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## Detecting Endangered Turtles with Environmental DNA

More than 60% of the world's turtle species are endangered, including Blanding's and wood turtles, which are native to Minnesota and may be found in the state's wetlands, ponds, lakes and streams. To protect these vulnerable populations and their habitats, a cost-effective tool developed in this study will efficiently allow for the early detection of these turtles at transportation project sites.

### What Was the Need?

Minnesota's Blanding's turtles and wood turtles are Minnesota state listed as threatened and are under review for federal protection. When performing transportation projects and maintenance activities, MnDOT must comply with environmental regulations that aim to protect these imperiled species, whose populations are difficult, and therefore expensive, to monitor through conventional means such as trapping and visual surveys.

For decades, MnDOT has relied on data maintained by the Minnesota Department of Natural Resources, some of which is decades old, to establish presence or absence of

Blanding's and wood turtles at any given project location. However, relying on potentially outdated information may lead to expensive and unnecessary mitigation measures in locations where the turtles are no longer present.

To ensure compliance and protect the state's imperiled turtle populations, MnDOT needed a better way to accurately detect their presence near project sites.

Environmental DNA (eDNA) is an innovative tool that can be used to determine if conventionally difficult-to-detect species are present within a project area. Organisms shed DNA—genetic material such as skin cells, scales or

*“We’re always trying to find the right balance—being good stewards of the environment while being responsible with taxpayer dollars.”*

—CHRISTOPHER SMITH, PROTECTED SPECIES PROGRAM  
COORDINATOR, MnDOT OFFICE OF ENVIRONMENTAL  
STEWARDSHIP

bodily fluids—into the surrounding environment. Samples of water, soil or air can be analyzed to quickly and effectively detect whether turtles are at the site.

## What Did We Do?

Species-specific eDNA tests were developed for both Blanding’s and wood turtles. Computer modeling, lab tests and field testing were used to ensure accuracy and build models that estimated how many samples would be needed to detect turtles with 95% confidence.

Researchers collected water samples from 50 sites across the state during all four seasons. In the lab, they tested the samples for traces of DNA and measured how environmental factors like water flow and temperature affected detection. Then they assessed per-sample costs and developed a model to calculate the cost of various detection probabilities.

## What Did We Learn?

The eDNA lab tests achieved the highest possible validation rating for detecting the presence of these turtles. In general, if samples are properly collected and processed, MnDOT can be 95% confident that the species is present if turtle DNA is detected and the species is absent if DNA is not detected.

Below are key findings from the research:

- eDNA testing was most reliable in late summer and fall, when turtles are active and water levels are lower. Winter detections were rare, since turtles are largely dormant in colder months.
- Blanding’s turtles were widely detected throughout the state, most commonly in small, slow-moving water bodies.
- Wood turtle detections were mostly limited to northeastern Minnesota, where their habitat is densely populated, but with sparse results obtained in the southeastern part of the state despite known populations.

The total cost per water sample was \$79.38, which included field sampling, processing and analysis. The cost per detection, which reflects how many samples are needed to detect a species with 95% confidence, was \$7,224 per site in the winter for Blanding’s turtles but decreased to \$476 in the fall. Costs for detecting wood turtles followed a similar pattern, ranging from \$5,477 per site in the winter to \$344 in the summer.

The study confirms that eDNA monitoring is a reliable and cost-effective alternative to conventional turtle

surveys and could help reduce costly project delays statewide.

## What’s Next?

Implementation will include developing practical guidance materials with detailed instructions for taking samples, interpreting test results and communicating findings to project partners.

Additional research is recommended for wood turtles—especially in southeastern Minnesota—using eDNA paired with telemetry to improve detection accuracy.

With continued investment, eDNA could become a standard tool for monitoring many of the state’s protected species, helping MnDOT meet environmental requirements with fewer delays, greater efficiency and reduced cost to taxpayers.

## About This Project

### REPORT 2025-35

“Assessing a New Tool for Early Detection of Endangered Turtles on Proposed Transportation Projects.”

Find it at [mdl.mndot.gov](https://mdl.mndot.gov).

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### PROJECT COST

\$251,676

[www.mndot.gov/research](https://www.mndot.gov/research)