

NRRI Mission:

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

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From the Editor:

If you like to gamble, you'll like research. It's not a sure bet, but the chances are in your favor. That's the game our wildlife researchers are playing this year.

Not sure of the best way to gather data on the elusive boreal chickadee, they decided to hedge their bets. The team built and hung hundreds of nesting boxes with the goal to learn more and help this species to thrive. Will this work? What can they learn? Read about the project below.

NRRI is also reporting on our progress (and promise!) of the state-funded Mining & Water Innovation Initiative. Lots of challenges. Lots of opportunities.



NRRI scientists research boreal chickadees to inform bog management

Pulling up to the green and golden boreal bog northwest of Duluth, NRRI researchers were greeted by a gray jay and a boreal chickadee.

"People come here from all over to see those two bird species" said Alexis Grinde, NRRI wildlife ecologist. She's co-leading a collaborative project to better understand more about the boreal chickadee to inform forest management of peatlands. "You generally don't see those species in your yard. These lowland conifer ecosystems are so unique with a unique diversity of not only birds, but also plants and insects."

And that's exactly why the Sax-Zim Bog Welcome Center recorded 4,316 visitors over the last three winter months, December to March. Bird enthusiasts flocked in from 41 states and five foreign countries, according to Bog Executive Director Sparky Stensaas. And given its remote location, it took some effort to get there.

On this October day, NRRI researchers were hanging some of the 500 nesting boxes that will pepper the Sax-Zim Bog and Big Bog north of Bemidji. Boreal chickadee has been identified as a Species of Greatest Conservation Need by the Minnesota Department of Natural Resources. The hope is that a half dozen or so boxes attract the bird as a place to lay eggs. The researchers can then capture and place tiny radio transmitters on them to learn more about how they use the forest.

The concern is that a warming climate is changing the bog ecosystem, which is at its southern-most range in Minnesota. If so, is that impacting boreal chickadee populations? Exploding numbers of Eastern larch beetles are killing off thousands of acres of tamarack trees. Is that where the birds like to nest? Is the harvesting of older trees – the ones with naturally occurring cavities – impacting available nesting spots?

"We don't know very much about these birds now, so anything we can learn will be really valuable," said Grinde. "Studying the changes here and now will ultimately inform future management, as landscape changes continue to push north into Canada."

The researchers will also study Connecticut warbler, a Neo-tropical migrant species that's also threatened and nests in sphagnum moss.

The nesting boxes, filled with sawdust to mimic tree cavities carved out by woodpeckers, will make



NRRI Senior Wildlife Ecologist Alexis Grinde heads into the forest with researcher Steve Kolbe

it easier for researchers to return next year to see if they've been inhabited by boreal chickadees or any other species.

"Potentially, if we learn more about the peatland ecosystems we can develop strategies for the long-term conservation of high quality habitats and mitigate the impacts of climate change on the birds," Grinde added.

Understanding exactly how these slow-growing bog grow and regenerate after a harvest and how the water levels influence their productivity is another important part of this project. Marcella Windmuller-Campione, Forest Resources professor, and Rob Slesak with the Minnesota Forest Resources Council, are collaborating with Grinde to understand the peatland bog system as a whole.

"This is a rather unique set of studies," said Windmuller-Campione. "This ecosystem is a large piece of our Minnesota landscape but there's so little research done there."

In order to better inform forest harvest practices, Windmuller-Campione

will gather data on all the unique peatland vegetation – from the mosses and lichen to varying age classes of trees, young to old. How does this resource develop after a harvest? Do we need to change practices to better accommodate wildlife and the timber industry? Slesak will focus on peatland hydrology and how it changes over time, before and after timber harvests.

"Everyone loves the birds, and understanding how hydrology influences this unique habitat is essential to maintaining it in the future," said Slesak.

The researchers hope to understand more about trade-offs for the timber industry and wildlife, as well as potential adaptation strategies.

This project is funded for four years by the Environment and Natural Resources Trust Fund (ENRTF) following recommendation from the Legislative Citizen Commission for Minnesota Resources (LCCMR).

Mining & Water Innovation Update

With an appropriation of just \$2.6 million, NRRI piloted innovative technologies to support Minnesota's mining industries and precious water resources. Here's a run-down of our progress:

Beyond taconite

Working with industry partners, NRRI completed the design and initiated fabrication of a globally unique simulator process to demonstrate opportunities to produce high value direct reduced iron (DRI).

- Designed to meet deficiencies in industry ore screening tests.
- Reveals opportunities to extend Minnesota ore resources into broader national steel markets.
- Stayed within budget and size constraints; learned more and expanded scope.
- Next steps: Continue to work with industry to fund, construct and deploy.

Iron Range of the Future

What will happen when Minnesota runs out of magnetic iron used to make taconite pellets? NRRI took the first steps in making pellets with iron resources that currently are not mined: hematite and goethite. This will potentially expand the state's available ore bodies and reduce mining waste. The research led to new understandings of the Range's mineral complexity that will require continued evaluation to develop a more broadly applicable technology. Sample products will be piloted and tested against current mining products.

Data for Decision-Makers

Over 250 multi-disciplinary layers of data – forest, water and mineral resources, infrastructure, community information and more – are compiled into the Natural Resource Atlas of Northeastern Minnesota. This search tool allows users to view, explore, analyze and share information for efficient and informed decision-making. It was developed with extensive input from end users and two Advisory Committees representing natural resources agencies and other stakeholders. Plans to expand the Atlas state-wide are underway. Beta roll-out was impressive: "Well worth the effort and money," according to several reviewers.



NRRI's natural flotation process, underway at the pilot scale, shows promise that could extend Minnesota's ore resources.

Low cost sulfate reduction

Industrial Applications: To meet water quality standards, NRRI harnessed an electrochemical/microbiological process that converts sulfate to sulfide, and then captures and removes it using waste iron resources. Scientists discovered ways to predict and control the rate and capacity of iron release for sulfide capture. This process has the potential to reduce sulfate from ranges in the thousands to hundreds parts per million. Industrial partnerships are helping to determine the design and operation parameters in the next phase pilot-scale demonstration.

Municipalities: Northern Minnesota communities are seeking affordable ways to meet the state's low sulfate standards for wild rice. NRRI is leading a multi-disciplinary team to pilot the transformation of soluble sulfate into a solid for removal from municipal wastewater effluent. This is a unique adaptation of known processes. A larger scale pilot is planned to develop a mobile unit to test the technology in northern Minnesota towns.



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