



NATURAL RESOURCES RESEARCH INSTITUTE

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With steel demand at an all-time high, Minnesota's Iron Range is poised for growth

Growing Strong Industries ~ Developing New Ideas ~ Nurturing Natural Resources



From the Director

Michael J. Lalich

Putting the “good times” into perspective

The article, “These are the good times,” in this issue has given me pause to reflect. If these are, indeed, the “good times” it was certainly the bad times that catalyzed the formation of NRRI in the early 1980s. With a loss of about 80 percent of the 16,000 jobs in taconite mines and plants, not to mention the commensurate large numbers of jobs lost by suppliers, the call for NRRI to assist with “job creation” at that time was relentless.

I’ll never forget an early meeting with legislators at the Governor’s residence. After a bit of discussion, one of the delegation declared: “Lalich, never mind the fact that you have not yet developed your labs or hired staff. We’ve got a crisis. You have one year.”

In retrospect, that missive and sense of urgency probably more than anything, served to focus NRRI. We cobbled together what business, scientific and engineering skills we could to offer support to entrepreneurs and small businesses. In doing so, we began to assist with business start-ups and expansions, a practice particularly successful in the forest products and peat business sectors.

These “near term” development efforts, as NRRI calls them in its statement of goals, gave NRRI early credibility. They are now a key part of NRRI’s strategy. When it comes to the minerals industry, however, NRRI’s efforts to assist taconite companies with improving process efficiency/cost and pellet quality have constituted its important core activity. Aided by the expertise and equipment associated with the 1986 transfer of the U.S. Steel Coleraine Minerals Laboratory to NRRI, the institute quickly became productive. A survey in the early '90s indicated that the taconite industry gave NRRI high marks in the area of assisting with “job retention.”

Today, NRRI is perhaps the major provider of research services to the taconite industry. NRRI’s strategy is to do its best to help keep the taconite industry

competitive in the face of rapidly growing world-wide iron ore production capacity. To that end, introduction of value added products (iron nodules and steel production) along with by-products (aggregates) may become very important.

With lack of a ferrous metals industry in Minnesota, but lots of potential, NRRI’s key move was to establish an Economic Geology Group. The group’s focus quickly became to better understand the potential of Duluth Complex copper-nickel deposits and to define the presence of precious metals such as platinum and palladium. There were no short cuts to economic development in this instance, only a diligent 20-year plus effort. If the program were a separate entity I do not think this vital effort would have survived scrutiny. But beginning with Polymet, exploration interests announced the formation of companies to commercialize copper-nickel deposits. Polymet, in its inaugural press conference, recognized the important work of NRRI geologists Steve Hauck and Mark Severson. At least three of NRRI’s geologists, a testament to NRRI, have taken key positions with these emerging companies. So now we are waiting optimistically for the final steps for commercialization to occur.

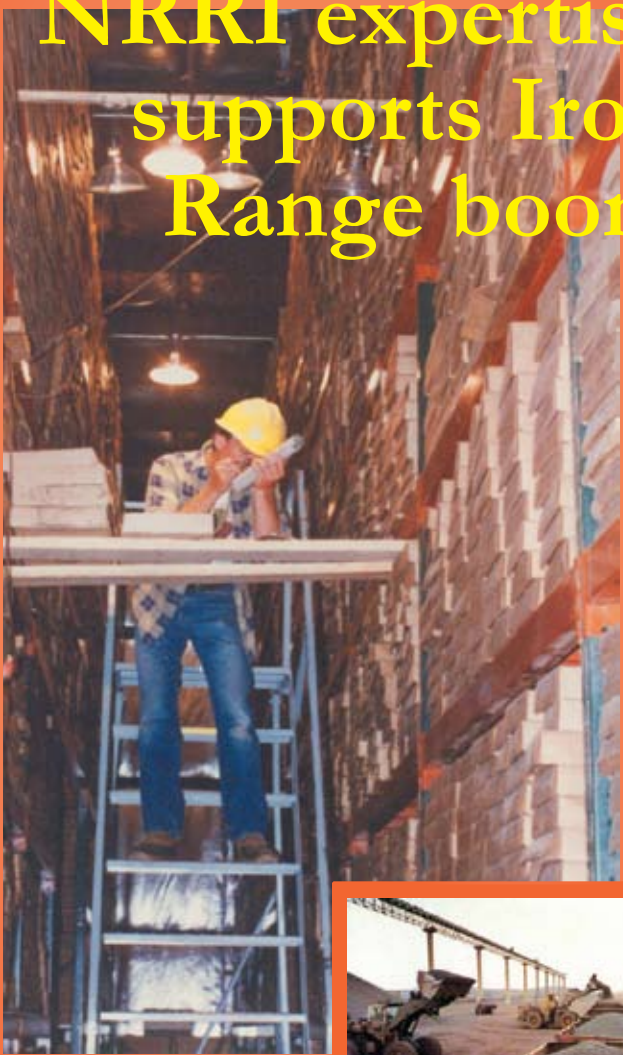
All in all, these are not only the “good times” but exciting times with potential to transform the economy of Northeastern Minnesota. None of this is easy, however, and none of it is absolutely certain. Thus we must impatiently wait to see how good the “good times” actually are.

These are the good times

They’re calling it “Boom Time” on Minnesota’s Iron Range. With steel demand at an all-time high from consumers around the globe—China and India, in particular—the steel industry, along with demand for taconite pellets, is expanding. This means the prospect of good paying jobs in towns that, in the recent past, were suffering from economically tough times.

Since opening its doors in 1983, NRRI has been working closely with Minnesota’s mining industries. NRRI’s long, hard work in defining copper-nickel deposits in Minnesota is now paying off for exploration companies ready to help meet demand for non-ferrous minerals. And through the years, NRRI has improved efficiencies in the taconite concentrating and pelletizing processes, worked on the development of value-added products, found new uses for taconite by-products, and assisted industry spin-off companies. This foundational support has helped Iron Range industries stay competitive.

NRRI expertise supports Iron Range boom



NRRI geologist Mark Severson logging drill core.



NRRI tackled the most basic question first: what minerals are here? Today Steve Hauck is leading NRRI's expanded Economic Geology Group, but back in 1985 he was logging drill core on the South Filson Creek deposit. In 1987 he hired geologist Mark Severson who has now logged over one million feet of drill core.

"And he's still logging drill core—at Keewatin Taconite, at the moment," said Hauck. "We've logged whatever drill core on the Range that's available."

Drill cores provide critical information to mining industries. On the Iron Range, the cores tell how much magnetic iron is in the deposit. Closer to Lake Superior, PolyMet and TeckCominco rely on data from Partridge River intrusion cores that show copper-nickel mineralization. Duluth Metals and Franconia Minerals are also doing exploratory drilling for copper, nickel, platinum, palladium and other non-ferrous minerals using a "stratigraphy," (the basic rock layering) developed by Severson. And NRRI geologist Dean Peterson developed a 3D model showing grades of metals

increasing as the copper-nickel mineralization in the Maturi and Nokomis deposits trend to the east.

"All this mapping and modeling builds a kind of road map for the exploration companies to know where to find minerals in Minnesota," explained Hauck.

Investors in Minnesota Steel, a new slab steel venture on the Iron Range, know there's excellent ore in the former Butler taconite pit and plant in Nashwauk. Back in 2000, NRRI geologist Larry Zanko took all of the drilling and iron data and made a three-dimensional "block model" with calculations of the grades of ore found there.

Mesabi Nugget is another new venture on the Range with a mine and mill under construction that will produce iron nuggets (96 percent iron) to feed mini mill steel producers. The first steps began with conversations and connections at NRRI. A trip to Kobe Steel in Japan grew into a delegation of NRRI staff, local industry and agency representatives, including Larry Lehtinen who returned convinced of the merits of iron nugget production in Minnesota.

Over the years, NRRI's Coleraine Minerals Research Laboratory team has supported the Iron Range taconite industry through some tough times.

"Our Coleraine Lab has been providing research assistance to all of the Minnesota taconite operations since 1986, resulting in millions of dollars in process savings and numerous improvements in taconite product quality," said Dave Hendrickson, lab director.

Dave Englund, for example, develops very specialized computer models that analyze proposed changes to the pellet induration process to reduce fuel consumption and increase productivity. Because the taconite pellet making process requires huge amounts of energy—during induration the pellets are cooked at about 2,300 degrees F—incremental increases in efficiency make large scale impacts to cost savings.

Computer models of the concentrator process developed by Salih Ersayin evaluate increases in concentrator throughput and reduce iron losses. Increased concentrator and pellet plant efficiencies, as well as improved product quality, are studied by Blair Benner and Dick Kiesel when taconite operations make process changes. And Iwao Iwasaki and Rod Bleifuss developed new ways to produce a nodular reduced iron product from Minnesota iron ore concentrate. Many renewable energy projects are also underway at the Coleraine Lab to help mining and power companies remain competitive and meet renewable energy goals.

Coming full circle, NRRI's groundwork in copper-nickel and platinum-palladium is now leading to a new hydrometallurgical lab at NRRI's Coleraine lab. This will allow NRRI to provide ongoing research for the non-ferrous mining companies on the horizon in the same way it does for the taconite industry.

"That's our whole purpose," said Hendrickson. "We help expand mining in northern Minnesota."



Iron Range can't rest on laurels

“These ‘boom times’ can explode if we don’t keep an eye on the competition, and compete rigorously in the years ahead,” warns NRRI center director Don Fosnacht.

The world is not standing still regarding the establishment of new iron ore sources. Australia, Brazil, China, Chile, Bolivia, and Africa all have active developments that will lead to much greater iron ore availability by 2012, he explained.

“The Iron Range must continue to enhance its recovery flow sheets and find alternative uses for the by-product materials from mining operations,” said Fosnacht. “These are areas that NRRI will continue to work on for Minnesota’s mining operations.”

Many of the overseas developments will mine iron ore that is a much higher grade than what the U.S. produces. In fact, some Australian ore mining locations harvest the ore using devices similar to corn harvesters because the ore is so close to the surface.

Growth and expansion on the Iron Range

[Source: Duluth News Tribune]

U.S. STEEL/KEEWATIN TACONITE, KEEWATIN

Boosting taconite production by 60 percent
Potential work force: 75 new jobs (currently at 400)

POLYMET, BABBITT (MINE), HOYT LAKES (PLANT)

Open-pit mine to produce copper, nickel, platinum, cobalt, silver, gold and palladium
Potential work force: 400

TECKCOMINCO, NEAR BABBITT

Characterization and development of copper-nickel and platinum group elements
Potential work force: [unknown at this time]

DULUTH METALS, ELY

Underground mine to produce copper, nickel, platinum, cobalt, silver, gold and palladium
Potential work force: 500

MINNESOTA STEEL, NASHWAUK

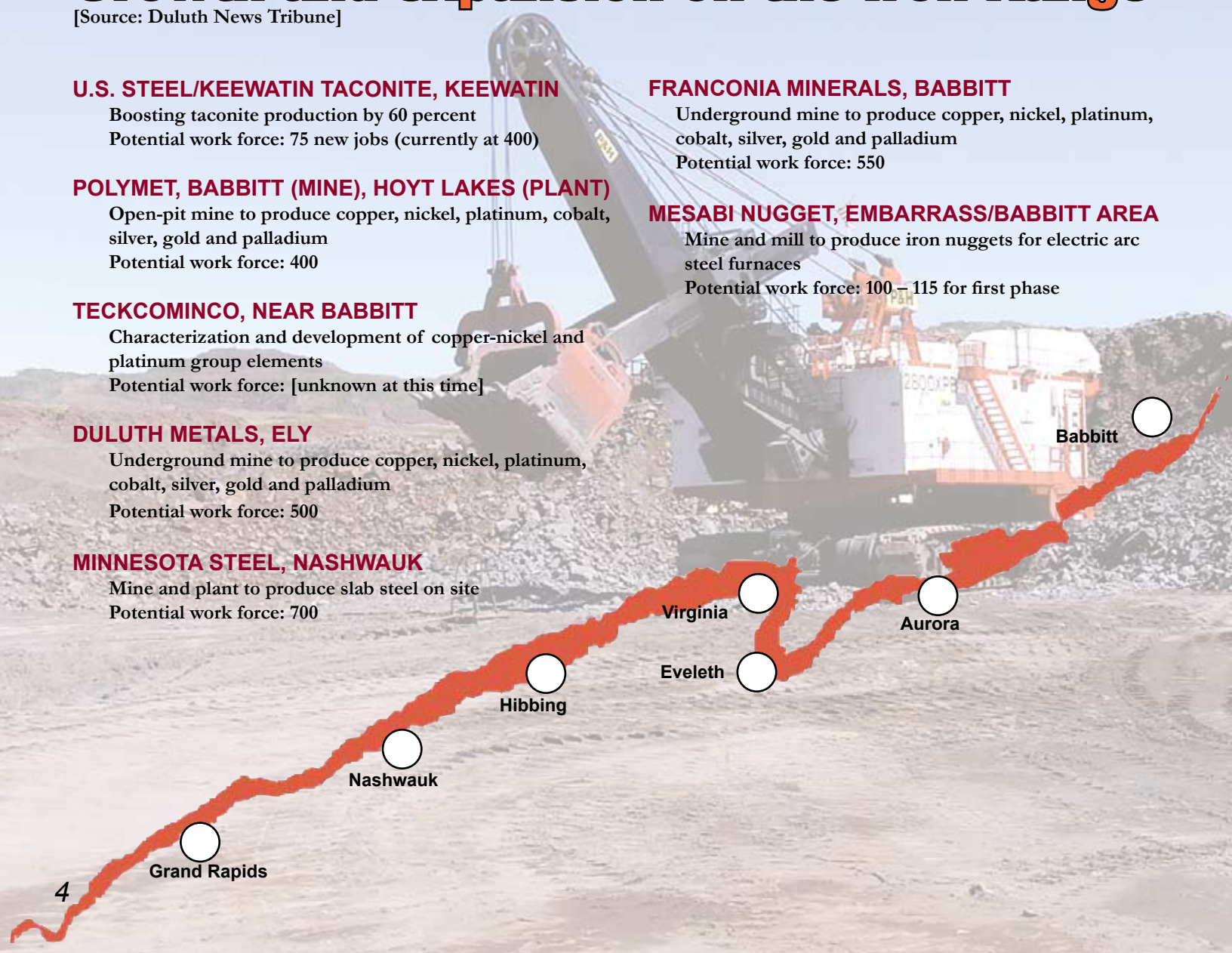
Mine and plant to produce slab steel on site
Potential work force: 700

FRANCONIA MINERALS, BABBITT

Underground mine to produce copper, nickel, platinum, cobalt, silver, gold and palladium
Potential work force: 550

MESABI NUGGET, EMBARRASS/BABBITT AREA

Mine and mill to produce iron nuggets for electric arc steel furnaces
Potential work force: 100 – 115 for first phase



Planning for the future



Coleraine Lab

Engineering students get ore education

The word is getting out—the Iron Range has jobs once again. Wise engineering students are giving the taconite industry a hard look as they prepare themselves for the work world. But most universities cancelled mining and metallurgical classes when the industry took a downturn in the 1980s.

NRRI is filling the education gap with a taconite mining internship program. Three summer months are filled with everything a newcomer to the industry needs to know.

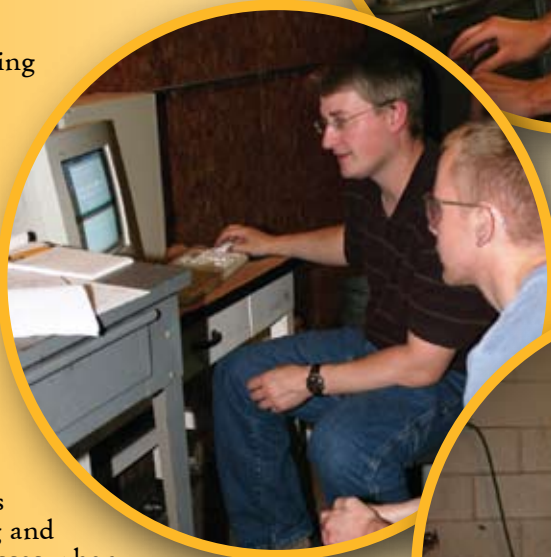
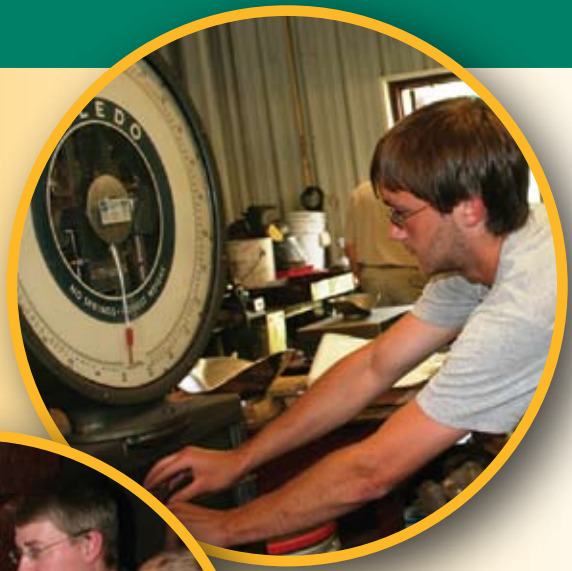
“We saw that there’s a big gap of people who just don’t know what opportunities the taconite industry offers,” said Dave Hendrickson, director of NRRI’s Coleraine Minerals Research Lab. “We need young college graduates, especially as we look to the future and so many of today’s engineers are reaching retirement age.”

The program opened with five positions and 20 applicants hoping for a spot. Four UMD engineering students, and one from the University of North Dakota were selected to participate. New dorms at Itasca Community College provided affordable housing nearby.

The first five days were held in the classroom with “Taconite 101.” NRRI professionals taught the students, including seven engineers recently hired by industry, the entire process—from the geology to mineral processing to pyrometallurgy.

The interns took the Mining Safety and Health Administration tests (similar to OSHA certification) and toured the MinnTac plant. The rest of the summer they worked side-by-side with NRRI technicians learning real world tasks to keep Iron Range industries competitive worldwide.

“There’s just no other way to get an education in iron ore mining,” said Hendrickson. “And you can bet they’ll have a good job reference from me when they complete the internship and start job hunting.”





Making a plan to protect...

“**T**here are critical issues concerning natural resources in every area of our state,” said NRRI scientist Jerry Niemi. “What’s unique about this plan is the view across the spectrum of land and water resources and their interconnectedness. That is very important.”

Niemi addressed the Legislative-Citizens Commission on Minnesota Resources and a gathered audience at the Minnesota State Office Building in St. Paul as the Statewide Conservation and Preservation Plan was released in July.

The Commission asked the University of Minnesota’s Institute on the Environment to coordinate an ambitious plan—an assessment of the condition of the state’s natural resources and comprehensive recommendations to conserve and preserve them for the next 50 years. The Institute turned to NRRI for expertise in energy, land and aquatic resources, and wildlife biodiversity issues. NRRI was the lead organization in mapping these resources.

In all, over 100 scientists, professionals, agency staff and citizen groups have been involved in the project for the past 18 months. NRRI managed an Intranet information sharing system so the various teams could stay connected via computer.

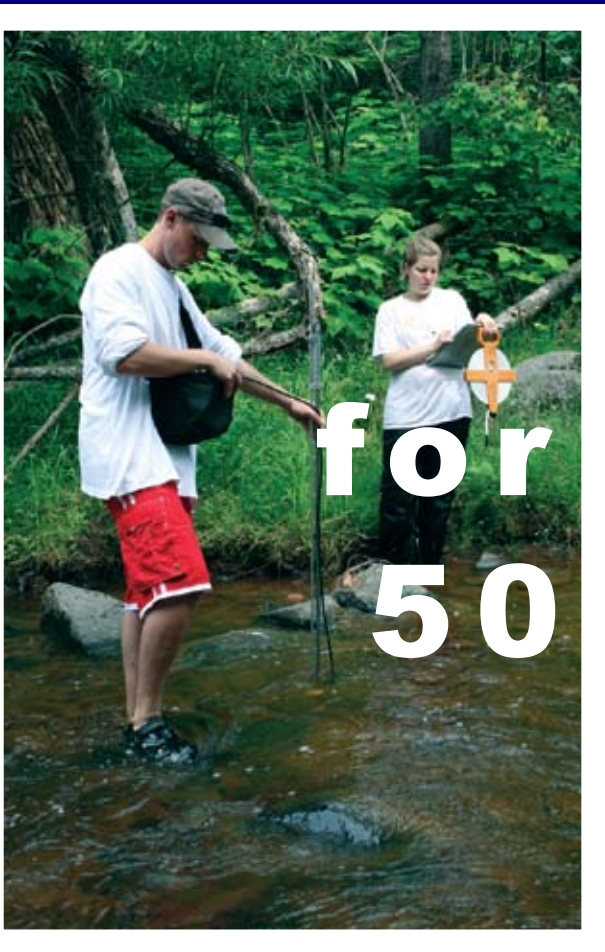
The final plan is massive and integrated—something new in the management of overlapping resources of forests, water, energy, air quality, transportation, and agriculture. The teams developed 13 recommendations for habitat conservation and preservation, nine for land use, three recommendations for transportation, and 25 energy recommendations.



“This plan has an integrated approach to managing multiple resources at once, so we don’t have policies that protect water but hurt the land, or protect the land and hurt the water,” explained Deb Swackhammer, U of M’s Institute on the Environment interim director and project leader.

The first phase compiled baseline conditions of Minnesota’s resources—basically what was here before European settlement and how farming, logging and development changed the landscape. Then a year was spent defining the effect of those changes and developing future scenarios and options for conserving, protecting and using those resources into the future.

NRRI Center Director Don Fosnacht is co-leading the project’s Energy Team. The group identified trends and impacts of energy consumption, natural resources likely to be affected, and investment and policy choices related to energy that impact natural resources.



for the next 50 years

Minnesota's Conservation and Preservation Plan unveiled

“Our ability to meet our future energy needs for Minnesota requires a variety of simultaneous approaches, said Fosnacht. “This includes an increased emphasis on energy conservation and a systematic adoption of alternative energy technologies that wean us from fossil fuels.”

He added that this includes the adoption of alternative electrical energy production techniques, new biomass-based fuels, and more efficient ethanol production. NRRI is developing research in each of these areas.

The 60 recommendations in the plan will help the Legislative-Citizen Commission invest environmental funds provided by the state lottery and set policy for managing resources in a comprehensive way.

“A healthy environment requires a healthy economy, and a sustainable economy requires a sustainable environment,” the report says. This has also been NRRI’s mission all along.

Some of the recommendations:

- Purchase and conserve the very best lands in the state (about one percent of land area), use conservation easements and other incentive-based conservation strategies (3-10 percent of critical habitat area), and provide cooperative management and education on progressively larger pieces of land (10-25 percent of critical habitat area).
- Critical stream and lakeshore land also needs to be protected using a variety of methods and incentives for shore land owners.
- The state should accelerate efforts to restore and improve shallow-lake habitat and restore some of the 500 drained shallow lakes.
- The state must invest to restore wetlands, both on public and private lands.
- A state land-use guide should be developed.
- Adopt policies that will gradually transition biofuel feedstocks for ethanol to perennial crops.
- Invest in perennial biofuel and energy crop research and landscape scale demonstration projects.
- Provide incentives for energy conservation efforts.



Pavel Krasutsky



U.S. Dept. of Energy, EERE Program News

Ethanol production gets needed boost from NRRI technology

Getting more from corn

As the debate surrounding corn ethanol continues—A viable alternative fuel or economy buster?—Minnesota’s 17 ethanol plants are producing billions of gallons of ethanol, and it is one of the state’s booming industries.

It won’t be going away anytime soon, that much we know.

So if the U.S. is going to dedicate 14.3 percent of its corn crop to energy production, the best we can do is make it as efficient as possible.

NRRI’s Chemical Extractives Lab has applied for a patent for a new technology to do just that. The scientists found a way to process the ethanol by-product—a low (30 percent) protein animal feed called Distiller’s Dried Grains with Solubles (DDGS)—into a feed with 45 percent protein. The process also produces an additional 10 percent biodiesel B-100 fuel, six percent more ethanol, and glycerine (used in many food, beverage and pharmaceutical applications). In all, NRRI’s new technology increases the efficiency

of corn ethanol manufacturing by 15 percent and provides additional valuable products.

The estimated monetary benefit for Minnesota is huge—potentially about \$233 million for the treatment of 1.8 million metric tons of DDGS. This technological advance would produce an additional 61 million gallons of diesel fuel and 900 thousand metric tons of high protein animal feed.

For the U.S., the benefits are extraordinary—approximately \$1.7 billion for processing 13 million metric tons of DDGS. It would provide 440 million gallons of diesel fuel and 6.5 million metric tons of high protein feed.

The Chemical Extractives Lab designed and constructed a low pressure extractor for pilot scale optimization of this DDGS process. Researchers will be able to conduct broad analyses and test the economics of the technology under optimal parameters.

“The destiny of this technology depends very much on our industrial partners,” said Pavel Krasutsky, director of the Chemical Extractives Program. “We are now searching for partners and investors interested in moving this technology into industrial applications.”

DID YOU KNOW . . .



Ethanol is ethyl alcohol, made by fermenting and distilling simple sugars from corn.

During Prohibition, the “white lightening” (200 proof alcohol) moonshiners didn’t sell, they used in the gas tanks of their Model T Fords.



Wood stands test of time & water



NRRI conducts wood testing on historical ship

The U.S. Brig Niagara was hastily built during the War of 1812 to help Commodore Oliver Hazard Perry's flotilla of ships fight the British during the Battle of Lake Erie. One of nine vessels, the Niagara played a pivotal role in the capture of the entire British squadron. This battle was one of the most resounding triumphs of the War of 1812, securing the Northwest Territory, opening supply lines, and lifting the young nation's moral.

A replica of the U.S. Brig Niagara sailed handsomely into Duluth this summer for the annual Maritime Festival, drawing 20 thousand visitors to its deck. NRRI is proud of its role to help keep this historical structure in ship shape.

NRRI researcher Xiping Wang, along with James Wacker from the USDA Forest Products Laboratory, specialists in non-destructive wood testing, used two technologies to conduct assessments on the wooden masts of the Niagara.

Wood and water can lead to rot, explained Pat Crosby, ship carpenter on the Brig Niagara, to a Duluth News Tribune reporter.

"Especially with fresh water, if you get much penetration into the wood, it provides a nice environment for the growth of organisms that can lead to rot," Crosby said.

NRRI's testing equipment lets the researchers and carpenters see under the exterior wood surface without cutting into the wood. One



Left: The U.S. Brig
Niagara sails into Duluth
(Photo by M.Lalich)

technology, stress wave timing, works on the theory that stress waves travel faster through high quality wood than they do through wood that is deteriorated or of low quality. Probes are placed opposite one another to measure the amount of time it takes a stress wave to pass from one side to another. The second technology, resistance micro-drilling, measures and charts the amount of resistance (drilling torque) encountered as a piece of wood is penetrated with a 3-millimeter diameter drill bit.

Over the course of two days Wang and Wacker collected data on the main and fore masts, waterway planks, keelson and forepeak cant frames at the forepeak cabin. The data went into a "Condition Assessment" report so that the carpenters can make strategic choices about how and where they make repairs.

"I usually look for surface signs of trouble, such as paint starting to bubble," Crosby told the newspaper reporter. "Then, I investigate by tapping and listening. Where it sounds hollow, I start to dig and probe. But what they [NRRI researchers] can do is way beyond tapping and poking."

Managing the patent portfolio



From idea development to market-ready, NRRI is putting increased focus on licensing new products—from natural chemical extractives (top right) to oil absorbent corn boards (bottom and top left photos).

NRRI*Innovation!* By the numbers...

72 NRRI inventors

21 New patents issued since 1999

NRRI inventions get market-ready with help from the U

“A great idea that doesn’t make it to commercialization isn’t worth the powder to blow it up,” NRRI Director Mike Lalich often says. And developing new ideas is an important part of NRRI’s mission.

But taking an idea from concept to commercialization in the university system is more complicated than in the private sector. That’s why Lalich developed a position for a liaison to work with NRRI’s inventors and the University’s Office for Technology Commercialization.

“I’d say my key role is communication,” said Pam Sarvela, NRRI business development specialist. “And to keep things moving the way a business would.”

NRRI has an impressive patent portfolio... and the disclosures for potentially patentable ideas keep coming. The Office for Technology Commercialization is responsible for the patent process and developing a marketing strategy. Sarvela collaborates with them to provide NRRI’s perspective in both areas. The Institute is working toward developing an income stream from licensed inventions that will allow for research in entrepreneurial endeavors that need funding.

“NRRI differs from the rest of the university in that our mission is applied research focused on finding solutions for industry, its focus is on process and product,” Sarvela explained.



“Traditional university professors focus on publishing in peer reviewed publications, which means ideas are carefully documented. NRRI researchers often generate ideas faster than they can manage a paper trail.”

So Sarvela manages the paper trail—the information and documentation needed by the Office for Technology Commercialization to file for patent applications and develop marketing strategies for commercialization. It boils down to understanding NRRI’s priorities from a management and an inventor’s perspective.

“They don’t always match,” said Sarvela, “so it’s important that communication is facilitated between all parties and all deadlines are met.”

This role is unique in the University of Minnesota, but increasingly necessary as the brainpower within the institution advances knowledge in areas that fit a particular market.

Eric Hoeckert, technology marketing manager for the Office for Technology Commercialization, says the focus on technology transfer is a new role for most universities that traditionally develop new ideas just for the sake of knowledge.

“NRRI is more application focused than other technology development departments at the U,” he said. “In order to get the inventions ready for the marketplace, we have to move as quickly as businesses do. Other alternatives are not standing still and our window of opportunity is not an infinite window.”

- 197 Ideas generated for disclosure at NRRI since 1990
- 16 U.S. patents (and 4 world patents) held by NRRI scientist Pavel Krasutsky

Great minds meet on common ground

The Fifth Indo-U.S. Workshop on Mathematical Chemistry

“If I were asked under what sky the human mind has most fully developed some of its choicest gifts, has most deeply pondered on the greatest problems of life, and has found solutions, I should point to India.”

Max Mueller, 19th century philologist and orientalist

Opportunities abound to solve many of the world’s complex problems with the power of computers. NRRI scientist Subhash Basak is at the center of a cross-disciplinary, international web of scientists who use mathematical chemistry for drug discovery, environmental remediation and unraveling genetic codes.

“The power of the computer is really amazing,” said NRRI scientist Jerry Niemi. “Using computers to sift through chemical structures, we don’t really need to be testing so many chemicals with animals. The savings are extraordinary.”

In the late 1980s, Basak’s research team at NRRI

began with a computer program that could predict the properties of new chemicals. Today, Basak has an international “virtual team” that stays connected via the Internet and broadens the reach of mathematical chemistry to real world problems. One result of this web of connections has been regular international conferences on mathematical chemistry.

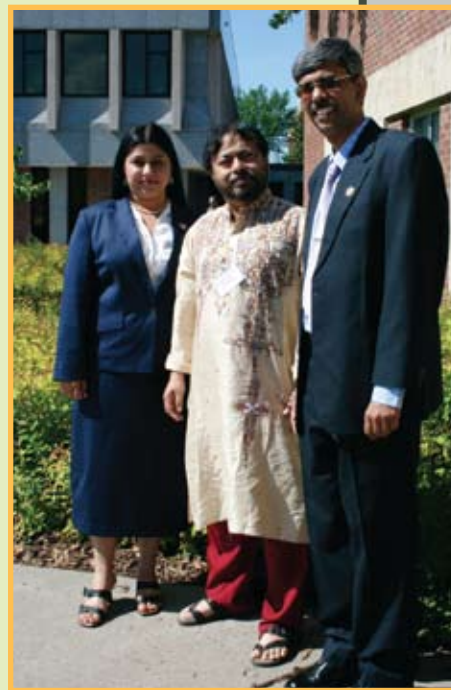
This June, Basak organized the eighth such conference, along with the Fifth Indo-U.S. Workshop on Mathematical Chemistry at the University of Minnesota Duluth. The gathered brainpower focused on environmental issues such as aquatic endocrine disrupters (which cause hormonal imbalances in humans and wildlife) new chemicals such as new insect repellents, and computational genomics and proteomics.

Special guests included the Executive Director of the Indo-U.S. Science and Technology Forum Arabinda Mitra, and Science Manager, Smriti Trikha.

“Our objectives are mostly to connect students with faculty and to develop cooperation between public/private partnerships,” said Mitra.

The Forum is an autonomous, not-for-profit organization that promotes and catalyzes Indo-U.S. collaboration in science, technology, engineering and biomedical research through substantive interaction among governments, academia and industry.

“India is the largest democracy in the world with 1.2 billion people,” says Basak. “Because of our global economy, developing new knowledge corridors between the U.S. and India will help basic science connect with real world applications.”



Smriti Trikha (left) and Arabinda Mitra (right) joined NRRI's Subhash Basak at UMD for the 5th Indo-U.S. Workshop.



What are the economics of large scale gasification in Minnesota? About 50 Minnesota industry professionals representing forest products, taconite, energy, and the Department of Commerce, gathered at NRRI this summer to get down to brass tacks. Frontline Bioenergy, LLC, operates the only large scale gasifier in Minnesota at the Chippewa Valley Ethanol Cooperative in Benson, Minn. Frontline co-founder John Reardon, came to NRRI to explain the details and answer questions.

“There is a lot of interest in understanding the economics of gasification right now,” Reardon said. “And there are a lot of funding opportunities for gasification projects.”

Thermo-chemical gasification converts plant matter—wood and agricultural residues—into a gas that can replace natural gas. The process takes place at the industrial site where the energy is used—like Minnesota’s paper mills or taconite pellet plants. The gas could also be liquefied in a second process to make a liquid fuel.

NRRI forestry and energy expert Bill Berguson organized the meeting at NRRI because he sees potential in gasification to replace natural gas that now powers many large industries. If they are less

vulnerable to upswings in natural gas prices, they’ll be more competitive. Natural gas sources could be freed up for transportation or other uses, reducing the U.S. dependency on foreign fuels.

But the opportunity for jobs is another benefit that piques Berguson’s interest. Northern Minnesota loggers lost an important market when the oriented strandboard industry took a hit because of economic downturns and the housing crisis. New interest in alternative energy sources got Berguson thinking about available biomass feedstock available in Minnesota. Wood sources that aren’t being fully utilized by other forest products industries—black ash, tamarack, and some maple—can be harvested for energy use and boost the local economy.

“There are many ways to displace fossil fuels, and this is one piece of the puzzle,” said Michael Twite, environmental manager at Ainsworth Engineered, LLC, who attended the meeting. “We have all of this mill residue. It would be crazy for me to sell it on one end and buy fossil fuels on the other end.”

“I want to help Minnesota industries evaluate the possibilities in gasification technologies,” said Berguson. “The market conditions are such that gasification of local, low-demand forest species may be feasible to stabilize the energy costs of Minnesota’s industry.”

NRRI explores the financial side of gasification

How can Minnesota move forward with biofuels?



Bill Berguson, left, talks with Mark Broses and Dale Hedtke, both of SEH, Inc., about bioenergy in Minnesota.

They fingered the spongy soil. They prodded the soft earth mounds. They squeezed the muck and watched it ooze between their fingers.

Why were 15 professionals touring a northern Minnesota peat bog on a Monday morning this summer? Peat is a prized resource ecologically and economically. Minnesota has some seven million acres of peat bogs across the state, but only about two thousand of those acres are harvested and sold for horticultural purposes. About 97 percent of the sphagnum moss peat sold in the U.S. is imported from our northern neighbor.

“I’m mostly interested in the ecology,” said Brad Cook, a biology professor from Minnesota State University in Mankato. “But this is great because we have peat harvesters and regulators here, so I’m really listening to those perspectives. After all, what we manage and regulate are ecological functions.”

Wetland delineators—those who define the boundaries of wetlands—were there to obtain necessary continuing education credits. Graduate students were gathering data for master’s projects. A Department of Natural Resources scientist was gathering information to help him quantify the benefits of wetlands ditching.

So what is there to know about this ancient, biodegraded plant

matter that thrives in Minnesota’s cold, glacier-carved wetlands?

NRRI peat researchers have been studying, and practicing, the “Canadian Method” for peatland restoration for some 15 years in northern Minnesota. NRRI’s Tom Malterer and Kurt Johnson led the full-day tour that began in a natural, undisturbed part of the Black Lake Bog, leased by Peatrex Ltd. (Premier Horticulture) in Cromwell, Minn.

“We’re starting here so everyone can understand how the bogs formed when the glaciers retreated,” Malterer explained.

He thrust a peat sampler a few feet into the soft soil and pulled out a long slice of what lies under the diverse vegetation—Labrador tea, leather leaf, cotton grass, and cranberry plants. The brown soil felt like a sponge, and when squeezed, released water like a sponge. As Malterer added length to the sampler to plunge deeper, the slices came out increasingly mushier, muddier. He finally reached the bottom of the ancient lake bed, hitting sand at about 10 feet.

“This layer here is about 11,000 years old,” he said, pulling up a long piece of the earth. “It took a long time to form.”

But peatlands have value beyond their unique ecosystem for plants and critters, as well as being nature’s sponge—collecting, holding

and filtering water. Bagging up peat for horticultural uses generates over \$300 million in U.S. sales.

Peatrex, Ltd.’s harvesting operation was next on the tour schedule. The Canadian-based company “mines” 237 acres at their Cromwell site, a process that comes with lots of frustration.

“Harvesting is extremely variable,” said Kevin Milne, Peatrex bog operations manager. “It’s highly dependent on every weather element—wind, rain, sun, and how much, or the frequency of, any of those. Everything.”

For example, when farmers everywhere were cursing the drought of the past couple of years, peat miners were luxuriating in ample harvests. They need dry conditions to vacuum the inch or two needed off the top of the drained bogs. This year has been more typically wet, which is frustrating for them.

A peat deposit, six feet deep, will support a harvesting operation for 20 to 30 years. For boggy counties that don’t have a lot of other natural resources to provide jobs, it’s a welcome option. Peatrex’s 237 acre peat harvesting operation provides about 20, mostly seasonal, jobs in rural Cromwell, paying an average of \$42,000 a month in cumulative salaries.

The evolution of a bog

NRRI leads teaching tour on peatland restoration

But because peatlands are wetlands, they are highly regulated. Watching closely at the federal level are the U.S. Army Corps of Engineers and the Environmental Protection Agency. At the State level are the Minnesota Department of Natural Resources and the Minnesota Pollution Control Agency.

“Close regulation insures that water quality will be maintained and the mined peatlands will eventually be restored to functioning wetlands after they’re harvested,” explained Johnson. “NRRI’s restoration research and our Canadian colleagues provide the methodology peat companies need to return their sites to Sphagnum moss dominated peatlands and jump-start the peat accumulation processes.”

NRRI is also able to provide wetland mitigation credits for road projects because of its efforts to restore a drained peatland near Zim, Minn. The touring group spent the afternoon at NRRI’s Fens Research Facility to learn about the restoration methodology, re-vegetation and other details of this large-scale restoration project.

The Peatland Restoration Tour was organized and sponsored by NRRI, the Wetland Delineator Certification Program, the Minnesota Peat Association, and the International Peat Society.



Red Carpet Tour

Five members of the University's Board of Regents toured NRRI in October and were impressed with the activity level and project successes they saw. The Regents held their monthly meeting at UMD. Pictured from left are UMD Vice Chancellor Vince Magnuson, University of Minnesota Board of Regents members Clyde Allen, Maureen Ramirez, Dallas Bohnsack, Venora Hung, Steven Hunter and NRRI Director Mike Lalich.



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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.

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