In Perspective
Special Edition

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Coleraine Groundbreaking
This is a special issue of *NRRI Now*, dedicated to projects that have been supported with state funding from Minnesota Technology, Inc. (MTI). There is an ulterior motive for publishing an issue with this focus. Unless action is taken during the current legislative session, NRRI’s funding for projects like these will be cut in half from a historical level of about $950,000 to $450,000 annually.

NRRI has used these funds primarily for applied research and technical assistance on a cooperative basis with entrepreneurs and industry. The MTI support has become NRRI’s single most valuable resource to assist entrepreneurs and companies with product and process development leading to creation of new jobs and retention of existing jobs.

The ongoing initiatives, that comprise the stories in this issue, are testimonials to the value of those efforts.

While most of these Minnesota Technology, Inc. efforts are focused on cooperative initiatives with entrepreneurs and small companies, occasionally the funds are used for scientists to prove new concepts prior to finding industry partners. Such is the case for NRRI’s natural resource based chemical derivatives program.

A direct outgrowth of this derivatives program is the recent formation of NaturTek, LLC. NaturTek is an exciting new-limited liability corporation formed in partnership between the University of Minnesota Duluth, Minnesota Power, Inc. and Potlatch Corp. NaturTek was launched to obtain natural compounds from birch bark, using patented processing technology developed at NRRI.

I’m tempted to discuss a number of themes associated with the NaturTek venture, such as its being a model for the University to work with industry, its economic development potential and the environmental sensitivity of using an industrial waste material as the feedstock for new products. Instead, I will conclude my remarks by capturing the excitement of the NaturTek launch and the importance of NRRI’s Minnesota Technology funding through quotes from the press release announcing the NaturTek partnership.

UMD Chancellor Kathryn A. Martin said, “The strength of this partnership lies in the unique expertise of each partner. NRRI has proven research capabilities, while Minnesota Power and Potlatch bring business development and operating expertise. This venture reflects UMD’s ongoing commitment to bring our research into the public arena.”

NaturTek President David F. Peterson noted, “The process is environmentally and economically sound. Plus, there is substantial interest in commercial applications of the compounds.”

“This partnership is an extension of our long-term investment in the region,” said L. Pendleton Siegel, Potlatch chairman and chief executive officer. “Bark byproducts have traditionally been used as fuel, but NaturTek offers access to alternative markets for value-added products that will better utilize the existing resource.”

“NaturTek is about economic development and diversifying the region’s natural resource-based economy,” said Edwin L. Russell, Minnesota Power chief executive officer. “We are excited about the business potential of this partnership.”

Michael J. Lalich
Not only do NRRI forest product researchers develop new products, but they also use their expertise and experience to make existing products better. In a newly initiated project, NRRI wood engineers will help Crystal Cabinet Works, Inc. of Princeton re-develop a veneered cabinet door that was dropped from the company’s product line a few years ago because of dimension stability challenges.

At the time of discontinuation, the door/drawer front accounted for two percent of Crystal Cabinet’s door sales. The company continues to receive requests for the discontinued style. NRRI wood experts Victor Krause, Suzanne French, Pat Donahue, Scott Johnson and Brian Brashaw are working hand-in-hand with Crystal Cabinet’s engineers to improve the product and return it to the market. Starting with material selection, prototype development and manufacturing technology, the entire manufacturing process will be analyzed and re-designed.

Building the Clay Industry in Minnesota

In the Minnesota River Valley lies a rich source of kaolin and ball clays. Kaolin is used in ceramics, cement and brick-making. Ball clays enhance the characteristics of ceramic and brick clays.

Minnesota Valley Minerals, Inc., leases, explores, tests and mines clays. NRRI geologists have been involved in many of the minerals projects by this company. Through the use of MTI funding, NRRI geologists’ help has ranged from initial exploration and testing to mining economics, product testing and development. Company president Scott Gooler says, “Without the assistance of NRRI, my company could not have accomplished as much as it has. We are a small company and do not have the resources or knowledge that NRRI geologists have. We feel that there is no other entity in the state with the knowledge, expertise and resources as NRRI.”

Due to the assistance of NRRI to Minnesota Valley Minerals, a new company, Courtland Clay, was formed by Gooler to develop the kaolin clay into the ceramic art market. These clays will be the first indigenous line of ceramic and pottery clays to be produced in the state. “Without NRRI’s help, my companies would not be in the position they are today. The knowledge, expertise and dedication of their staff has proved them to be exemplary and our first choice for technical assistance,” said Gooler.

Colonial Craft manufactures hardwood moldings, window and door grilles and picture frames. America’s largest supplier of decorative hardwood grilles, Colonial Craft wants to reduce the production cost of the fasteners that attach each grille to the window sash. In their current state, the fasteners consist of a plastic pin encased in a metal spring. However, the new fastener will have the spring built into it. NRRI forest products engineers are extensively testing the fastener through compression cycling tests, withdrawal strength tests and heat freeze cycling to determine performance. The successful development of the new spring will result in an estimated 30 percent cost savings of the pin system.

Victor Krause, NRRI’s coating specialist, helped Colonial Craft develop standard operating procedures in their paint line. They are doing major equipment modifications that will lead to a cost effective and efficient machine.

The partnership between NRRI and Colonial Craft resulted because “I knew what resources were available and we didn’t have the expertise or testing equipment that NRRI had,” said Bill Callas, the corporate technical manager at Colonial Craft. The search for improvement has led to the development of new fasteners and a modified paint line that meet customer requirements.
Baitfish Hatched, Raised in Captivity

Brainerd Area, Minn. —

Hornyhead chubs, known as redtails in central Minnesota, are rapidly becoming a popular native baitfish. However, demand is rapidly exceeding supply. NRRI researchers used MTI funds to conduct a three-fold experiment. First, scientist Paul Tucker raised wild-caught fry to marketable size in one year compared to the usual three years. Next, he set up an artificial stream system in NRRI’s aquatic lab and simulated winter conditions with temperature and light to encourage the adult redtails to spawn in captivity. In a third role, Tucker helped three baitfish wholesalers in the Brainerd area set up artificial outdoor stream systems so they could also attempt a redtail hatch in captivity. All three efforts were successful.

Aquaculture in Minnesota is a quiet but growing industry which links tourism, recreation and the state’s natural resources to rural communities and businesses. Redtails have been known to sell for up to eight dollars per dozen compared to less than five dollars for most other bait species.

According to Carl Richards, who oversees the project, sharing the technical information with cooperators gave them an advantage in the aquaculture industry. “Linking NRRI scientists with active members of the industry is essential for maintaining these types of successful business opportunities. These partnerships have already started to produce results.”

Long-term Monitoring

Central Minnesota —

Eleven years ago NRRI forestry researchers Bill Berguson and Dan Buchman initiated a project to increase yield in Minnesota’s aspen stands using an age-old fundamental — get rid of the weeds to leave more nutrients, water and sunlight for growth of the remaining plants.

By mechanically strip thinning — using standard logging equipment to clear an eight-feet-wide strip within aspen stands — they were able to increase growth rates by 17 percent. To date, Minnesota companies have mechanically strip thinned 10,000 acres (an area equivalent to a one-mile by 17-mile strip of land).

The NRRI forestry team used MTI funds to continually monitor and analyze the effects of this promising strip thinning project.

Berguson projects the mechanical strip thinning will increase yield by 10 cords per acre. That translates to 100,000 additional cords of harvestable wood from the original 10,000 acres. With an approximate stumpage price of $20 per cord, the process increases yield by $2 million.
Ramp Company Hits the Pavement

Duluth, Minn. —

Just over one year ago, SunRamp Solutions founders approached NRRI forest products engineer Pat Donahue with a concept for a skateboard ramp. Donahue and Brian Brashaw formed an NRRI project team that quickly designed, prototyped and developed several ramp designs for the skateboarding, in-line skating and trick bike-riding market. The newly formed company, SunRamp Solutions, Inc. then took the prototypes to the streets—literally—by letting the kids and teens test the product themselves in Duluth parks.

Today, SunRamps are selling their initial ramp design with plans to bring two additional designs to the market by spring of 2000. Based in Duluth, the young company utilized MTI funds to both develop the concept and the prototype itself along with the initial mold for their first phase of commercialization. The company has started to implement their marketing strategies and has received inquiries from across the United States.

According to SunRamps’ president, Gerald Sabol, NRRI played a crucial role in bringing the concept to market so quickly. “NRRI’s forest products team demonstrated that they will do what it takes to make this business a reality,” said Sabol. “NRRI and SunRamps are true partners in this business venture and we realize how important these professionals are to our success every day.”

Fergus Falls Company Benefits from Research Partnership

Fergus Falls, Minn. —

The value of all forest products produced annually in Minnesota exceeds $7 billion. The industry provides more than $180 million in annual taxes to the state.

Northern Contours of Fergus Falls, a manufacturer providing membrane pressed components to the cabinet and furniture industries, partnered with NRRI for research. The company benefited from the association growing to 250 employees in just seven years and over $25 million in sales. As part of an in-kind contribution, Northern Contours donated a membrane press to NRRI. Researchers were able to provide the company with the latest and most efficient technology to produce veneered insert panels and thermofoil doors.

This year, the company signed an exclusive, three-year, $120,000 contract with NRRI for research and development. The process improvement, product development, equipment selection and modification, and market research that NRRI has provided has been instrumental to their rapid growth.
Stronger Direction for Coatings Company

Van Technologies, Inc. formulates and manufactures environmentally compliant coatings for products ranging from paper and automobiles, to glass and wood products. Since the company’s inception in 1992, Van Technologies, Inc. has maintained a continual relationship with both NRRI’s wood product experts and Business Group.

Using NRRI’s Idea Evaluation Grant program, Business Group consultant Jim Skurla helped company president Larry Van Iseghem write a business plan, access start-up capital and analyze the coatings market. Over the years, they revised the business plan and constantly reviewed the company’s marketing in effort to stay abreast of trends.

On the technical side, NRRI coatings technician Victor Krause spent 18 months at Van Technologies formulating and testing water-based and UV finishes for wood stains, sealers and topcoats. Although Krause did not develop specific products, the work he completed eliminated some product line variables and gave Van Technologies stronger direction. The resulting products are especially noted for performing the same as traditional oil-based coatings without emitting toxins into the atmosphere.

According to Van Iseghem, having an on-site expert gave the company a competitive advantage. “It gave us a good survey of available raw materials that we can use in our formulation approach to better coatings,” he noted. “Knowing these raw materials allows us to specifically target our customers’ needs, especially when they want to make the conversion to environmentally-compliant coatings.”

Van Technologies employs seven and has steadily grown by forty percent since 1992, most recently branching into international markets.

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Technology with World-Wide Applications

Apprise Technologies, Inc. was launched in 1997 with a primary product, called RUSS or Remote Underwater Sampling Station, that allows multiple users to request, download and analyze water quality parameters from a remote location. In a few short years Apprise has moved from one product to four with several more in the research and development stages.

In conjunction with NRRI and the UMD chemistry department, Apprise has also developed an optical-based nitrate sensor and a chlorophyll sensor. Currently, the company is negotiating with industry partners for the near-term commercial development of these two sensors.

Using NRRI as an incubator location, Apprise develops solutions for the biomedical, environmental and process control instrumentation markets worldwide. With a staff of eight and over 25 RUSS units sold, Apprise has grown into a small, Minnesota-based company with international applications.

According to Apprise’s Chief Executive Officer, Rondi Erickson, “NRRI and MTI have provided invaluable support for the technologies developed by Apprise. Our product development would have been much slower without them, and without products we wouldn’t be a new and growing employer in Minnesota.”

**APPRISE TECHNOLOGIES, INC.** is a Minnesota corporation which was established to develop, produce and market analytical sensors, sensor data acquisition and data telemetry systems for the biomedical, environmental and process control instrumentation markets.
Grand Rapids’ Blandin Paper Company Partners with NRRI

Duluth, Minn. —

Approximately 80,000 chemical substances are currently manufactured or processed for commercial use in the United States, and nearly two thousand more are introduced annually. NRRI researchers Subhash Basak and Alexandru Balaban use computers to make new compounds both effective and environmentally friendly—or benign by design.

Basak and Balaban have been collaborating with scientists at Duluth’s Chromaline Corporation, an international developer, manufacturer and marketer of photochemical imaging systems for the screen printing industry. Recently the company requested NRRI’s expertise in evaluating the toxicity of new chemicals.

Jointly NRRI and company researchers created 40 new chemicals, some of which belong to a totally new class of chemicals. Chromaline specializes in chemicals for the screen printing industry and has received ISO 9000 Certification, an internationally recognized quality certification program.

These new compounds are in the patent process and some are expected to be in production soon.

Chromaline Corporation Teams with NRRI for New Chemicals

Wastewater Project Seeded

Northern Minn. —

Four years ago NRRI researchers began a new initiative—an in-depth look at alternative methods to treat on-site wastewater across northeastern Minnesota. Using MTI funds to seed the projects, researchers installed and monitored systems for residential on-site systems, a small community system and systems designed specifically for northern resorts.

Spearheaded by NRRI’s Barb McCarthy and Rich Axler, a team of industry experts, county health departments and state agencies examined each scenario and developed customized solutions. The projects offer valuable performance data with the goal that they will be considered as alternatives in areas where standard systems fail to meet state requirements.

In addition, the three-part project has brought the on-site wastewater treatment issue to the limelight and stimulated industry-specific business growth. For example, several companies have expanded their services to include these alternatives while other companies were actually established specifically to deal with on-site wastewater issues.

“These projects created the awareness of the need for alternative methods,” said McCarthy. “That, in turn, created the opportunity for existing companies to expand or for new ones to develop.”

Grand Rapids’ Blandin Paper Company Partners with NRRI

Duluth, Minn. —

The forest products industry is one of the largest and most stable employers in the state with nearly 60,000 Minnesotans relying directly on the industry for their earnings.

Minnesota’s paper industry needs the highest quality pulpwood available for making lightweight, coated printing papers. By detecting inferior trees before they are cut, project cooperator Blandin Paper Company, can obtain the highest quality trees cost effectively.

NRRI researchers are evaluating equipment already on the market to determine which methods will best identify decay in standing trees. The equipment needs to be forester-friendly and weather hardy, be easily used with minimal training and summarize results quickly as part of an overall site evaluation.
**Peat Harvesting Initiated**

**Big Falls, Minn. —**

Minnesota has 35 percent of the peat available in the lower forty-eight states. To horticulturists, peat is an important product due to its acidic and water-retaining qualities. U.S. demand for peat, especially Sphagnum moss, is steadily increasing.

The Pine Island Bog, near Big Falls, contains a substantial amount of Sphagnum moss peat, approximately 750 to 1000 acres. NRRI scientists worked with Koochiching County officials to match Berger Peat Moss, an established Canadian peat company, with the Pine Island Bog. NRRI’s “knowledge and expertise have been the guiding force that has brought the project this far along,” said Big Falls Mayor Rod Burmeister.

Peat harvesting includes bog preparation, harvesting, packaging and shipping. Berger will harvest two inches of peat a year for an estimated thirty to forty years. Big Falls will experience an economic boom with the additional twenty to thirty jobs the plant will bring.

Currently NRRI is working with Berger Peat Moss and the Minnesota Department of Natural Resources to complete environmental assessment requirements. When completed, bog preparation and harvesting will begin.

**Peat Product Expansion**

**Floodwood, Minn. —**

Minnesota Sphagnum, Inc. has been in the horticultural peat processing industry since 1985. NRRI researcher Tim Hagen is currently working closely with Minnesota Sphagnum to expand the company’s capabilities and products.

A granular mulch made from Sphagnum peat is a coffee-bean-like pellet designed to spread across golf courses, athletic fields and lawns. The pellets are then activated with water. The specially formulated granules expand to over three times their original size, adding organic matter to the soil and increasing moisture retention in root systems while increasing the soil’s pH level. This product can be used in a standard fertilizer spreader for ease of application. Other products under development include wastewater treatment pellets and innoculent carriers.

Hagen works directly with the company to help identify several of the key processes and formulation steps necessary to make the granules at the pilot-scale level. “As we scale-up to the commercial stage, Tim Hagen has been very hands-on and instrumental,” Tim Davern of Minnesota Sphagnum noted.

He describes the company’s relationship with NRRI as crucial to their success. “NRRI has assisted us in every way—from flow sheet development and engineering cost analysis, to technical product assistance to research and development. This assistance means survival for us because we are a very small company.”

Minnesota Sphagnum currently employs 27 during the summer-fall harvesting season. When the production line is expanded with these two products, Davern expects to see more employees on a year-round basis.
Natural Resource-Based Chemical Derivatives

Duluth, Minn.—

Co-products from Minnesota’s forest products industry show promising potential for high-end, value-added products.

NRRI focuses on the chemical extraction of compounds from natural resource-based sources, including energy streams from industrial partners. One derivative has shown extraordinary potential in preliminary testing as a pharmaceutical and has resulted in a University patent. Other compounds show promise for environmentally-friendly applications for both agriculture and industry, for example, as potential sources of pesticides and adhesives.

NRRI completed a $500,000 pilot research laboratory in January 1999. With this capability, research activity has surpassed the $1 million per year level with support from several major industry partners.
NRRI’s Geographic Information Systems Laboratory focuses on creating and using digitally mapped data to explore natural resource problems.

A geographic information system (GIS) is a computer-based tool for mapping. GIS technology integrates common database operations such as query and statistical analysis with the unique visualization and geographic analysis benefits offered by maps. At NRRI’s GIS Lab, this technology has been used for scientific investigations, resource management, predicting outcomes and planning strategies.

How GIS works

Information is stored as a collection of thematic layers, including topography, roads, vegetation or watersheds, which can be linked together by geography. The major challenges we face in the world today—overpopulation, pollution, deforestation, natural disasters—all have a critical geographic dimension.

Input to the GIS may come from any number of sources and in different forms. Data may be from aerial photographs, maps drawn to different scales, satellite remote sensing and textual material.

LTV Steel – GIS in action

LTV forester Dave Youngman said, “Even to a computer dinosaur like me, the potential of this information system is obvious. I’m amazed at the huge savings in time and money that will be realized in this one project alone!”

From notebooks and memories of long-time employees came the information that NRRI’s scientists turned into an interactive database.

LTV Steel controls approximately 60,000 acres of land in three counties in northeastern Minnesota. The company’s concern was that all the information regarding leases, land holdings and land uses associated with their mining operation was spread out over various notebooks and maps and none of the information was computerized.

NRRI researchers through the use of optical character recognition software were able to convert information into a computer spreadsheet. The spreadsheets were imported into a geographic information system and merged with digital maps showing the boundaries of each 40-acre parcel. A user-friendly system allowed employees to select records by querying the database or clicking on the map. Digital tax records were obtained from St. Louis, Lake and Cook counties and merged with the parcel map.

A primary benefit of a GIS is that it integrates data and information that may be scattered throughout an organization, in different departments and on different documents. It can transfer information from one layer to another without duplication of data. Poor accessibility of data prevents efficient management,
planning and operation, is wasteful of resources and severely hampers the decision-making process.

Brimson Labs—a software developer partners with NRRI

Airborne Videography

NRRI focuses on natural resources because information is often needed in a time-sensitive manner. When a natural resource event such as an algal bloom takes place, cost-efficient aerial imagery at low altitudes is ideal for collection of data. Peter Berger of Brimson Labs worked with NRRI’s GIS team to develop an airplane system for simultaneously taking video images of the ground and coordinating locations with a Global Positioning system (GPS). This system made it possible to correct airborne video images for distortion caused by plane tip and tilt and also arrange frames from adjacent flight lines into a single georeferenced image, suitable for capturing events in a timely manner.

“This system makes it possible to have the images within hours of an overflight,” said Berger. “It’s also possible to customize the images for specific tasks.”

Virtual Reality

When virtual reality first hit the video game market, most uses of computer-created images called for expensive equipment. Today, NRRI’s lab and Peter Berger’s Brimson labs have teamed again to develop virtual reality for low-end equipment at an inexpensive cost. A landscape simulated from GIS databases is more realistic. The landscape can be explored interactively on a personal computer with movement controlled by a mouse. Data is embedded in the landscape displaying text, graphics and water pollution information. Visual information is particularly helpful for those unable to picture landscapes from topographical maps. By activating a computer, the user can move through the landscape as though walking enabling one to “see” the landscape without leaving the office.

“One of the most useful tradeoffs we explored was to use a low-resolution imagery to get a feel for the terrain and then instruct the computer to create high-resolution movies that could be viewed later,” said Berger. “This turned out to be a good way to get high quality results using low cost consumer-level computer hardware.”

There are currently more than 2,000,000 GIS users in the world, but most of the public is unaware of this growing technology. GIS enables decisionmakers to integrate and visualize complex information so that they can better understand and manage valuable resources.
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Address Correction Requested

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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