

NRRI Now



NATURAL RESOURCES RESEARCH INSTITUTE

AUTUMN 2000



Census 2000

The Black-capped chickadee (Poecile atricapillus) is a common site in Minnesota's northern forests and backyard feeders. As a year-round resident, it commonly eats insects, seeds and fruits. The chickadee, which is easily identified by its familiar call and distinct markings, is one of over 100 birds that NRRI avian researchers count during the annual spring songbird migration.

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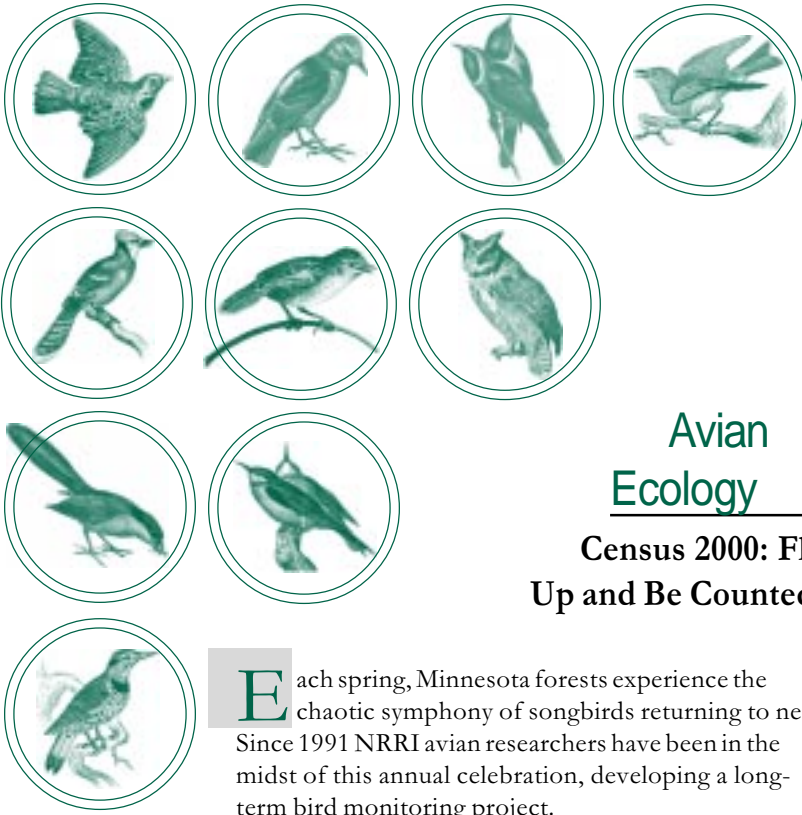
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Cover Story



Avian Ecology

Census 2000: Fly Up and Be Counted!

Each spring, Minnesota forests experience the chaotic symphony of songbirds returning to nest. Since 1991 NRRI avian researchers have been in the midst of this annual celebration, developing a long-term bird monitoring project.

The NRRI research team has standardized the primary collection method, called point counts. This entails having an experienced and trained field ornithologist walk a daily route, stopping for ten minutes at each designated point and recording how many and which species of bird was heard or sighted. The points are surveyed in the same order each year and the results are added to an increasingly large database. Currently, the project tracks over 1,600 census points in 20 different types of habitat.

The information is also coupled with changes due to forest age, logging, weather, fire and wind. Scientists then develop predictive models and management recommendations for a variety of wildlife.

“We really want to avoid the spotted owl situation that caused controversy in the Pacific Northwest,” said lead researcher Gerald Niemi. “By compiling and analyzing long-term trends and the response of bird species changes in the forest, we can better our

understanding of how to maintain sustainable logging and reduce impacts on Minnesota’s precious wildlife and forest resources.”

NRRI avian expert JoAnn Hanowski estimates that 90 percent of the birds are identified by sound. To be part of the exclusive research team, a birder must pass an audio test covering the songs of at least 80 birds. As a result, the avian group has developed a reputation for its cumulative expertise, comprehensive ecological knowledge and long-term data.

While the census project is the backbone of the program, several specialty projects have been directed toward NRRI because of the team’s renowned work. For example, Niemi is looking at the foraging, nesting and roosting habits of boreal owls. Studying this rare bird’s basic ecology will give detailed insight about its reaction to forest management strategies.

NRRI researchers also monitor nine large study plots that represent a broad array of forest management practices across northern Minnesota. In this project, the bird surveyor walks a straight line across the one-mile square area, stopping every 100 yards to record every bird heard and seen for five minutes. Conducted every three years, this survey looks specifically at how birds use the forest patches and edges created by harvesting.

In the end, the cumulative information from these avian projects serves several purposes. First, it is a proactive rather than reactive approach to integrating wildlife and ecosystem management with increasing timber demands. Decisions can then be made using the best available knowledge rather than guesses or speculation. Second, by using birds as indicators of the forest’s health, scientists have a built-in early warning system to identify problems before they get to crisis stage. The results to date indicate that Minnesota’s forests are in relatively good shape. However, declines of a few species such as the ovenbird are being watched carefully. Third, the amount and extent of the information collected improves with age.

“For every year that we monitor, the data becomes more valuable,” noted Hanowski. “In order to detect trends, you need a long-term data set.”

With that in mind, researchers set out before sunrise each morning to greet and count their feathered friends, knowing that each tally points toward an ever-improved understanding of healthy Minnesota forests.

CURRENTLY, THE PROJECT TRACKS OVER 1,600 CENSUS POINTS IN 20 DIFFERENT TYPES OF HABITAT.

Staff Highlights

Outstanding NRRI Staff

NRRI Researchers Recognized Nationally



Carol Johnston

NRRI researchers are often called upon to share their expertise with legislators, federal agencies, state organizations and the general public because of their comprehensive and detailed knowledge in their chosen field. Several scientists have recently traveled to Washington, D.C. to showcase their work.

National Appointment

Carol Johnston, wetlands researcher and Geographic Information Systems Lab administrator, recently made history by being the first UMD scientist appointed to a rotating position with the National Science Foundation (NSF). She recently assumed the directorship of the Ecosystem Studies Program where she will facilitate peer reviews of NSF ecosystem grant proposals to insure integrity and consistency. She will also represent the ecosystem program and NSF within the scientific community, other agencies, organizations and the public.

In her research, Johnston looks at the impact that beavers have on watersheds. Historical maps, files and photos showed that areas of the Kabetogama Peninsula in Voyageurs National Park were once flooded with beaver ponds. By incorporating current research with historical information, Johnston developed models of how beaver population trends affect water quality. Johnston's work has proven that their structures improve water quality and once vacated, rich soil remains.

Showcased Work

In February, George Host presented his Lake Superior Decision Support project to members of Congress. As one of only six projects selected nationally, this study uses the Internet to deliver comprehensive information to local governments, planners and citizens who are working with land-use issues.

As demand for Lake Superior's unique resources increases, the need to make well-informed decisions must follow. Host's presentation was introduced and supported by U.S. Congressman Oberstar, who represents northeastern Minnesota.

"It was quite an honor for this project to be selected and to be supported by Congressman Oberstar," noted Host. "That attention reinforces the importance of this work."

The Lake Superior Decision Support project can be viewed at www.nrri.umn.edu/lsgis via the Internet.



George Host

WOW

A University of Minnesota-led project, the Water on the Web Internet site—wow.nrri.umn.edu—received a gold award from the Association of Natural Resource Extension Professionals last May. The award recognized the site's outstanding educational value. The Water on Web project integrates advanced environmental monitoring into educational curricula designed for advanced high school and first-year college students. NRRI staff associated with the project include Rich Axler, George Host, Lindsay Anderson, Elaine Ruzycycki and Norm Will. Scientists from Minnesota Sea Grant, Apprise Technologies, Inc. and Lake Superior College complete the research team.

In April, NRRI's Pat Donabue and Greg Peterson were named as recipients of UMD's Continuous Service Awards for their outstanding contributions.

Fourteen other UMD employees received similar honors.

Environment *North*

Aquaculture

Researchers Test the Water with Redtails During Fishing Opener



Hornyhead chubs, locally known as redtails, that were bred, hatched and raised in captivity made their debut at the 2000 Minnesota Fishing Opener. In a joint project between NRRI and the University of Minnesota Sea Grant Program, researchers supplied one gallon—approximately 440 fish—each to Fisherman's Corner and Chalstrom's Bait & Tackle to test the waters, so to speak. As a continuation of a 1997 project, researchers are studying the technical and economic feasibility of selling farm-raised redtails in Minnesota. The minnows, averaging three to four inches in length were priced at \$6 per dozen for the Duluth-area test.

According to Jeff Gunderson, associate director at Minnesota Sea Grant, the weekend's mini-market analysis was an attempt to assess the redtail market outside of the Brainerd lakes area.

"They've been proclaimed the best bait minnow around by many guides and professional fishermen, but we need to determine if the redtails will sell in areas where they are not typically available and for how much. It is critical to determine the economic feasibility of redtail fish farming," he said.

Redtails sold in the market test were spawned and hatched by two aquaculture industry collaborators last summer. In the wild, redtails can take up to two years to grow to marketable size. Using pelleted feed and the indoor aquaculture facility at NRRI, aquatic biologist Paul Tucker was able to reduce growing time to less than one year.

Redtails are locally popular in central Minnesota because they are native to the area and are reputed to be heartier in the bait bucket and more active on the line than other minnow species. Last fall, redtails were sold in the Brainerd area for more than \$8 per dozen and availability was limited.

"I think there's a market for them here, but it will take a while," noted Scott Van Valkenburg of Fisherman's Corner. "Rainbows and shiners have been the thing, but once fishermen see what the redtails can do, they'll come back."

Both Van Valkenburg and Sue Chalstrom, who has been in the bait industry over 16 years, found that while customers were surprised with the higher price on the redtails, many were willing to try the novelty baitfish.

The project was funded by Minnesota Technology, Inc., Minnesota Sea Grant and the Agricultural Utilization Research Institute, with research conducted at NRRI's aquaculture laboratory and three industry collaborators' facilities. Aquaculture in Minnesota is quiet but growing industry that links tourism, recreation and the state's natural resources to rural communities and businesses.

Environmental Chemistry

Top Mathematical Chemists Converge on Duluth

Over 100 mathematical chemists converged on Duluth to showcase their latest findings at the Second Indo-US Workshop on Mathematical Chemistry last spring. Researchers representing four continents, twelve countries and hundreds of years of collective experience presented their research. The workshop was organized by NRRI's Subhash Basak and Dilip K. Sinha of Visva Bharati University, India.

Mathematical chemistry has recently spawned a new age of science. Using computers and mathematical methods to manipulate immense numerical databases, mathematical chemists create computer-generated models to predict physical, pharmaceutical and toxicological characteristics (such as toxicity or boiling point) of chemicals. In essence, they develop hypotheses and conduct experiments *in silico*—in the computer—instead of *in vitro*.

Moving out of the petri dish has enabled researchers to develop new chemicals for a variety of pharmaceutical and industrial uses. In the U.S. alone, there are 80,000 chemicals in the TSCA—Toxicity Substance Control Act—inventory. The

international organization, Chemical Abstract Services, has inventoried over 16 million chemicals.

The scientists who visited Duluth cover a wide range of mathematical chemistry disciplines. Some focus on risk assessment in which they

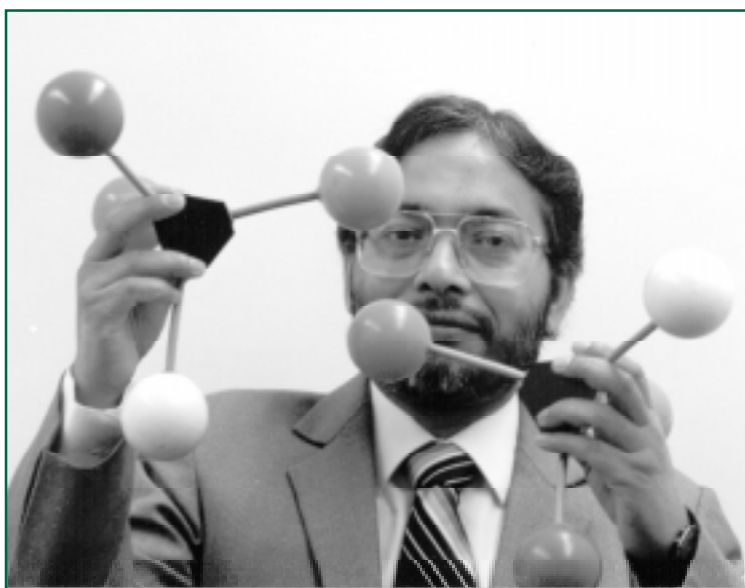
compounds. They can predict the new compound's behavior based on the documented behavior of each chemical in the compound. Still other researchers operate in the pharmaceutical realm, working with drug companies to narrow down the search for drugs that fit desired parameters.

“While the importance of this research may seem abstract, it is part of the daily lives of every Northland citizen,” he said. “From household cleaners to prescription drugs to food additives and preservatives, we use many chemicals every day. Other by-products of mathematical chemistry, drug design and hazard assessment affect everyone.”

The workshop offered a place for these researchers to share their philosophies, theories, experiments and results. It also initiated future activity in the chemical and drug discovery realms.

“This conference served as a catalyst for converting basic science into applied research which, in turn, stimulates economic growth,” noted Basak. “As we quickly move into the Information Age, mathematical and computer modeling will progressively have more impact. In that sense, the topics discussed at this workshop will have numerous practical implications in our daily lives.”

Over 90 percent of the world's top mathematical chemists attended, representing countries as far away as India, Japan, Croatia and Russia.



Subhash Basak heads NRRI's mathematical chemistry group, which uses science in silico - in the computer - to hypothesize and predict chemical properties and behaviors.

use computer models to predict toxicity before the chemical is created in the laboratory. Others combine existing chemicals, with known behaviors, into new

According to workshop co-chair and NRRI mathematical chemist Basak, the opportunity to bring chemists from across the globe into one location is invaluable.

Minnesota *Industry*

NaturTek

Unique Partnership Forges New Company

In February 2000, the University of Minnesota Duluth, Minnesota Power's Synertec division and Potlatch Corporation formed a new company to develop and market worldwide the compounds derived from birch bark. The company, NaturTek, is poised to provide compounds for a variety of uses including polymers, anti-corrosive and cleaning materials, lubricants and cutting materials, wood protection, skin care products, agrochemicals, pharmaceuticals, nutraceuticals and coatings materials.

NaturTek president, David Peterson, heads the unique venture. "We've got the solid support of three well established partners, excellent researchers and strong resources," said Peterson. "We're establishing our foundation for future success through teamwork and planning. A person with expertise in our markets, David Gibson, has been hired to lead our marketing and commercial development efforts and we've retained the services of marketing experts to give us some key market information. We now have a good team of people with the skills we need to move forward successfully."

Peterson noted that they have also been busy cultivating customer relationships. Several companies contacted them out of the blue as a result of the publicity they received. The company aims to meet a customer's needs better than anyone else. Peterson



also pointed out that the birch bark needed for this process is currently being used as fuel for energy generation in Potlatch's mills so that no new cutting of birch trees will be done.

The NaturTek compounds come from research done by UMD chemistry professor Robert Carlson and NRRI researcher Pavel Krasutsky. The ability to effectively isolate compounds from birch bark in an environmentally friendly manner resulted in the first processing patent. Five more patents are already either granted or pending.

"NaturTek has been working with over a dozen companies interested in our compounds," said Peterson. "With much of our initial planning and groundwork expected to be completed soon, we launched our market development plans this past summer."

NRRI director Mike Lalich has also been named as vice-president of technology development for the company. "NaturTek is an off-shoot of what NRRI was designed to do—create economic diversification for Minnesota using its natural resources in an environmentally sound manner for private sector employment," said Lalich. "This company is developing markets for its products. With enough interest, a plant to produce the compounds may be built."

Minerals

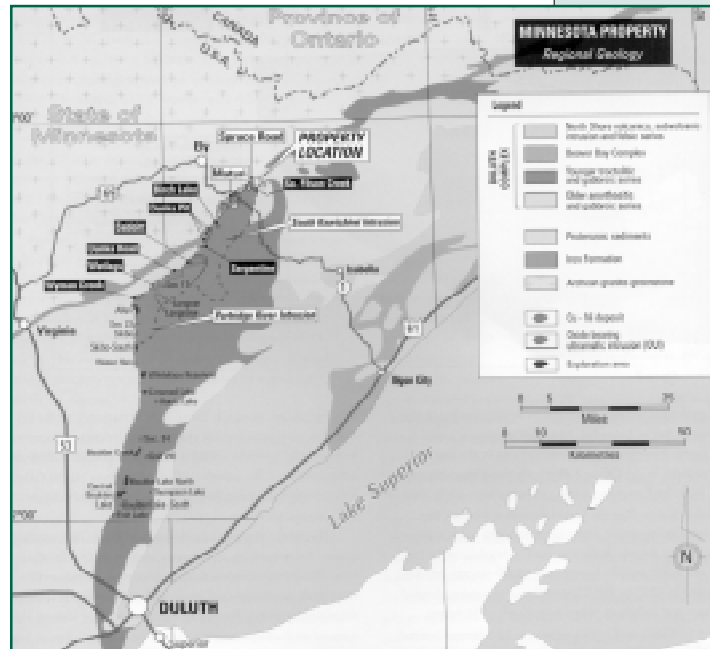
Duluth Complex Explored by Wallbridge Mining

In northeastern Minnesota a Canadian exploration company, Wallbridge Mining Company, Limited, is launching a major effort in the Duluth Complex this year.

Vice president of exploration, Doug Hunter, says the company's focus is on the discovery of high-grade polymetallic mineral deposits such as nickel and copper sulfides. The company, along with NRRI geologists, believe that the deposits of nickel and copper sulfides contain economically significant amounts of palladium. The presence of these elements makes the Duluth Complex one of the most exciting areas in the world for development. Recent improvements in mining and mineral recovery associated with environmentally sensitive processing methods have increased interest in this resource.

"Improvements in metallurgical processing, higher values for platinum group elements and a clearer understanding of the area's geology, now create a strong commercial opportunity for mining companies," said NRRI geologist Larry Zanko.

Wallbridge geologists believe the Duluth Complex's concentration of nickel sulfide may be one of the richest deposits in the world. Nickel, one of the most useful non-ferrous metals, is used in stainless steel. Palladium, one of the rare platinum group elements, is used in catalytic converters for automobiles. The



Wallbridge Minnesota Project

potential resource of these two metals is the primary purpose for the exploration now being undertaken. Hunter hopes to start drilling in October 2000 and have results of assays available by the end of the year.

Working on the Duluth Complex are NRRI geologists Steve Hauck, Mark Severson and Larry Zanko. With 35 years of combined experience, they help companies like Wallbridge determine when further explorations are potentially viable from both an economic and environmental viewpoint.

The Duluth Complex— Where and What

The Duluth Complex starts just north of Duluth arcing up the north shore of Lake Superior. Encompassing the communities of Aurora-Hoyt Lakes, Babbitt, Gunflint Trail and Hovland, it is

approximately 140 miles long and 28 miles in width. This area may prove to be the world's third largest nickel-sulfide resource and is currently being explored by at least three companies.

The complex is comprised of numerous sheet-like and cone-shaped intrusions ranging in composition. Nickel and copper sulfides and platinum group elements such as palladium are

known to occur. To date, all significant mineralization that has been discovered is located near the base of the complex along its northwest margin.

In Business

Business Expansion

Diversification Yields Business Growth

For many small businesses, diversification may be the key to controlled growth. Hermantown Millwork, located just north of Duluth, has accomplished both expansion and relocation since the company's inception in 1991 by not relying solely on one product.

Although the company was originally founded to manufacture wood golf display racks, that sector now makes up only 40 percent of the company's gross sales. According to company president and founder, Rob Irving, custom cabinetry makes up another 55 percent of the business. The remainder ranges from their unique DinoBonz—three-dimensional wood dinosaur puzzles for children—to cedar Adirondack furniture and fireplace surrounds. Although small in terms of overall gross sales, it is these diverse and often seasonal products that helped Hermantown Millwork move smoothly through several transitional stages, including a recently opened new shop and showroom.

"They have done a good job of maximizing their equipment by sticking with their core business while exploring new options," said Kathy Forslund of the NRRI Business Group. "That, in turn, helped smooth out their cash flow."

Forslund has worked closely with Irving and company vice president Mike Dunaisky since 1997. Initially she helped them develop a business plan that they needed to complete loan applications. The following year she helped evaluate new opportunities and product lines.

Irving noted that the business plan was especially helpful in securing a business expansion loan. "It's so important for a small business to have that tool—a business plan," he said. "It helped tell our story to the bank and it all comes back to business growth and jobs in the area—it comes full circle."

The diversification plan has worked well for Hermantown Millwork. Dunaisky said the company is on track to reach its first one million-dollar year in revenue.

The company employs 12 at its Hermantown location and can be found on the Internet at www.dino-bonz.com and www.cedarcollection.com. The golf display line is marketed through international suppliers.



Company owners Mike Dunaisky and Rob Irving, along with NRRI's Kathy Forslund, showcase the company's original product—innovative golf displays.



Customize cabinetry, like the one being assembled here, make up 55 percent of Hermantown Millwork's business.

NRRI *On-Site*

Facilities

Computerized Greenhouse Aids Institute Research



Since the NRRI greenhouse was built in 1993, several projects have used the facility to expedite plant growth. Most recently, the Institute's forestry division bred and propagated hybrid poplars that will be planted throughout Minnesota under the direction of the Minnesota Hybrid Poplar Research Cooperative. This organization is developing hybrid poplar trees that can be harvested in 10 to 12 years instead of the 40 years needed for native aspen. These trees will be treated as an agricultural crop and used to supply fiber to Minnesota's pulp and paper industries.

"The breeding program at NRRI would not exist

without the greenhouse," noted NRRI forester Bill Berguson. "It's a very unique facility—we can control all factors affecting plant growth and ensure quality pollination. It really is a central part of our tree breeding program."

The 1,200-square-foot greenhouse is divided into two bays and is completely automated. The computer program allows researchers to control temperature, humidity and light intensity. Scientists can also shorten or lengthen their plants' day using automated shades and grow lights. Sensors compare the outdoor environment to the programmed parameters and adjust accordingly.

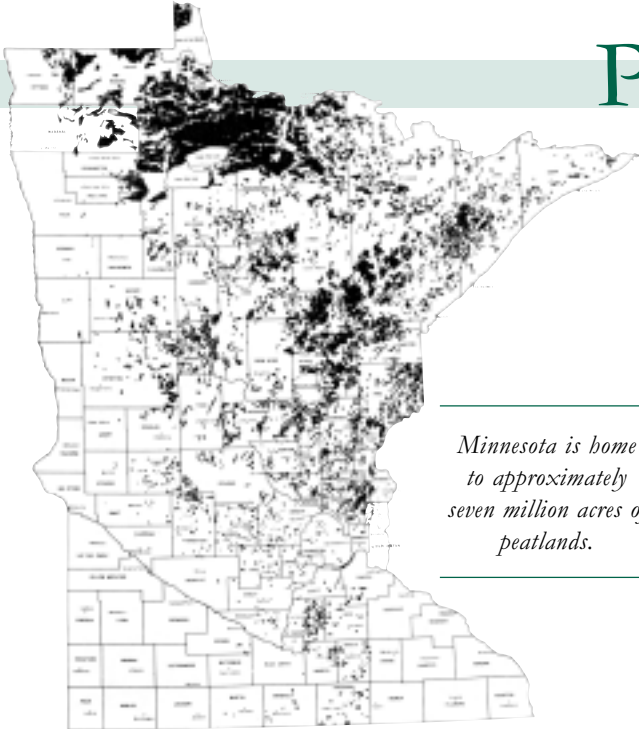
This spring researchers grew over 12,000 hybrid poplar plants and made 150 controlled crosses as part of the breeding program. Trees from each cross will eventually be planted in field trials across western and central Minnesota. The best trees will eventually become the new generation of commercial hybrids.

In the past, the greenhouse has been home to bulrushes for constructed wetlands, top moss experiments for commercial production and soil nutrient studies. In addition, researchers have examined soil seed banks to uncover the secrets that lie beneath Minnesota's northern

forests. Seed banks give clues about which plants, shrubs and trees would naturally grow in the event of a disturbance such as a forest fire, wind blowdown or forest clearing.

According to NRRI director, Mike Lulich, the greenhouse is an integral part of the Institute's overall functions. "NRRI's greenhouse is one of the Institute's important tools that gives us an outstanding overall capability to do natural resources research on a variety of resource management and environmental issues," he said.

Partnerships *in Action*



Minnesota is home to approximately seven million acres of peatlands.

The Dirt on Peat

What Does it Take to Develop a Bog?

A primary function of the NRRI Peat Group is to help companies develop peat bogs. In that role, peat researchers use their scientific acumen to fit a potential producer with the appropriate bog type, economics and local community while maintaining a healthy environmental perspective.

Minnesota has approximately seven million acres of peatlands, which equal 35 percent of the total in the lower 48 states. Of the estimated 30,000 acres available for development, about 2,000 acres are currently being managed for horticultural peat.



Vacuum harvesters suck up dried peat into giant canisters and move it to field stockpiles. Approximately one-fourth to one-half inches of peat is harvested during each pass, a total of two- to four-inches per year.

From the Beginning

The development process generally starts with an inquiry from a peat producer. Working as a team, scientists from NRRI and the Minnesota Department of Natural Resources Minerals Division compile a list of potential sites based on the type of peat desired and historical resource information such as maps and reports.

Once the list of sites is presented to the industry collaborator, they then evaluate based on reports and site visits. If a suitable resource is found, the collaborator usually moves from the “shopping” mode to serious consideration. In the case of a state-owned peatland, the company meets with state regulators to negotiate a rental fee and royalty rate. A similar agreement is usually developed for county- or privately-owned peatlands. Local economic development incentives may also be offered at this time.

Moving from speculation to a signed agreement can take two years. The next phase, the environmental review and permit process may take another one to two years, depending on the size of the site. Larger bogs require more intensive environmental review. Regulating agencies include the Minnesota Department of Natural

Resources, the U.S. Army Corps of Engineers, the Minnesota Pollution Control Agency and local governments.

Throughout the entire process, NRRI peat researchers supply the technical and resource information necessary for development and act as liaison between industry, regulators and landowners.

According to Mike Hanson, Koochiching County Commissioner, the Pine Island Bog would not be on its way to development without the NRRI Peat Group. “They are the engine that drove the car,” he said. “From relationships with the developer to technical expertise, they took a vital, active role. We also maintain a strong level of trust and that’s important. I seriously doubt that we would be this far without them.”

Getting to Work

Once environmental review and permits are approved, site preparation begins. This process includes removing trees and shrubs, raking leftover debris and digging drainage ditches. Each harvesting field is also crowned into a dome shape to further encourage drainage.

When the field can support equipment, operators loosen the top layer of peat in a process called milling. This surface layer is then turned to take advantage of natural drying agents—sun and wind. Next, vacuum harvesters drive across

the field, sucking up the air-dried peat, which is then transferred to the manufacturing plant for further processing and packaging.

The entire process of developing a peat bog, from site speculation to harvesting, can take up to five years and costs up to \$2 million. With an annual harvest rate of two-to four-inches per year, bogs generally sustain harvesting for 30-40 years.

Minnesota’s horticultural peat industry employs about 200 people and adds approximately \$10 million to the rural economy annually.

Operation Restoration

When peat harvesting has ceased, the site must be returned to a wetland condition according to regulations. Left alone, the bog may re-vegetate in 15-20 years. However, using techniques developed in Quebec and proven on Minnesota sites by NRRI researchers, restoration time has been cut in half.

Using this method, the dome-shaped fields are flattened, ditches are plugged and fragments of native vegetation are added. Given time and precipitation, the bog naturally restores itself over time—the definition of a true natural resource.

Department Director On Board

Donald Fosnacht was recently appointed director of NRRI's Center for Applied Research and Technology Development. An executive with over 20 years of experience at Ispat Inland Steel, Fosnacht brings a unique blend of motivating leadership, business acumen and specialized research to his new position.

"We are excited that Don has accepted this key position at NRRI," said Institute director Mike Lalich. "He has excellent instincts and experience when it comes to applied research and

development of technology. His knowledge in minerals processing is augmented by a strong background in steelmaking that previously had not been available to northern Minnesota."

Most recently, Fosnacht served as president of Steel Profitability Consulting, a company he founded. Throughout his career, Fosnacht has proven his leadership abilities and technical expertise of the entire iron ore industry, from mines to steel manufacturing.

"As center director, I look forward to meeting the challenges ahead," said

Fosnacht. "It is clear from such events as the announced LTV Mining closure that we must identify ways to keep our minerals, forest products and peat resources competitive in the future. This implies that NRRI must be at the leading edge in analyzing the key issues that would hinder our future competitiveness. Maintaining and enhancing viability will help ensure the economic well being for our citizens and the jobs they need."

As a metallurgical engineer, Fosnacht earned a doctorate from the University of Missouri-Rolla and a master's degree in minerals engineering from Columbia University.



Don Fosnacht joined NRRI in May. He brought over 20 years of mining and steel making experience, specialized research and business leadership to the center director position.



Check us out: www.nrri.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

Gerald Niemi, director

Center for Applied Research & Technology Development

Donald Fosnacht, director

Center for Economic Development

Stephen Marder, director

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