



NATURAL RESOURCES RESEARCH INSTITUTE

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Spring/Summer 2012

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NATURAL RESOURCES RESEARCH INSTITUTE
UNIVERSITY OF MINNESOTA, DULUTH



*NRRI Director
Mike Lalich
and UMD
mascot Champ
celebrate
NRRI's
outreach
mission.*

~ Growing Strong Industries

~ Developing New Ideas

~ Nurturing Natural Resources



Rowley C. Black

Chancellor Black values NRRI outreach and opportunities

Universities have historically been called “Ivory Towers” – places of intellectual pursuit, far removed from the practical working world. And while the University of Minnesota Duluth certainly values basic research – knowledge for its own sake – our recently crafted Strategic Plan calls for stronger responsibility to meeting the needs of the community. The applied research mission of our Natural Resources Research Institute is especially relevant given today’s economic condition and Minnesota’s valuable natural resources.

NRRI’s mission is to foster the economic development of Minnesota’s natural resources in an environmentally sound manner to promote private sector employment.

Not only does NRRI play an important role in meeting many of our university goals, its wide variety of applied research helps us meet our responsibility as a land-grant university. NRRI scientists and engineers are charged with focusing their knowledge to help entrepreneurs, small businesses and entire industries to be more efficient and competitive. The environmental research mission centers on sustainable resources to ensure a productive future for our region. And while the institute doesn’t have a teaching mission in the classic sense, who better to usher in a new generation of mining professionals than industry experts who work daily with the ore mines? Who better to share expertise on water quality than an ecologist who is monitoring Duluth streams? Who

better to teach a class on wildlife than a biologist who is immersed in studying local moose populations?

UMD’s number one goal is to provide excellent and relevant education to our students. NRRI helps us meet that goal by engaging students with applied research opportunities that meet community and industry needs. During the 2011-2012 academic year, 34 undergraduate, 12 masters level, and three post-graduate students worked side-by-side with NRRI researchers. And during the summer months, NRRI kept 66 seasonal workers busy, as well as 15 volunteers. Their experiences included testing taconite tailings for new industrial uses, collecting water samples around the Great Lakes, developing marketing plans for local businesses, mapping the mineral potential in northern Minnesota... and much more, which you’ll read about in this issue. Students learn so much more when they turn their textbook knowledge into solutions that make a real difference.

Partnering with the local and global community is another valuable role that NRRI plays. The institute has long provided research and development to the mining and wood products industries of the region, but outreach such as efficient manufacturing training, online environmental curricula, and stormwater education for city workers and developers, to name a few examples, are valuable ways of educating outside of the classroom.

UMD is not an Ivory Tower. It’s a place to become a lifelong learner and expand the knowledge base with the wider world. NRRI helps our university to be the vital partner it strives to be. ■

NRRI brings the world to the lecture hall

“... engaging students in the creative process of research is much more valuable than lectures.” –Lucinda Johnson

There is a quote attributed to Benjamin Franklin that aptly describes NRRI’s contribution to UMD’s teaching role: “Tell me and I forget. Teach me and I remember. Involve me and I learn.”

Whether it’s studying moose, working alongside mining professionals, or understanding toxins in our environment, NRRI researchers offer unique, real-world experiences to enrich student coursework at UMD.

Ron Moen is a wildlife biologist at NRRI, currently heavily involved in studying Minnesota’s declining moose populations. But about a quarter of his time is also spent in the classroom teaching undergraduate courses in biology, mammalogy and evolution.

“I’m able to show them real research on threatened species and big game animals, even animals that aren’t protected, like mice and bats,” Moen said. “I take them to my research sites and they can see how we collect data.”

And because NRRI scientists are engaged daily in their areas of expertise, they are also well-connected with the local scientific community. Those connections allow Lucinda Johnson, the busy director of NRRI’s Center for Water and the Environment, to pull in knowledgeable colleagues to help her team-teach Stream Ecology and Landscape Ecology courses.

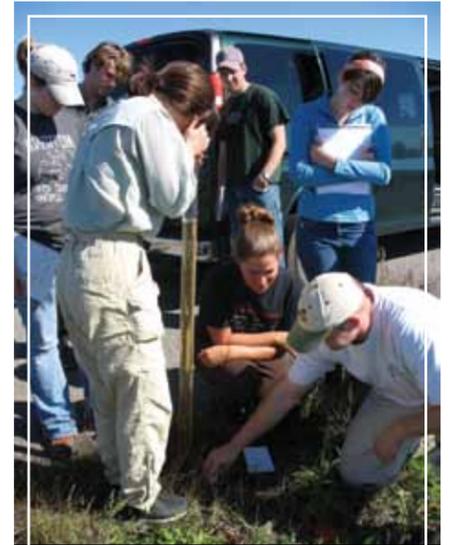
“I think engaging students in the creative process of research is much more valuable than lectures,” said Johnson. “We include them on project development, implementation and most importantly, communicating in writing and speech.”

Aquatic Ecologist Valerie Brady works hard to find new and relevant wetlands issues for her Wetlands Ecology graduate students. And her small class sizes make it easy for her to get to know her students’ skill levels and serve as a reference when they move on.

“They tell me that my class demands the most work of any other class they’ve taken,” Brady admits. “But they also tell me they gain a lot of knowledge that helps them get jobs.”

In the team-taught Landscape Ecology class, students recently benefited from Forest Ecologist George Host’s involvement on the Minnesota Forest Resources Council. By end of the semester, the students are developing a research proposal, conducting analyses and writing a manuscript. They end by giving a professional presentation on their work.

Juggling research and teaching can be a challenge for the scientists, but their efforts are rewarded when some of the students become valuable research assistants or, even better, when they go on to manage

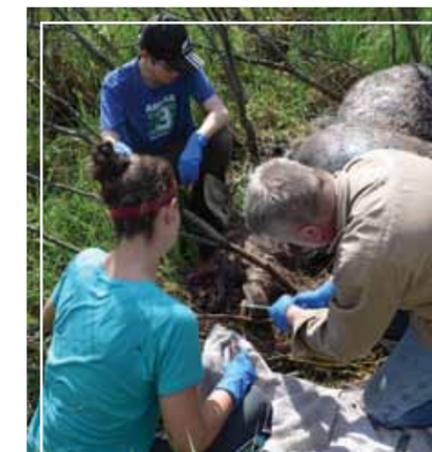


NRRI Scientist Valerie Brady in the field with UMD students.

programs that further engage NRRI [See “NRRI Alumni” story, page 11.]

“Teaching broadens my outlook on my field,” said Ecotoxicologist Pat Schoff. “I find that my focus can narrow considerably when I’m concentrating solely on research. Teaching demands that I keep up with the rest of the field.”

Other NRRI staff who teach are Ornithologist Jerry Niemi, Geologists George Hudak and Jim Miller, Paleolimnologist Euan Reavie, Limnologist Rich Axler, Forest Ecologist Cindy Hale and Wood Scientist Pat Donahue. NRRI’s Minerals Research Lab also provides a taconite mining industry internship – Taconite 101 – that covers everything from ore geology to mineral processing to pyrometallurgy. ■



NRRI Biologist Ron Moen teaches in the field.



Sharing wood industry knowledge NRRI uses web tools for technology transfer outreach

The timing was prescient. Just when NRRI's Brian Brashaw was figuring out how to be more efficient using new web portal and webinar tools to assess structural condition in 2005, Hurricane Katrina hit the City of New Orleans.

In the aftermath of the clean-up, the city's Chief Building Inspector searched for help evaluating homes and structures that had been flooded, and in most cases, underwater for several weeks. Brashaw, working with the USDA Forest Products Lab, had researched real-world application of technologies to do just that.

"We wanted to go down there to help, but they had no place to put us," said Brashaw, director of the Wood Materials and Manufacturing program. "So our first webinar was for the New Orleans chief building inspector and his staff."

With grant money to create an electronic information portal, Brashaw's New Orleans webinar was a success. The team developed a portal focused on inspection of historic structures that included publications, equipment links and webinar case studies. Their goal was information outreach to a wide variety of interested parties – from caretakers of historic buildings to Department of Transportation inspectors. The portal was cost effective, convenient and archival.

The grant ended in 2008 but evolving technologies have allowed Brashaw to inexpensively produce short information modules relevant to the wood products industry. For instance, he has done several webinars on NRRI research about heat-treating firewood to sterilize it against invasive species like the Emerald Ash Borer, moderating electronic presentations on harvesting ash trees in urban areas, and others.

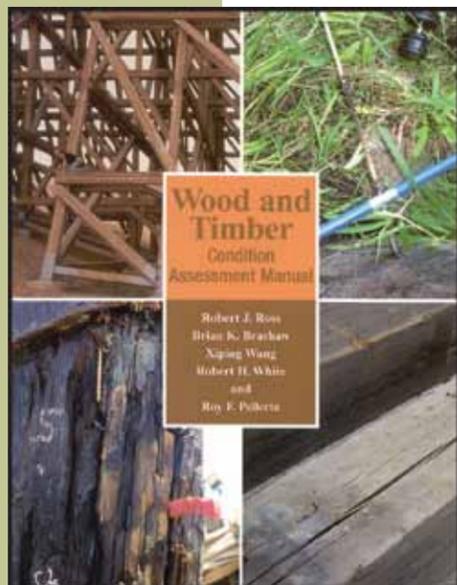
"We were doing webinars before they really caught on and became industry-accepted practice," said Brashaw. "The key was access to the University of Minnesota platform, UM Connect – and connect us it did, to people across the country."

But some information transfer is better done in person so Brashaw combined hands-on workshops with online, archived video and training material about inspection techniques for timber bridges. His experience has shown that the bridge inspectors are more likely to buy and use the more efficient equipment if they've had hands-on training.

"I went all over Minnesota to give training seminars. We know that visual inspection of wood bridges is not enough and the short courses identify the right equipment, develop the best inspection techniques and transfer the information to the inspectors," Brashaw said. He and his team are starting a new MnDOT inspection project this summer.

Hands-on courses also work best for Lean Manufacturing training. Brashaw and his collaborators developed table-top simulations of a dovetail drawer box manufacturing facility for companies that assemble products, and a sawmill simulation for continuous process manufacturing. It helps employees understand how to implement lean techniques on the job and is also a good team-building exercise.

"Over the past 10 years I've worked with 400 companies and over 1,000 employees in lean training and in-plant continuous improvement projects," Brashaw said. "That's a lot of Minnesota businesses operating more efficiently and better able to compete nationally and globally." ■



Smart Phones can help make people smarter, too. Capitalizing on the "fun factor" of cool apps for the phones and the adaptable technologies, NRRI scientists are using Smart Phones to share knowledge of the natural environment. They're also using the World Wide Web as a store house of easily accessible environmental information for students, teachers, city workers... well, anybody.

WaterOnTheWeb.org (WOW) started with remote water quality sensors in five Minnesota lakes. Information was collected on things like water temperature, oxygen and salinity levels, then downloaded to the WOW website. From there the "real world" data can be used as a basic science teaching aid. The project team, funded by the National Science Foundation from 1997 to 2005, included staff from NRRI, Minnesota Sea Grant and UMD's Department of Education.

"WOW hasn't been funded in six or seven years and it still gets about a million requests a month," said project scientist Rich Axler. "It seems like every week or so a teacher or student from somewhere in the world requests information. And a number of textbooks have images and graphics from it."

WOW's water science curriculum was developed using the same real-time data from ecologically important lakes, streams and rivers around the country. The site includes free, online lectures and lab exercises on the ecology of fresh waters to challenge students and teachers with real data – which is often messier than what they get in text books.

"There's less and less money for teachers to get this kind of training," said Axler. "This helps train teachers, new scientists, engineers and technicians in how science works in the real world. It's extremely valuable."

After the successful launch of WaterOnTheWeb.org, the team received funding from a U.S. Environmental Protection Agency initiative called Environmental Monitoring for Public Access and Community Tracking (EMPACT) which perfectly fit the web tools

value of clean water systems and sustainable development.

Another project to use Smart Phones turns a hike or visit to the St. Louis River Estuary into a learning experience. Using the location-sensitive GPS technologies in the



High-Tech Teachers NRRI uses fun technology to connect people and water



and field sensors. Targeting Minnesota's metropolitan area, they partnered with the Three Rivers Park District to track algal growth in Lake Minnetonka and how fertilizers in stormwater exacerbate noxious algal blooms in Medicine Lake.

When funding was available to expand to northern Minnesota, similar sensors were used to collect data on Duluth's trout streams and LakeSuperiorStreams.org was launched.

"Stormwater issues were hitting the fan nationally with new regulations from the Clean Water Act," Axler explained. "Duluth and other towns in the region had a charge to improve public and industry understanding that we thought we could address with our tools, allowing people to 'see' how streams work and download information to reduce stormwater pollution."

This effort was accomplished by partnering with the City of Duluth, the Western Lake Superior Sanitary District and the Minnesota Pollution Control Agency. The project also helped create the Regional Stormwater Protection Team that for almost a decade has sponsored workshops, an annual festival and shared information and technical expertise.

LakeSuperiorStreams.org is still actively connecting weather, landscape and people's activities on land to streams, wetlands, the St. Louis River Estuary and Lake Superior. It's a resource that helps the community to understand the

phones and real locations, the free app will trigger information about a place – a video, text or a photo – when the user is near it, making the walk into a game.

For example, in the game, you might be a chef with the task of getting fresh fish. You find a local fish market and talk with the seller (all on your phone app, of course) to get what you need. Near a fish advisory posting, your phone might be triggered to share information about the risks of high mercury in the fish. Passing a bridge where real anglers often fish might cause your phone to ask if you want to join them "virtually."

"So you pick your bait using the phone, you catch a virtual goby and then you learn about invasive species," explained NRRI project lead George Host. "Kids get to use the tools they enjoy, but they're also out in the real world."

Those who have GPS units and enjoy the popular pastime of Geocaching can also do an environmental education version the team developed. Navigating to hidden caches with their GPS receivers to, say, Duluth's Stryker Bay, the player will find a container with tools and instructions for taking water samples. In the woods they might find information about the plants and birds in the area.

The tools and website were developed with Wisconsin and Minnesota Sea Grant to improve understanding of the many issues associated with the history of the river.

"Our goal is to connect people with science focused on the St. Louis River Estuary, and drive home the understanding that people are part of the ecosystem," said Host. ■

STUDENT PERSPECTIVE ON THE NRRI EXPERIENCE

Access to high quality students to help with a wide variety of research is an obvious bonus for the institute's busy scientists and engineers. But the students tell us they get as much or more out of their work experiences here.

"My friends think I'm lucky to work at NRRI," said Wen Chen, a master's degree candidate in Business Administration using her marketing and business management skills in NRRI's Market Oriented Wood Technology program. "I get the opportunity to do job-related tasks in my field, and also financial support to continue my MBA."

Tessa Tjepkes, a senior majoring in biology, gets a lot of questions from her peers about the moose and bat research she's working on. "I haven't quite started my bat project yet, but I have over a dozen friends who want to help me with it," she said. "Everyone is always interested in what we're researching."

Civil Engineering major Will DeRocher impresses

friends at other Midwest colleges who tell him that opportunities at their schools to do undergraduate research are slim to non-existent. "Within the three years I have been here, I have worked on at least six completely different projects, each with professionals within the field," he said.

NRRI provides opportunities to develop practical skills that stand out on resumes, and that's very apparent to college students with an eye on their future.

"There aren't too many scanning electron microscopes out there, and I've gotten first hand lab skills with it that few students in my position acquire," said Allison Severson, a junior majoring in Geological Sciences. "That skill will definitely go on my resume and will make me stand out because I can use it for many applications in geology."

Edmund Zlonis, a recent master's graduate in Integrated Biology, has a passion for nature and understanding how to evaluate biological degradation. That, and he really likes birds, so working with NRRI ornithologists to monitor regional bird species for a variety of projects, and compile data for a

Minnesota Bird Atlas, has been deeply satisfying.

"Working in the Boundary Waters Canoe Area Wilderness has been an absolutely wonderful place to be in the 'singing season,'" said Zlonis. "NRRI is a great mix of realistic work opportunity and education."

Depending on the project, work at NRRI ranges from seasonal to year-round. And because the research deals with real-world problem solving, the work can be demanding for busy students who also have full class loads and sometimes have another job to juggle. Because of her supermarket job, Tjepkes had to miss out on a moose capture to get tracking technology on the animal. But she's been able to support the research from the lab and this summer is working on her own study to measure bat species and their relative densities in urban, suburban and parks in Duluth.

"I've been out in the field to see what goes into studies," she said. "I'm familiar with GPS, GIS and telemetry equipment. I know how to research peer-reviewed journal articles and have new skills in compiling data... it's like everything I've learned in my classes is coming together."

And while Mike Harris, a master's candidate in Water Resources Sciences, works long summer days in waders collecting invertebrate samples and data for Great Lakes water quality research, he just lets his friends keep on thinking that he gets paid to fish. ■



Working together, students and business professionals gain with the Student-to-Business program at CED.



UMD serves up small business success

Students and experts go 'behind the counter' to give assistance

It's hard to pin down who benefits the most – the students or the business owner – in the Center for Economic Development's Student-to-Business Initiative. It started as a way to give UMD accounting and marketing students a chance to put their new skills to work. And it took off from there.

Students in the Sustainable Business Practices class help small businesses reduce their carbon footprint. Graphic Design students develop logos and marketing elements specific to business needs. Business students write handbooks, interviewing procedures and position descriptions.

"Students tell us, now I understand why I had to take the classes I've taken," said Elaine Hansen, CED director. "They have to write, make a presentation, understand a budget, manage the project and finesse teamwork."

And of course, when it comes to the new social media and Smart Phone tools, there's no one better

than a savvy college student to explain how it fits in a small business marketing plan, then help launch the effort. Business owners definitely benefit from the affordable assistance the students provide.

Each year, the program attracts over 100 UMD students, but small business assistance continues to be the broader goal of the Center.

"We create a link between the business community and UMD," said Hansen. "We know that if key decisions are made at critical points along the way, the chances for profitability and longevity of that business dramatically improves."

Each year CED works with more than 900 companies in Northeastern Minnesota, offering one-on-one counseling, business and computer workshops, and accounting assistance. The Center has facilitated more than \$20 million in loans, and assisted in the creation, retention and stabilization of more than 3,000 jobs.

Already established small businesses get special focus because they're

already invested in the community. And entrepreneurs are shown a little "tough love" to be sure they have the motivation to launch a new venture. In 2011, CED held 238 workshops for 1,411 participants.

"First we direct them to the website to see the online workshops," Hansen explained. "If you're not willing to spend 45 minutes working through a couple of online workshops, you're not going to start a business. It takes work."

Those with drive and a good idea get help with a business plan and acquiring the financing to get their business up and running. Consultants are also available in Small Business Centers scattered in regional small towns for easy access. They've also addressed their clients' need for financial analysis by developing an accounting template to help small business owners organize the numbers.

The Center for Economic Development is a joint program of NRRI, the Labovitz School of Business and the Swenson College of Science and Engineering. ■



Caitlin Leach, student researcher.



Sandi Larson



Jan Zigich



Richard Braun



Elaine Hanson and Caree Gordon



Curt Walczak

A FUTURE SET IN STONE

NRRI geologists train the next generation of mineral mappers

Metals of all kinds – copper, nickel, gold, platinum, and others – are increasing in demand world-wide. And that means geoscientists who can map out where to find these metals are also in high demand.

As it turns out, northern Minnesota is a great place to become a geologist. The area's bedrock terrain formed during the Precambrian era of the earth's formation beginning some 4.6 billion years ago. The activity of early life forms left behind thick deposits of iron ore, now mined for taconite. But it takes specialized skill in field mapping to identify the rocks that host non-ferrous and precious metals deposited in Precambrian rock.

In 2007, NRRI and UMD's Department of Geology formed the Precambrian Research Center to supply the next generation of expertly trained field geologists. NRRI and UMD Geologists Jim Miller, George Hudak along with Dean Peterson, Vice President of Exploration for Duluth Metals, share their summers with eager geology students at the Precambrian Field Camp. It didn't take long for word to spread nationally about the leadership and experience it offers geology students. Twenty-four students from 17 different colleges from across the country have filled the roster for this summer's camp.



"We noticed that geologic mapping was becoming a lost art," said Miller. "Universities simply have not been mentoring students in this experience-intensive activity. This Center and our Field Camp is reversing that trend."

In addition to fundamental mapping skills, the Field Camp focuses on specialized training for the glaciated Precambrian shield terrains. This involves diamond drill core logging, glacial mapping, mineral prospecting techniques, magnetic and gravity geophysical surveying and interpretation, and much more. Then the students disperse across northeastern Minnesota to put their skills to the test.

During the fifth week of camp, the students and instructors break into groups to tackle capstone mapping projects as far north as the Canadian border and throughout the Boundary Waters Canoe Area Wilderness. They map previously unmapped or poorly mapped areas. This summer, three of five capstone projects will focus on areas within the wilderness area that were impacted by last fall's Pagami Creek fire.

"It was kind of a shock to be in the field right away, but I learned a lot straight away," said Taylor Balogh, a 2010 field camp student from UMD. "The professors were very involved in the whole learning experience."

The students also appreciated having representatives from the minerals industry come to their capstone project presentations, allowing them to make valuable connections.

"My field skills have never been anywhere near what they are now," said another 2010 graduate. "And with the connections I made at the final capstone presentation, I'm confident that my career will be successful."

That confidence is important as they enter the realm of field geology.

"Probably the most rewarding aspect of putting on this field camp in a challenging geological setting is the confidence that the students develop in their field abilities," Miller said. "And we see the success as many field camp students find employment in minerals exploration, not only in the Canadian Shield, but throughout the world."

The Center is planning to expand training beyond the new generation of field geologists. With encouragement from the minerals industry, a specialized field training program for professional geologists is being planned for next fall. ■

Reaching the young learners

Mentoring middle schoolers and teaching teachers

NRRI has found ways to bring its real-world research to the elementary and secondary school level. One way is by helping the students compete in the regional science fair. Each year, in addition to providing some cash awards, a handful of scientists and student researchers judge the event and a few mentor student projects.

Research Fellow Elaine Ruzycski helped a Duluth 8th grader develop an experiment to understand how algae grows under different light conditions.



Research Fellow Elaine Ruzycski.

"I loaned him the glassware and we ordered the culture, then he set up the flasks with screening to create different amounts of light," Ruzycski explained. "He also borrowed our meter to measure turbidity and he set up the whole experiment at home."

NRRI graduate student researcher Will Bartsch participated as a Special Awards judge for his first time this year. He said it was both overwhelming – "We

had about 30 seconds to decide whether to stick around and ask more questions," – and nostalgic – "I did the science fair in middle school and into high school. It was fun to see it from a different perspective."

Scientist Rich Axler knows the teachers appreciate the support. "Duluth has a high density of environmental scientists and resources for them to tap. Teachers work hard and I think they get a morale boost when we pitch in and support what they do," he said.

Another way NRRI reaches young learners is less direct – through their teachers. Each summer, NRRI geologists organize an annual Minnesota Minerals Education Workshop for K-12 educators. The goal is to help them expand their knowledge of Minnesota minerals and the mining industry so they can pass that knowledge along to their students.

"We really emphasize the importance of educating students about the critical role that minerals play in their everyday lives," said Jim Miller, a NRRI economic geologist and geology professor at UMD. "As earth science educators, our job is to teach the next generation to become responsible stewards of the earth's non-renewable mineral resources."

Part of the workshop offers a choice of many short courses in the classroom, and then they go on location to mining operations and out in the field to look at and collect rocks. Teachers say their students show a lot of interest in geology, so it's good for them to stay on top of the latest research.

"Kids who have a rock collection or an agate want to know how it got there," said Middle School Teacher Laurie Severson. "And in Duluth, there's so much geology to see in your own backyard."

The NRRI/UMD Precambrian Research Center is the principal organizing agency for the teacher workshops, helped by volunteers and industry donations. Overall funding is provided by the Minnesota Center for Mineral Resource Education. ■

(Read more about the K-12 set on page 10.)



NRRI Geologist Jim Miller (far left) teaches a summer workshop.



Scientist Ryan Hueffmeier teaches students about earthworm impacts.

Eighth grader Michael Chelseth was mentored by NRRI Hueffmeier

K-12 students learn to be citizen scientists

Using earthworms as teaching tools, NRRI's Great Lakes Worm Watch crew are showing students and teachers how to be contributing members of the regional science community.

The invasive wigglers have an easy-to-see, but little understood impact on the native forests of the Great Lakes region. The Worm Watch crew need data and collecting it is fun and fascinating. A perfect combination for the K-12 set.

"These kids have played with worms most of their lives, so they're very comfortable with them," said Scientist and Program Leader Ryan Hueffmeier. "We give them the tools and show them how to collect earthworm specimens... they get their hands dirty and learn a lot about ecosystem science."

The Worm Watch program is careful to integrate the science curriculum into what the teachers are already doing in the classroom, so as not to overload the busy educators. Even more, they can work earthworm science into art, math and English classes. And they connect with school administrators at teacher workshops.

"Our goal is to introduce them to new concepts and hopefully develop lifelong learning skills for science and a curiosity about nature," said Hueffmeier. ■

“*... they get their hands dirty and learn a lot about ecosystem science.*”



NRRI alumni transfer their skills to industry, agency positions

(Left to Right: Pat Collins, Nick Danz, Carl Richards.)

NRRI Director Mike Lalich likes to call it NRRI's "Can-Do Attitude" and researchers who have worked at the institute tend to carry it with them to new positions.

The mission of economic development and environmental sustainability firmly guides NRRI scientists and researchers, who get the lab space, technologies, support and time to creatively solve real problems. And those problem-solving skills translate well to important industry and agency positions.

For geologist Dean Peterson, it was the time to explore that he valued most during his eight years in NRRI's Economic Geology Group. Today, he's Senior Vice President of Exploration for Duluth Metals, a minerals exploration company with development plans in northeast Minnesota. While at NRRI he helped map the copper-nickel and precious metals deposits in the Duluth Complex.

"I was allowed the time to think things through, let my curiosity lead my exploration and I made progress," said Peterson. "In industry, you don't have the opportunity to think about things for a long period of time; competition for my time is challenging for me now."

But the knowledge Peterson and his NRRI colleagues gained about the mineral potential of Minnesota is now part of his every day work life at Duluth Metals.

"What I learned at NRRI is that sharing knowledge and interacting with others allows you to increase your knowledge," he said. "That's what NRRI does - takes information, understands it and shares it. A good business does the same thing."

Carl Richards, a former NRRI scientist, shared similar sentiments.

"NRRI is a talented group of scientists in an atmosphere that supports the creativity to tackle important ecological problems," said Richards. "And it has the support of the broader University system. That's important."

Today, Richards is director of the U.S. Environmental Protection Agency's Mid-Continent Ecology Division in Duluth so he especially leans on management skills he acquired as Program Manager and Acting Director of NRRI's Center for Water and the Environment.

"As a scientist, it was a unique experience for me to work on applied research for business development ideas," he explained. "Research for the aquaculture

industry, wastewater treatment systems, and water quality... I enjoyed interacting with a variety of people to meet the science needs of applied research."

Statistician Nick Danz is now a biology professor at the University of Wisconsin, Superior whose forest ecology students delve into real world science. Danz spent nine years at NRRI developing ecological statistics for a forest bird database and the Great Lakes Environmental Indicators project.

"I was involved in the whole scientific process - carrying out the science from design through analysis and writing papers," said Danz. "I learned how to run a meeting, apply for funding, manage budgets and supervise... The collaborative nature of NRRI gave me a connection to the greater research community."

Matt Mlinar was a research fellow at NRRI's Minerals Research Lab in Coleraine for a little over two years before he left to work as a Process Engineer at the growing Iron Range business, Magnetation, LLC.

"It was very satisfying to work within many different industries," he said. "In a short period of time I acquired excellent project management and minerals processing techniques. And I still

get to work with NRRI. I am starting a service contract now for minerals characterization."

A professor in the Department of Natural Resources at South Dakota State University, Carol Johnston also continues to collaborate with NRRI staff on research. And she regularly pulls from the huge dataset on wetlands restoration that she helped compile during her 18 years at NRRI.

"It's been a rich, rich resource of information," said Johnston. "And we're still working to publish the results of the Great Lakes Environmental Indicators project. We generated a lot of valuable data."

Pat Collins started at NRRI from its beginning in 1983 as a work-study student and left in 1993 to work for the Minnesota Department of Natural Resources. Today, he works today as Fish and Wildlife Service Conservation Coordinator on the St. Louis River.

He lists several skills he honed at NRRI that apply to his work today.

"I have a better understanding of the value and the limitations of field studies to answer important questions. I learned how important communication is between researchers and resource managers. How to apply research results to management questions and needs..." said Collins. "It's hard to imagine that I would be in the position I am now if not for my time at NRRI." ■

Visit us online: www.nrrri.umn.edu



The Natural Resources Research Institute was established by the Minnesota Legislature in 1983 to foster economic development of Minnesota's natural resources in an environmentally sound manner to promote private sector employment.

Michael Lalich, director

Center for Water & the Environment

Lucinda Johnson, director

Center for Applied Research & Technology Development

Donald Fosnacht, director

Center for Economic Development

Elaine Hansen, director

NRRRI Now

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Sharing our knowledge and experience

Aside from their busy research agendas, NRRRI researchers take time to serve on a multitude of committees & appointments.

Internationally:

- Int'l Joint Commission, Binational Forum
- Int'l Joint Commission, Ecosystems Committee
- Int'l Nondestructive Inspection & Evaluation of Wood
- Lake Superior Binational Forum
- Landscape Ecology Editorial Board
- QSAR Foundation Board
- Society for Freshwater Science
- United Nations' International Maritime Organization

Nationally:

- Cooperative Institute for Limnology & Ecosystems Research
- Hawk Migration Association of North America
- Healing Our Waters Great Lakes Coalition
- Society for Economic Geologists
- Sustainable Forest Education Cooperative
- Nat'l Ecology Observing System Domain Science & Education
- North American Moose Conference and Workshop
- Superior National Estuarine Research Reserve & Education
- Transportation Research Board Pavement Maintenance
- U.S. EPA Science Adv. Board, Ecosystems Processes & Effects
- USFS Great Lakes Fish Habitat Assessment
- Wood Utilization Research Centers

State level:

- Arrowhead Manufacturers and Fabricators Association
- Department of Natural Resources (various committees)
- Forest Resources Council
- Minnesota Audubon
- Minnesota Center for Minerals Resource Education
- Minnesota Corn Growers Association
- Minnesota Logger Education Committee
- Minnesota Minerals Education Workshop
- Minnesota Forest Research Committee
- Minnesota Mineral Coordinating Committee
- MPCA Lake Superior Beach Monitoring Adv. Committee
- Regional Stormwater Protection Team

Regionally:

- Arrowhead Partnership for Economic Expansion
- Arrowhead Growth Alliance
- Arrowhead Regional Stream Team
- Flute Reed River Watershed Partnership
- Heart of the Continent Partnership Organizing Committee
- Heating the Midwest with Renewable Resources
- Institute on Lake Superior Geology Board of Directors
- Itasca County Lake Classification Advisory Committee
- Northland Foundation Technical Advisory Committee
- St. Louis River Estuary Habitat Working Group
- UPM, the Biofore Company, Technical Committee
- Wolf Ridge Environmental Learning Center

Locally:

- City of Duluth Friends of the Parks
- City of Duluth Technical Advisory Committee
- Duluth Community Action Habitat
- Ely Field Naturalists
- Great Woods North
- Harbor Technical Advisory Committee
- Hawk Ridge Bird Observatory
- Miller Creek Temperature TMDL Technical Adv. Group
- Poplar River Turbidity TMDL Technical Adv. Group
- Rotary International
- St. Louis County Extension
- Sugarloaf Northshore Stewardship Association
- White Iron Chain of Lakes Association
- WOLF Wood, Inc. Board of Directors

Serving the University:

- Society for Economic Geologists
- UM Water Resources Program (various committees)
- UMD Department of Biology Awards Committee
- UMD Educational Policy Committee
- UMD Integrated Biosciences (various committees)
- UMD Precambrian Research Center
- UMD Sustainability Team
- University of Wisconsin Search Committee (other university)