Natural Resources Research Institute
University of Minnesota Duluth
Driven to Discover

NRRI Now

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

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From the Editor:

What makes working at NRRI especially exciting is that our scientists and engineers try to see the world around us in a new way.

The two stories in this issue are great examples.

Scientist Marshal Patelke explains how she's trying to catalog excess biomass resources to develop specialty soils. And Scientist Elizabeth Alexson is excited about naming a new algae species.

Minnesota, we see your potential.

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NRRI catalogs waste resources to develop specialty soils

Soil is so much more than dirt. Especially in northeast Minnesota where the bedrock is near the surface, soils are a valuable commodity. The Minnesota Department of Transportation, for instance, needs soils with specific drainage properties for their road building efforts. A mineland reclamation project needs soils with high nutrient content.

"But why would you take top soil from one area, to put it on another area?" said Marsha Patelke. "That's disturbing the environment."

Patelke is a NRRI researcher trying to figure out how to make a variety of soils for a variety of purposes out of local waste resources. Her current goal is to document the availability of resources and compile it into an online catalog. And that could lead to a lot of opportunities.

NRRI has done extensive research on readily available materials such as dredged sediment from the shipping canal. Patelke also knows there is a lot of mining waste rock, as well as sawdust and tree bark from wood products manufacturing in our region. But she suspects there are many useful regional by-products that she doesn't know about.

For example, during a conversation with staff at the Western Lake Superior Sanitary District, Patelke learned that they get a lot of sand in their system this time of year. "I never would have thought of that," she said.

So her first goal is to reach out to local industries to gather data on their by-products and waste materials. Then she and her team members will start to characterize the physical, chemical and nutrient make-up of the materials. NRRI Peat Scientist Kurt Johnson is conducting greenhouse studies to determine plant growth potential. NRRI Scientist Meijun Cai is doing chemical analyses and leachate studies replicating rainwater to understand what chemicals leach out. David Saftner, a professor in UMD's Dept. Of Civil Engineering, and students are studying the engineering properties of the soils -- the grain size distribution and texture.

NRRI Scientists Marshal Patelke and Kurt Johnson mix a variety of materials together for soil testing..

Once they understand the "ingredients" available, the team can develop recipes for soils designed for specific purposes.

When peatlands are disturbed for road building, the removed peat could be stockpiled and added to the NRRI database as an ingredient for a unique soil mixture with filtering properties. Nutrients in animal manure could be useful in a topsoil application.

Patelke thinks her database could lead to interesting commercialization prospects. But first she needs to tap into NRRI's broad stakeholder network to get waste resources information from local industries and agencies.

"When I explain this project to people, they get really excited and jump ahead to how to do this on a large commercial scale," she added. "But right now I'm just focused on getting all the information cataloged. We'll go from there to deliver some exciting opportunities for Minnesota."

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NRRI scientists name new algae species

The best part of science is discovery. And NRRI scientists made a big discovery about a tiny, single-cell algae.

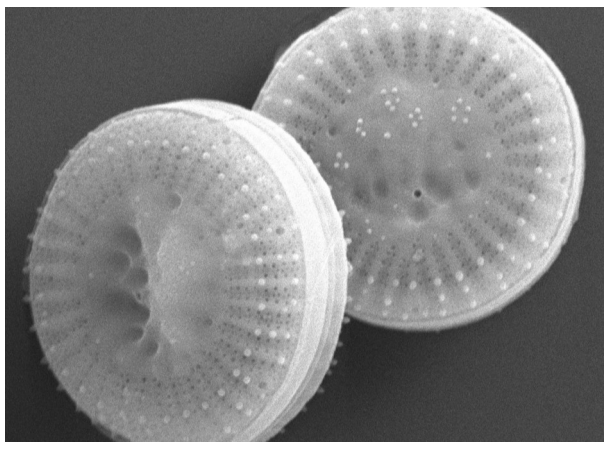
This little enigma – neither plant nor animal – started showing up in Euan Reavie's Great Lakes research with greater abundance in about 1980. Reavie is a NRRI paleolimnologist, studying how tiny Great Lakes algae have responded to water quality changes over the last 200 years.

So when he and his team stumbled upon this unknown species, they gave it a temporary name, "Cyclotella species #1" and moved on. But they went back to it because exact taxonomy – the classification of species – is really important to these scientists. And they got to name this one.

"Diatom algae are really good indicators of the health of the environment around them because they're so specific," explained Elizabeth Alexson, lead scientist on the paper they published in Diatom Research, Vol. 33, No. 3. "They're very predictable and we know this species is more commonly found in higher temperature waters."

With decades of diatom species records from the Great Lakes, Reavie and his team have related species to their optimal range of environmental parameters. And this newly classified species – Pantocsekiella laurentiana (so named because of its dominance in the Laurentian Great Lakes) – is clearly indicating a rise in air temperature and low nutrients. How that will affect the aquatic food chain is yet to be studied.

"This diatom is very common and exclusive to the Great Lakes, but likely has been misidentified for many, many years," said Alexson.



The diatom formerly known as Cyclotella species #1.

"Since we're out on the Great Lakes every summer we can really see the patterns and consistencies in diatoms. It's really exciting to correct the taxonomy and name a new species."

About Paleolimnology

NRRI scientists extract long tubes of sediment from lakes to reconstruct historical changes in water quality over hundreds of years. The sediment, deposited slowly over 300 – 400 years, holds fossilized diatom algae. These diatoms are very sensitive to stressors like nutrient pollution, salinity loading and suspended sediments. The changes in the diatom species indicate changes in water quality. It is estimated that there are as many as 100,000 species of diatoms, although only about 8,000 species have been described.