

NRRI Mission:

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

www.nrri.umn.edu



From the Editor:

When Twin Cities Business magazine highlighted Duluth as a city of innovation in their January 2018 issue, NRRI is called out as a "chief innovation engine."

Our approach is uniquely focused to help Minnesota economic drivers in three ways: repurposing waste, seeking higher value and embracing sustainability.

One excellent example of that is the story below. NRRI researchers collaborate broadly so that University research connects to private sector problems.

And sometimes our research joins many other efforts that helps prepare for the future, as our moose and Canada lynx research has done. Read about that in this issue, too.

June Breneman



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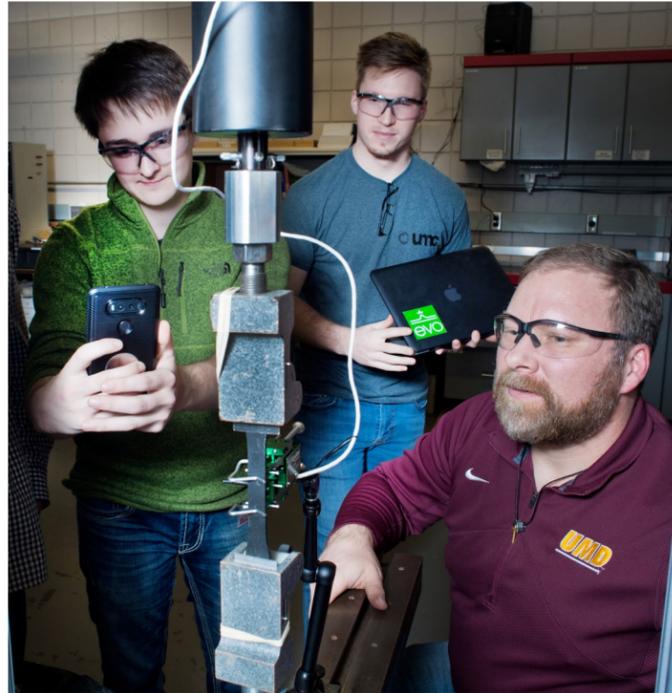
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Research turns unprofitable lignin into high value plastic



NRRI Scientist Victor Krause tests the bio-plastic strength with two UMD students.

Eric Singaas, director of NRRI's Wood Products and Bioeconomy Initiative, developed a patented process that separates a tree's cell wall compounds: cellulose, hemicellulose and lignin. Scientists at Oak Ridge National Laboratory and the University of Tennessee figured out how to make a polymer resin from the lignin. This bio-plastic can replace the popular ABS (acrylonitrile-butadiene-styrene) material, which is derived from petroleum. Attis Innovations, Inc. is the company that will commercialize the technologies.

"We are very excited about this," said David Winsness, president of Attis Innovations. "We can potentially double the revenue for biorefineries and make that industry sustainable."

The lignin will be converted into ABL (acrylonitrile-butadiene-lignin) resin, worth about \$1.20 per pound. For comparison, lignin burned for energy is valued at only five cents per pound. And industries are seeking bio-

based composites. The lignin-based resin will compete directly with ABS resin, a durable plastic commonly used in home siding and window products, bumpers on cars, whitewater canoes and many household products.

"Realizing that difference in value and expanding markets for lignin makes an integrated biorefinery financially viable," said Singaas. "We'll be able to sell Minnesota forest resources into markets that don't typically use them, and add value to the fledgling biorefinery industry."

The first target is to develop composite siding products. NRRI will be testing its fast-growing hybrid poplar tree species to make the first sample plastics. By the end of three years, the team plans to have sufficient quantities of the lignin-based resin to demonstrate its properties. Then it will branch out into the automotive market and beyond. NRRI will also analyze the properties of lignin from a variety of tree species and other plant materials.

"NRRI brings great value to this whole project," said Winsness. "They understand the process, how to develop new products and have the analytical capabilities we need."

NRRI prepares state for changes to mammal populations

We know – because it is happening in our lifetimes – that changes to the environment are impacting iconic Minnesota mammals. Moose in Minnesota have declined over the last 25 years. Caribou are long gone. White-tailed deer have moved north from where they lived 200 years ago. There are fewer Canada lynx, while the bobcat population has spiked.

"Minnesota mammal species that call the boreal forest their home have declined compared to 100 years ago," explained Ron Moen, NRRI Senior Researcher. "And in the next 50 to 100 years, four species of shrews and moles, nine species of rodents, the snowshoe hare, moose and three carnivores could be gone from Minnesota if climate trends continue."

Like in real estate, the issue is location, location, location. The state is split into the boreal forest and hardwoods to the north and the prairie grasslands to the south. That means many of the state's mammal species are living at the southern edge of their range. And the environment they're adapted to is moving north.

"So we're looking ahead to where the climate is taking us," said Moen. "And we know that new species will move in, like we're seeing the opossum move north. It hasn't reached Duluth yet, but it likely will. At the same time, some other southern species could move to Minnesota, like rodents and bats."

Minnesota's moose

Moen and others in Minnesota have been studying the decline of moose populations in Minnesota for the past eight years. Moose are highly adapted to cold temperatures and the ever-warmer summers are especially hard on them. Two NRRI projects currently underway are coming together to address these state challenges. The Carnivore Project, funded by Environment and Natural Resources Trust Fund, uses strategically placed trail cameras to



Lynx kittens were found during NRRI's research, proof that breeding pairs were there.

collect data on animals roaming the woods. And the National Parks Climate Change Adaption project is documenting significant vegetation changes to the year 2100 in seven protected Great Lakes parks.

The goal is to understand what changes are in store for Minnesota mammals and the large-scale implications of those changes. "If climate change is the ultimate cause of the disappearance of a species, what do we do? We can't manage climate change like we can manage habitat," Moen added.

Canada lynx

In January, the U.S. Fish and Wildlife Service announced their intention to propose removing Canada lynx status as a threatened species under the Endangered Species Act. The status helps a species to recover from population declines that threaten extinction.

Moen and several graduate students have been studying lynx since 2003 to understand the big cat's habitat and food needs, seek out evidence of breeding and track their movement. This data gathering at NRRI largely ended in 2009, but it provided important knowledge about the lynx in Minnesota.

"We have Canada lynx here, but probably never more than 200, so the population is not huge," said Moen. "Our population depends in part on periodic immigration from Canada."

Minnesota's shorter, warmer winters and less snow cover means the big footed lynx may lose their advantage of easy travel across deep snow allowing bobcats to increase.

"It isn't just Minnesota that lynx are in, and it isn't just Minnesota where lynx are in decline," said Moen. "Lessons we've learned here could also be applied in other states, and vice-versa."