

Final Abstract

Final Report Approved on November 26, 2025

M.L. 2021 Project Abstract

For the Period Ending June 30, 2025

Project Title: Improving Resiliency and Conservation Outcomes for Minnesota Turtles

Project Manager: Tricia Markle

Affiliation: Minnesota Zoological Garden

Mailing Address: 13000 Zoo Boulevard Conservation Department, A-bldg

City/State/Zip: Apple Valley, MN 55124

Phone: (952) 431-9296

E-mail: tricia.markle@state.mn.us

Website: <http://mnzoo.org/>

Funding Source:

Fiscal Year:

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 03d

Appropriation Amount: \$391,000

Amount Spent: \$390,336

Amount Remaining: \$664

Sound bite of Project Outcomes and Results

The Minnesota Zoo successfully worked with partners to improve outcomes for state threatened wood and Blanding's turtles. Wood turtles benefitted from habitat restoration, tracking, and head-starting, while a long-term monitoring initiative will safeguard a key population of Blanding's turtles. Outreach and education activities engaged the public to benefit turtle conservation.

Overall Project Outcome and Results

The past few years the Minnesota Zoo has utilized its strengths as a zoo-based conservation organization and worked to improve outcomes for Minnesota's imperiled wood and Blanding's turtles. Populations of both species have declined in southern Minnesota due to habitat loss and landscape changes. Partnering with the Minnesota Department of Natural Resources, Zoo staff tracked adult and juvenile wood turtles for multiple years using radio telemetry and GPS tracking. Information gathered has been instrumental in understanding habitat needs, threats, and survival, so that we can work with landowners to restore critical habitat. Tracking also enabled us to identify nesting sites and collect eggs from wild wood turtles. Through a head-starting program, 136 hatchlings and 121 one-year old head-starts were cared for and released by Zoo staff when less vulnerable to predation. These efforts will bolster remaining populations of wood turtles

to help ensure long-term success in Minnesota.

For Blanding's turtles, Zoo staff worked closely with the MN DNR to conduct a multi-year comprehensive population survey of an integral population in southeastern Minnesota. Mark-recapture provided key information on population structure, including evidence of mixed age distribution and roughly equal sex ratios. The study also provided baseline numbers and a protocol for ongoing monitoring efforts in the future.

Finally, Zoo Education and Conservation staff continued to build awareness for turtle conservation through outreach and education opportunities both on and off site. Teachers were provided online content and training opportunities, while students were engaged through Zoomobile, tabling events, and zoo camps. An on-site citizen science initiative allowed for students to track native turtles and gain hands-on experience in the field of wildlife conservation. Turtle basking platforms were also installed to provide safe basking and public viewing of turtles.

Project Results Use and Dissemination

Dissemination for this project came in many forms, from public outreach events, to news stories, scientific talks, newsletters, publications, and one-on-one meetings with landowners. Key highlights included features on The Wandering Naturalist podcast, Pioneer PBS's Prairie Sportsman episode "Save the Turtles", Kare 11's Minnesota Bound, and a publication in The Wildlife Professional magazine. Further, presentations for community groups, students, and scientific conferences helped to raise awareness, while communication with landowners enabled restoration of nesting and foraging habitat for wood turtles. Finally, news stories on turtle conservation efforts have reached hundreds of thousands of Minnesotans through Zoo social media platforms.



Environment and Natural Resources Trust Fund

M.L. 2021 Approved Final Report

General Information

Date: December 2, 2025

ID Number: 2021-087

Staff Lead: Mike Campana

Project Title: Improving Resiliency and Conservation Outcomes for Minnesota Turtles

Project Budget: \$391,000

Project Manager Information

Name: Tricia Markle

Organization: Minnesota Zoological Garden

Office Telephone: (952) 431-9296

Email: tricia.markle@state.mn.us

Web Address: <http://mnzoo.org/>

Project Reporting

Final Report Approved: November 26, 2025

Reporting Status: Project Completed

Date of Last Action: November 26, 2025

Project Completion: June 30, 2025

Legal Information

Legal Citation: M.L. 2021, First Special Session, Chp. 6, Art. 6, Sec. 2, Subd. 03d

Appropriation Language: \$391,000 the first year is from the trust fund to the Minnesota Zoological Garden to improve the conservation of Minnesota's imperiled turtles through animal husbandry, field conservation, and educational programming. This appropriation is available until June 30, 2025, by which time the project must be completed and final products delivered.

Appropriation End Date: June 30, 2025

Narrative

Project Summary: We will improve the conservation of Minnesota's imperiled turtles by leveraging our strengths in animal husbandry, field conservation, and educational programming to bolster populations and raise public awareness.

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

The Minnesota Zoo and our partners will improve conservation outcomes for Minnesota's turtles through field-based conservation projects, a head-starting initiative, and educational programming. Turtles play a key role in facilitating healthy lakes and rivers, serve as indicators of pollutant levels and environmental health, and promote public connections to wildlife. However, turtles face numerous threats, ranging from habitat loss to nest predation and road mortality; two of the nine species native to Minnesota – the wood turtle and Blanding's turtle – are categorized as threatened in the State.

Climate change may provide an additional obstacle to long-term viability, particularly for wood turtles already contending with low recruitment, as more regular flooding threatens nesting habitat along rivers. Minnesota hosts one of the largest historical populations of Blanding's turtles in North America, but the current status is uncertain. Updated information is needed to inform conservation action that will increase resiliency and buffer against the potential impacts of climate change.

This proposal represents a continuation of work initiated in 2018 with ENRTF support, as well as new efforts designed to benefit turtle conservation. Activities outlined in this proposal also follow recommendations described in the forthcoming State Wood Turtle Conservation Plan.

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 and build upon our current ENRTF-supported conservation activities to improve the viability of Minnesota's turtles, particularly imperiled wood and Blanding's turtles. Specifically, we will use our expertise in field conservation and animal husbandry to bolster remnant populations and improve resiliency to climate change and environmental perturbations. We will accomplish this by enhancing nesting sites of wood turtles that may be susceptible to flooding and predation. We also will head-start wood turtle eggs from nests that are prone to inundation or destruction, rearing the juveniles for 1 year and releasing them the following spring when they are less susceptible to predation. To address knowledge gaps and improve the conservation of Blanding's turtles at an integral population in southeastern Minnesota, we will conduct a comprehensive population survey, which will yield new estimates of abundance and age structure. Finally, we will continue to build public awareness state-wide by providing teachers with online content and resources addressing the conservation of our aquatic resources and scientific practice more broadly. An on-site citizen science initiative will allow students to track native turtles and gain hands-on experience in the field of wildlife conservation.

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 turtle populations 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 populations of imperiled wood turtles by improving nesting sites and head-starting young turtles to improve survival during their most vulnerable life stage;
- 2) Assess the status and evaluate the resiliency of an integral population of Blanding's turtles to inform conservation actions; and
- 3) Promote conservation of turtles through development of online educational resources and implementation of citizen science initiatives on Zoo property.

Project Location

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

Region(s): SE, Metro,

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: Reinforcing wood turtle populations with nest site enhancement and head-starting

Activity Budget: \$293,495

Activity Description:

In southeastern Minnesota, populations of the State-threatened wood turtle are severely depleted and suffer from poor recruitment due to threats such as nest predation. Because wood turtles nest in close proximity to rivers and use floodplain habitats during all life stages, extreme weather events and higher levels of precipitation associated with climate change also pose significant threats. Nesting habitat is altered or altogether lost during high water events, and incubating wood turtle nests are vulnerable to wash-out and prolonged inundation during more prevalent floods. To improve recruitment and bolster populations, we will build upon our recent conservation successes. We will identify and assess key characteristics of successful nesting sites and use this information to restore and create nesting sites in areas less prone to flooding. We will quantify the resiliency of eggs to inundation that may occur during more regular flooding events. We also will continue our head-starting program to hatch and rear juveniles in captivity during their vulnerable first year, providing a stop-gap against continued declines while other management actions are put in place. Post-release, we will track head-start turtles to document their habitat use, movements, and survival to evaluate program success and inform future conservation actions.

Activity Milestones:

| Description | Approximate Completion Date |
|--|-----------------------------|
| Expand Zoo's on-site capacity to rear juvenile (head-start) wood turtles to 30 individuals annually | August 31, 2021 |
| Determine key nest site characteristics and restore nesting sites to improve hatching success (ongoing) | June 30, 2024 |
| Release up to 30 head-start wood turtles annually to bolster recruitment (ongoing) | July 31, 2024 |
| Collect data to quantify nest site susceptibility to flooding and loss of eggs (ongoing) | September 30, 2024 |
| Monitor head-start wood turtles post-release to quantify movements and survival (ongoing) | May 31, 2025 |
| Complete final analyses and prepare project reports and manuscripts for publication in peer-reviewed literature. | June 30, 2025 |

Activity 2: Updating the status and informing the conservation of Blanding's turtles in southeastern Minnesota

Activity Budget: \$63,310

Activity Description:

Although they are classified as threatened in Minnesota, what is believed to be the second largest population of Blanding's turtles in North America occurs in the southeast corner of our state. Anecdotal evidence suggests that there is some successful reproduction occurring at this site, but the population's current status is uncertain, and threats such as road mortality, habitat degradation, illegal collection for the pet trade, and climate change jeopardize its long-term viability. To better understand the population's current status and its vulnerability to these threats, we will implement a comprehensive population inventory. This work will complement Minnesota DNR-led survey efforts at the site and yield an updated and robust estimate of abundance, as well as key demographic metrics including sex and age-class ratios. Results will fill a significant knowledge gap and inform management actions to improve the conservation of Blanding's turtles in Minnesota. This is particularly important given that the species will be undergoing status reviews to determine if it should be proposed for listing under the federal Endangered Species Act.

Activity Milestones:

| Description | Approximate Completion Date |
|-------------|-----------------------------|
|-------------|-----------------------------|

| | |
|---|------------------|
| Conduct pilot study and subsequent analyses to inform comprehensive survey design | October 31, 2022 |
| Outfit sample of population with radio transmitters to inform abundance estimation | June 30, 2023 |
| Implement survey to generate estimates of abundance and demographic metrics, including sex and age ratios | July 31, 2023 |
| Complete analyses and prepare report and manuscript for publication in peer-reviewed literature | May 31, 2024 |

Activity 3: Raising awareness and engaging the public to benefit turtle conservation

Activity Budget: \$34,195

Activity Description:

The Zoo's Conservation and Education departments will partner to promote turtle conservation and raise public awareness both on-site and statewide. Our off-site strategy consists of providing teachers online learning materials, data sets, and videos of researchers at work to align with current standards around scientific practice. Using online platforms will ensure that content is available state-wide and will facilitate distance learning across Minnesota. Zoomobile, which provides Minnesotans the opportunity to experience wildlife in their own communities, will continue to engage the public in programs featuring Blanding's turtles. On-site, we will establish a citizen science initiative with painted and snapping turtles that occur in the Zoo's natural areas. We will outfit turtles with radio transmitters, and with the support of Zoo staff, visiting students will track turtles via radio telemetry to receive hands-on experience with research methods and enhance their understanding of wildlife science. This initiative will collect data on turtle habitat use, nesting sites, and phenology (the study of the timing of seasonal events). We will establish basking areas with anchored logs in ponds at the Zoo, thereby helping students view the turtles they are tracking and providing a place for public nature viewing and interpretive programming.

Activity Milestones:

| Description | Approximate Completion Date |
|--|-----------------------------|
| Create basking areas for public nature viewing of wild turtles at Zoo | May 31, 2022 |
| Develop online learning resources, data sets and videos (ongoing) | October 31, 2024 |
| Track native turtles on Zoo site as part of citizen science project (annual) | June 30, 2025 |

Project Partners and Collaborators

| Name | Organization | Role | Receiving Funds |
|----------------|---|--|-----------------|
| Matthew Graeve | The Nature Conservancy | Technical guidance and assistance with implementation of Activity 2. | No |
| David Ruff | The Nature Conservancy | Technical guidance and assistance with implementation of Activity 2. | No |
| Barb Perry | Minnesota Department of Natural Resources | Technical expertise and guidance. Assistance with implementation of Activities 1 and 2. Funding provided by the DNR to support other relevant conservation activities. | No |
| Krista Larson | Minnesota Department of Natural Resources | Technical expertise and guidance. Assistance with implementation of Activities 1 and 2. Funding provided by the DNR to support other relevant conservation activities. | No |
| Carol Hall | Minnesota Department of Natural Resources | Technical expertise and guidance. Assistance with implementation of Activities 1 and 2. Funding provided by the DNR to support other relevant conservation activities. | No |

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.

Findings of this study will be shared with land managers, collaborators, and relevant agencies to inform management efforts for turtles. Manuscripts summarizing these studies, key findings, and associated recommendations will be prepared and submitted for publication in the peer-reviewed scientific literature. Education staff at the Zoo will also incorporate data and results into their programming to promote conservation efforts in the state. In addition, information will be shared with members of the public through presentations and tabling events both at the Zoo and off site. Important results and any associated actions will be communicated through social media channels to the Zoo's large online following. Finally, the Environment and Natural Resources Trust Fund will be acknowledged through the use of the trust fund logo or attribution language on project print and electronic media, publications, signage, and other communications.

These data will provide a platform for evaluating the utility of expanding efforts to headstart wood turtles and restore nesting areas. A population inventory of Blanding's turtles at a key site in southeastern Minnesota will complement long-term DNR efforts and provide critical information for management actions at that site.

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?

Direct conservation outcomes will include restored nesting sites, increased recruitment, and updated demographic estimates. Findings will be shared with wildlife managers, and recommendations will be implemented with relevant partners. Wood and Blanding's turtles are undergoing status assessments for proposed listing under the Endangered Species Act (ESA). Hence, our proactive approach will improve conservation outcomes, reducing the potential for listing under ESA and associated impacts.

Because improving the viability of Minnesota’s turtles will require several years, our activities may continue beyond this grant’s scope. We will supplement ENRTF support with other sources and explore other opportunities for funding.

Other ENRTF Appropriations Awarded in the Last Six Years

| Name | Appropriation | Amount Awarded |
|---|--|----------------|
| Conserving Minnesota’s Nine Species of Freshwater Turtles | M.L. 2018, Chp. 214, Art. 4, Sec. 2, Subd. 03k | \$300,000 |

Budget Summary

| Category / Name | Subcategory or Type | Description | Purpose | Gen. Ineligible | % Benefits | # FTE | Classified Staff? | \$ Amount | \$ Amount Spent | \$ Amount Remaining |
|---|---------------------|--|--|-----------------|------------|-------|-------------------|------------------|------------------|---------------------|
| Personnel | | | | | | | | | | |
| Population ecologist: average 0.08 x 4 years (0.12 FTE for FY22 and FY23; 0.04 FTE for FY24 and FY25) | | Coordination of activity 2; assistance with implementation of activity 1 | | | 29% | 0.32 | X | \$51,700 | - | - |
| Biologist and Project Manager: average 0.7 FTE x 4 years | | Overall coordination of project activities, implementation of activity 1 and assistance with implementation of activities 2 and 3 | | | 36% | 2.8 | X | \$287,500 | - | - |
| Education project coordinator: average 0.04 FTE x 4 years | | Implementation of activity 3 | | | 21% | 0.16 | X | \$17,200 | - | - |
| | | | | | | | Sub Total | \$356,400 | \$356,400 | - |
| Contracts and Services | | | | | | | | | | |
| | | | | | | | Sub Total | - | - | - |
| Equipment, Tools, and Supplies | | | | | | | | | | |
| | Tools and Supplies | VHF transmitters @ \$170 / unit: 8 units for adult female wood turtles / yr x 3 years; 10 units for head-start wood turtles / yr x 3 yrs; 15 units for population assessment of Blanding's turtles; and 4 units for citizen science initiative on Zoo site x 3 years. 2 to 4 solar GPS transmitters (\$1500 each). | Track wood turtles to identify nesting sites and monitor movements (adults) and evaluate post-release movements and survival (head-starts); track Blanding's turtles to quantify habitat use and inform population survey; | | | | | \$18,300 | \$18,286 | \$14 |

| | | | | | | | | | | |
|-------------------------------------|-----------------------|---|--|--|--|--|-----------|----------|----------|-------|
| | | Plus ~\$230 / year x 3 years for attachment supplies and miscellaneous supplies. | track turtles on Zoo site to engage public in citizen science | | | | | | | |
| | Tools and Supplies | Miscellaneous supplies for population survey of Blanding's turtles, including receiver and antenna for radio telemetry, traps and marking supplies: \$3,500 | Implementation for Activity 2, including capturing Blanding's turtles for population survey and uniquely marking individuals | | | | | \$3,500 | \$3,391 | \$109 |
| | Tools and Supplies | Head-starting supplies for juvenile wood turtles: \$1000 / tank rearing system x 2 systems; food, supplies and replacement parts: \$1450 / yr x 4 yrs | Rear young wood turtles through most vulnerable life stage to boost recruitment and bolster population | | | | | \$7,800 | \$7,573 | \$227 |
| | Tools and Supplies | Data loggers and cameras for monitoring nest site water levels and temperatures: \$150/unit x 20 units | Quantify duration that turtle nests are underwater during flooding events | | | | | \$3,000 | \$2,997 | \$3 |
| | | | | | | | Sub Total | \$32,600 | \$32,247 | \$353 |
| Capital Expenditures | | | | | | | | | | |
| | | | | | | | Sub Total | - | - | - |
| Acquisitions and Stewardship | | | | | | | | | | |
| | | | | | | | Sub Total | - | - | - |
| Travel In Minnesota | | | | | | | | | | |
| | Miles/ Meals/ Lodging | Fuel and mileage: \$500/yr for 4 years. Reimbursement rates as allotted per the State of Minnesota travel regulations. | Travel to field sites in southern and central Minnesota | | | | | \$2,000 | \$1,689 | \$311 |
| | | | | | | | Sub Total | \$2,000 | \$1,689 | \$311 |
| Travel Outside Minnesota | | | | | | | | | | |
| | | | | | | | Sub Total | - | - | - |
| Printing and Publication | | | | | | | | | | |

| | | | | | | | | | | |
|-------------------|--|--|--|--|--|--|----------------|-----------|-----------|-------|
| | | | | | | | Sub Total | - | - | - |
| Other Expenses | | | | | | | | | | |
| | | | | | | | Sub Total | - | - | - |
| | | | | | | | Grand Total | \$391,000 | \$390,336 | \$664 |

Classified Staff or Generally Ineligible Expenses

| Category/Name | Subcategory or Type | Description | Justification Ineligible Expense or Classified Staff Request |
|--|---------------------|---|--|
| Personnel - Population ecologist: average 0.08 x 4 years (0.12 FTE for FY22 and FY23; 0.04 FTE for FY24 and FY25) | | Coordination of activity 2; assistance with implementation of activity 1 | Classified : A classified staff position will be partially supported by these ENRTF funds. This staff member will have the necessary expertise required to successfully coordinate activity 2 and assist with activity 1. 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. Further, the nature of the success of this project necessitates some level of expertise coming from the Zoo, which this staff member will be instrumental in providing. Responsibilities for the classified staff will be reprioritized and reallocated as necessary to support this project. |
| Personnel - Biologist and Project Manager: average 0.7 FTE x 4 years | | Overall coordination of project activities, implementation of activity 1 and assistance with implementation of activities 2 and 3 | 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 Activities 1, 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. Further, the nature of the success of this project necessitates some level of expertise coming from the Zoo, which this staff member will be instrumental in providing. Responsibilities for the classified staff will be reprioritized and reallocated as necessary to support this project. |
| Personnel - Education project coordinator: average 0.04 FTE x 4 years | | Implementation of activity 3 | 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 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. Further, the nature of the success of this project necessitates some level of expertise coming from the Zoo, which this staff member will be instrumental in providing. Responsibilities for the classified staff will be reprioritized and reallocated as necessary to support this project. |

Non ENRTF Funds

| Category | Specific Source | Use | Status | \$ Amount | \$ Amount Spent | \$ Amount Remaining |
|------------------|------------------------------------|--|----------------------------|------------------|------------------|---------------------|
| State | | | | | | |
| In-Kind | DNR Nongame funds | Field research expenses including supplies | Secured | \$29,000 | \$29,000 | - |
| In-Kind | Minnesota Zoo General Operating | Grant administration and other expenses associated with program implementation, valued at 15% of the total grant | Secured | \$69,000 | \$59,952 | \$9,048 |
| In-Kind | Legacy appropriation | Supplemental funds to cover additional, unforeseen project expenses (~\$2500/year) | Pending | \$10,000 | - | \$10,000 |
| | | | State Sub Total | \$108,000 | \$88,952 | \$19,048 |
| Non-State | | | | | | |
| In-Kind | Minnesota Zoo Foundation | Supplemental funds for additional, unforeseen project expenses, (valued at \$2.5k per year) | Pending | \$10,000 | - | \$10,000 |
| In-Kind | SWG fund (federal grant) to MN DNR | Staff salary and expenses (travel,supplies/processing, etc) | Secured | \$45,000 | \$16,450 | \$28,550 |
| In-Kind | CSWG (federal grant) to MN DNR | Staff salary and expenses (travel, supplies/processing, etc) | Potential | \$80,000 | \$80,000 | - |
| | | | Non State Sub Total | \$135,000 | \$96,450 | \$38,550 |
| | | | Funds Total | \$243,000 | \$185,402 | \$57,598 |

Attachments

Required Attachments

Visual Component

File: [e9850668-315.pdf](#)

Alternate Text for Visual Component

Graphic includes pictures of state-threatened wood and Blanding's turtles and details the objectives of our project which are:

GOAL: Advance conservation of threatened wood and Blanding's turtles

Activities:

- Bolster remnant populations of wood turtles
- Assess the status of an integral population of Blanding's turtles
- Engage the public in turtle conservation...

Supplemental Attachments

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

| Title | File |
|--|-----------------------------------|
| Revised Research Addendum Turtles | 99ae09f9-767.docx |
| Background Check Form | 97b7bb54-a5f.pdf |
| Painted Turtle Outreach Sign | 7c948ed2-b18.jpe |
| Snapping Turtle Outreach Sign | 571b6d19-88d.jpe |
| Turtle Signs Installed at Zoo | 54808674-840.jpe |
| Turtle Basking Platform with Eagle Scout | 8b7f0b93-94d.jpe |
| Turtle Basking Platform Installed | 614cdcef-d4d.jpe |
| Poster for AZA (Association Zoos and Aquariums) Conference | 72cfc18e-b66.pdf |
| Results Activity 2 Blanding's Turtle Study | 3285a174-11f.docx |
| Wood turtle hatchlings | 6741a7ba-d95.jpe |
| Headstart turtle release | 12f0b108-42f.jpe |
| Headstart rearing tank | 5b68eef0-44d.jpe |
| Summary Blanding's Population Study | ae70135b-847.docx |
| Comparable study juvenile wood turtles in Iowa | c27475e5-c98.pdf |

Media Links

| Title | Link |
|---|---|
| Save the Turtles - Prairie Sportsman | https://www.pbs.org/video/save-turtles-mz8pe8/ |
| Kare 11 MN Zoo Wood Turtle News Story | https://www.kare11.com/article/news/local/kare11-extras/effort-to-protect-minnesotas-rare-wood-turtle/89-3b3795b4-978e-498a-822e-f8ac92a160d8 |
| MN Zoo Wild Nights Turtle Conservation | https://vimeo.com/819628551 |
| KSTP News story Turtle Conservation and Zoo Wild Nights Event | https://kstp.com/special-coverage/minnesota-live/whats-happening-at-the-minnesota-zoo/ |
| Minnesota Bound episode featuring Zoo and DNR turtle tracking efforts | https://www.youtube.com/watch?v=SsbeVzsDWIA |
| ARC Solutions Wonderful World of Wildlife Crossings online storymap. | https://storymaps.arcgis.com/stories/5ac07a58cdfe44c495e6f82c40d8d87c |
| Headstart Turtle Release Instagram post | https://www.instagram.com/mnzoo/p/C-8hSCfszE6/?img_index=1 |
| Watch for turtles on roadways - Instagram post | https://www.instagram.com/mnzoo/p/C8dIsLalfk8/ |
| Turtles All the Way Down: Collaborating to Inform Wood Turtle Conservation Efforts in the Upper Midwest | https://www.fs.usda.gov/pnw/pubs/journals/pnw_2025_brown001.pdf |

| | |
|------------------------------|---|
| CBS News Story Turtle Traker | https://www.cbsnews.com/minnesota/news/turtle-tracking-app-minnesota/ |
|------------------------------|---|

Difference between Proposal and Work Plan

Describe changes from Proposal to Work Plan Stage

None

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 understand that travel expenses are only approved if they 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 understand the Commissioner's Plan applies.

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

Work Plan Amendments

| Amendment ID | Request Type | Changes made on the following pages | Explanation & justification for Amendment Request (word limit 75) | Date Submitted | Approved | Date of LCCMR Action |
|--------------|-------------------|---|---|------------------|----------|----------------------|
| 1 | Amendment Request | <ul style="list-style-type: none"> Budget - Capital, Equipment, Tools, and Supplies | Certain activities initially budgeted for had all costs covered by partners (nest site improvement and restoration (\$3000) and turtle basking platforms (\$500)). We request to move \$2000 of these unused funds to cover additional costs associated with headstart wood turtle care and \$1500 to our transmitter budget to purchase newly available solar GPS transmitters that will greatly assist in data collection. All activities and milestones will remain as proposed and no changes are needed there. | January 17, 2024 | Yes | January 22, 2024 |
| 2 | Amendment Request | <ul style="list-style-type: none"> Other Budget - Capital, Equipment, Tools, and Supplies | We recently learned that our supplier of GPS units will not be producing the particular model we need this spring. In addition, with rising costs of supplies in recent years, we are running short in funds for care of our headstart turtles. We propose to move \$1400 from our VHF/GPS budget (where the full amount is no longer needed), to our head-starting supply budget to cover the remaining few months of this project. | April 15, 2025 | Yes | April 15, 2025 |

Status Update Reporting

Final Status Update August 14, 2025

Date Submitted: October 29, 2025

Date Approved: November 6, 2025

Overall Update

Over the past few years the Minnesota Zoo has utilized its strengths as a zoo-based conservation organization and worked to improve the viability of Minnesota's turtles, particularly imperiled wood and Blanding's turtles. Through nest site restoration and headstarting, we helped to bolster remaining populations of wood turtles to ensure long-term success in Minnesota. We also tracked released headstarts to better understand movements, threats, habitat use, and survival. For Blanding's turtles, we worked closely with the MN DNR to conduct a multi-year comprehensive population survey of an integral population in southeastern Minnesota. Mark-recapture provided key information on population structure including age distribution, and sex ratios. The study also provided a protocol and baseline numbers for ongoing monitoring efforts in the future. Finally, Zoo Education staff continued to build awareness for turtle conservation by providing teachers with online content and training opportunities. Students were engaged both on and off-site through Zoomobile, tabling events, and Zoo camps. An on-site citizen science initiative allowed for students to track native turtles and gain hands-on experience in the field of wildlife conservation. Turtle basking platforms were also installed to provide safe basking habitat and public viewing of turtles.

Activity 1

The past four years, Minnesota Zoo staff have worked closely with the MN DNR on efforts to boost populations of state threatened wood turtles. Efforts included tracking adult and juvenile wood turtles to better understand habitat needs, restoring nesting habitat, and collecting eggs for headstarting. We also attempted to quantify the resiliency of eggs to inundation during flooding events, but data was limited due to multiple years of drought. Through this project, a total of 347 eggs and 121 head-starts have been cared for and released by Zoo staff. Post-release, we tracked head-start turtles through radiotelemetry to document habitat use, movements, and survival of juvenile wood turtles, as there is a significant knowledge gap in the literature. To date we have found that annual survival averages around 75% for juvenile turtles and they use much of the same habitat as adults. We are continuing to collect data, and next year will be studying survival rates of 1-year versus 2-year old released head-starts. We fully intend to publish these results in a scientific journal when the study is complete. I have attached an article published by colleagues in Iowa as an example of what we hope to present for Minnesota turtles.

(This activity marked as complete as of this status update)

Activity 2

The three-year mark-recapture study of Blanding's turtles in SE Minnesota, in partnership with the MN DNR, successfully produced a practical survey protocol and population baseline to monitor this key population over time. Unfortunately, data from a previous survey in the early 2000s was not available as planned. As a result, we were unable to make comparisons on how the population has changed in the past 20 years. Annual surveys from 2022 to 2024 identified 149 unmarked turtles, representing ~41% of captures each year (remainder were previously marked). Sex ratios were found to be nearly equal (48.2% female) and samples represented various age classes. Overall the population appears to be holding steady, at least in the short term. The area sampled has a minimum population size of several hundred Blanding's turtles, however, more extensive capture efforts are needed to access hard to reach areas and better estimate the population size as a whole. While the initial intent was to publish data from these findings in a scientific journal, the absence of the historical data makes this a challenge. A summary report detailing more specifics on the mark-recapture data has been added to the Attachments section.

(This activity marked as complete as of this status update)

Activity 3

With 1.5 million annual visitors, the zoo had a unique opportunity to raise awareness about turtle conservation in Minnesota, including promoting personal action visitors could take and highlighting the conservation work of the zoo and its partners. On-site programs included meeting Minnesota turtle ambassadors, biofacts such as shells and eggs, simulations, and telemetry searches for live painted turtles found on site. Youth also participated in turtle-themed field trip stations during school visits, and 25 teachers were trained in a wetland workshop that featured a follow-up virtual turtle program. During the summer, adult programming was offered through the Wild Nights conservation series, while the middle school summer zoo camp engaged in turtle tracking and simulations. During this project, Zoomobile brought native Minnesota turtles to meet over 3,000 participants. We also tabled at larger venues without live animals but with turtle conservation as a theme, including the Minnesota State Fair, Flint Hills Family Festival, Turtle Fest, and Latino Nature Fest. Finally, Zoo staff worked with a SES student to construct turtle basking platforms as his final Eagle Scout project. The platforms were installed on Zoo grounds to provide safe basking areas for turtles, along with turtle viewing for visitors.

(This activity marked as complete as of this status update)

Dissemination

Since the last status update Dr. Markle presented a talk titled "Turtles and Turnarounds: Effective Strategies to Mitigate Turtle Road Mortality" at the international meeting JMIH (Joint Meeting of Ichthyologists and Herpetologists) in St. Paul, MN on July 11, 2025.

Dr. Markle was also interviewed for a July 3rd CBS news story on turtle conservation related to the new Turtle Traker App launched by a Minnesota resident. She has also been active presenting information to kids about turtle conservation at MN Zoo summer camps in recent weeks.

In addition, Zoo staff have worked closely with land managers including Nature Center and DNR staff in southeastern Minnesota to help guide habitat restoration for wood turtles. Recommendations were informed by our tracking research and included removal of invasive plant species (such as buckthorn) and clearing additional areas along the river for nesting habitat. Dissemination came in the form of meetings and email communication. Project funding came from grants secured by partners specifically to help imperiled species at these sites.

Overall, there has been a large variety of dissemination activities over the past few years reaching a wide range of audiences through social media posts, newsletters, talks, publications, news interviews, and public events.

Status Update Reporting

Status Update May 1, 2025

Date Submitted: May 1, 2025

Date Approved: August 1, 2025

Overall Update

All activities are nearing completion as this grant approaches its end date. Tracking of wood turtles continues this spring as we plan to collect more eggs for headstarting efforts this summer. We will also be monitoring survival of the remaining handful of juveniles in the study and working on analyses to determine habitat use and movements of young turtles.

Blanding's fieldwork is complete, along with most of the mark-recapture analyses. We found 149 unique Blanding's turtles over the course of the 3-year study, with 35.6% to 46.3% rate of newly marked turtles each year. We also found there to be a good proportion of males, females, and juveniles in the population. This combined with roughly stationary numbers of capture per effort each year indicates a relatively large and stable population.

The Minnesota Zoo's Education and Conservation Departments have been busy engaging young members of the public with turtle conservation through classes, camps, talks, and programs. For adults we are offering a camp on freshwater turtles, along with our second year of the Wetland Conservation Workshop, training teachers on using their local wetlands to engage students in studying turtles.

Activity 1

Fieldwork for Activity 1 is mostly complete, however, we will continue to track adult female wood turtles through this spring for the opportunity to collect more eggs for headstarting efforts. Thirty headstarts currently in our care from last year are nearing their pre-release checks and will be released back to the wild in June/July when conditions are optimal. We have completed three seasons of data collection on habitat use and movements of headstart turtles post-release, but we are still following a small number released last year to better understand long-term juvenile survival.

In late April we started off the field season with a team of turtle tracking dogs to help assist with surveys and find additional mature females for egg collection. To date the dogs have helped us add one new female to a key site, along with two additional males. As we gear up for egg laying season in June, we will be assessing whether the enhanced and protected nest sites created in the last couple of years will need any repairs or modifications.

Activity 2

Over the course of 2022, 2023, and 2024, DNR and MN Zoo staff captured, marked, and released a total of 149 unique Blanding's turtles of various age classes in southeastern Minnesota. In addition we recaptured and released 234 marked Blanding's turtles that had been previously captured. The proportion of newly marked turtles each year ranged between 35.6% and 46.3% over the sampling period, while the proportion of recaptured turtles ranged between 53.7% and 64.4%. Counts of both newly captured and recaptured turtles increased each year due to increasing trap-nights of effort; 166, 406, and 450, respectively. However, the number of Blanding's turtles captured per trap-night remained approximately stationary between 2022 and 2024. Sex ratios were found to be nearly equal, with 48.2% female. The trapping locations represented a relatively small proportion of the available habitat for this population and we believe our capture-recapture efforts resulted in reaching just a small proportion of the total population. Our results underscore the relatively large size of the Blanding's turtle population in Weaver Dunes, and highlight the need for more extensive capture and marking efforts in order to more accurately sample the extent of the area.

Activity 3

The 2024-2025 school year gave us several opportunities to highlight freshwater turtle conservation in our events and programs. Last summer six camps discussed freshwater turtles and the pet trade, reaching ninety-six middle-to-high school aged children; this summer we have eight camps scheduled. At our Field Trip Stations in March, close to one thousand school aged students and their teachers learned about local turtle conservation. They identified native turtles, discussed the challenges they face, and engaged in simulated turtle telemetry to better understand how the Minnesota Zoo is trying to study wood and Blanding's turtle behavior in their native habitats. Some specialized classes and programs met "Tiny", our resident wood turtle. Lastly, a sponsored Zoo-wide event this past winter, highlighted wildlife trafficking with the freshwater turtle pet trade as one of the focuses reaching over two thousand guests.

Looking forward, we are planning an adult camp on freshwater turtles and its conservation, our second year of the Wetland Conservation Workshop (previously H.E.R.P. Project) training teachers on using their local wetlands to engage students in studying turtles, and we are participating in the Three Rivers Park District's Turtle Fest, a community-wide event highlighting freshwater turtle and conservation.

Dissemination

Dissemination activities over the past several months have included:

- Publication in the Wildlife Professional Journal: Brown, D., A. Badje, G. Crozier, T. Markle, and J. Tamplin. 2025. Turtles All the Way Down: Collaborating to Inform Wood Turtle Conservation Efforts in the Upper Midwest. The Wildlife Professional. March/April 2025:50-54.
- Tabling event on wood turtle conservation and impact of invasive species at the 2nd Annual Wildlife Conservation Benefit, held April 10th, 2025, organized by the Minnesota Zoo Foundation .
- Multiple presentations about turtle conservation to students and community groups including: Central Minnesota Audubon, School of Environmental Studies students, MN Zoo volunteers, River Bend Nature Center high school group, and Carleton College environmental club.
- Dr. Markle was also invited to participate in a podcast on turtle conservation with The Wandering Naturalist (3 Rivers Park District podcast), set to be released later this spring.

The Minnesota Zoo has continued to share regular updates to internal and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels.

Status Update Reporting

Status Update November 1, 2024

Date Submitted: November 1, 2024

Date Approved: November 27, 2024

Overall Update

This past season we wrapped-up much of the remaining field components of our current LCCMR projects. We also continued efforts to boost populations of wood turtles through egg collection and headstarting, with another 32 one-year-old wood turtles released back to the wild and 73 new eggs collected for incubation. Our multi-year field monitoring of juvenile turtles to help better inform management also reached completion.

Fieldwork for the MN Zoo/MN DNR Blanding's turtle population assessment was completed this summer after another successful year of trapping at six sites. We were able to recover the majority of the 6 GPS transmitters deployed last spring. This data will be important as we conduct the population abundance analysis this winter.

The Zoo's Education team was also very busy the past few months informing summer campers and Zoo visitors about turtle conservation. The new H.E.R.P. Project teacher training was a great success and is hoped to result in many wetland conservation initiatives around the metro area. Finally, Minnesota Zoo staff continue to disseminate turtle focused conservation messaging through social media, as well as at large events such as the Association of Zoos and Aquariums (AZA) annual meeting.

Activity 1

After two years of drought we faced the opposite problem this year, with extensive rain causing some substantial flooding at our field sites. Fortunately, we did not lose any of the wood turtles we were tracking and 73 eggs were successfully collected before inundation, with data loggers added to nest cavities. Of the new hatchlings, thirty are being kept at as headstarts, while the remaining hatchlings were released back to the wild. In addition, 32 one-year-old headstarts (collected as eggs last spring) were successfully released this summer. We did not attach transmitters to any of these, as the project to study movements, habitat use, and survival of juvenile wood turtles is wrapping-up. We did, however, continue to track 7 headstart turtles released last year. Of these, one died from predation, one had its transmitter fall off, and a third appeared ill mid-summer and was brought back to the Zoo for medical treatment. This last individual tested positive for ranavirus and died 2 days later. Ranavirus is a high-mortality, naturally occurring disease that impacts amphibians and reptiles. We hope to study impacts and prevalence of ranavirus (and other emerging diseases) on wood turtles as part of a future LCCMR project.

Activity 2

This past spring, MN Zoo and MN DNR staff worked together to conduct a final season of data collection for our Blanding's turtle population study in southeastern Minnesota. Mark-recapture at 6 locations (18 total traps) occurred over 6 weeks from April 15th to May 24th. In addition to the trapping, we also continued to track 6 female Blanding's turtles outfitted with radio and GPS telemetry. This data is being gathered to help us better understand movements, habitat use, and the distribution limits of the population. Tracking proved challenging both with the landscape (which is difficult to access), and also with the habits of Blanding's turtles, which spend a lot more time underwater compared to wood turtles and also trek longer distances over land. Despite these challenges, we were successful in recovering transmitters from 4 of the 6 turtles and hope to recover the remaining 2 in 2025.

This fall we are compiling trapping data from the last 3 years of fieldwork and will be conducting the population

assessment analysis this winter. The data collected should enable us to generate estimates of abundance, along with demographic metrics including sex and age ratios of the population.

Activity 3

During summer 2024, several programs implemented freshwater turtle conservation education and activities. Our middle school summer Zoo camp program engaged nearly 100 students in turtle tracking this year. Students were able to learn about turtle habitat use and movements by following wild painted turtles using radio telemetry. Conservation staff also engaged younger summer camp students with discussions on wildlife trafficking of turtles and solutions for reducing other threats such as road mortality.

Our member and adult programs had dedicated dates focused on freshwater turtle awareness and their conservation, reaching approximately 75 adults. Lastly, the H.E.R.P. Project teacher training for K-5 teachers was piloted. Fourteen teachers attended a 3-day training focusing on wetlands and freshwater turtles. The goal of this program and training is to increase teacher confidence in guiding students outdoors, exploring their local wetland habitat, and culminating in a student-drive conservation action project focused on helping wetland habitat and wildlife. In order to complete their projects, teachers will receive support from Zoo naturalists throughout the school year, along with access to digital resources provided by the Zoo.

Dissemination

The Minnesota Zoo has continued to share regular updates to internal and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels. A couple of key Instagram posts include one on our annual wood turtle headstart release and another on watching for turtles crossing roadways (see Attachments page).

In addition, Dr. Tricia Markle presented a poster (see Attachments) summarizing some of the LCCMR funded turtle conservation projects over the past few years at the international annual meeting of the Association of Zoos and Aquariums (AZA) in Calgary, Alberta Canada, Sept. 16-19th, 2024. Further, Dr. Markle was invited to give a presentation on Minnesota turtles at the the Zoo's H.E.R.P. Project teacher training in June, 2024.

Finally, Dr. Markle was recently elected to the Advisory Board of the Midwest Partners in Amphibian and Reptile Conservation (MW PARC). The mission of the group is to foster data-driven conservation of native amphibians, reptiles, and their habitats through inclusive outreach, research, networking, and collaboration at the regional level.

Status Update Reporting

Status Update May 1, 2024

Date Submitted: May 1, 2024

Date Approved: July 8, 2024

Overall Update

Winter tracking of state-threatened wood turtles revealed key habitat features and interesting behavior with the aid of an underwater camera. We will track juvenile turtles through the end of the summer in order to quantify habitat use and survival. During the fall and winter, we also continued to care for 32 head-start wood turtles that will be released back to the wild in late June when environmental conditions are most suitable.

In partnership with the MN DNR, we are continuing to assess a key population of Blanding's turtles in southeastern Minnesota. After several additional weeks of mark-recapture surveys this spring, we will use data collected from the past 3 years to index abundance and evaluate population trends. The 6 solar GPS transmitters placed on Blanding's turtles last year are starting to come back online as turtles emerge from the water. Data from these turtles will help inform analyses and provide a better understanding of the spatial ecology and habitat use of Blanding's turtles in this area.

Zoo Education efforts for turtle conservation are expanding this spring and summer with the establishment of a new teacher professional development opportunity called the HERP Project.

Activity 1

Fieldwork continued through the winter months, as Zoo staff occasionally checked on overwintering wood turtles outfitted with radio transmitters. To better understand habitat features of overwintering sites, we deployed a camera to film underwater. Video revealed that juvenile turtles often overwinter mid-stream tucked slightly behind turtle-sized rocks, while adult wood turtles tended to shelter under logs and other debris along the river margins. With mild temperatures this winter, our GPS transmitters indicated that adult wood turtles emerged from the water and basked for a few days in mid-March, well ahead of their usual mid-April emergence. The dry winter and light snowpack also kept river levels at low levels so that we did not have juveniles displaced far downstream from spring flooding as in previous years. As of late April, Zoo and DNR staff had relocated all of the turtles monitored the previous fall.

Throughout the winter and spring, Zoo staff also cared for 32 head-start wood turtles, which will be released later this spring. To understand juvenile survival rates and quantify habitat use, we will continue to track a subset of head-starts released in previous years; we will not be deploying transmitters on additional head-starts this year.

Activity 2

This April, we began our final season of trapping Blanding's turtles at a key site in southeastern Minnesota. Mark-recapture data collected during this study will be used to estimate or index abundance and other demographic parameters (as possible) to evaluate population status. In partnership with the Minnesota DNR, a total of 18 traps were set across six locations at our study site. All turtles captured are carefully marked, measured and released. Trapping is anticipated to continue until mid-May when female turtles begin to move further across the landscape to nest. In addition to trapping, we are continuing to track 6 female Blanding's turtles outfitted with solar GPS transmitters to help inform our demographic analyses and to provide details on turtle movements, range size, and habitat use.

Over the next several months, we will be working with the DNR to analyze the last three years of trapping data to

improve our understanding of population health and status. Our planned analysis and reporting remains on track for late 2024 or early 2025.

Activity 3

Zoo Education staff are piloting a new teacher professional development opportunity this spring and summer called the HERP Project. Staff are partnering with K-5 teachers to explore how to engage students in taking on a real, conservation action-based project in order to help Minnesota freshwater turtles and wildlife, engage their community, raise awareness, and preserve wetlands in our state. Part of this program will involve teachers writing a standards-based classroom conservation science activity with a wetland or turtle focus, and guiding students through the culminating conservation action project in spring, 2025. Information is available on the Zoo's website as well as on the Minnesota Zoo for Educators Facebook page.

In addition, Zoo camps this summer will continue to feature materials and activities promoting the conservation of Minnesota's turtle and aquatic resources. Activities will include tracking wild painted turtles on Zoo grounds; turtle locations will be plotted on a map to inform discussions about their habitat use and needs. Additional camp activities will include student-led actions to help address threats such as road crossings and poaching.

Dissemination

The Zoo continues to distribute regular updates to internal and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels. Education and outreach staff both on- and off-site also share our work with the public of all ages.

Media mention of the Zoo's turtle conservation program in recent months has included:

ARC Solutions published a story of our previous LCCMR road mortality project in the Wonderful World of Wildlife Crossings online storymap. <https://storymaps.arcgis.com/stories/5ac07a58cdfc44c495e6f82c40d8d87c>

Recent presentations by Dr. Tricia Markle have included:

November, 2023 talk entitled "Mitigating Vehicle Collisions with Small Animals" at the Center for Transportation Studies (CTS) Research Conference, University of Minnesota; and

February, 2024 presentation on Minnesota Turtle Conservation for a high school group at River Bend Nature Center.

Finally, in April, 2024 Dr. Markle served as a panel member at the Minnesota Zoo Foundation's first annual Wildlife Conservation Benefit, discussing threats posed by illegal wildlife trafficking.

Additional Status Update Reporting

Additional Status Update January 17, 2024

Date Submitted: January 17, 2024

Date Approved: January 22, 2024

Overall Update

Project staff are looking to move a little of the funding for equipment and supplies from budget items where funding is no longer needed to activities where additional money would be beneficial. The movement of these funds should not require any changes to work plan activities or milestones. All activities identified will still be completed as proposed. The purchase of the GPS transmitters is new, but we did not specify in the work plan whether we would be tracking with VHF or GPS. The data gathered will still be used in the same way to help identify and assess key characteristics of successful nesting sites and to track female wood turtles to collect eggs for our headstarting efforts.

Activity 1

Our initial budget had \$3000 allocated to turtle nest site improvement and restoration, however, our partners in the Minnesota DNR were able to cover these expenses and have actively restored wood turtle nesting areas at three of our study sites. This has included invasive plant species removal, thinning of forest canopy to improve light filtration, and tilling/mounding of sand and soil to optimize digging and nesting conditions. With a combined \$3500 in surplus funds, we propose to allocate \$2000 to our wood turtle head-starting budget where expenses have exceeded our initial projections. An additional \$2000 to this budget item should cover project needs through the end of this grant.

Further, we are hoping to move the remaining \$1500 surplus to our "VHF Transmitter budget". \$5030 of this will be used to purchase 24-30 VHF transmitters to cover tracking needs in both 2024 and 2025. With the remaining \$5700 we propose to purchase up to 4 solar powered GPS transmitters to deploy on adult wood turtles. This new model from ATS enables year-round GPS monitoring of turtles. Fine scale movement data is exceedingly beneficial when attempting to better understand nesting site locations and habitat use, and far outperforms VHF.

Activity 2

No additional update for this activity/dissemination

Activity 3

In addition, the \$500 we had budgeted for constructing turtle basking platforms (i.e. basking logs) was covered by an Eagle Scout student who we partnered with for the project. The student was able to raise funds and construct 3 basking platforms as his final community project. These platforms were then installed at the Minnesota Zoo and School of Environmental Studies this past summer.

Dissemination

No additional update for this activity/dissemination.

Status Update Reporting

Status Update November 1, 2023

Date Submitted: December 14, 2023

Date Approved: December 15, 2023

Overall Update

Our 2023 field season was busy! Fieldwork with Blanding's turtles in southeastern Minnesota began in mid-April once ponds there became ice-free. While there were initial challenges due to flooding, efforts began to pay dividends by early May. In partnership with the Minnesota DNR, several dozen Blanding's turtles were trapped, marked, and released over multiple weeks. Six of these individuals were outfitted with GPS transmitters to track their movements and habitat use.

The 29 head-start wood turtles in our care continued to grow throughout the spring and were released to the wild in early summer. We deployed VHF radio transmitters on six of these individuals to facilitate post-release tracking. Two solar GPS transmitters affixed to adult wood turtles also helped to document habitat use and movements. In June, collection of eggs for incubation at the Zoo was successful, with 104 obtained from three sites. Our current cohort of head-starts includes 32 hatchling wood turtles, with the remaining hatchlings released at egg collection sites.

The Zoo's Education Department continued programming on freshwater turtle conservation this summer via adult and family events and youth camps. Their efforts included turtle tracking at the Zoo and looking for turtles on newly installed basking platforms.

Activity 1

Despite the challenges created by ongoing drought conditions, Minnesota Zoo and DNR staff were successful this summer in collecting a record total of 104 wood turtles eggs from wild females across 3 sites in southeastern Minnesota. Eggs were incubated at the Zoo with good success, and 32 are being head-started this year. The remaining hatchlings were released back to nesting sites in late summer. The 29 head-start wood turtles from last year's cohort continued to do well in our care and were released in the early summer. Six of these individuals were outfitted with VHF radio transmitters for post-release tracking to improve our understanding of juvenile turtle movements, habitat use, and survival. Two solar GPS transmitters and 12 VHF transmitters on adult wood turtles also helps to document their habitat use and movements in restored areas.

For habitat restoration and improvement of nesting sites, MN DNR staff conducted work at each of the four core wood turtle sites in the southeast, removing invasive species such as buckthorn, thinning trees for better sunlight penetration, and tilling areas to entice nesting. Further, water and temperature loggers were added to several nest locations to document risk of flooding and other climate change impacts.

Activity 2

We began fieldwork with Blanding's turtles in southeastern Minnesota in mid-April after ice had melted from ponds. In partnership with the DNR, several dozen Blanding's turtles were carefully trapped, marked, and released. Six adult female turtles were also outfitted with new solar GPS transmitters to help inform the abundance estimation. Remote data collection is critical to better understanding habitat use and movements of turtles in this population, as much of the area remains largely inaccessible. Early data already indicate that turtles are traveling longer distances than expected. We will continue to track the 6 GPS turtles in spring 2024, as telemetry (via VHF or GPS) is necessary to help define the study area and inform what proportion of the population is available for sampling at the time of the survey. Although mark-recapture trapping was successful in 2023, efforts were limited by an unfilled critical position within the DNR. We have bolstered staffing on the Zoo end to compensate for this in 2024 and will attempt to nearly double

trapping efforts over 2023. As the more extensive field survey was delayed a year, our planned analysis and reporting will now be targeted for later in 2024 or early 2025.

Activity 3

The Zoo's Education Department continued freshwater turtle conservation education through events/resources for different ages, along with youth camp programs. Field trip stations, including a turtle telemetry booth, provide interactive opportunities for school groups on site. Online, the Minnesota Zoo for Educators Facebook page contains curriculum ideas, photos, videos, and vocabulary. Staff are currently working with teachers to develop a training program complete with online learning resources (including data sets and videos) that will be piloted next summer. Turtle conservation was especially highlighted during World Turtle Day on May 23rd and a summer 'Wild Nights' adult event.

In addition, guests were engaged in telemetry through both simulated demonstrations as well as active searches for live painted turtles affixed with transmitters on Zoo campus. A total of four painted turtles on or adjacent to Zoo grounds were outfitted with VHF radio transmitters between spring 2022 and 2023. Our partnership with a local high school Eagle Scout student was also successful, as the student was able to construct three turtle basking platforms. These platforms were installed in two ponds accessible to Zoo summer camp students. The platforms will help to keep native turtles out of reach of predators and facilitate viewing.

Dissemination

The Minnesota Zoo's turtle conservation program had a few notable media appearances in recent months. This included a Kare11 piece featuring the Zoo's efforts to bolster populations of wood turtles, which aired on the 10pm news as part of their Earth Care Series: <https://www.kare11.com/article/news/local/kare11-extras/effort-to-protect-minnesotas-rare-wood-turtle/89-3b3795b4-978e-498a-822e-f8ac92a160d8>

In addition, the Zoo's summer event Wild Nights showcased local conservation themes, including freshwater turtles. The turtle conservation initiative was highlighted via social media and a short info-mercial (<https://vimeo.com/819628551>).

Presentations by Dr. Tricia Markle in recent months have included:

- The "Corridors, Connectivity, and Crossings" national conference in Tucson, AZ, May 2023.
- The "Emydine Turtle Conservation Symposium for Wood, Blanding's, and Spotted Turtles" in Pennsylvania, July 2023. This provided an excellent opportunity to connect with other turtle researchers and managers from across North America to share results and identify potential collaborations.

The Zoo also continues to distribute regular updates to internal and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels. Outreach staff both on and off site also share our work with the public of all ages.

Status Update Reporting

Status Update May 1, 2023

Date Submitted: May 1, 2023

Date Approved: May 8, 2023

Overall Update

Preparations and initial activities for the 2023 field season are well underway. Through this spring and summer, Zoo staff will partner with the DNR to track threatened wood turtles to learn about habitat use of all age classes and to collect eggs for head-starting efforts. We also are continuing research to assess the population of Blanding's turtles in southeastern Minnesota, with multiple weeks of mark-recapture surveys this spring conducted in partnership with the DNR. We will deploy 6 solar GPS transmitters on Blanding's turtles to better understand their spatial ecology and habitat use in this area.

We continued to provide care for 29 head-start wood turtles this winter. These young turtles will be released later this spring when environmental conditions are suitable. A subset of ~5 to 10 individuals will be outfitted with VHF radio transmitters to document their post-release survival, habitat use and movements.

Education efforts for turtle conservation continue to grow, with plans including new wetland-focused teacher training initiatives in 2024 and continued Zoo events and camp activities on campus.

Activity 1

Through the winter months, Zoo staff cared for 29 head-start wood turtles, which will be released later this spring. Head-starting helps to boost depleted wood turtle populations in southeastern Minnesota while threats to long-term population persistence can be addressed. We will deploy VHF radio transmitters on a subset of individuals prior to release to document post-release survival and space use.

Although fieldwork is much reduced during the colder months, we do occasionally conduct overwintering checks to document turtle locations. Checks during mid-February revealed that turtles were located at the same sites as late fall. However, by late-March, flooding had swept many turtles further downstream. As of late April, Zoo and DNR staff had relocated all but one of the turtles monitored the previous fall. The turtle furthest displaced was found ~5 miles downriver of its overwintering location. We assume that the last missing turtle was swept further past this point and will continue searching to locate it. Any young head-start turtles swept far downstream are returned to the main study area.

Preparations for other field activities in 2023 continues, with plans to track wood turtles and collect eggs associated with head-starting efforts later this spring and summer.

Activity 2

Planning for the comprehensive population assessment of Blanding's turtles in southeastern Minnesota continued through the winter in close coordination with the DNR. These discussions helped to finalize sites for trapping and other logistical considerations including the number and style of traps, personnel needs for monitoring, and timelines for trap deployment. Although trapping began in mid-April 2023, efforts have faced challenges due to cool temperatures and extensive flooding throughout much of the region. To date, only one Blanding's turtle has been captured this season, but we expect increased success in May as conditions become more favorable.

In addition to marking individuals and collecting data for the population assessment, we also are planning to deploy 6 solar GPS transmitters on adult female Blanding's turtles this spring. Telemetry (via VHF or GPS) is necessary to define

the study area and inform what proportion of the population is available to sampling at the time of surveys. Deploying GPS transmitters will further provide us with critical data on movements, range size, specific habitat use, nesting sites, and potential threats.

Activity 3

The Zoo's Education department continues to partner with the Conservation team, educating school groups and Zoo guests about freshwater turtles. This spring, we dedicated 7 weeks to Minnesota's turtles at one of our field trip stations on Zoo grounds. Our focuses included identifying turtle species in Minnesota and communicating threats that turtles face, actions the public can take, and how the Minnesota Zoo and our partners are improving turtle conservation, such as via the telemetry and the head-starting programs.

Later this year, we will have several programs and events providing more opportunities to educate the public about turtle conservation. Events will include Endangered Species Day and World Turtle Day in May, summer camp programs, and the evening Wild Nights adult programs.

Finally, additional painted turtles will be outfitted with VHF radio transmitters this spring and summer to provide summer camp participants an active learning opportunity. Three turtle basking platforms also have been completed in partnership with an Eagle Scout student. These platforms will provide valuable basking areas for turtles on the Zoo and School of Environmental Studies campuses. The design will help to keep native turtles safe from predators and may facilitate viewing opportunities.

Dissemination

We have continued to distribute regular project updates to staff and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels. Turtle conservation was featured in one of the "Zoo After Hours" events this winter as well.

In addition, the Midwest Wood Turtle Working Group met virtually in December and February to discuss ongoing research and partnership opportunities. Minnesota turtle research and the Zoo's conservation work was featured at the February meeting. We will be presenting research at the Wood, Blanding's, and Spotted Turtle Conservation Symposium this summer.

Presentations by Dr. Tricia Markle during recent months have included:

An online talk entitled "Minnesota Turtle Conservation" to the Cannon River Chapter of the Minnesota Naturalists in November, 2022;

A presentation on turtle conservation at the monthly meeting of the Minnesota Herpetological Society in February, 2023;

An hour-long seminar for Zoo staff and volunteers to update on the Zoo's freshwater turtle conservation program in February; and

A public talk on wood turtle conservation to ~50 attendees at River Bend Nature Center as part of a lunchtime seminar series in March.

Status Update Reporting

Status Update November 1, 2022

Date Submitted: November 1, 2022

Date Approved: November 7, 2022

Overall Update

The Minnesota Zoo's field season began in May, as we conducted several weeks of mark-recapture surveys of Blanding's turtles in collaboration with the DNR. Work this year was intended as a pilot project to inform a larger, future population assessment. We currently are coordinating with the DNR to finalize study design, project timeline, transmitter deployment, and other logistical elements.

We also continued to partner with the DNR to improve the conservation of wood turtles, tracking 23 adults and juveniles this summer via radio telemetry. During June, we collected 68 wood turtle eggs from the wild and returned them to the Zoo for incubation. We are head-starting 30 of these hatchlings at the Zoo for release in summer, 2023. The 30 head-starts reared during the previous year were released to the wild in July. We outfitted 6 individuals with radio transmitters to improve our understanding juvenile movements, habitat use, and survival post-release.

Public outreach and dissemination remained strong during the past several months. In-person Zoo camps returned and featured turtle tracking and other conservation messaging. In addition to regular social media and newsletter updates, the turtle conservation program was profiled in two television features and a Minnesota Lottery advertisement.

Activity 1

We continued our efforts to bolster populations of wood turtles across southeastern Minnesota. During summer, 2022, we tracked 23 adult and juvenile wood turtles using radio telemetry. A handful of individuals also were outfitted with GPS devices to help us better quantify habitat use.

During the June nesting season, Zoo and DNR staff successfully collected 68 eggs across 3 sites. We located fewer nests than in previous years, but all eggs were returned to the Zoo for incubation. Of the resultant hatchlings, 30 are being reared at the Minnesota Zoo until their anticipated release in early summer, 2023. The remaining hatchlings were returned to the wild in late summer. We also placed data loggers into nest cavities to record temperature and document any flooding events. A major flood occurred in mid-June; it is unlikely that incubating eggs would have survived this event.

In July, we released a group of 30 head-starts reared at the Zoo during the previous year and deployed radio transmitters on 6 of these individuals. Tracking juvenile turtles allows us to document habitat use of this elusive demographic and estimate survival after their release.

Activity 2

In May, 2022, Zoo staff joined the DNR in southeastern Minnesota to help trap and mark Blanding's turtles over a multi-week period. We captured turtles using several hoop net designs, measured individuals, and marked them via shell notching and PIT tags (microchips). This season was structured as a pilot study to inform a large-scale population assessment, and objectives included determining those traps that are most effective for capturing turtles and those sites that yield the best results. Other logistical considerations for future studies include site accessibility, type of bait used, and time commitment to check traps and process turtles.

During the summer and fall, we regularly met with DNR staff involved in this project. With funding provided by the DNR,

we hope to deploy ~6 GPS transmitters in spring, 2023, to improve our ability to estimate abundance and procure fine-scale spatial data to quantify range size, habitat use, nesting sites and threats such as roads. Because much of this study area is inaccessible, this technology will help to answer key questions to improve management of the population.

Activity 3

The Zoo's Education and Conservation departments collaborated this summer to introduce turtle conservation to Zoo visitors. In the May celebration of Endangered Species Day, naturalists tabled and held informal discussions, educating over 500 students, teachers, and other Zoo guests about turtle conservation. This summer, we also welcomed the return of in-person Zoo camps. Focal topics for these camps included: why do turtles need our help, what are the Zoo and our partners doing to improve their conservation, how do we monitor and track turtles, and how we use these data. To provide summer camp participants an active opportunity to learn about turtle conservation, we captured two wild painted turtles on campus and outfitted them with radio transmitters.

In addition, Conservation staff are partnering with an Eagle Scout student to construct turtle basking platforms. These platforms will provide critical habitat for native turtles and offer additional turtle viewing opportunities for the public. Interpretive signs for painted and snapping turtles also were installed near the Zoo's main lake this spring. The signs detail general life history facts and conservation needs for each species.

Dissemination

The Zoo's turtle conservation efforts and continued work with the DNR were featured in multiple television productions this summer, including an episode of Pioneer PBS's *Prairie Sportsman* entitled "Save the Turtles". This feature was nominated for an upper Midwest Emmy Award in the category Informational/Instructional. Our work was also detailed in an August episode of *Minnesota Bound* called "Turtle Tracking," which aired on Kare 11. Finally, the Minnesota Lottery interviewed project manager Dr. Tricia Markle and created a TV commercial highlighting the turtle project which ran through the summer during Minnesota Twins' baseball games.

We continue to distribute regular project updates to internal and public audiences through All Staff meetings, the quarterly Conservation Connection newsletter, and our social media channels. The Zoo's summer adult evening event entitled "Wild Nights" featured turtle conservation as a theme and included turtle trivia and a video of the Zoo's turtle conservation efforts. Conservation staff also shared our work with middle school students during summer camps.

Finally, the Midwest Wood Turtle Working Group met virtually in October to discuss 2022 field season successes and challenges. The meeting provided an opportunity to collaborate with regional partners to improve turtle conservation.

Status Update Reporting

Status Update May 1, 2022

Date Submitted: April 30, 2022

Date Approved: May 2, 2022

Overall Update

Minnesota Zoo staff continued efforts to bolster populations of wood turtles in southeastern Minnesota during the first year of this project. In partnership with the Minnesota DNR, we tracked 20 adult and 3 juvenile wood turtles during summer and fall, 2021 that were outfitted with VHF transmitters. Earlier in the summer, we collected 68 wood turtle eggs and returned them to the Zoo for incubation. We are head-starting 31 of these individuals at the Zoo for release in summer, 2022.

We also continued logistical preparations and planning efforts for our population assessment of Blanding's turtles at an important site in southeastern Minnesota. We will conduct pilot research this spring and summer, assisting the DNR with mark-recapture surveys to inform plans for larger scale efforts in 2023.

Zoo Education staff are preparing for the return of summer camps in 2022. Camps will feature turtle conservation and involve deployment of VHF transmitters on wild turtles at the Zoo, providing an opportunity for students to learn about an important technique in wildlife research. Finally, we continue to share information about turtle conservation in Minnesota via media requests and numerous other outlets.

Activity 1

Minnesota Zoo and DNR staff continue our multi-year effort to benefit the conservation of wood turtles in southeastern Minnesota. Information gathered through our ongoing radio-tracking research will improve our understanding of habitat use to inform land management and will facilitate the identification of current and potential nesting sites. In summer 2021, VHF transmitters were attached to 20 adult and 3 juvenile wood turtles across 4 sites in southeastern Minnesota. We successfully collected 68 eggs from the wild for incubation at the Minnesota Zoo. Of these, 31 hatchlings have been reared at the Zoo for the past year and will be released in 2022 as part of our head-starting efforts. The remaining hatchlings were released back to the wild shortly after hatching in late summer, 2021.

We currently are preparing for 2022 field activities, which will include radio-tracking, collecting additional wood turtle eggs for head-starting, identifying new nesting sites, protecting nests, and outfitting a sample of one-year-old head-start wood turtles with radio transmitters to document habitat use and survival after release.

We also will quantify the susceptibility and resiliency of turtle eggs to inundation that may occur during flooding events.

Activity 2

We have closely coordinated with the DNR this winter in preparation for pilot research that will help inform a comprehensive survey to assess a key population of Blanding's turtles in southeastern Minnesota. Hoop net trapping is scheduled to begin in early May as part of current DNR-led mark-recapture efforts. Zoo staff will assist with this work and collect information on trapping locations and other logistical considerations for our larger-scale population assessment. This work will complement DNR-led survey efforts at the site and will yield an updated and robust estimate of abundance for Blanding's turtles, as well as key demographic metrics including sex and age-class ratios. Trapping and mark-recapture will occur over multiple weeks in May; we anticipate additional site visits later this summer as well.

Activity 3

During 2021, Zoo summer camps were virtual with limited in-person activities due to the pandemic. Radio telemetry was

among the topics highlighted during these camps, including its use in our turtle research. Although Zoomobile programs were paused at this time, limited virtual programs with Members and Schools Out camps also included turtle themes.

In-person summer camps will be returning to the Minnesota Zoo during 2022. Education staff have been preparing content and materials, and turtle conservation will be featured in several camps. Activities will include sharing information about threats to turtles and associated conservation needs, and tracking wild turtles that have been outfitted with VHF transmitters on Zoo grounds. This work will be part of a citizen science initiative in which students can help track turtles by using radio telemetry, thus receiving hands-on wildlife research experience. Data collected will include movements, habitat use, and potential nesting sites.

Conservation staff have started planning for establishing turtle basking areas at the Zoo to provide critical habitat for turtles as well as additional turtle viewing opportunities for the public. Interpretive signs for painted and snapping turtles will be installed near the Zoo's main lake later this spring.

Dissemination

The Minnesota Zoo disseminated information about the ecology and conservation of Minnesota's turtles in several ways during the first phase of this project:

We used the Zoo's monthly All Staff meetings to provide regular updates to staff and volunteers. We shared happenings with external audiences via the quarterly Conservation Connection newsletter, distributed electronically to member and donor households, and through our social media channels. In particular, the December newsletter featured radio telemetry, with highlights and applications from the turtle conservation initiative.

In February 2022, Dr. Tricia Markle was a guest career speaker for a high school Field Biology internship class, discussing the Zoo's turtle research and sharing insights on being a wildlife biologist.

In March 2022, Dr. Markle gave an online presentation titled "Minnesota Turtle Conservation" to ~70 Minnesota Naturalists with the West Metro Chapter.

The Zoo and DNR's wood turtle conservation work was featured in an episode of Pioneer PBS's "Prairie Sportsman" in April, 2022. (Video: <https://www.youtube.com/watch?v=FRxG9SWoH1w>; starting at 15:23).