Staff or Generally Ineligible Expenses

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

Category	Specific Source	Use	Status	Amount
State				
			State Sub Total	-
Non-State				
			Non State Sub Total	-
			Funds Total	-

**Total Project Cost: \$238,000**

**This amount accurately reflects total project cost?**

Yes

## Attachments

### Required Attachments

#### *Visual Component*

File: [98483740-736.pdf](#)

#### *Alternate Text for Visual Component*

Chart displays the environmental factors likely to affect loon survival and breeding success and -- ultimately -- population growth or decline (Credit: Daniel Gibson). I also include photos of a male feeding his young chick and a female returning to her territory (Credit: Linda Grenzer)....

### Supplemental Attachments

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

Title	File
Media Attention	<a href="#">6628f418-208.docx</a>
Chapman University 2021 Form 990	<a href="#">ba24e7bc-3c8.pdf</a>
Chapman University FS Audit 5-31-2023	<a href="#">d4c00372-bdb.pdf</a>
Chapman University Entity Status Letter	<a href="#">90cc44a5-c31.pdf</a>
Support Letter	<a href="#">0e0a160e-7f4.pdf</a>
Paper Showing Loon Population Decline in Wisconsin	<a href="#">aac4b2f6-ddd.pdf</a>
Proof of Water Clarity paper	<a href="#">a77752a4-f16.pdf</a>

## Administrative Use

**Does your project include restoration or acquisition of land rights?**

No

**Does your project have potential for royalties, copyrights, patents, sale of products and assets, or revenue generation?**

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

**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

**Provide the name(s) and organization(s) of additional individuals assisting in the completion of this proposal:**

Todd Arnold, University of Minnesota; Daniel Gibson, University of Minnesota; Linda Grenzer, The Loon Project; Molly McCarty, Director of Pre-Award Administration at Chapman University.