NRRI Now

A monthly newsletter from the
Natural Resources Research Institute

March 2021 | Volume 06 | Issue 03

NRRI Now is a 2021 CASE V Award Winning Newsletter!

Award Winning. March news from NRRI.

It is hard to believe that March is here already, and with it, the accelerating 2021 Legislative Session. While our researchers continue to drive our Research Platforms, NRRI has two legislative appropriation bills in play to support our efforts to deliver for Minnesota's economy of the future.

SF1388/HF1505 seeks continuing funding to (1) extend the forest management assessment tool statewide and (2) develop and demonstrate biochar opportunities for our forests and new industries.

SF1389/HF1506 seeks continuing funding to (1) pilot sulfate reduction technologies around the state and (2) define and develop Minnesota's future iron resources, technologies and products.

We greatly appreciate your support and encourage you to contact your legislators to support this legislation and NRRI.

Be safe, stay healthy and we'll keep working.

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NRRI receives $2.1M to research Minnesota's iron of the future

March 1, 2021
June Breneman

U.S. Department of Energy awards NRRI $2.1M to research Minnesota's iron products for expanded steelmaking markets.

"Our goal is to keep all of our mines active and producing the iron ore of the future." - Don Fosnacht

NRRI has received a $2.1 million grant from the U.S. Department of Energy's (DOE's) Office of Energy Efficiency and Renewable Energy to develop technologies for more efficient production of direct reduced iron. NRRI is providing matching funds of $530,000, leveraging Minnesota legislative support from past appropriations.

NRRI is one of 46 projects in 23 states receiving funding aimed at stimulating technology innovation, improving energy productivity of American manufacturing, and enabling the manufacturing of cutting-edge products in the United States.

Direct reduced iron pellets are needed by the growing electric arc furnace steel industry which now make up 70 percent of the steel market. This DOE funding is intended to advance production of DRI and pig iron from Minnesota resources for this growing steel market.

Specifically, NRRI researchers will seek to enhance iron ore pellet chemistry to increase efficiency of the direct reduced iron (DRI) process and downstream processes to convert into metallic iron. These metallic iron products (nodules, pig iron, etc.) are 97 percent pure iron and low in impurities. By removing the gangue (mostly alumina and silica) before the pellets get to the steel plant, it will save the electric arc furnace operation 33 percent in energy use in comparison to DRI use. This saves money and increases productivity.

“Different mines on the Iron Range have different capabilities for making direct reduced grade pellets. This research will assist Minnesota mines to produce pellets for direct reduced iron,” said Don Fosnacht, NRRI Associate Director. “This is a big deal for our Minnesota mining operations. Our goal is to keep all of our mines active and producing the iron ore of the future.”

In 2019, Cleveland Cliffs converted the Northshore Mining facility to produce both taconite and a direct reduced grade, the latter to supply the Toledo, Ohio, DRI facility.

The Natural Resources Research Institute, part of the University of Minnesota research enterprise, works to deliver integrated research solutions that value our resources, environment and economy for a sustainable and resilient future.

Wall-mounted vanities get put to the test at NRRI

March 1, 2021
June Breneman

Manufacturing association turns to NRRI to test trending wall-mounted cabinets.

"We brainstormed worst-case scenarios involving cabinet installation, use and abuse." - Victor Krause

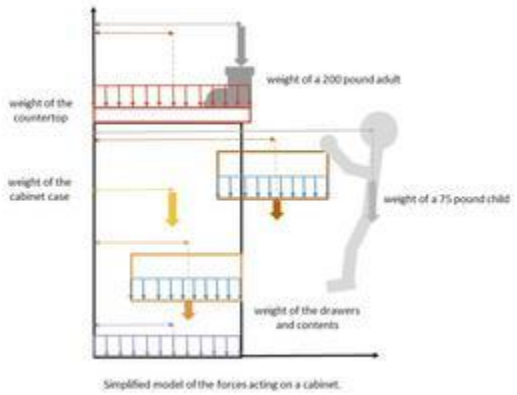
Bathroom vanities that rest on the floor is SO 2010. Trending now are vanities mounted on the wall – especially in hotels. It's a great look, but it brought up some testing questions for the Kitchen Cabinet Manufacturing Association that certifies cabinet performance.

What happens if a young child climbs up on the drawers? What if an adult stands on it to reach something? Can it meet the same standards as floor cabinets?

A NRRI team approach to addressing the KCMA's questions resulted in a report that outlined current options on the market, potential stresses and testing results.

Patrick Donahue, NRRI Building Materials Program manager, had heard through his national network in the cabinet industry about the challenges with wall hung cabinets meeting specifications for weight.

"We have the wood products expertise, cabinet testing capabilities and engineering to pull together a comprehensive study for them," said Donahue. "So that's what we did."



Simplified model of the forces acting on a cabinet.

First, the team had to know what's out there – the different shapes, sizes and mounting systems in use. NRRI student technician Kamryn Kalal searched the internet for product examples, how they're built and types of brackets used.

"Then we brainstormed worst-case scenarios involving cabinet installation, use and abuse," said Victor Krause, NRRI wood products scientist. NRRI Engineer Kory Jenkins diagramed the testing protocol.

They received 10 different cabinets from four different companies for testing against the KCMA's current cabinet standards. They mounted them – one by one – upside down on a test wall and turned on the pressure.

A hydraulic press was used to apply loads at a rate of about 150 pounds-per-minute, taking four minutes to reach a 600 pound load, which is the KCMA standard. They kept applying pressure until something broke.

The final report, delivered in January, gives the cabinet association the formulas they need to make calculated decisions for certification of wall-mounted cabinets.

"We're hoping that by demonstrating our capabilities for product testing, we'll attract more opportunities for expanded testing or some research projects, maybe on new, lighter materials or stronger adhesives," said Krause.

Advisory Board Spotlight - Andrea Schokker

PHOTO: *Dr. Schokker at her home office with office mate, Prada, a Pharaoh Hound.*

February 25, 2021
Q & A with Andrea Schokker, UMD Head of Civil Engineering & Professor

Money to support NRRI research and sustainable markets for Minnesota's natural resources can turn into a multifold payback to our economy.

NRRI: In your opinion, what challenges face Minnesota's natural resource-based economies and how does NRRI play a role in addressing those challenges?
As is true of many things in our country right now, the opinions around using natural resources have moved increasingly to strong unyielding positions in opposite directions. As a center for research, NRRI is in a unique position to provide science-based practical solutions to problems that can't be simplified into a one-size fits all answer. The interaction of humans and our needs with the environment is complex and the solution often lies in balance rather than extremes. NRRI can lead us into a future for Minnesota that balances economics and the environment through solutions to problems while also generating new markets for existing resources.

NRRI: What opportunities have caught your attention as bringing value to Minnesota and the region?
I'm particularly impressed with work focused on taking a fresh look at some of the traditional resources from our region and finding new markets for today and the future. For example,

value-added products from the forestry industry such as thermally modified wood can open up new revenue sources with a sustainable and highly durable product. Likewise, research and pilot activities to support implementation of Direct Reduced Iron (DRI) technologies is important in transitioning Minnesota's taconite industry to product higher grade metallic iron pellets.

One of the most important benefits of NRRI is the ability to go from research to application, even when that application requires significant scale-up. This is the work that means that dollars spent to support research at NRRI result in high returns on the investment and great strides forward for Minnesota. As a hub of experts in multiple areas tied to natural resources, product development and commercialization, NRRI is unique in being able to take a challenge, find the right team, and implement a solution. As an applied engineering researcher, myself, I appreciate seeing research at NRRI reach the intended application efficiently with practicality and economics at the forefront through the process.

NRRI: What role could the Minnesota Legislature play in NRRI's success in 2021?
Clearly, Minnesota has plenty to deal with right now, but we need to continue to think about both the short- and long-term needs for economic recovery. As our economy ramps back up, we want to ensure that we sustain that growth by looking to the next innovations while supporting our existing natural resource industries in developing new markets for the future. That work on the future has to start now to be fruitful in time to keep the growth going as we pull out of the decline and beyond our pre-pandemic levels. As I mentioned previously, NRRI has shown to be a great investment in our economy over the years. Money spent to support NRRI research and implementation of resilient and sustainable markets for Minnesota's natural resources can turn into a multifold payback to our economy. Not many bets are as good as that one.

NRRI: What might NRRI achieve in 2021 that you'll be especially proud to promote?
I'd be proud to promote and support NRRI in the work of interweaving industrial and economic progress with a true protection of our environment. It can't be an all or nothing proposition, and I think NRRI is making strides toward the innovations needed to show how that can realistically work.

NRRI: You have been on NRRI's Advisory Board for more than six years. How has your participation helped you grow professionally or personally? Has your advice to NRRI evolved?
The NRRI Advisory Board has been a great education for me on Minnesota's natural resources and the evolution of industries like mining and forestry. I am an engineering professor specializing in concrete bridges, so while the technology and process were familiar, the dive into new industries has been fascinating for me. I'd been involved with research institutes at a previous University before coming to UMD and was pleasantly surprised to find that NRRI is truly unique in their mission and purpose. This is a place where research goes not only to the point of the rubber hitting the road, but beyond that to the plan for the whole trip.

My advice on the board has evolved with my knowledge of the value of NRRI and its unique role for Minnesota and as an important part of the University of Minnesota, particularly UMD. The partnerships and integration of NRRI with UMD researchers, students and as well as the Advanced Materials Center at UMD are all instrumental in the success of the Minnesota economy while protecting our natural resources.

Meet the Researcher - Katya Kovalenko

February 25, 2021
June Breneman

Scientists love their data. But tracking and sorting the ever-increasing amounts of data can be a time consuming effort. Enter the data wrangler.

“On any given day, I could be working in a range of disciplines from paleoecology to geomorphology.”

Data wrangling is a thing. Like cattle wrangling, it involves gathering, sorting and settling the data where it can be retrieved for future use. Spurs not needed.

Katya Kovalenko is an aquatic ecologist and data scientist who came to NRRI in 2013 with a doctorate degree from Mississippi State University, picking up data wrangling skills while working on a wide variety of projects at NRRI.

It's a critical role because for scientists, the more data, the better. But managing that data is time-consuming. In her work as a data scientist, Kovalenko's skill accelerates the data-intensive research at NRRI, making it more accessible.

"I know it sounds dry, but I really enjoy this work," said Kovalenko. "My goal is to increase the utility of existing high-value datasets by applying new analytical approaches."

Kovalenko provides input for experimental design and statistical analyses, optimizes workflows and makes on-screen graphics work.

"I love the variety," said Kovalenko. "On any given day, I could be working in a range of disciplines from paleoecology to geomorphology."

One interesting project has her analyzing 16 years of data from Google searches to understand changes in public interest of invasive species and harmful algal blooms. She's also part of a global effort – funded by the U.S. Geological Survey – to analyze the impact of sea-level rise on coastal marshes.

"The data for that project is being collected all over the world and it's so important because millions of people live near coasts," Kovalenko explained. "Marshes are important protectors of the land."

Away from the computer, Kovalenko dons waders for research in understanding invasive species, aquatic food webs and ecosystem ecology. She studies many species in the Great Lakes and Minnesota's inland lakes to understand impacts of invasive species and other human-caused stressors on macroinvertebrates, fish and other aquatic communities.

Collaborations

Within NRRI, Kovalenko's skills – both as a data scientist and an ecologist – are well used by researchers, especially the water, forest and bird scientists. She is also part of the Informatics Institute and Minnesota Supercomputing Institute on the U's Twin Cities campus, sharing her specific expertise, as needed.

"We are likely to rely more and more on these institutes as the amount of data is increasing exponentially in nearly all fields represented at NRRI," she said.

And because of her coastal marshes work and work on scientific editorial boards, Kovalenko collaborates with colleagues around the globe, on every continent.

In 2019, she identified a need for all of NRRI's data users to get on the same page, so she pulled together a small internal team to document data management best practices – backing

up data, how to analyze and structure data, documentation, etc. And then NRRI Quality Manager, Lisa Estepp, organized and designed the information in an easy-to-follow guide.

Passing Pandemic Time

As an avid hiker and mountain climber (she has 30 14,000-foot ascents under her belt), Kovalenko hoped the pandemic lock-down would free up more time to hike locally. It hasn't. She also misses the extensive travelling she's done in the past.

"On the other hand, online meetings save a lot of time, increase efficiency and allow interactions which would otherwise be logistically impossible," she added.