

Science You Can Use **in 5 minutes**

Big data on a little chip: New eDNA tools save time and money on invasive species detection and monitoring



In a field that is hyper-focused on efficiency and cost savings, environmental DNA (eDNA) sampling — or detecting fish and wildlife from traces of genetic material in the environment — has become the gold standard. Over the last decade, eDNA sampling has emerged as a [powerful and cost-effective tool](#) for national forests to obtain the data they need to make management decisions. Now, Forest Service scientists have created “biochips” that generate these high-value data even more efficiently, buoying the value of eDNA monitoring capacity far into the future.

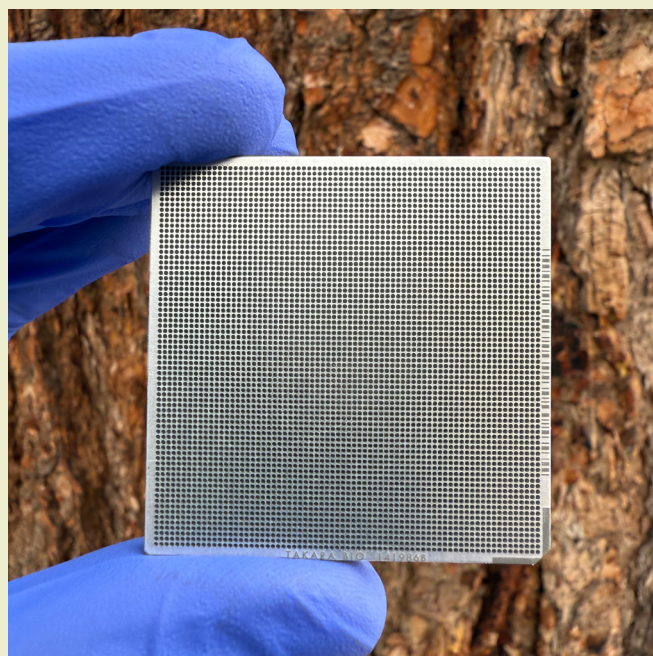
Imagine you are a land manager responsible for the health of rivers and streams across two million acres of land. You are charged with keeping invasive species out, expanding sport fishing opportunities, and monitoring trends in at-risk species. You dream of being able to test a single water sample for every species of interest at once.

You're in luck: scientists from the Rocky Mountain Research Station and the [National Genomics Center for Wildlife and Fish Conservation \(NGC\)](#) have developed high-throughput qPCR (HT-qPCR) biochips that make this possible. In contrast to past methods requiring separate laboratory tests for each species, these biochips provide data on dozens of fish and wildlife species in a single analysis without sacrificing accuracy.

Most recently, the team contracted with the Department of Defense to build a biochip called “SmartScreen-AIS” that simultaneously detects 46 aquatic invasive species (AIS) of widespread concern, including some of the most aggressive and costly invaders. The biochip has been validated for use across the entire continental United States, ensuring that it only detects DNA

from species of interest without being fooled by closely-related species. “The ability to detect DNA from dozens of different species with just one water sample is a game changer for our aquatic invasive species early detection program,” said Michelle Cox, the Invasive Species Program Manager with the Northern Region of the Forest Service.”

Beyond invasive species, these biochips are equally useful for native species inventories. The “SalmonidPLUS” biochip was developed for whole-basin fisheries assessments in the Pacific Northwest. It detects 10 ecologically and socially important fishes in the region: bull trout, rainbow trout (steelhead), coastal cutthroat trout, brook



A scientist holds up the biochip they have developed to simultaneously test microscopically small water samples for 46 invasive species. USDA Forest Service photo by John Kronenberger.

trout, sockeye salmon, Chinook salmon, coho salmon, chum salmon, pink salmon, and Pacific lamprey.

The team also showed that biochips can be used to understand interactions between species that can have implications for land management. For example, they developed a biochip that tests for a suite of native, invasive, and disease-causing species in the southwest U.S. and showed how the spread of invasive bullfrogs may be linked to amphibian diseases resulting from pathogens like chytrid fungus and Ranavirus.

Ultimately, these tools have the power to dramatically shape the way that fish and wildlife are monitored and managed across the United States by saving time, money, and resources. “For 25 years, the NGC has honed our ability to build molecular tools that are not just accurate, but also affordable for our Agency and our partners,” said Dr. Michael Schwartz of USDA Forest Service Research and Development. “We are proud to deliver defensible, reliable, and cost-effective tools to the American people.”



A scientist sets up an eDNA collection kit (a pump, tubing, a filter, and a bucket) on a stream bank. USDA Forest Service photo by Michael Schwartz.

Management Implications

- Environmental DNA often enables more sensitive and cost-effective monitoring of fish and wildlife presence than traditional methods.
- Biochips enable users to seamlessly inventory a list of species, providing immense value for managers needing more data for less money.
- The most recent biochip – SmartScreen-AIS – covers 46 priority aquatic invasive species and is validated for use across the continental U.S.

Featured Publications

- Kronenberger, John; Wilcox, Taylor M.; Schwartz, Michael K. 2025. [SmartScreen AIS: A high-throughput qPCR chip for nationwide surveillance of aquatic invasive species](#). *Environmental DNA*.
- Elmore, Joanna W.; Wilcox, Taylor; Young, Michael K.; Kopp, Steve; Carim, Kellie; Mason, Daniel; Franklin, Thomas; Schwartz, Michael K. 2024. [The riverscape on a chip: high-throughput qPCR enables basin-wide fishery assessments](#). *Canadian Journal of Fisheries and Aquatic Sciences*. 00: 1-14.
- Sleeting, Michael F.; Wilcox, Taylor M.; Mason, Daniel H.; Franklin, Thomas W. 2024. [From jaguars to pathogens: simultaneous genetic detection of diverse taxa across biodiversity hotspots in the U.S.](#) *Conservation Genetics Resources*.

Contributors to this Science You Can Use

Taylor Wilcox is a research geneticist (former). John Kronenberger is an ecologist. Joanna Elmore and Michael Sleeting are research associates. Thomas Franklin is the eDNA Program Leader, and Michael Schwartz manages the Wildlife Ecology and Forest & Woodland Ecosystems Programs at the USDA Forest Service Rocky Mountain Research Station and the National Genomics Center for Wildlife and Fish Conservation.

The National Genomics Center for Wildlife and Fish Conservation is located in Missoula, Montana and serves partners around the country. To learn more about working with us, please [visit our website](#) or contact ngc@usda.gov.

Jennifer Helm is the lead author of this Science You Can Use.

The Rocky Mountain Research Station is one of seven units within USDA Forest Service Research & Development. RMRS maintains 14 field laboratories throughout a 12-state geography encompassing parts of the Great Basin, Southwest, Rocky Mountains, and the Great Plains. While anchored in the geography of the West, our research is global in scale. RMRS also administers and conducts research on 14 experimental forests, ranges and watersheds and maintains long-term research databases for these areas. Our science improves lives and landscapes. More information about Forest Service research in the Rocky Mountain Region can be found here: <https://research.fs.usda.gov/rmrs>.

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