

Non-native earthworms are damaging hardwood forests

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Think of earthworms and a few things come to mind: they make great bait for fishing, they aerate the soil, and they're an excellent addition to a compost pile. But what a lot of people don't know is many earthworms are actually invasive species.

"The western Great Lakes region, which is the area we're focused on, has no native earthworms," says [ecologist](#) Cindy Hale, a research associate with the Natural Resources Research Institute at the University of Minnesota in Duluth.

Native earthworms in the region were all wiped out after the last Ice Age. The current [population](#) was brought by Europeans hundreds of years ago, (soil was often used as ballast in ships) and they're now changing the face of local forests. Anglers are adding to the problem by dumping worms that don't end up on the end of a hook.

With support from the National Science Foundation (NSF), Hale's team created the Great Lakes Worm Watch website and outreach programs to stop the spread of non-native earthworms and to clear up the common misconception that they're harmless.

"Earthworms aren't good or bad," says Hale, who has used earthworms for composting at her own organic farm. "Earthworms are just earthworms; they do what earthworms do, and what they do in agricultural systems, we like, and what they do in these native hardwood forests, we don't like. The reason for that is those two ecosystems are completely different."

"The native forest ecosystems in the western Great Lakes region adapted to earthworm-free conditions for 10,000 years or so, since glacial retreat, and all of the ground rules of these forests are based on the premise that there are no earthworms that rapidly consume, mix and decompose organic material," continues Hale. "As a result, all of the nutrient dynamics and organic matter recycling dynamics were controlled by fungi and bacteria;

so, (there was) a very slow turnover, that resulted in the accumulation of a forest floor."

Earthworms may be small but when they take over a forest, the impact is dramatic. They cause the rapid incorporation of organic material into the [soil](#), changing its structure, chemistry and nutrient dynamics. What's known as the duff layer is suddenly removed, and this duff, or decaying organic material on the forest floor, is habitat for several species of insects, spiders, small vertebrates, bacteria and fungi. It is also the primary rooting zone for most plants.

"What's really the biggest negative effect on the plants directly is the removal of their rooting zone. It can cause mortality of adult plants but, furthermore, it can cause a loss of reproductive potential. A lot of these native plants have seeds that have very complex seed dormancy and germination strategies," says Hale.

For example, some plants may take several seasons to germinate, because they have to go through multiple freeze and thaw cycles. Other seeds, including some native orchids, require very specific fungi to infect the seeds before they can germinate. So, if the earthworms are changing these fungi populations, the changes can have direct effects on the plants.

Hale and graduate student Ryan Hueffmeier gave a tour of the Bagley Nature Center on the campus of the University of Minnesota-Duluth, an area heavily invaded by non-native worms.

To help land managers, park personnel and resort owners evaluate the level of earthworm invasion and impacts, Hueffmeier has been developing an "Invasive Earthworm Rapid Assessment Tool" (IERAT). According to the IERAT scale, a score of one means the area is earthworm-free, and a score of five, the highest, means heavily invaded.

"[Bagley] is a heavily infested area," explains Hueffmeier, "so when it comes to the [IERAT] scale, this would be a five. These are maple trees; sugar maples. What we are seeing is they are being impacted. Whether it is a cause of the earthworms, or it is one piece of a larger thing going on, we are noticing impacts."

There are tips and instructions on the [Great Lakes Worm Watch](#) website to help "Citizen Scientists" gather earthworms and data.

"We send them sample vials, instructions and data sheets [with which] they can do the sampling and send it to us," explains Hale. "We [then] confirm the identifications and send them back that information. We have in excess of 10,000 submissions at this point. We are really starting to develop this geographic database, which was our goal."

With millions of earthworms per acre in invaded areas, there are no known methods to remove earthworms from where they have established. The focus is on preventing further spread of at least a half-dozen invasive earthworm species to currently earthworm-free and minimally impacted forests.

Much of the work starts with anglers.

Many people who use earthworms as bait routinely dump their leftover earthworms in forests or water near their fishing locations. Student interns working under a U.S. Department of Agriculture (USDA) Invasive Species grant have spent recent summers in northern Minnesota surveying and speaking with anglers, and fishing camp and resort owners about containing the spread of these non-native earthworms.

As part of that educational campaign, labels designed for fishing bait containers read: "Unused earthworms? Toss 'em in the trash. Earthworms are an invasive species. Help protect the health of our native forests and waters, toss in the trash, not on the ground, or in lakes and streams."

Jenna Kallestad, a recent graduate of Hamline University in St. Paul, Minn., says when people find out that earthworms are invasive, they are really shocked--especially when they find out just how

much earthworms can affect the forest. "People who live in northern Minnesota love the area because of the natural resources," she adds. "Their entire livelihood is based on it so they really do try to stay informed."

According to Hale, earthworm invasions are also a global problem. European and Asian [earthworms](#) are invading Russia, China, New Zealand, Australia and other regions.

"They can colonize lots of different habitats and the key here is they're readily moved by human activity," she says.

Spreading the word and keeping tabs on these [invasive species](#) could help stop them from worming their way into more hardwood forests.

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