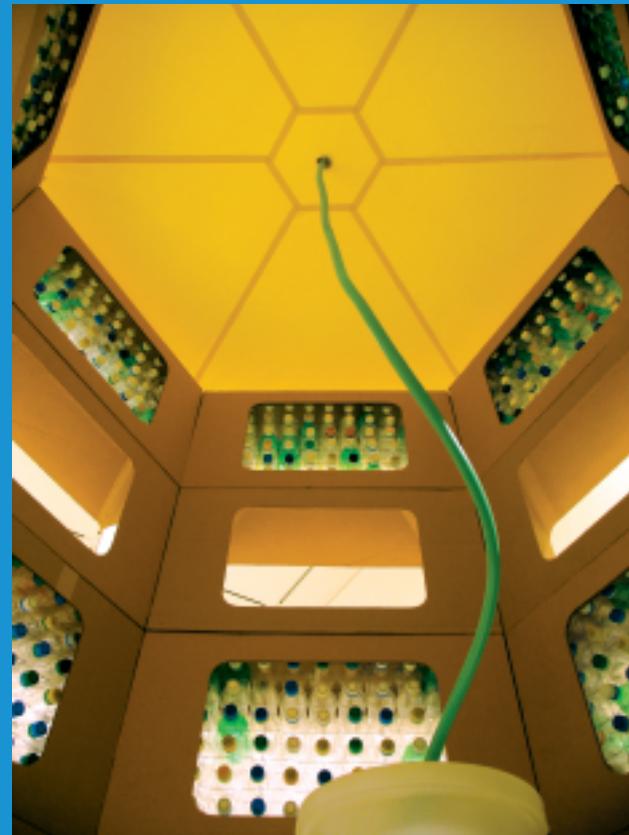


# Planet Art



*Beyond Green: Toward a Sustainable Art* is an exhibition that examines sustainable design and its potential to transform everyday life through an approach that balances environmental, social and aesthetic concerns. NMU's DeVos Art Museum will host the traveling show January through March 2009. Shown, clockwise, is *Returning a Sound* (video projection) by Allora & Calzadilla; *Collected Material Dwelling* by The Learning Group; a mobile weather station and library by Nils Norman; solar-powered bag and cell phone designed by JAM; top border is a detail of recycled paint swatches from *Transport 1: Loop and Soil Starter* by People Powered. ■

Photos courtesy of Beyond Green: Toward a Sustainable Art, a traveling exhibition co-organized by the Smart Museum of Art, University of Chicago, and by iCI (Independent Curators International), New York, and circulated by iCI.

# Alumni in action

## The Big Thaw



*Nelson (center) with colleagues conducting ground-penetrating radar studies near Barrow, Alaska, during winter. The three-dimensional images constructed with data from the radar traverses provide detailed pictures of the distribution of subsurface ice.*

**F**rederick E. “Fritz” Nelson, ’73 BS, was a contributing author on the United Nations’ Intergovernmental Panel on Climate Change (IPCC) *Fourth Assessment Report*, for which IPCC was awarded the 2007 Nobel Peace Prize (with Al Gore) “for their efforts to build up and disseminate greater knowledge about man-made climate change, and to lay the foundations for the measures that are needed to counteract such change.” Nelson, who received the 2007 NMU Distinguished Alumni Award, is a geography professor at the University of Delaware and an expert on permafrost.

**Q:** In your studies in Alaska, Siberia, Mongolia and Tibet, what kinds of changes are you seeing and what impact are they having on their citizens?

**A:** There are many indications that warming and thawing of permafrost is occurring on a scale that we haven’t seen previously. When ice-rich permafrost thaws, there’s a reduction of volume below the surface as ice melts and the water drains off. This can result in uneven settlement at the surface and structures atop the ground can be damaged or even rendered unusable. A lot of this kind of thing is occurring where permafrost is marginal—in other words, where it’s close to the freezing point. In Fairbanks, Alaska, for example, hundreds of buildings have been damaged by settlement caused by thaw of ice-rich permafrost.

**Q:** What may be the larger effect of these changes?

**A:** Once a structure is damaged through “thaw settlement,” the owner can’t get insurance and the

building can’t be mortgaged or sold. So, there are very distinct economic ripples created in local economies where that kind of thing is happening. In contrast to some other kinds of natural hazards, though, damage from thawing permafrost can be prevented through wise land-use planning and appropriate engineering practices. But that can be expensive, and lots of people don’t like being told what they can or can’t do with their land.

Another really important possible consequence of widespread thawing is that much of the organic carbon locked up in the upper layers of permafrost—and there’s a lot of it—will become subject to decomposition and ultimately contribute more carbon dioxide and methane to the atmosphere, leading in turn to further atmospheric warming.

**Q:** Do you generally attribute the changes and effects you’re seeing to human causes or natural variations?

**A:** You’ve just hit on the big question—how do we separate climate-induced changes from those that are more localized and related to bad planning or engineering? The answer isn’t all in yet, but there are many lines of evidence that seem to be pointing to widespread warming and degradation of permafrost. Ecosystems in places like Alaska are undergoing profound changes as permafrost thaws and drainage patterns are altered. The snow cover in northern Alaska doesn’t last as long as it used to each winter. Permafrost temperatures throughout most parts of the Arctic have warmed dramatically in the last hundred years. We’re seeing expanded areas affected by thaw-induced subsidence of the ground surface. Tundra lakes are disappearing through subsurface drainage as patches of permafrost thaw out. These diverse lines of evidence add

up to very strong evidence that, when taken with other observations like melting glaciers, tells us that wide-reaching changes are affecting the Arctic and that they’re related to a warming climate.

**Q:** Do you see the recent “green” movement as a fad? What will or has to happen in order to sustain individual, corporate and government involvement in environmentally friendly practices?

**A:** It is absolutely not a fad. The environmental movement, like most other long-term, worthwhile enterprises, is evolutionary. It goes back much farther in history than many people recognize—modern environmentalism in our country has its roots with people like George Perkins Marsh, Henry David Thoreau and John Muir. I think, though, a lot of people trace the roots of current environmental concerns, political action, and governmental regulation in the U.S. to the original April 22 Earth Day in 1970. That doesn’t seem too long ago to me—I was a sophomore at NMU at the time!

The changes in environmental regulation that took place in this country in ensuing years were quite remarkable, as were many of the social changes taking place at that time. There’s an ebb and flow related to political and economic cycles, of course, but a lot of the initial environmental regulations were brought about through a combination of scientific discovery, political action and a kind of optimism about the capacity for societal change that had salutary effects for everyone.

I work on Alaska’s North Slope, where oil was discovered in 1968. If the original industry plans for constructing a buried, hot-oil pipeline across Alaska’s North Slope had been carried out it would have been an unmitigated disaster. The pipe would have been broken by thaw subsidence and the resulting oil spills on the tundra would have been an environmental catastrophe. Moreover, the oil wouldn’t have gotten to market, so industry would have been a big-time loser! Fortunately, there were savvy scientists who understood the potential consequences of such an engineering blunder, and they were able to communicate their concerns to the public and to responsible parties in government. The design modifications mandated by government action ultimately resulted in a well-designed and competently implemented pipeline that, until recently, has performed very well.

**Q:** When and how did you get involved in IPCC?

**A:** I’ve contributed to each of the four major reports that IPCC has published, beginning in the late 1980s. I was probably invited to participate initially because I had been publishing some work on modeling permafrost distribution and that particular expertise was something they needed.

The IPCC reports aren’t basic or primary research. They involve reviewing and synthesizing existing peer-reviewed literature. So, my job was to read a lot of published papers about permafrost and climate change, synthesize the essential points from those articles, and rewrite the material in such a way that it would dovetail well with what others in my group had written about related topics. It’s an interactive process—working with other experts to review and adjust the report. This ensures that the statements made are accurate. Representatives of governments are given the opportunity to argue against aspects of what appears in the initial drafts of the document. Significant changes to the penultimate draft version result from those discussions. I am told that people really go eyeball-to-eyeball in those sessions. In a very real sense, it’s a conservative document, and is based on compromise and consensus.

**Q:** How did you find out that you shared in the Nobel prize?

**A:** I was very surprised when I heard that IPCC had been awarded the Nobel Peace Prize. It’s kind of a funny story. I had just finished a program of



*Close-up of Nelson during field work at -30 C near Barrow. Having had numerous encounters with grizzly bears, Nelson carries a slug-loaded 12 gauge shotgun in the field.*

field work in the Huron Mountains near Big Bay, which is of course a very remote area. The place I was staying had no phones or e-mail. I had checked into a motel the night before the announcement and was thinking about the large amount of e-mail that must have accumulated while I was in the field. The next morning (Friday, October 12) I opened my e-mail and found a message from the IPCC chairman, addressed to all IPCC authors, telling us that IPCC and Al Gore had been awarded the Nobel Peace Prize. He also said that IPCC’s share of the honor was to be regarded collectively—in other words, it’s to be shared by everyone involved in IPCC. That’s a lot of people! I’m honored to be one of them. ■



## What Birds are Telling Us

By Cindy Paavola, '84 BS

**B**ill Bowerman '91 MA looks to the sky to answer questions about a changing planet. There, eagles help him answer how different human and environmental stressors are impacting the world.

Bowerman is an internationally recognized expert in eagle research. The Munising native is also one of only nine U.S. scientists on the International Joint Commission's Great Lakes Advisory Board. The commission oversees United States-Canada boundary water issues. Bowerman's day job is associate professor of wildlife ecology and ecotoxicology at Clemson University in South Carolina.

"Eagles are nesting earlier and earlier," Bowerman says. "In fact, we're currently seeing a two-week shift, which is a significant amount of

time. Animals are showing us that human activity is definitely changing the environment."

Trained as both a wildlife ecologist and an environmental toxicologist, Bowerman's extensive research career has involved avian population ecology and migration; wildlife toxicology, habitat requirements and diseases; endangered species and factors limiting their populations; forest management related to wildlife; human recreation and wildlife interactions; and wildlife as ecosystem monitors of contaminants.

Bowerman has traveled throughout the United States and to Sweden, Russia, Canada and South Africa to study four of the eight sea eagle species: bald eagles, white-tailed sea eagles, Steller's sea eagles and African fish-eagles.

"We are training people in these countries how to create monitoring systems like we have in the Great Lakes region. These programs can provide a lot of information," he says.

"One finding of our research is the presence of legacy compounds everywhere in the foods, such as fish, that the eagles eat. Unfortunately, we expect to see even higher levels of these compounds in European, Asian and African countries as India and China continue to burn more and more fossil fuel."

Legacy compounds are environmental chemicals that were banned in the 1970s. However, because they don't break down quickly, it will take generations for them to disappear from the air, soil, sediments and water. Because they are lipophilic, or fat-loving, they accumulate in fish, animals and humans.

"We're also finding new and emerging compounds in wildlife, fish and humans, which are, in the case of brominated fire-retardants, doubling their concentrations every three to five years in the Great Lakes. That is a very real concern and something that bears watching," he says.

In the Great Lakes region, though, Bowerman's research with eagles has yielded some positive results, showing a decrease in the legacy compounds, such as DDT, that caused bald eagle populations to decline. As a result, the region has nearly doubled the number of eagles since 1984 and they have now been taken off the federal endangered species list.

"This goes to show how governmental regulations can help the environment," Bowerman says. "In 1984, we were monitoring about 220 pairs of bald eagles in Michigan and now there are over 500."

Bowerman points to Michigan's bottle return law as another example

of legislation having a significant impact on the environment.

"As a kid growing up in Munising, my Boy Scout troop would volunteer to clean up garbage along Highway 13 from the airport to the county line. I remember it taking us 16-18 pickup truckloads to clean the area. After the bottle act was passed, we eventually got down to about a load and half. There is no such law in the South and there is trash everywhere."

Bowerman is hopeful that the recent non-scientific population's focus on "going green" isn't a short-term trend.

"I don't think citizens of this country can afford to ignore the issues anymore," he says. "For example, over the past 20 years we've been driving bigger and bigger vehicles. In the rest of the world, the trend is smaller, gas-efficient cars. Here our homes are nine times larger than the average house in Europe.



Photos left and right, Dr. Vladimir Masterov, Moscow State University

Adult, left, and nestling Steller's sea eagles, above. The Steller's is the largest sea eagle, about 4 feet from head to tail, weighing around 24 pounds. Bowerman's studies of various species of eagles indicate both positive and alarming findings.

"The European Union is light years ahead of us on sustainability. For instance, when a person in a European country buys a car, there is a tax added to the price before it goes out the door to cover the cost of recycling it when it must be disposed of. Europe's environmental standards

are much higher than ours."

When asked what five pieces of information that the average, non-scientific U.S. citizen should understand about today's environmental issues, NMU's 1992 Outstanding Young Alumnus Award recipient does not hesitate long enough to take a breath.

"No. 1: Fossil fuel use and the subsequent global warming are going to drastically change the way animals and humans live.

"No. 2: Water use—both quantity and quality. Water will become the most precious natural resource of the future. Michigan may have a boom due to its access to the Great Lakes as water becomes scarcer. And the Great Lakes must be protected. We can't be naïve or passive about this because the fight over water has already begun.

"No. 3: The danger in the shift of land ownership from pulp and paper companies to private ownership. While many view the pulp and paper industries as hard on the environment, most of those companies actually had long-term, sustainable plans to manage their land. Now, speculators who are buying these properties are looking to make a quick return on their investment. They are not developing with the long term in mind.

"No. 4: The new and emerging environmental compounds, which evidence suggests are very damaging. More research needs to be done and more information provided to the public on these compounds.

"No. 5: The relaxation of environmental standards over the past few decades cannot continue. The government must be up front with its citizens about the issues. Right now, it seems as though the government

only wants to put out news about positive environmental efforts. Those things need to be recognized, but downplaying the negative isn't going to make these issues go away. People have to understand these are big problems that can't be solved



Lee Grim

Bill Bowerman with a nestling eagle at Voyageurs National Park.

overnight by a few people and without any inconvenience. Also, the government and the scientific world must put out information at a level that everyone can understand, so people can make educated decisions."

Bowerman advocates for economic incentives that support sustainability. He also says education must play a critical role in helping to motivate new behavior and attitudes.

"Our K-12 schools and universities have a unique opportunity to train future leaders and adult citizens to be environmentally aware and knowledgeable. What happens to the environment will have an impact on every other aspect of people's lives.

For those of us who grew up in the U.P. or attended NMU, the natural beauty of the Upper Peninsula is something that is part of us and we must protect it." ■



# Farming the Wind

By Cindy Paavola, '84 BS

As a student, **Jesse Tarr '06 BS** would see the wind turbines on the water's edge as he crossed the Mackinac Bridge on his way to and from Northern and his native metro Detroit hometown of Lake Orion.

He had attended a grade school that had done some wind experiments on a small scale and the "whole wind thing" caught his attention.

"Each time I'd see those turbines at the bridge, I'd find myself more curious about them. I was fascinated and inspired by them. I was a construction management major and started exploring what opportunities were available in the wind energy field. Over time, I just knew I had to do it. I was made to get into this field and I knew I just had to be a part of working with wind."

And he is. He works for White Construction, Inc., which develops wind farms—a booming industry. Tarr is responsible for helping to clear a site for wind turbines, as well as building roads to the site, pouring and building the foundations for the turbines, putting up the turbines and restoring the area around the turbines after construction.

About two years ago, Tarr was part of the team that built the largest wind farm in the United States east of the Mississippi, which is located in central Illinois and has 240 wind turbines. Today, he is on a site in northern Wisconsin that will have 86 turbines.

These wind farms are built mostly on private land, such as family farms, by corporations who then pay the

landowner for housing the turbines.

"Often the contracts are 20-year agreements that pay about \$5,000 per turbine per year," says Tarr. "So you can see why so many small farmers are getting involved. Just one or two turbines on their property can make a big difference in resources for their farming operations."

Each turbine needs about a quarter-acre of land, but additional land lost to construction and roads can add a couple more acres. The electricity generated by the wind is transported through underground cables to a substation, where it is introduced to the grid.

According to Tarr, there are a lot of misconceptions about wind energy.

"For one thing, people think the turbines are noisy, but there have been huge advances in turbine construction to make them extremely quiet. Wind going through leaves of a tree might be noisier," says Tarr.

Bird migration is another argument presented against wind farm construction, says Tarr.

"The migratory bird issue comes up on nearly all wind farms. People also include bats in that category. I know of no sound evidence suggesting that wind turbines kill birds. I have been around working wind turbines for some time and have never found a dead or wounded bird," he says.

Another thing opponents of wind focus on is the size of the turbines and the land required to support them.

"The turbines are 400-foot structures, so they do change the landscape, but I love the way they look. To me they represent a cleaner, brighter, and more intelligent future, both for America and around the world."

Tarr knows just how big 400 feet can be, having climbed to the top of many turbines. At his first company, he went up turbines a couple times a day. In his current position his responsibilities keep him on the ground, but he says being at the top of a turbine is among his most exhilarating experiences. In fact, once he and a friend arranged for Tarr to be photographed on a turbine raising an American flag to the sky.

"It took a lot of coordination because my buddy needed to be about a quarter of a mile away on another turbine to take the photo. I'd been to the top of turbines before, but I'd never stood upright with my arms in the air waving a flag. Even though I was tied up and, of course, well protected from a fall, it was

really scary. I was shaking like a leaf on a tree. But what a rush."

Tarr is quick to point out that there are many positive arguments for wind power. It doesn't produce any emissions, is a renewable resource and the more wind power generated in the United States, the less dependent the country is on foreign oil.

One of the most overlooked positives of wind energy is that it's creating many new jobs.

"In my opinion, the biggest industry in the world right now is energy, and the fastest growing source of energy is wind. However, the field is hampered by a huge lack of well-qualified people. The potential for work in this industry is awesome and there's no projected downturn for a long, long time—if ever. There are construction site jobs, wind turbine production jobs, distribution-related jobs. There are folks who monitor the weather and do wind feasibility decide if and where to develop wind farms. Once the farms are built, these companies need qualified people to maintain and operate the sites. Even areas within city government, banking and environmental agencies need people who understand wind power in order to make decisions related to wind energy opportunities. This is a hot, hot field right now."

Although there are many positives in using wind power, Tarr doesn't expect to see turbines in every backyard

anytime soon.

"Right now commercial wind energy is actually very economical, although the upfront costs are considerable. The companies I've worked for that are building these wind farms are spending millions. When all the costs are added up, commercially, the only cheaper energy is coal, which is the largest contributor of greenhouse gases. However, small-scale, personal wind energy systems are still expensive, so most average households simply cannot afford to use wind power at this time."

In fact, Tarr says the price of turbines is rising as the production hasn't been able to keep up with the demand, driving costs up. There is almost a two-year waiting list for turbines.

Also, not everyone's backyard is right for wind power.

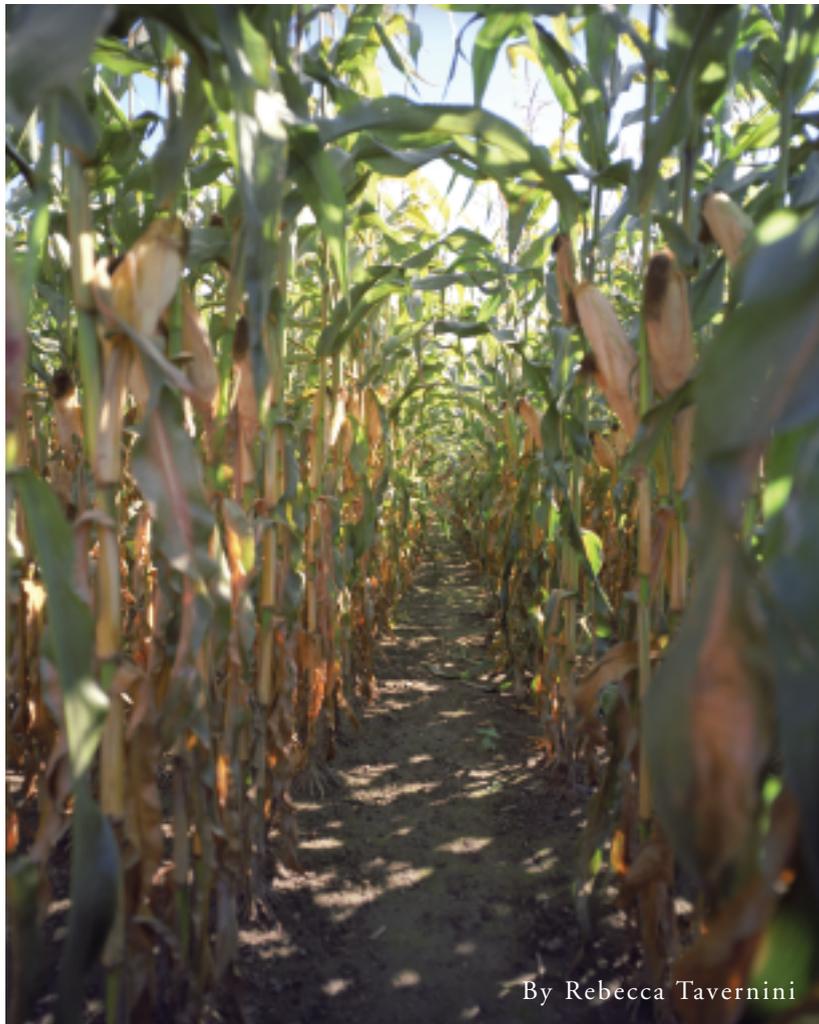
"To be efficient, a site must have enough wind to produce electricity 32 percent of the time. Many places—even some that people think of as being windy—just don't have enough consistent wind to be efficient wind power sites," says Tarr, who adds that sites are usually tested between one and two years to determine their wind capacity.

Whether one's property and financial status is suitable for turbines or not, Tarr says there is something everyone can do related to wind energy. "Be open to the idea that if there is an opportunity to use wind, it's worth exploring. It's not for everyone in every area, but we're going to see more and more turbines and wind farms, so understanding the true advantages and disadvantages is important. I used to think the turbines at the Mackinac Bridge were so huge, but the ones I work on now are far bigger. Well, the whole industry has gone like that—it just keeps growing." ■



Photos courtesy of Jesse Tarr

Tarr on a turbine, holding the American flag.



By Rebecca Tavernini

## From the Ground Up

Making plants naturally resistant to harmful insects

**A**s a biochemistry graduate student at NMU, **Kristin Fencil '91 BS, '95 MS** was already researching new ways for plants to make their own fertilizer. Now, working in discovery research and development at Dow AgroSciences in Indianapolis, she identifies and finds new insecticidal proteins with the ultimate goal of putting the genes into crop plants, conferring natural protection from insect pests, and reducing the need for chemical pesticides.

"The majority of my work involves a lot of protein characteriza-

tion, purification of known proteins and preparing samples for testing on various agricultural insect pests," she says, adding that she's also involved in discovering novel proteins.

To test their effectiveness, she takes bacterial samples, applies them to an insect's diet and watches for detrimental effects.

She's also done some regulatory work, such as participating in the creation of large lots of proteins for testing so the products can be registered in the U.S. and other countries. Some products she has helped bring to market are

Herculex® and WideStrike™ Insect Protection.

A challenging part of her work involves identifying whether or not a specimen is a protein or a small molecule metabolite, which determines which methods can be employed in capturing, testing, purifying and concentrating the sample.

"At every step, bioactivity on the insects must be tested," she says. "It can be a difficult and time-consuming process. Consequently, new insecticidal proteins do not get discovered very often. And when they do, it takes many years to develop them into products, if they make it through the entire process at all. I find the work challenging and interesting, in spite of the numerous frustrations."

Plants haven't been the sole focus of Fencil's career, however. Before plants were sharks.

After graduating, her first job was with Mycogen, in San Diego, Calif. "I was hired to work on a project funded by a government grant, which centered around developing certain yeast strains to produce high-value isoprenoids (oil-like compounds), such as squalene." Squalene is obtained from deep sea sharks, which have large amounts in their liver. It's used in many ways—as a health-supplement, high-cholesterol treatment, cosmetic moisturizer and machine oil—to name a few. "We were looking for an affordable and more sustainable source," explains Fencil.

Whether it's preventing animals from being over-hunted for a precious commodity or protecting farm fields and groundwater from harmful chemical pesticides, Fencil continues to look to nature, in the smallest detail, for its own good. ■

# energy evangelists

By Rebecca Tavernini

**D**iesel vehicles running on vegetable oils.

Water fountains powered by the sun.

Free furnaces.

Sound crazy? Futuristic? Maybe so, but they're real efforts being undertaken by NMU grads and embraced by the Marquette community and beyond.

In hopes of spreading the word and use of renewable energy options and energy efficiency, Northern Options was started in true grassroots style by former NMU student Jennifer Silverston and downstate Urban Options Executive Director Aileen Gow, who met at a Marquette Citizens for Wind event, a group Silverston founded. Drawn to the organization by a grant to do community biodiesel education, environmental scientist **TJ Brown '05 BS** joined the small staff, who at first worked out of their homes.

Today, Northern Options has a downtown Marquette office and is part of a group of eight Michigan Energy Demonstration Centers—the only one in the Upper Peninsula. **Jennifer Binkley-Power '97 BS** (with a master's in environmental policy) is now the organization's program manager.

Their work goes far beyond oil and water, though.

They've assisted Marquette's historic Landmark Inn to become the Upper Peninsula's first Green Lodging facility by assessing and recommending changes to energy usage.

They're working with the City of Marquette to meet the goals of the Mayor's Climate Protection Agreement, a national initiative. And they've created and posted greenways

trail maps of the city, designed to make Marquette more walkable and bikable.

They're also helping the Upper Peninsula Children's Museum be more energy-efficient and to create an "Enlightening Power" wind and solar exhibit—that's where the solar fountain comes in. It will provide an

**Kids didn't only learn about biodiesel, they made samples, tested them and poured them into Brown's truck.**

outdoor habitat for the museum's popular reptiles and teach kids about sun energy. Inside, there will be a solar house and hands-on modules about different types of power and fuel.

Kids at Marquette Senior High School and students who attended the annual Great Lakes Youth Symposium didn't only learn about biodiesel, they made samples, tested them and poured them into Brown's truck.

When the high school program was introduced in 2006, students were so excited by this effort that 40 participated in the chemistry labs after school. Using waste soybean oil from a local restaurant, and virgin oils such as sunflower, canola and peanut, they

chemically processed biodiesel with methanol and sodium hydroxide. The samples were tested for acidity, specific gravity and cold-flow properties. The students also performed a 13-week-long bus trial using 300 gallons of purchased biodiesel. After convincing bus drivers and head mechanics to use the biodiesel, the students "splash blended" different mixes, from a 5-percent bio-to-diesel ratio to a 20-percent blend. The students also worked with U.P. Engineers and Architects to measure exhaust emissions, including unburned hydrocarbons, volatile organic compounds and carbon monoxide.

The high school students then shared their research project with two other schools, the local school board, the City of Marquette's Transportation Advisory Committee, and more than 100 Upper Peninsula fleet



TJ Brown and Jennifer Binkley-Power at Northern Options

managers who attended a 2006 Biodiesel Workshop at Northern Michigan University.

The students aren't the only ones learning. "The kids teach me so much based on their questions," says

Brown, who has continued presenting about biodiesel and energy efficiency around the U.P. “We get a great response from children, especially with energy efficiency, since they have an immediate impact. Kids can take energy efficiency to the next level because they can see and feel the results and teach their parents how to save money.”



Students discuss the use of biofuel in their school buses.

Northern Options also focuses its energy on homes. On-site energy audits are offered to low- and moderate-income households. These are practical, do-it-now visits, where Brown goes into a home and insulates

**“It won’t be a choice in the future, as people will be forced to do these things because of rising prices, more regulation and legislation and stricter building codes.”**

windows, doors and outlets, wraps hot water pipes and installs compact fluorescent lightbulbs, all while educating the homeowner about other ways to save on heating and electrical costs—some of them simple behavioral changes. “We’ll usually save

them 15 to 20 percent, and in some instances up to 50 percent,” says Brown. “Often it’s not a drastic difference right away, but over time it really adds up.”

Through another grant program they’re also able to replace furnaces for low-income clients. These same services are available to any resident and to businesses for a reasonable fee.

Not only are clients shown a report of the money they’ll save with usually low-cost modifications, but the measured reductions they’ll make in carbon dioxide, sulfur dioxide and nitrous oxide emissions.

Little by little, more people are seriously looking at their energy usage and alternatives for today and the future.

“There are many creative people who are working on new solutions and who embrace a new way of doing things,” says Binkley-Power. “But generally it’s a slow process. I don’t mean to sound bleak, but it won’t be a choice in the future, as people will be forced to do these things because of rising prices, much more regulation and legislation and stricter building codes.”

“We have a lot of education still left to give,” adds Brown.

Who knows what idea lightbulbs (the compact fluorescent kind, of course) will be sparked by the students Northern Options teaches, and what energy solutions their imaginations will fuel. ■

# Fueling the Future

Oil, farming and food in the new age of energy

By Rebecca Tavernini

“The state that put the nation on wheels should be the state that makes those wheels independent of foreign oil,” said Michigan Governor Jennifer Granholm, lauding the opening of Ag Solutions, Michigan’s first biodiesel processing plant. **Mike Sanville ’00 BS, ’07 MS** is doing his part toward that goal, and more, creating new sources and new fuels that not only turn wheels, but propel ships, fire furnaces and create jobs.

Sanville has been a partner in development of Ag Solutions since the conceptual stages back in 2003. As the product manager for the environmental systems group at VanAire, the parent company of Ag Solutions, located in Gladstone, Mich., he’s been involved in the research of the chemical processes, system design, construction and production of the plant. Sanville has more than employment wrapped up in environmental solutions—he’s got his heart in it, too, and a perfectly suited set of skills in biochemistry and chemistry acquired at Northern, plus a business background.

“The beauty of biodiesel is that it can be burned in any standard diesel engine without modification,” he explains. It also allows engines to burn cleaner and require less maintenance.

“There are many environmental and health benefits, including greatly reduced or eliminated emissions of harmful gases and particulate matter,” he adds. “It essentially removes the diesel odor. Also, it’s domestically produced, which helps many sectors of the economy.”

While biodiesel may alleviate

dependence on diminishing and polluting carbon-based fuels, the industry faces similar raw-material supply challenges. But that’s not to say the dilemma is slowing the blossoming biodiesel market or hindering the search for creative sources of oils used to make the fuel.

“There is a finite amount of oil available. In 2005 the U.S. produced/consumed around 11 billion gallons of fat/oil/grease,” Sanville explains. “Most of the oil was used by the food industry or for feeding animals. Around 53 billion gallons of diesel fuel was consumed during the same year. Since the majority of the oil is used by the food industry, only a small portion of the fuel demand can be filled by a renewable, environmentally friendly fuel—biodiesel.”

Plus, in an interesting twist in the race for greener fuel, a battle for agricultural acreage is taking place:

**In an interesting twist in the race for greener fuel, a battle for agricultural acreage is taking place: corn vs. soybeans; ethanol vs. biodiesel.**

corn vs. soybeans; ethanol vs. biodiesel. “Last year the number of acres planted in soybeans, which is the major oil crop for biodiesel, decreased substantially as the number of corn acres increased to supply corn to the ethanol industry,” Sanville reports. “The increase in demand for these crops due to the renewable fuel industry has caused the price of both



Mike Sanville holding a beaker of biodiesel in the Ag Solutions processing facility.

to substantially increase. Soybean oil was 15 to 22 cents per pound as we developed the process and plant, and currently it’s selling for 51 cents.”

Consequently, work is being done to produce oil from “non-stand” (crop) sources. The main area of progress and interest is in the use of algae. Some strains of algae produce a large amount of lipid or oil, and algae are the fastest growing oil-producing plants—ready for harvest in only 15 days—and most efficient at converting carbon dioxide to bio-

mass, according to Sanville, offering an additional environmental benefit.

Another unique method is what prompted the formation of Ag Solutions in 2006—Van Aire’s wastewater equipment it manufactures for businesses, which captures and recycles oils from waste streams.

“The ability of our technology to remove fats, oils and grease from wastewater without chemicals makes our equipment sought after in the market,” he says. “In addition, we wanted to capture the greatest value for these oil by-products, so we decided to use them for their energy content.” This whole process not only keeps waste out of landfills, but businesses save on removal, processing and transportation costs. Ag Solutions plans to start producing biodiesel from

the recovered oil products, mostly from the food industry, this year.

Currently, the plant uses soybean oil from the Midwest, recycled restaurant grease and rendered tallow. It produces five million gallons per year, and they are currently expanding to produce 20 million gallons by year’s end.

Most of the fuel is sold through fuel brokers at this time, but the company has had interest from stationary power/electrical generation plants, home heating fuel distributors, railroads and shipping, ferry and mining companies.

The possibilities are enormous, and the road ahead holds promise. ■

# Challenging the Next Generation

*"We do not inherit this land from our ancestors; we borrow it from our children."*

Those who abide by this Native American proverb might agree that the key to preserving our environment for the youngest generation is to educate these future stewards about responsibility and sustainability at an impressionable age.

**John Inch '96**

BS embodies this belief through his work with the

EnviroChallenger program in Tacoma, Wash. The program provides free environmental lessons to children, mixing science and fun while aligning with state education standards. It is financed by the city's public works department of environmental services through a portion of the water, sewage and garbage/recycling rates collected from city residents.

"The bottom line is that we can't keep saying the next generation will take care of it; we have to do something now," Inch emphasizes. "The issues these kids will deal with are massive. They have the potential to make a huge difference and I try to focus on that positive. I tell them they're so much more aware of all of this than I was at their age, and better equipped to facilitate effective and meaningful change.

"Every day there's something in the news about hybrid technology, electric cars, solar panels, wind or hydro power. They have television channels and programs devoted to wildlife and the environment. They're surrounded by these messages, and I



By Kristi Evans

make fake wastewater with coffee grounds and lemonade, sponges and aquarium gravel. Then we illustrate the filtration process—the seven steps at our wastewater plant required to clean all that up. We use things like plastic strainers, coffee filters, and Alka-Seltzer to simulate oxygen-rich bacteria and a little soap at the end to simulate the chemical treatment before it's released into our waters."

Other examples include an adaptation of

the classic rock, paper, scissors game that illustrates the salmon life cycle and a memory game with cards illustrating good and bad lifestyle choices. Inch says children have an easier time grasping what to do than why.

"For example, turning off the water while they're brushing their teeth," he said. "We show them that it not only saves water at the house—and money, as a result—but if all of us left our taps running, how would that impact our rivers, streams and lakes? Or they know walking, biking or carpooling are better, but why? Because for every mile you drive, you're emitting nine pounds of greenhouse gases."

The EnviroChallenger team also educates adults at several community events and service-club functions. Inch says the challenge with adults is overcoming the longstanding presumption that preserving the environment adversely impacts the economy.

"Many think it's an either-or proposition, but it's not," he added. "For every job at a landfill, there are 10 jobs at a recycling center, so the

## EnviroCHALLENGER

tell them this gives them an edge in terms of what they can do in the future. There are already great examples of kids initiating activities in their schools or writing grants on behalf of their cities. Adults are sometimes too jaded with governmental processes and officials to try things like that."

Inch and a colleague cruise Tacoma in an EnviroChallenger van en route to participating elementary and middle schools or home-schooled students. They deliver six lessons designed to promote the following goals: reduce the amount of trash going into landfills and toxins making their way into the environment; increase recycling efforts; and protect water quality and endangered salmon.

Recognizing that young audiences are more receptive to fun and humorous messages than heavy topics or gloom-and-doom forecasts, the EnviroChallenger team packages the information in hands-on activities and games.

"One of the kids' favorites is 'What's the Scoop on Poop?' They

economy can receive a boost from doing what's right. And taking steps to protect the environment can result in a cost savings, but most don't realize that. I've read that 80 percent of the population would change their views on the environment if they could be shown that such efforts will save them money."

Growing up in Detroit, where "any wildlife sighting was a blessing," Inch developed a love for the outdoors through family camping trips and Boy Scout activities. He attended NMU to major in outdoor recreation and leisure services with an emphasis in experiential education and interpretation.

He left Marquette to serve as a naturalist at Northwest Trek, a 723-acre, free-roaming wildlife park located near Mount Rainier in Washington that is home to more than 200 North American animals. After a six-week training course, he narrated bus tours.



John Inch mixing up a concoction with Tacoma schoolchildren.

"Working there and with wildlife gave me a better understanding of our impacts on wildlife and the challenges they face throughout the world," Inch explains. "I also created a junior naturalist program, which served as a catalyst for working with kids. I was bringing in kids to give them a voice and tell them they have the ability to talk to people and explain things to make a difference."

One of the people who hired Inch at Northwest Trek had gone on to work for the city of Tacoma's EnviroChallenger program. At the urging of his acquaintance, Inch

applied for a vacancy and was hired as a program instructor in 2006.

Many believe that the emerging green economy sector will become one of the nation's hottest employers. Inch believes he has found his calling and no matter what the future holds professionally, he will never stray too far from working for the environment.

"I feel I'm doing my service to my country by working with the next generation to promote issues we have to deal with. It's ridiculous to think our political leaders will do anything about this. It's us. The base of the pyramid has to be solid before it can move upward. We can change the world by working in our local areas first.

"I don't recite quotations very often, but Gandhi once said 'I have only one life to make this message heard.' I feel that way, too—I have only a short time to make a difference, but it is possible." ■



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