



Environment and Natural Resources Trust Fund

2025 Request for Proposal

General Information

Proposal ID: 2025-093

Proposal Title: Improving Conservation Outcomes for Imperiled Wood Turtles

Project Manager Information

Name: Tricia Markle

Organization: Minnesota Zoological Garden

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Project Basic Information

Project Summary: We will help to restore imperiled wood turtles by leveraging our strengths in animal care, veterinary sciences, and field conservation, to bolster populations and inform conservation actions.

ENRTF Funds Requested: \$242,000

Proposed Project Completion: June 30, 2028

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?

Region(s): SE

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.

State threatened wood turtles (*Glyptemys insculpta*) continue to face numerous obstacles that impede their recovery. Major threats include habitat loss and degradation, nest predation, emerging disease, and impacts associated with climate change. Recruitment of wood turtles in Minnesota remains low, with many turtles predated during early life stages. As turtles play a key role in facilitating healthy lakes and rivers, population declines can have far-reaching impacts.

Although habitat restoration efforts by the Minnesota DNR have been underway for years, questions remain on how best to manage areas to benefit wood turtles and promote their recovery. In addition, climate change and potential for introduction of novel disease are increasing the threat of infectious outbreaks in Minnesota. Finally, we have a poor understanding of the population viability of wood turtles in southeastern Minnesota; addressing this information gap will help to guide future conservation actions.

This proposal represents a continuation of ENRTF supported projects, as well as new initiatives designed to benefit wood turtle conservation. Activities outlined in this proposal follow recommendations described in the State of Minnesota Wood Turtle Conservation Plan and will inform federal recovery efforts given that wood turtles are undergoing consideration for Endangered Species Act (ESA) listing.

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.

We propose to leverage our strengths as a zoo-based conservation organization, building upon our current ENRTF-supported conservation activities to improve the viability of Minnesota's imperiled wood turtles. Specifically, we will use the Zoo's expertise in field conservation and animal health to bolster remnant populations, improve our understanding of critical habitat, establish baseline information on disease prevalence, and use population viability analyses to provide a new decision-making tool. To bolster wood turtle populations, we will continue to head-start wood turtle eggs collected from vulnerable nests, rear the juveniles for one year and release them when they are less susceptible to predation. To improve habitat management, we will track wood turtles before and after MN DNR led habitat restoration work to determine if efforts are having desired impacts. To better prepare for emerging disease threats, we will partner with the Minnesota Zoo's veterinary team to quantify disease metrics for wild wood turtles and establish a protocol for baseline disease monitoring. This will help to track disease trends and provide a template for disease monitoring that can be used elsewhere. Finally, we will conduct a comprehensive population viability analysis for wood turtles in southeastern Minnesota, helping to evaluate and prioritize future conservation actions.

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?

Without targeted conservation action, imperiled wood turtles in the southern half of the state are likely to continue to decline. To help sustain and rebuild populations, the Minnesota Zoo and our partners will:

1. Bolster remnant wood turtle populations by protecting eggs and head-starting young turtles during their most vulnerable period.
2. Improve outcomes for wood turtles by quantifying the effectiveness of habitat management strategies.
3. Investigate infectious disease prevalence in wild wood turtles in Minnesota and develop standardized protocols.
4. Develop a population viability analyses (PVA) as a support tool for decision-making to help prioritize conservation actions.

Activities and Milestones

Activity 1: Bolstering depleted populations and quantifying habitat use to inform management

Activity Budget: \$155,890

Activity Description:

Wood turtles face numerous threats to their recovery. Populations in southeastern Minnesota remain severely depleted, with few young surviving to maturity. The MN Zoo proposes to continue headstarting efforts, which began in 2017, to collect eggs from the wild and hatch and rear juvenile wood turtles in captivity during their vulnerable first year. Ahead of release, headstarts will be tested for common infectious diseases that could spread to wild populations. These efforts will provide a stop-gap against continued declines while other management actions are put in place. We know from tracking previously released headstarts that survival remains high in the years following release. In addition, invasive species removal to restore floodplain areas is a critical component of habitat management, yet we have a poor understanding of how wood turtles select habitat and what determines key criteria in terms of lighting, plant communities, and food resources. We will attach GPS transmitters to track adult wood turtles before and after partner-led restoration efforts, providing data to quantify how wood turtles are utilizing restored areas and if we are achieving the desired conservation outcomes. Data gathered and analyzed will inform best management practices for wood turtles across Minnesota.

Activity Milestones:

Description	Approximate Completion Date
Track adult wood turtles with GPS transmitters to determine movements and habitat preference	November 30, 2027
Complete final analyses and prepare project reports	May 31, 2028
Collect wood turtle eggs from vulnerable nests and headstart up to 30 turtles annually	June 30, 2028
Release headstarts at one year of age to bolster recruitment	June 30, 2028

Activity 2: Assessing disease prevalence and establishing standardized monitoring protocols

Activity Budget: \$40,425

Activity Description:

Emerging diseases can present new threats to already imperiled populations. A warming climate will also create more opportunities for novel disease to move into areas previously inhospitable. For wood turtles in southeastern Minnesota, there is little understanding of baseline infectious disease presence and the potential impacts on wild populations. A mass die-off event of dozens of wood turtles in northern Minnesota in the early 2020s ignited concerns over a possible disease outbreak. Indeed, disease monitoring is highlighted as a need by the USFWS and is prioritized in the Minnesota Wood Turtle Conservation Plan.

Utilizing the expertise of Minnesota Zoo’s veterinary staff, we propose to establish a protocol for baseline infectious disease monitoring and to begin surveilling wild wood turtles. Some of the more common and emerging diseases include *Emydomyces* fungus, *Mycoplasma*, ranavirus, herpesvirus, and adenovirus. Minnesota Zoo Veterinarians will help to prioritize diseases of potential concern, along with sampling and testing protocols. In partnership with the MN DNR, we will collect biological samples for disease testing from up to 50 wild wood turtles within Minnesota. Protocols developed can be used by researchers across the range of wood turtles to track regional trends and identify potential threats.

Activity Milestones:

Description	Approximate Completion Date
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Collect and submit samples for disease testing from wild wood turtles in Minnesota	October 31, 2027
Analyze test results and establish baseline data for disease prevalence	December 31, 2027
Develop disease monitoring protocol to share with other researchers to track trends	February 28, 2028
Complete final analyses and prepare project reports	May 31, 2028

Activity 3: Developing a population viability analytical tool to support decision-making

Activity Budget: \$45,685

Activity Description:

Wood turtles in southeastern Minnesota face unique risks from development, pollution, agriculture, and climate change. With limited remaining habitat for nesting, and high prevalence of nest predators, recruitment remains much lower than in other places. Surveys to better understand population abundance and trends have been challenging. As such, the Minnesota Wood Turtle Conservation Plan outlines that the development and implementation of a Population Viability Analysis (PVA) to inform conservation actions benefitting wood turtles in southeastern Minnesota is a high priority. The PVA will use existing multi-year data collected by the Zoo and MN DNR to quantify the probability that a population will become extinct in the near future. Importantly, the PVA will also facilitate an evaluation of different conservation actions and management scenarios, thus providing a decision-making support tool to help prioritize limited conservation resources. This process includes collating input from different stakeholders to develop potential management scenarios to explore with the PVA. Given the technical expertise required in the development and use of PVAs, the Zoo will leverage our close partnership with the Conservation Planning Specialist Group (CPSG) to help complete this work. CPSG was founded at the Minnesota Zoo and provides local and international species conservation planning expertise.

Activity Milestones:

Description	Approximate Completion Date
Contract CPSG to develop a wood turtle specific PVA	May 31, 2026
Compile data needed to parameterize the model and finalize the initial PVA model	February 28, 2027
Develop conservation scenarios to explore with the PVA and complete analyses	December 31, 2027
Complete final analyses and prepare project reports	May 31, 2028

Project Partners and Collaborators

Name	Organization	Role	Receiving Funds
Carol Hall	Minnesota Department of Natural Resources	Herpetologist. Will assist with wood turtle fieldwork and habitat restoration efforts.	No
Dr. Krista Larson	Minnesota Department of Natural Resources	Research Biologist. Will assist with wood turtle fieldwork and habitat restoration efforts.	No
Dr. Annie Rivas	Minnesota Zoo	Veterinary Support. Will help to facilitate disease testing and headstart turtle care.	No
Dr. Stephanie Zec	Minnesota Zoo	Veterinary Support. Will help to facilitate disease testing and headstart turtle care.	No
Dr. Phil Miller	Conservation Planning Specialist Group	Senior Program Officer. Will support implementation of Activity 3.	Yes

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?

This project will help to guide long-term management of wood turtles in Minnesota and support their recovery. Direct conservation outcomes will include increased recruitment, improved habitat management, baseline information on disease prevalence, and a PVA tool that supports decision-making. Findings and recommendations will be shared with wildlife managers and relevant partners.

Given their life history and the pervasiveness of threats, improving the viability of Minnesota's wood turtles is a long-term initiative and activities are likely to continue beyond this grant's scope. We will supplement ENRTF support with other funding sources, including the Minnesota Zoo Foundation, while exploring other grant opportunities.

Other ENRTF Appropriations Awarded in the Last Six Years

Name	Appropriation	Amount Awarded
Improving Resiliency and Conservation Outcomes for Minnesota Turtles	M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 03d	\$391,000

Project Manager and Organization Qualifications

Project Manager Name: Tricia Markle

Job Title: Wildlife Conservation Specialist - Turtles

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

As the lead biologist of the Minnesota Zoo's Freshwater Turtle Program, Dr. Tricia Markle has worked exclusively on Minnesota turtle conservation for the past 6 years. In close partnership with other state agencies, including the Minnesota Department of Natural Resources and the Minnesota Department of Transportation, the program's research activities have included implementing and testing turtle road mortality mitigation strategies and tracking state-

threatened wood and Blanding's turtles to determine habitat use, home ranges, nesting sites, and threats. Responsibilities at the Zoo also have included establishing a head-starting initiative and caring for juvenile wood turtles. As a trained herpetologist (zoologist who studies amphibians and reptiles), Dr. Markle is adept at identifying and handling Minnesota's native turtles and other wildlife, and she is well-versed in relevant wildlife techniques, including radio telemetry. In 2019, she was selected as a member of the Minnesota Wood Turtle Team, tasked with helping the Minnesota DNR draft a Minnesota Wood Turtle Conservation Plan that will direct conservation efforts over the next 10 years.

Prior to work at the Minnesota Zoo, Dr. Markle completed a doctorate in conservation biology investigating climate change impacts on salamanders. She has presented at numerous scientific conferences and has authored several scientific papers. Her years of previous field and research experience have included work with turtles, salamanders, spotted owls, and invertebrates. Her graduate work (both MSc and PhD) required planning, managing, and executing research activities with great attention to detail. Finally, Dr. Markle has worked with numerous outreach programs to promote wildlife conservation, including the Minnesota Zoo, Society for Conservation Biology, and community organizations.

Organization: Minnesota Zoological Garden

Organization Description:

The Minnesota Zoo is a unique state agency. Established in 1978 to provide Minnesota residents and guests with an opportunity to experience animals from the exotic to the familiar, today the Zoo is one of the State's premier cultural, educational, and conservation institutions.

The Zoo's mission is to connect people, animals and the natural world to save wildlife. With 1.3 million guests, and state-wide outreach programs reaching thousands more, the Zoo is well-positioned to strengthen Minnesotans' awareness and understanding of our state's commitment to wildlife, science, and conservation. The Zoo is the State's largest environmental educator with >500,000 participants in Zoo education programs.

The Zoo is also a leader in conservation – directing efforts and partnering with others on a variety of initiatives in Minnesota and across the globe. Over the past decade, the Zoo has enhanced efforts to focus on Minnesota wildlife, including projects to conserve moose, bison, turtles, prairie butterflies, and freshwater mussels. Advancing the science of wildlife conservation is an important part of the Zoo's work.

The Zoo has a proven record of using its resources effectively and matching the State's investment.

Budget Summary

Category / Name	Subcategory or Type	Description	Purpose	Gen. Ineligible	% Benefits	# FTE	Classified Staff?	\$ Amount
Personnel								
Biologist and Project Manager: average 0.35 FTE x 3 years		Overall coordination of project activities, implementation of activity 1 and assistance with implementation of activities 2 and 3			32%	1.05	X	\$137,900
Student Worker Paraprofessional Sr: average 0.20 FTE x 3 years		Support project implementation			8%	0.6		\$29,800
							Sub Total	\$167,700
Contracts and Services								
TBD	Professional or Technical Service Contract	Laboratory analysis of samples for disease testing in both pre-release headstarts (Activity 1) and wild wood turtles (Activity 2). Disease panel laboratory testing including Emydomyces fungus, Mycoplasma, ranavirus, herpesvirus, and adenovirus = \$250/turtle x 60 turtles.				0		\$15,000
Conservation Planning Specialist Group	Professional or Technical Service Contract	Conduct Population Viability Analysis, including model development and workshop facilitation to review results with stakeholders and develop conservation scenarios to explore with the PVA.				0.15		\$25,000
							Sub Total	\$40,000
Equipment, Tools, and Supplies								
	Tools and Supplies	Field Supplies: 8 solar GPS transmitters (\$1500 ea.) = \$12,000 and 60 VHF transmitters (\$180 ea x 20/yr x 3 yrs) = \$10,800, plus misc. supplies including epoxy, handheld GPS, notebooks etc. = \$500	Supplies necessary for tracking wood turtles to learn about habitat use and find eggs for headstarting efforts					\$23,300
	Tools and Supplies	Headstarting Supplies: New tanks and equipment including heaters and pumps = \$3000, headstart care (including food, shelter, enrichment) = \$200/mo x 10mo, x 3 yrs = \$6000.	General care of hatchling wood turtles reared for 1 year before release back to wild					\$9,000

	Tools and Supplies	Disease testing clinical supplies: collection vials, swabs, storage boxes, gloves etc. estimate at \$10/ turtle x 50 = \$500	Supplies necessary to collect samples for disease testing of wood turtles					\$500
							Sub Total	\$32,800
Capital Expenditures								
							Sub Total	-
Acquisitions and Stewardship								
							Sub Total	-
Travel In Minnesota								
	Miles/ Meals/ Lodging	Fuel, food, and accommodation for fieldwork in state: \$500/yr for 3 years. Reimbursement rates as allotted per the State of Minnesota travel regulations.	Travel to field sites in southern and central Minnesota					\$1,500
							Sub Total	\$1,500
Travel Outside Minnesota								
							Sub Total	-
Printing and Publication								
							Sub Total	-
Other Expenses								
							Sub Total	-
							Grand Total	\$242,000

Classified Staff or Generally Ineligible Expenses

Category/Name	Subcategory or Type	Description	Justification Ineligible Expense or Classified Staff Request
<p>Personnel - Biologist and Project Manager: average 0.35 FTE x 3 years</p>		<p>Overall coordination of project activities, implementation of activity 1 and assistance with implementation of activities 2 and 3</p>	<p>Classified : A classified staff position will be partially supported by these ENRTF funds. This staff member will have the necessary expertise required to successfully implement Activity 1 and coordinate Activities 2 and 3. The ENRTF funding will make it possible for the staff member to work on this project for the percentage of time indicated in the budget. Without this funding they would not be able to support this project with their time. Responsibilities for the classified staff will be reprioritized and reallocated as necessary to support this project.</p>

Non ENRTF Funds

Category	Specific Source	Use	Status	Amount
State				
Cash	Minnesota Zoo's General Operating budget	Administrative costs, utilities and other expenses associated with implementation of activities, estimated at 15% of the total request	Secured	\$36,300
			State Sub Total	\$36,300
Non-State				
Cash	Minnesota Zoo Foundation	Implementation of project activities, including additional staffing support and other equipment and supplies. Estimated at \$8,000 / year for 3 years.	Pending	\$24,000
			Non State Sub Total	\$24,000
			Funds Total	\$60,300

Total Project Cost: \$302,300

This amount accurately reflects total project cost?

Yes

Attachments

Required Attachments

Visual Component

File: [27964e10-bc1.pdf](#)

Alternate Text for Visual Component

Graphic is a compilation of photographs to help illustrate wood turtles and their habitat as they relate to the different activities of the proposal. This includes hatchling turtles to bolster populations, habitat for management, and adult and juvenile turtles for disease testing and population viability analysis....

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:

Seth Stapleton, Minnesota Zoo

