



NRRI Now

A monthly newsletter from the Natural Resources Research Institute
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A mix of NRRI researchers and leaders meet with WLSSD leadership and staff in April at NRRI to discuss partnership potential.

'Get rid of it right'

The WLSSD motto

Like NRRI, the Western Lake Superior Sanitary District (WLSSD) was created by the Minnesota Legislature. Like NRRI, WLSSD

addresses environmental issues with real solutions. And like NRRI, their acronym is a real tongue-twister.

It's about time we got serious about partnering up. Members from the WLSSD team came to NRRI in April to discuss challenges that might best be addressed together. The free-flowing discussions ranged from PFAS and mercury pollution to disinfectant challenges. NRRI researchers also presented their current environmental work.

According to NRRI's Acting Director of Research, Pat Schoff, the group ended with a discussion about next steps and more visits, including a trip to the WLSSD facility.

Stay engaged and collaborate! That's where the action is.

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Taming the wild river



Computer model shows water flow currents in the St. Louis River Estuary.

June Breneman
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Project models St. Louis River estuary rip currents to decrease drowning risks

Lake rip currents are powerful, channeled currents of water flowing away from shore. And if a person gets caught in one, they can be deadly. Great Lakes rip currents cause, on average, 10 drowning fatalities a year.

NRRI water researchers have helped inform efforts to better understand the dangerous rip currents along Lake Superior's south shore, including at Duluth's Park Point Beach. Buoy observations and rip current models are used by the National Weather Service in Duluth to help inform rip current advisories and warnings of when conditions point to especially dangerous rip currents.

NRRI has long worked with other local stakeholders to deploy and maintain monitoring buoys and sensors to provide Lake Superior observational data. And that information produced rip current computer models developed by Chin Wu, a professor at the University of Wisconsin - Madison.

But what about the St. Louis River estuary? Alive with game fish and shore birds aplenty, it attracts folks in boats, canoes and kayaks, as well as swimmers along the shore. NRRI is involved in a new project to more broadly apply Wu's water current model to the estuary to identify potential and imminent drowning hotspots.

This effort is funded by the Minnesota Department of Natural Resources Minnesota's Lake Superior Coastal Program and the Wisconsin Coastal Management Program.

Hotspots and Rips

How do river currents move at and below the surface of this 12,000-acre area of freshwater? How do tributary inflows to the estuary create dynamic mixing patterns, and potentially localized dangerous currents? And what happens when water flow is especially heavy, like during spring snowmelt? Or how does it flow under the ice in the winter?



“We know the estuary is very dynamic and has influences from the St. Louis River and other tributaries, as well as from Lake Superior’s seiche,” said Chris Filstrup, NRRI limnologist and one of the leaders of this effort, “but we don’t know where the drowning risks are and how they change depending on flow conditions.”

Photo left: Chris Filstrup

The researchers are working with search and rescue personnel in Minnesota and Wisconsin who have responded to incidents in the estuary to provide them with information about when and where the drowning hotspots are.

First, they will look through historical drowning incidents data – old newspaper articles, community archives, and any rescue crew records. Beyond the incident itself, they hope to glean information about what the conditions were like at the time.

Once they’ve established the historical record, the next step is to understand the currents to prevent future drownings.

“With this year’s rapid snowmelt, there’s a lot of water moving through the estuary, with high flow from the St. Louis River and other streams,” said Filstrup. “That could create some pretty strong currents, and combined with the really cold water, could create a dangerous situation for people on the water.”

Volunteer Science Support

The effort relies on two groups of volunteers to gather and validate information for the project.

UMD’s Recreation Sports Outdoors Program will host kayak tours outfitted with a GPS and temperature sensor towed behind. This will collect data to help validate the temperature portion of the model.

A second citizen science volunteer group will tap recreational paddlers to record the height of the river and use sensors to record surface observations of temperature, conductivity, and total dissolved solids through the summer and fall.

Preventing drownings hasn’t been a strategic mission of NRRI, but having the expertise to contribute data collection and real-time measurements of water conditions to this important project is fulfilling. But as a scientist, Filstrup is also thinking about applications of the circulation model to support NRRI’s mission.

“We are working on several projects in the estuary this summer, looking at different aspects of water quality,” Filstrup said. “Once we’ve developed the circulation model, we can apply it to how water movement affects nutrient cycling and harmful algal blooms.”

Learn more about volunteering for this project by contacting Tiffany Sprague at tsprague@d.umn.edu.

Bird watchers get out your binocs!



The Common Tern is one of many species of migratory birds that NRRI researchers help tag and monitor with GPS units. This site on Interstate Island in the Duluth harbor is one of the species few remaining habitats.

Talking Minnesota's migratory birds with NRRI avian ecologist, Steve Kolbe

[World Migratory Bird Day](#) is celebrated annually on the second Saturday in May and October to raise awareness of migratory birds and their habitats. This year’s first observance is May 11.

Avian Ecologist Steve Kolbe with the Natural Resources Research Institute (NRRI) at the University of Minnesota Duluth answers questions about migratory bird populations in Minnesota, their migration routes and patterns, and the condition of their habitats.

Q. What species of migratory birds are commonly found in Minnesota and where?

Kolbe: Minnesota contains varied habitats — from grasslands in the west and bottomland deciduous forests in the southeast to boreal forests in the north. The combination of these habitats in a single state means that Minnesota is an extremely biodiverse state during migration (and the summer breeding season)! Additionally, the harsh winter conditions we experience in Minnesota mean the majority of birds migrate away from the state each fall. Combine these two factors and we see massive numbers of birds of a wide range of species leaving and returning to the state each year. Minnesota is also fortunate because it’s the end of the migratory journey for a wide range of species that spend the summer in the

state. Many southern states see species such as warblers only during spring and fall migration, but in Minnesota we get to enjoy them all summer long!

One of the first signs of spring is the huge flocks of geese and waterfowl that arrive as soon as open water is available. This year, many of these species migrated north very early due to the mild winter and lack of ice cover in the early spring. Eagles and hawks migrate back in large numbers throughout March and April. These birds are soon accompanied by the arrival of short-distance migrants such as American Robins, Red-winged Blackbirds and Eastern Bluebirds that have spent the winter in the southern United States. After the weather warms and leaves start to appear on trees, long-distance migrants — species that have spent the winter in Central or South America — such as orioles, tanagers, grosbeaks, and warblers begin to arrive and prepare for the breeding season. Birdwatchers are able to see well over 100 species of birds in a morning during this peak spring migration season along migratory corridors such as the Minnesota and Mississippi Rivers and Lake Superior.

In the fall, this pattern is reversed. Long-distance migrants leave as early as late July and early August, and short-distance migrants trickle south throughout September and early October. Eagle and hawk numbers peak in October as the weather starts to turn, and finally the small number of hardy migratory species, such as finches, that spend the winter in Minnesota arrive in November and December.

Q. What is the typical migration route for these migratory birds? And how do they get there?

Kolbe: Migration routes vary depending on the species and the location of their non-breeding grounds. For most species, the well-worn concept of migratory flyways is a gross oversimplification. Spring migration routes that end in places as distant as Alaska and Hudson Bay cross in Minnesota. Similarly, birds that winter on the Gulf of Mexico, the Atlantic Coast, and Central and South America all pass through the state in the fall.

In general, most spring migrants fly as directly as possible to their breeding grounds in order to occupy the best territories as quickly as possible. In the fall, birds will often take a more southeasterly route at a more leisurely pace to get to their wintering grounds.

The majority of bird species migrate at night and use multiple cues to help them navigate in darkness, including magnetic and polarized light fields and the stars. During a typical night of migration, an individual bird likely tries to travel as far as it can, given its energy stores and the flying conditions. Some species, such as Tundra Swans and Sandhill Cranes, are dependent on very specific habitats during migration and will follow traditional migratory routes and stop at the exact same areas each year. Because these species migrate in groups — often including adults and their offspring — knowledge of these prime stopover areas is passed down to future generations. Species that migrate during the day are much more likely to use geographic landmarks like river valleys or lake shorelines as landmarks and to use soaring flight, which utilizes updrafts off ridgelines or thermals of rising air produced by the uneven heating of the Earth's surface.

Q. How and what changes in habitats impact migratory birds and their migratory behavior?

Kolbe: Of the approximately 315 species that are regularly detected in Minnesota, nearly 250 breed in the state. Quality habitat that provides food and shelter is critical for birds during migration and for breeding

activities. In terms of migration, the majority of birds are relatively flexible and use any available stopover habitat that they can find. Some bird species stop for a day, or even a few hours, during which time they try to regain fat stores used to migrate by eating as much as possible. Other birds stay for much longer to refuel or wait for nice weather before making another migratory flight. For all species, habitat quantity and quality are the most pressing concerns. If a bird is unable to find enough suitable stopover habitat, it will be unable to refuel and make another migratory leap. Because human presence on the landscape in much of the state is high, we must make sure that as much natural habitat is saved as possible. Additionally, if a bird stops over at a site of lower quality, such as a site filled with invasive plant species, it may take much longer to gain enough nutrients to prepare for the next leg of the journey. Ensuring high quality stop-over and breeding habitat is available for all birds is a top priority for bird conservation!

Q. How do migratory birds respond to extreme weather events?

Kolbe: Birds have an amazing ability to respond to changes in the weather. In the spring, birds are incentivized by the choice of good breeding territories to arrive on the breeding grounds as soon as it is possible for them to find food and survive. However, when unexpected weather such as the snow and ice storms we sometimes experience in the spring occur, birds will often reverse course and migrate south until conditions improve before heading farther north.

Q. What are you doing to advance research on Minnesota's migratory birds?

Kolbe: The Avian Ecology Lab at the Natural Resources Research Institute is on the cutting edge of the study of migratory bird species in Minnesota. We specialize in using the latest technology to answer questions about how, where, when, and why birds migrate. For example, along with collaborators across North America, we have placed geolocators and GPS tags on Common Terns, American Woodcock and Golden-winged Warblers in order to understand migration routes and where they spend the winter.

Our group is also heavily involved in a global effort called the Motus Wildlife Tracking System. The goal of this project is to use automated telemetry to track the migratory movements of birds that are too small to be equipped with more sophisticated GPS tracking devices. Our group currently has nine stations along the north and south shore of Lake Superior. These stations have detected birds that were tagged as far away as Maryland and British Columbia! These new technologies have helped us to start to unravel the mysteries of migration and help inform conservation of Minnesota's birds.

[Steve Kolbe, M.S.](#), is an avian ecologist and staff member of the [Avian Ecology Lab](#) at the Natural Resources Research Institute. He has a special interest in bird migration and movement, testing novel survey methodologies and acoustic identification. Kolbe's research focuses on the ways in which birds use their environment at varying scales throughout the annual cycle. The Avian Ecology Lab focuses on developing economically sustainable conservation strategies and land management guidelines to preserve and enhance the species diversity of Minnesota bird populations and to protect species in need of greatest conservation.

Spring is prep time for upcoming field season



Paul Jeffrey replaces batteries in air temperature loggers and tests them prior to deployment in the field.

June Breneman
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NRRI technicians travel far and wide to get the data that informs the research.

“The challenge – and the beauty – of field work is that it will take you to really remote places that you otherwise have no reason to go, and see things you wouldn’t otherwise see.”

NRRI aquatic research technician Bob Hell is a 20-year veteran of field work.

He knows that the summer field season also often means many nights on the road, is physically demanding, weather-dependent... and vitally important. It’s when scientists gather the real-world data to add to NRRI’s many environmental monitoring databases and on-going research projects.

Springtime signals preparation for getting out in the wetlands, on the water and deep in the forests.

“Field work also adds a lot of diversity to my job,” said Hell. “I’m not doing the same thing day after day, and it breaks up the seasons. I’m not sure I could handle a normal desk job.”

For the Birds

Since 1995, NRRI’s avian ecologists have braved the biting flies and ticks of Minnesota’s Superior and Chippewa National Forests to document the presence of breeding birds. Returning to the same spots



year after year, they listen for the early morning calls of over 100 species of birds to understand population trends over time.

Photo left: Alexis Grinde

This information helps scientists and resource decision-makers better understand changes to the environment and make informed management decisions.

Other bird research involves improving habitat for young forest species such as the golden-winged warbler. And another seeks to understand the role of black ash wetlands and how to adapt management practices in the face of Emerald Ash Borer invasions.

Especially exciting for the field teams are new technologies – high quality cameras and better tracking tags – that allow them to gather more information, while keeping their distance from nests.

“Technologies and their applications have improved a lot over the years,” explained Avian Ecology Lab Leader Alexis Grinde, “They allow us to better understand different aspects of their ecology that we haven’t been able to document before, filling in important details.”

Neither Rain nor Heat... nor Tornado

High winds, rain and thunderstorms can turn a routine trip to collect samples into quite an adventure on lakes and in streams. Of course, all equipment is thoroughly checked and fixed before crews get started. New equipment is onboarded and everyone is trained for emergency situations.

Preparedness – and good communication tools – certainly helped when a tornado approached a field crew working near Green Bay, Wisc., last year. The team leader in Duluth watched the radar and stayed in communication with the technicians so they had plenty of time to get off the water. They got to their lodging safely, but the next day had to saw their way through downed trees to get back to the site to retrieve their sampling nets.

Improvements in water research equipment over the decades are well appreciated by Hell and his research crews. Reaching some of the sampling locations requires long hikes through dense vegetation. Lighter electrofishing equipment – a tool used to capture, identify and measure fish in streams – is especially appreciated.

“Back in 2003, when I first started, our electrofishing equipment was gas powered with a generator, and it was heavy,” said Hell. “We looked like ghostbusters! Those were hard days.”

Other gear hauled out includes specialized nets to capture tiny macroinvertebrates in the water column and sediment and “Hess” samplers used in cobbly stream environments.

Help Wanted

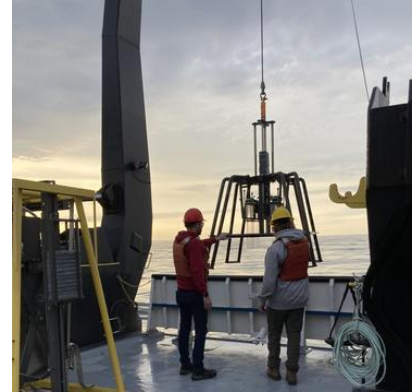
Photo right: Researchers collecting Great Lakes samples for a sediment surveillance project. Photo: D.Edge

NRRI hires large crews of college students to work as field technicians each spring. Hell and Grinde know what it takes to do well in a job like this – including getting dirty.

“A good field worker is a hard worker, observant and asks questions,” said Hell. “You have to endure long days, crappy weather and enjoy being outside. The technical stuff, we can teach.”

Avian field technicians are specially trained to identify birds by sight and sound, search for nests, and use radio-telemetry to track tagged birds throughout the summer.

“But what we can’t teach them is how to tolerate biting insects while working both independently and on a team,” said Grinde. “And truly, the key to a successful field season is having a good sense of humor.”



In the Lab

Samples and data collected throughout the summer are carefully stored for analysis later in the year and throughout the winter. And come spring, the process starts over again. Each year there are over a dozen simultaneous projects underway requiring field data gathering.

“Summer is all about the field work, going out and collecting samples and nothing gets processed until the off season,” said Hell. “So the stacks of gathered data sheets and hundreds of bottles of samples wait until October.”

Meet the Researcher - Jestos Taguta



Jestos Taguta gets to know the Iron Range community at the Society of Mining & Metallurgical Engineers conference held in Virginia, MN in April.

June Breneman
May 8, 2023

NRRI attracts global talent to minerals research group in Coleraine

From balmy Johannesburg, South Africa (with temperatures in the 80s) to Duluth, Minnesota, in a well-below zero January blizzard. Jestos Taguta was committed to a career move that brought him to NRRI earlier this year. But he wasn't quite sure what was in store for him, his wife and three children.

"We never imagined that our settling in northern Minnesota was going to be easy and seamless, but thanks to the amazing support of the NRRI staff, we are settled into our new home," said Taguta. "My boys were excited to see and experience snow for the first time. They engaged in snowball fights and quickly tried winter sports, like ice hockey."

Minerals Expertise

Bringing an impressive minerals processing and metallurgy skillset, Taguta is now a Principal Research & Development Engineer at NRRI's Coleraine facility. He brings specialist expertise in the processing of non-ferrous metals. His previous position was as Flotation Director at a large global company, Eriez, a global leader in separation technologies. He was also Commissioning Manager for the world's first coarse particle recovery plant in the platinum group minerals (PGMs) processing industry.

Photo right: Jestos Taguta in his NRRI office.

Prior to that, Jestos held very senior roles at Mintek, South Africa. He received a doctoral degree in Chemical Engineering specializing in Minerals Processing from University of Cape Town in South Africa in 2019.

At NRRI, Taguta hit the ground running, pioneering and leading the Advanced Process Development Program in NRRI's Minerals and Metallurgy Group. He is focused on developing sustainable, carbon-neutral strategies and processes for mineral resource extraction with reduced water and energy consumption.



“Minnesota is endowed with critical minerals like copper, nickel, cobalt, precious metals and rare earth elements,” said Taguta. “And the demand for these minerals is increasing. I am helping NRRI play a lead role in developing innovative and safe solutions to remove the barrier to the commercial use of these critical minerals deposits.”

Water Everywhere

Minnesota hosts 10% of the world's freshwater. Mining activities impact water resources, so one of Taguta's research areas is designing zero effluent discharge concentrators in mineral processing plants. To do this, he will be collaborating with NRRI's Water Research Group in areas of process water chemistry characterization. He'll also explore targeted treatment of process water to remove or reduce the concentration of ions that are detrimental to the recovery of valuable minerals. Taguta is also interested in reclaiming mine impacted waters by using them as a process medium in mineral processing.

“Challenges faced by the mining industry today require multidisciplinary and integrated research solutions,” said Taguta. “I was attracted to NRRI because of its integrated research model.”

And of course, Taguta is collaborating with NRRI's Geology and Minerals Opportunity Group and will seek out several university departments to design and develop equipment and chemistry solutions for mineral processing.

Off Hours

Settling his family into a new house and getting to know the Grand Rapids community is taking up a lot of Taguta's time these days. But he is grateful for the warm welcome. He also enjoys going to the gym and attending church with his family.

One Last Thing



In the News: Biochar

NRRI researchers were interviewed by WDIO "The Lift" host about the potential of biochar for its climate and environmental benefits.

[Watch Here>](#)

About NRRI

The Natural Resources Research Institute was established by the Minnesota legislature in 1983 as an applied science and engineering research organization to inform state citizens and decision-makers while leveraging the power of the University of Minnesota. **The forward-looking charter provided by the Legislature is to foster the economic development of Minnesota's natural resources in an environmentally sound manner to promote private sector employment.** We are a mission-driven, project-focused team working to create opportunities for natural resource stewardship.

As part of the University of Minnesota system research enterprise, the Natural Resources Research Institute (NRRI) employs over 140 scientists, engineers, technicians, staff and students in two industrial research facilities.

Two Industrial Research Facilities



NRRI has extensive laboratory capabilities to discover and deliver at the bench-to-pilot scales, reducing risk inherent in commercializing innovations. NRRI Duluth has 19 labs to meet the needs of land, wildlife, water and minerals research. There's also an additive manufacturing lab and several technology development labs. NRRI Coleraine is a 27-acre site focused on minerals and bio-based energy research.

NRRI Mission

Deliver integrated research solutions that value our resources, environment and economy for a sustainable and resilient future.

NRRI Vision

Discover the economy of the future.

Find out more: [NRRI website](#) / [Facebook](#) / [Twitter](#) / [Instagram](#) / [YouTube](#) / [LinkedIn](#)