

NRRI Mission:

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

www.nrri.umn.edu



Entrepreneurs drive economic growth. They freshen up the business climate and increase competitiveness. They spur innovation. They create jobs.

UMD's Labovitz School of Business and Economics will celebrate this at their 5th Annual Entrepreneurship Conference on November 5. NRRI's own innovation leader, Tim White, will be one of the keynote speakers.

And NRRI's own innovations for fiscal year 2019 (July 1, 2018—June 30, 2019) is now available in a printed Annual Report Highlights or online on our website.



NRRI Leadership

Rolf Weberg, Executive Director

Directors:

Don Fosnacht, Energy Management
George Host, Forest & Land
George Hudak, Minerals & Metallurgy
Lucinda Johnson, Water
Kevin Kangas, Coleraine Labs
Eric Singaas, Materials & Bioeconomy

Duluth Labs & Administration
5013 Miller Trunk Highway
Duluth, Minn., 55811
218-788-2694

Minerals & Energy Labs
One Gayley Avenue
Coleraine, Minn., 55722
218-667-4201

The University of Minnesota is an equal opportunity educator and employer.



Den boxes provide nesting sites to help fisher populations

Packing out a 52 pound wooden box, deep into the woods – and this will happen 100 times when all's said and done – makes NRRI Biologist Michael Joyce feel more like a pack mule than a scientist.

The insulated and specially designed boxes are for forest fishers – cute, brown, mammals in the weasel family – to give the mama fishers a safe place to den and raise their young. The goal is to increase the fishers declining populations in northern Minnesota, in the same way nesting boxes for wood ducks and blue birds helped those species.

"I'm either going to get good and strong through this, or I'm just beating up my body," Joyce laughed. "But I think the data we get will make it worth the effort."

The artificial den boxes could make up for the lack of big, old cavity trees – 20 inches in diameter, on average, which are the fishers preferred habitat. Trees of that size are hard to come by in forests managed for timber sales or that have succumbed to other disturbances.

Over the past 20 years, the fisher population in Minnesota has declined by 50 percent. And after extensive surveying of more than 10,000 northern Minnesota trees, the researchers found less than 2 percent were large enough for fishers to use. Industries that depend on forests understand that when species are deemed threatened or endangered it increases the burden of regulatory and administrative restrictions on forest management plans.

Hiked out to sites through brush and swamp that are well away from roads, the boxes are hung high on the trees, trail cameras are affixed to watch the box opening and a branch is attached to the entryway. This project will evaluate the success of the boxes and develop guidelines and construction plans for land and wildlife managers, as well as private land owners



Scientist Michael Joyce installs a fisher den box in a forest north of Duluth for the research project.

and other groups that want to improve fisher habitat. The box openings also have sticky tape on one side to collect hair samples that can later be used for genetic testing.

The pilot study, completed in May 2019, showed the new homes attract the attention of the neighbors. Trail cameras show barred owls, rodents, flying squirrels, raccoons and bears at the den boxes.

"We've even seen red squirrels mating on the roof," said NRRI Wildlife Biologist Michael Joyce. "But we know fishers are there and using them. We've got them on camera, too."

Aside from being an iconic north woods mammal, healthy fisher populations indicate good habitat conditions for other critters that also rely on older forests. Landscapes with young, middle aged and older forests provide for a variety of species.

"Despite the recent decline, our fisher population isn't doing as poorly as they are in other places, but we don't want it to get to that point," said Joyce. "Right now we are trying to learn as much as we can to reverse the trend and provide tools to

maintain a healthy fisher population in Minnesota."

NRRI researchers are leading the effort, but other groups are helping deploy and monitor den boxes. Project partners include biologists and managers at Minnesota Department of Natural Resources, 1854 Treaty Authority, Carlton County Land Department, Cloquet Forestry Center, Blandin Paper Company, the Leech Lake Band of Ojibwe and students at Vermilion Community College.

The den boxes are just one part of a multi-pronged approach to understanding the fisher population decline. Researchers are also examining tree cavities that were previously used by fishers to understand how long it takes for a natural nesting site to form and how long they last in the forest. They are also collecting scats near the boxes to understand fisher diets, and they will examine interactions between fishers and other carnivores in the future to learn more about common predators of fishers.

The two-year Fisher Den Box Project is funded by the Environmental and Natural Resources Trust fund as recommended by the Legislative Citizens Commission for

NRRI sheds light on complexity of biodiversity

Two-thirds of America's bird species are threatened with extinction, according to the National Audubon Society. Many other studies show similar declines in mammals, insect and fish species across the globe.

Scientists are trying to better predict how biodiversity loss will affect ecosystems – how well they function and perform services we all need – especially in the face of climate change stress. Pioneering research at the Natural Resources Research Institute found a better way to understand biodiversity impacts.

NRRI limnologist [Chris Filstrup](#) is the lead author on a paper [published in the journal Ecology Letters](#) this month, that suggests that species richness – the number of different species in a given ecological community – is not the only, nor necessarily the best, way to measure biodiversity impacts on ecosystems. A stronger measure to predict how well the ecosystem is functioning is how evenly the species are distributed.

For example, in Filstrup's research on algae in lakes, he looked at whether or not multiple species have about the same number of individuals in a community, no matter the number of different species. It's easy to understand that having similar numbers of species across a community is a good thing. What's unexpected is that "even" communities don't always lead to high-functioning or highly productive ecosystems, as scientists thought.

"Evenness of species tends to be overlooked, but we found it can be more important than richness when predicting how well ecosystems function," said Filstrup. "As scientists, we need to determine how ecosystems will respond to environmental change, including biodiversity loss, especially when it impacts things we care about, like water quality and aquatic food webs."

Consider the harm caused by overabundant and toxic algae in lakes. This is an example of a highly "uneven" ecological community where one species takes over. While some algal blooms are benign and promote a healthy food web, toxic algal blooms can lead to health problems and water quality issues. An example on the land are prairies that have more evenly distributed plant species that leads to higher productivity.

Ecosystems with reduced biodiversity may not be as resilient to new or changing stressors. In those situations, climate change and land use in watersheds are more impactful compared to ecosystems with more diverse



Harmful algal blooms of cyanobacteria is an example of an uneven ecosystem, where one species dominates.

communities. A species that dominates under one set of conditions may perform poorly under another set of conditions.

Filstrup leads the water quality program at NRRI and is focused on understanding changes to Minnesota lakes. For this study, however, he pulled in U.S. Environmental Protection Agency data from 1,130 lakes across the U.S. with researchers Katelyn King and Ian McCullough from Michigan State University.

"We thought we'd find these responses only in intense agricultural regions," said Filstrup. "But we found these strong but opposite responses to 'evenness' throughout very different regions of the country, suggesting this may be the rule rather than the exception."

Considering species evenness can help inform conservation practices that preserve ecosystem services important to all. The study was funded by the National Science Foundation, award number 1638679.