

Research Need Statement 640

I. Need Statement Champions and Information

I.A. Need Statement Champion Information

- I.A.1. First and Last Name of Research Champion: **Christopher E. Smith**
- I.A.2. Research Champion's Office: **MnDOT Environmental Stewardship**
- I.A.3. Research Champion's Phone Number: **651-366-3605**
- I.A.4. Research Champion's Email: Christopher.e.smith@state.mn.us

I.B. Research Co-Champion

- I.A.1. First and Last Name of Research Co-Champion: Lisa Gelvin-Innvaer (MnDNR)
- I.A.2. Research Co-Champion's Office: MNDNR Div. of Ecological & Water Resources – Nongame Wildlife Program
- I.A.3. Research Co-Champion's Phone Number: 507-233-1254
- I.A.4. Research Co-Champion's Email: lisa.gelvin-innvaer@state.mn.us

I.C. Research Needs Title (115 Characters): **Assessing a New Tool for Early Detection of Endangered Turtles on Proposed Transportation Projects**

I.D. Project Sponsor: **MnDOT Research Program**

II. Research Need Background and Description

II.A. Research Need Background

II.A.1. Describe the problem or opportunity.

Turtles are among the most imperiled animals in the world, with over 60% of turtle species are at risk of extinction (Lovich et al. 2018). Two species found in Minnesota, the Blanding's turtle (*Emydoidea blandingii*) and the wood turtle (*Glyptemys insculpta*) are currently listed under the State of Minnesota's endangered species statute and have been petitioned for listing under the federal Endangered Species Act (ESA). These turtles can occur in a variety of aquatic habitats, including public waters such as lakes, ponds, and streams, as well as in ditches and in created wetlands used to manage stormwater. Transportation projects and maintenance activities that impact habitats near documented observations of these species may be required to follow costly avoidance and minimization measures, even if turtle presence within the project area is unknown. Currently, one or both turtle species are known to occur in approximately 50 of 87 Minnesota counties.

Transportation agencies must comply with a variety of environmental regulations, including state and federal Endangered Species Acts. Compliance with these Acts can be costly and may

delay projects due to limitations related to the timing of surveys and other investigations (i.e., wildlife surveys are often limited to summer months). Innovative tools can help overcome some limitations, and potentially streamline regulatory approval processes for projects. A new tool of particular interest is the use of environmental DNA (eDNA), which can be used to determine if difficult-to-detect protected species are present within a project area. eDNA may be used in both terrestrial and aquatic environments and may be more versatile and efficient than traditional survey methods (e.g., able to detect species even during winter hibernation periods). The potential to increase the seasonal window for protected species surveys and other investigations using eDNA analysis could reduce the impacts of environmental regulations on project schedules and expedite regulatory approval processes.

II.A.2. If applicable, describe how this project will build on previous research.

One eDNA application of particular interest nationally is the use of eDNA to detect threatened and endangered turtles ahead of projects that may impact these species (Adams et al. 2019, Akre et al. 2019). Turtles are susceptible to impacts within suitable habitat near bridge and culvert repair and replacement projects that clean, modify, dewater and/or reconstruct stormwater infrastructure, and that stabilize erosion along shorelines. Early detection of protected turtles ahead of such projects allows for better coordination with regulatory agencies, ample time to develop and incorporate mitigation into project plans and provisions, and quicker approval of project plans and permits. In addition, transportation agencies could expect significant cost savings by foregoing turtle-specific mitigation when sampling determines endangered and threatened turtles are absent from a project area.

The Blanding's turtle (*Emydoidea blandingii*) and the wood turtle (*Glyptemys insculpta*) have been petitioned for listing under the federal Endangered Species Act and are currently placed on U.S. Fish and Wildlife Services (USFWS) listing workplan for Federal Fiscal Year 2023 (USFWS 2021). Currently the Rights-of-Way as Habitat Working Group comprised of transportation and energy organizations, in collaboration with USFWS are discussing recovery and compliance strategies in the form of Candidate Conservation Agreements, Habitat Conservation Plans, and similar regulatory mechanisms – much like was recently done for the monarch butterfly (USFWS 2020). This project could inform key components of any future regulatory agreements and minimize impacts of a federal listing on imminent projects as well as all future proposed project.

II.A.3. If applicable, include the title/s or previous research.

Adams, C. I., Hoekstra, L. A., Muell, M. R., & Janzen, F. J. 2019. A brief review of non-avian reptile environmental DNA (eDNA), with a case study of painted turtle (*Chrysemys picta*) eDNA under field conditions. *Diversity*, 11(4), 50.

Akre, T. S., Parker, L. D., Ruther, E., Maldonado, J. E., Lemmon, L., & McInerney, N. R. 2019. Concurrent visual encounter sampling validates eDNA selectivity and sensitivity for the endangered wood turtle (*Glyptemys insculpta*). *PLoS one*, 14(4), e0215586.

Davy, C. M. Kidd, A.G., and Wilson C.C. 2015. Development and validation of environmental DNA (eDNA) markers for detection of freshwater turtles. PLoS ONE 10(7): e0130965. Doi:10.1371/journal.pone.0130965.

de Souza, L.S., Godwin, J. C., Renshaw, M.A. and Larson, E. 2016. Environmental DNA (eDNA) detection probability is influenced by season activity of organisms. PLoS ONE 11(10):e0165273 doi:10.1371/journal.pone.0165273

Feng, W., Bulte, G. and Lougheed, S. C. 2020. Environmental DNA surveys to help identify winter hibernacula of a temperate freshwater turtle. Environmental DNA 2(2): 200-2009.

Kessler, E. J., Ash, K. T., Barratt, S. N. , Larson, E. R., and Davis, M. A. 2020. Radiotelemetry reveals effects of upstream biomass and UV exposure on environmental DNA occupancy and detection for a large freshwater turtle. Environmental DNA 2(1):13-23.

Loeza-Quintana, T., Crookes, S., Li, P., Reid, D. P. Smith, M. and Hanner, R. H.. 2021. Environmental DNA detection of endangered and invasive species in Kejimikujik National Park and Historic Site. Genome 64:172-180.

Lovich, J., J R Ennen, M Agha, J W Gibbons. 2018. Where Have All the Turtles Gone, and Why Does It Matter?, BioScience, Vol. 68:771–781.

Roehl, L. 2016. Using environmental DNA to determine wood turtle (*Glyptemys insulpta*) presence in New Brunswick, Canada rivers. M.S. Thesis. Univ. New Brunswick. 41p.

Tarof, S. A., Crookes, S., Moxley, K., Hathaway, J., Cameron, G., and Hanner, R. H.. 2021. Environmental DNA bioassays corroborate field data for detection of overwintering species at risk Blanding's turtles (*Emydoidea blandingii*). Genome 64:299-310.

U.S. Fish and wildlife Service. 2020. Nationwide Candidate Conservation Agreement on Energy and Transportation Lands. Accessed February 21, 2021. <https://www.fws.gov/savethemonarch/ccaa.html>

U.S. Fish and Wildlife Service. 2021. Listing and Critical Habitat | National Listing Workplan. Accessed February 21, 2021. <https://www.fws.gov/endangered/what-we-do/listing-workplan.html>

II.A.4. What is the **objective** of the proposed research?

Assess the efficacy of eDNA for detecting Blanding's turtles and wood turtles across their ranges in Minnesota through:

- Optimize field and laboratory methods for Blanding's and wood turtle eDNA collection and assay
- Sampling representative populations across Minnesota to account for any genetic differentiation as well as aquatic/environmental conditions that could affect detection by eDNA.

- Assess efficacy for detecting these target turtle species in:
 - Lotic vs lentic aquatic systems
 - Turtle active season vs winter hibernation season
- Assessing costs associated with implementing eDNA surveys, including sampling design and detection probabilities (sampling effort, number of replicate samples, sample processing, DNA extraction, and PCR replicates) and desired statistical power.

III. Strategic Priorities, Benefits, and Expected Outcomes

Section III. is for MnDOT sponsored and co-sponsored projects only; all LRRB projects proceed to section IV.

III.A. MnDOT Strategic Priorities

Instructions: Briefly describe how the project aligns with the following MnDOT Research Strategic Priorities. Complete all that apply.

III.A.1. Innovation & Future Needs: Blanding's and wood turtle have been petitioned for listing under the federal Endangered Species Act, with a decision anticipated in the next two-three years.

III.A.2. Advancing Equity:

III.A.3. Asset Management:

III.A.4. Safety:

III.A.5 Climate Change & Environment: If eDNA surveys prove sufficiently reliable and cost effective for the target species, they could greatly improve the accuracy of population detection and therefore improve transportation agencies' coordination with regulatory agencies, allow agencies ample time to develop and incorporate mitigation into project plans and provisions, and ensure approval of project plans and permits under state and, should the species be listed federally, federal law. A cost-effective sampling methodology, such as eDNA, will result in significant cost savings over more traditional survey methods. In addition, transportation agencies could expect significant cost savings by foregoing turtle-specific mitigation when sampling determines endangered and threatened turtles are absent from a project area.

III.B. Expected Outcomes

Instructions: Check all expected direct outcomes of this research.

- New or improved technical standard, plan, or specification
- New or improved manual, handbook, guidelines, or training
- New or improved policy, rules, or regulations
- New or improved business practices, procedure, or process
- New or improved tool or equipment
- New or improved decision support tool, simulation, or model/algorithm (software)
- Evaluation of a new commercial product
- New or improved technical standard, plan, or specification
- Other. Please specify below:

III.C. Expected Benefits

Instructions: Select all expected benefits that may be realized if the findings and recommendations from this research is adopted or implemented

III.C.1. Construction Savings **Cost savings achieved by a reduction in time**
Increase in the seasonal window for protected species surveys and potential to expedite regulatory approval processes.

III.C.2. Decrease Engineering/Administrative Costs Choose an item.

III.C.3. Environmental Aspects **Other environmental impact. Please describe below.**
Assessing a new tool for detection of endangered turtles

III.C.4. MnDOT Policy Choose an item.

III.C.5. Lifecycle Choose an item.

III.C.6. Operations and Maintenance Savings Choose an item.

III.C.7. Reduce Risk Choose an item.

III.C.8. Reduce Road User Cost Choose an item.

III.C.9. Safety Choose an item.

III.C.10. Technology Choose an item.

III.C.11. Other, please describe below:

IV. Technical Advisory Panel

Instructions: Please list the name and affiliation of individuals to consider for the Technical Advisory Panel.

- Christopher E. Smith, MnDOT – Technical Liaison
- Ryan Foley, MnDOT
- Krista Larson, DNR Nongame Research
- Lisa Gelvin-Innvaer, DNR Nongame
- DNR Fisheries - Someone familiar with DNR invasive carp eDNA work
- Carol H., Erica H., Nancy or Brian at Camp
- USFWS – TBD
- USCOE – TBD

Your assigned Project Advisor is available to answer questions and provide guidance (assigned by the Office of Research & Innovation).

Your Project Advisor is: Marcus Bekele, (651)366-3903, marcus.bekele@state.mn.us