Natural Resources Research Institute
University of Minnesota Duluth
Driven to Discover

NRRI *Now*

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NRRI Mission:
Deliver research solutions to balance our economy, resources and environment for resilient communities.

www.nrri.umn.edu

From the Editor:

NRRI innovative research has resulted in a new potential for turning waste biomass resources -- invasive plants, wood mill waste, forest fire problem species -- into a new solid fuel product.

This 'biocoal' has many attributes and, after a decade of research, NRRI is finally producing it at a commercially relevant scale. Our 'biocoal' does not have the heavy metal pollutants that fossil coal has and it provides comparable energy content. It also sheds water, like coal does, for ease in shipping and handling.

NRRI will work with industry partners to test it in full-scale power plants and other energy generators.

This is just the first of many bio-based fuel possibilities that NRRI will be experimenting with in its Renewable Energy Lab in Coleraine, Minn.

Stay in touch!

June Breneman

NRRI Associate Director Don Fosnacht, left, is interviewed by local TV and newspaper organizations during a media event to showcase NRRI's Renewable Energy Lab.

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Innovative Research: Doubling down on invasive species

Across the Great Lakes "Clean, drain and dry! Clean, drain and dry!" is the battle cry to stop the spread of aquatic invasive species.

No one wants to spread troublesome plants and animals that mess with native species. And clean-drain-dry is an effective protocol for boats. But spiny water fleas, for example, are known for gumming up fishing lines.

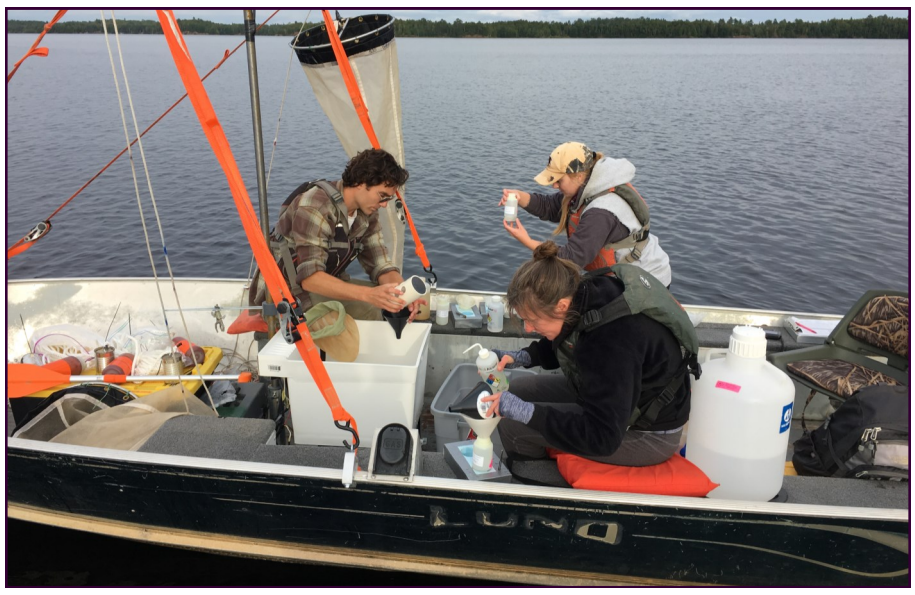
What role does fishing gear play in spreading invasives? Is some gear more likely to spread spiny water fleas?

NRRI joined UMD's Biology Department to get some answers. The spiny water flea is a non-native organism that eats even tinier organisms in lakes – the food needed by baby fish – thereby disrupting the food web. Like many aquatic invasive species, they arrived from Europe in ship ballasts, established themselves in the Great Lakes in the 1980s, then began hitchhiking to smaller lakes in the Midwest.

If the long, barbed spine of the spiny water flea gets it caught on fishing lines, increasing the risk of accidental movement to other lakes, what else might it catch on?

"Are the frayed anchor ropes a problem? What about the bait bucket? The downrigger? Are they hiding in the live wells in the boat?" asked NRRI Project Co-Lead Valerie Brady. With funding from St. Louis County, she and NRRI Scientist Josh Dumke devised a new research protocol to figure it out.

On a late summer evening, NRRI researchers motored in two boats on Island Lake Reservoir in rural Duluth "fishing" for spiny water fleas. Evenings and mornings are the best time to catch their research samples. Spinys swim deeper into the water to avoid the bright light of midday and hide from predators.



NRRI researchers Matt Santo, Kari Hansen and Holly Wellard-Kelly on Island Lake in September.

"Twilight hours, when anglers are often on the water, may present increased risk of ensnaring spiny water flea on gear due to the upward migration taken by these organisms under low light conditions," explained Donn Branstrator, UMD Biology Professor and project leader. "That's one thing we might learn with this research."

Large, long nets are lowered off the side of one boat, and then raised to collect the tiny, spiny invaders. A second boat trolls the lake slowly with three fishing poles set off the back and a downrigger on the side while a live well pumps water into a bucket. Meanwhile, buoys suspend anchors and anchor lines to see if the fleas attach to them. They are testing three types of fishing line material – monofilament, braided nylon and fluorocarbon – along with three different anchor rope materials.

Island Lake Reservoir is one of about 40 Minnesota lakes known to be infested with spiny water fleas. And this small, voracious predator can have a big impact. A recent study of Rainy and Kabetogama lakes showed that while the spiny water flea is just 2-3 percent of the lake's microscopic zooplankton, they reduced the native populations by 40-60 percent.

By spring 2018, the researchers will know more about how these invasive species are spreading and will begin an outreach campaign to share the information with anglers.

Minnesota Value: NRRI gives Hwy. 53 reroute a strong start

If you're going to study ore; you must go where the ore is. Which is why NRRI's geologists spent two years living in campers and cabins with their three dogs. But being onsite allowed them to finish their research for an important project on time and under budget.

In July 2013, NRRI's John Heine and Marsha Patelke moved to their temporary shelters to help the Minnesota Department of Transportation with a huge challenge – rerouting U.S. Highway 53 to make way for expanded mining near Virginia. They wanted to be able to gather data as efficiently as possible to inform the project's preliminary planning. And the clock was ticking. MnDOT had to get the re-route completed by November 2017.

They beat the deadline.

NRRI's ore resource model and analysis provided foundational data to the Minnesota Department of Transportation for this major road reroute project.

But those first two years of NRRI research, 2013 to 2015, laid the foundation – almost literally – for three and a half miles of new road and a massive, 204-foot-high, 1,100-foot-long bridge. NRRI's geologists were able to help MnDOT determine the best re-route plan for the project by studying the rocks on which it would be built.

"We did the preliminary work that went to the engineering company so they knew what the foundation would be," explained NRRI Geologist Marsha Patelke. "Is it bedrock? Or fill from previous mining activity?"

Even more importantly, NRRI's analysis of the rock showed the value of the ore under the new road and bridge. This allowed MnDOT to purchase that ore value from Cliffs Natural Resources and the Minnesota Department of Natural Resources. They would never have to move the road again.

The original roadway was built in 1960 with an easement from iron mining interests. At the time, MnDOT agreed to move the road with three years notice if the mining company needed to get to the ore underneath. When that time came, the agency came up with three options to reroute the highway, and there was a lot to know about each scenario.

Patelke and Heine pulled over 35,000 feet of rock core samples out of the ground and brought it straight to NRRI's minerals lab in Coleraine. Staff there ran taconite industry-standard tests to assess the resource quality and NRRI Geo-engineer Larry Zanko used the data to model what was ore, what was waste, and then estimated how much would be made inaccessible by each reroute option.

"I generated a resource model that provided an objective third party estimate for what tonnage MnDOT would have to pay for," said Zanko. "And our numbers were in close agreement with leaseholder tonnage estimates, so that made it easier to arrive at a consensus."

The team was also asked to evaluate the resources for potential gold reserves. In the end, MnDOT built Minnesota's tallest bridge connecting Virginia and Eveleth for decades to come.