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WISCONSIN

NATURAL RESOURCES

December 2002 \$3.50



Deer
mouse
about the
house

Mighty
big muskies

New map
views of Wisconsin

Ideas for our
energy future

The midnight marauder

This “house guest” is up and about kind of late in winter.

John Yost



A deer mouse gathers food in a hazelnut thicket for winter. This mouse forages mostly at night relying on a keen sense of smell to find fresh insects, grains and berries in season. In fall, the deer mouse fills caches with up to two gallons of seeds and nuts in hollow logs, rocky crevices or the snug walls of a warm cabin.

I wake to what sounds like a miniature drum, followed by the telltale cadence of running feet. Startled, I flick on the light hoping to catch a glimpse of the looter. But like every other time this scenario has played out, the rascal disappears into a hole in the wall before I can get a good look.

It's 4:30 a.m., the busiest time of day for a working woodland deer mouse (*Peromyscus maniculatus*). The little rodent is busy stuffing a large food cache with black oil sunflower seeds from my bird feeder. In this case the “cavern” she's filling happens to be the felt liner of my mukluks.

Every couple of weeks I check to see how much birdseed she has stored in her pantry. The supply of nuts grows during spring, summer and fall as she pilfers goodies from the feeders that I keep full year-round. When the snow flies, I reclaim my boots and lend her the use of my tennis shoes for the winter.

My furry companion and I share a cabin in the middle of a forest rich in oak, elm, spruce and balsam fir. This is perfect habitat for a woodland deer mouse. Abundant throughout Wisconsin, these tan rodents with white underparts inhabit deciduous, coniferous and mixed forests. They are abundant

in manmade buildings, often residing in old sawmills, shacks and cabins. Another subspecies of deer mouse, the prairie deer mouse (*P.m. bairdii*), inhabits hay and grain fields and especially likes the fencerows where vines or shrubs provide additional protection.

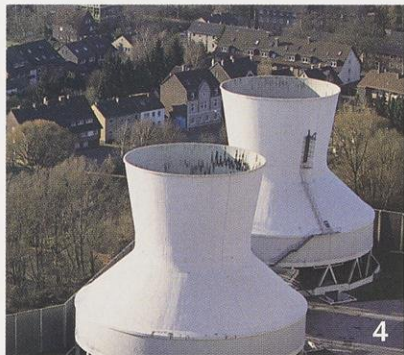
It's in these fencerows where habitat varies between open field and shrub that anomalies of the mammalian world occur. The female prairie deer mice grow bigger than males and establish larger home ranges as well. Maintaining a bigger home range is helpful when raising her young, as a female needs two to three times her normal food intake to produce milk for offspring.

Deer mice give birth to one to eight young, and usually have three to five in a litter. The female can have four litters or more a year in a warm winter. The tiny pink babies are blind for the first two weeks of their lives. During this time they often remain firmly attached to their mother's teats for nourishment and protection. If startled, the female can run from the nest with her family in tow. Two to three weeks after their eyes open, the babies are weaned and ready to leave the nest.

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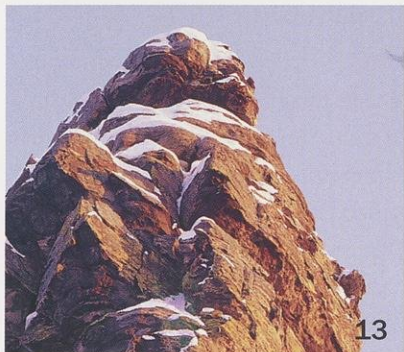
Lisa Gaumnitz

The biggest, baddest muskies of your lifetime are cruising Wisconsin waters thanks to angler ethics and sound management.

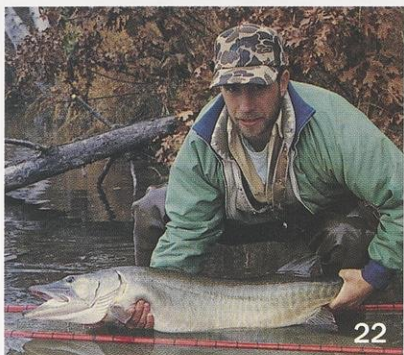
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RJ & LINDA MILLER



TERRY MARGENAU

FRONT COVER: The deer mouse is active all winter sharing quarters with other mice or nestling into a cabin. Those in wooded areas spend as much time in the trees as on the ground.

JOHN YOST, Wausau, Wis.

BACK COVER: Dells of the Eau Claire River State Natural Area, Marathon County. For a map or more information, contact the State Natural Areas Program, Bureau of Endangered Resources, DNR, P.O. Box 7921, Madison, WI 53707 or visit www.dnr.state.wi.us/org/land/er/snas

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The complex business of keeping the



lights on

Smart energy policy takes more than flipping a switch.
Germany provides lessons.

Natasha Kassulke

Story photos by Wolfgang Hoffmann

Rise and shine!

Turn off the snooze alarm, take a hot shower, pour some coffee and turn on the news. Your morning routine? It's a piece of the energy puzzle.

Future energy use and supply is a concern in Wisconsin amid growing demand, instability in the Middle East, rising gas prices, evidence of global warming, debate over nuclear waste disposal, Enron Corporation's bankruptcy and health research. A Wisconsin Environmental Decade study found that in 1997, ozone or smog was responsible for 4,200 hospital emergency room visits in Wisconsin.

In our next two issues of the magazine, we will explore Wisconsin's energy challenges and consider energy innovations that are working in Germany, which is considered ahead of the game in conserving and making rational, environmentally sound use of energy. In the second part of the series we'll consider renewable energy sources and explore some of their applications at home.

Wisconsin's energy outlook

In the summer of 2000, California created a "could it happen here" panic when it experienced large-scale power disruptions. While Wisconsin has not experienced rolling blackouts, we have energy concerns.

There's debate over the proposed 250-mile transmission line to power 400,000 homes. The \$175 million Arrow-

head-Weston project would be the largest electricity transmission project in Wisconsin in at least 25 years. The 345-kilovolt line would run from Wausau to Duluth, Minn., and rise as high as a 12-story building. Opponents have fought the line for three years arguing it is bad for the environment and their property values.

The Public Service Commission (PSC) is concerned that Wisconsin's current transmission system could overload leading to blackouts. Wisconsin currently relies on four major transmission lines connecting it to other states, while Illinois has 25 interstate transmission lines and Minnesota has 18.

The PSC also estimates that state de-

mand for power will grow two percent per year between now and 2007. Wisconsin imports roughly 15 to 20 percent of its electricity, according to the Energy Lifeline Coalition of Wisconsin.

Another major concern — state power plants are aging. Over half of Wisconsin's 16 coal-fired power plants are 30 to 50 years old. Older plants tend to be viewed as inefficient and dirty.

Recently, as many as 20 power plants have been proposed in Wisconsin by independent power producers. Eight plants powered by fossil fuels are likely to be proposed here during the next three to five years to meet growing energy needs.

The governor's energy outlook estimates that Wisconsin needs at least 6,300 megawatts of additional capacity — a nearly 50 percent addition to present production — in the next 15 years to keep its homes, stores, farms and industry supplied with reliable energy.

Consider this: The state Division of Energy reports that in 1970 the average Wisconsin electricity customer used 6,711-kilowatt hours per year. In 2000, that average was 8,545 kilowatts — a 27 percent increase. Demand from commercial customers jumped 120 percent during the same period.

Most of the power plants are proposed by independent producers, a new kind of enterprise born as the power

(left) Cooling towers at a soft-coal power plant in Lippendorf.

(top, left to right) Wisconsin delegates get many views of energy conservation and practices in Germany including compact appliances, commuter options, transmission corridors, efficient cars, clustered power production and higher gas prices sold in liters.

industry is deregulated. Spin-off companies of traditional Wisconsin utilities have proposed other projects.

Last year, WE Energies proposed a 10-year, \$7 billion energy reliability plan — “Power the Future.” Under the plan, the utility would spend \$3 billion to build five new power plants — two in Port Washington and three in Oak Creek using new coal and coal-to-natural gas technologies that reduce emissions of nitrogen oxides, sulfur dioxide and other pollutants. Using natural gas is arguably cleaner, natural gas costs customers at least 7–10 percent more and its future supply is uncertain.

The Public Service Commission (PSC) leads the power plant review process under the state’s Power Plant Siting Law, which focuses on environmental impacts. The Department of Natural Resources weighs-in by reviewing air and water quality consequences, solid waste (ash) management and more. State utilities are regulated to limit pollutants including sulfur dioxide, nitrogen oxides, carbon monoxide and soot.

This summer, DNR staff reviewed a flurry of proposals for gas-fired combustion turbine plants and three large (600-megawatt) coal-fired units. State energy policy calls for ongoing dialogue on how to meet future energy needs while evaluating Wisconsin’s current energy mix comprised of 75 percent coal-generated power, 20 percent nuclear, two percent gas and the rest in renewables.

A recent study by the nonprofit Leonardo Academy found that Wisconsin imports oil, gas and coal at a cost of more than \$7.5 billion a year. It reported that increasing energy efficiency and alternative energy use could save about \$500 million annually. Also noted — transportation accounts for about 30 percent of the greenhouse gases emitted in Wisconsin.

Providing energy is a complex issue that links environment, economics, politics, social trends and more. Energy fuels more than homes and cars. It fuels debate. But most people agree that Wisconsin needs an affordable and reliable energy supply — a combination that is also being pursued elsewhere.

Achtung! Why Germany?

Officials are turning to Europe for ideas, particularly Germany, which is considered technologically progressive and a leader in policies and financial innovations to generate clean, efficient power.

Signs of energy conservation in Germany are everywhere. Shoppers return or pay extra for grocery bags, hotels ask that you conserve water and shampoo, cars are smaller and semi trucks are really semis. People heavily rely on public transportation — buses and trains. In Munich, there are separate sidewalk lanes for bicycles.

Germany also is tackling tailpipe emissions. Old cars are inspected and retired. Three out of four cars in Germany have catalytic converters or low-pollution, fuel-efficient diesel engines to reduce ozone. German cars average 32 miles a gallon compared with 24.5 miles in the United States. Diesel engines burn as much as 30 percent less fuel than gasoline engines of comparable size and emit far less carbon dioxide and other greenhouse gases. Diesel is a popular fuel in Germany where gasoline prices are often three times U.S. prices and where slightly looser particulate standards allow its use. European diesel fuels are lower in sulfur than fuels available in the United States.

Efforts to conserve energy are bringing environmental benefits.

According to Johann Hahlen, president of the Federal Statistical Office, energy consumption in Germany decreased two percent between 1991 and 2000, CO₂ discharges were down 15 percent from 1990. Sulfur dioxide and nitrogen oxide decreased 56 percent between 1991 and 1998. These waste reductions were accompanied by an 11.5 percent increase in gross domestic product, adjusted for price changes.

Germany has also committed to reduce greenhouse gas emissions by 21 percent from 2008 to 2012 compared to 1990 levels and reduce carbon dioxide emission by 25 percent from 1990 levels by 2005. Further, the country is committed to doubling its use of renewable energy sources by 2010.

Nitrogen oxide controls were placed on coal-fired plants more than 11 years



Delegates visited several German cities to see modern coal-fired plant designs, operation and renewable energy options. Many power plants have been built or renovated here in the last 15 years.

ago.

Many changes in Germany are a result of ecological tax reform, which will gradually increase energy prices to create incentives for new technologies and energy economy. A Renewable Energy Sources Act obliges energy grid operators to pay a set price and buy all renewable energy generated from solar, hydropower, wind, biomass, geothermal, sewage and other sources.

Arguably most important, the fall of the Berlin Wall in 1989 and reunification of East and West Germany created fertile ground for change. The European Union directive of December 1996 became the cornerstone for reorganizing electricity markets. The Energy Industry Act in April 1998 led Germany to become a pioneer of deregulation.

With this background in mind, a 23-member Wisconsin delegation visited Germany earlier this year to learn how German power utilities develop, manage and maintain plants that burn fossil fuels in an environmentally sound manner. The goal? To see if some of the German facilities and techniques are worth considering as Wisconsin develops future power plants. The answer, was “yes.”

The delegation included DNR staff along with a PSC representative, Alliant Energy Corp., Madison Gas & Electric and WE Energies (formerly Wisconsin Electric Power and Wisconsin Gas), the Wisconsin Environmental Initiative, UW-Madison environmental engineering faculty, the Environmental Decade and others. The delegation was diverse

because it will take many people from various disciplines and expertise to tackle Wisconsin's energy challenges.

The delegation visited Munich, Lip-pendorf, Dresden, Berlin and Essen to tour plants, learn about how Germans are responding to climate change, view technology, and see how modern plants are designed and operated.

The trip continued DNR's partnership with Bavaria from the 1990s to examine pollution control policies that consistently produce environmental results greater than what is legally required. The Bavarian "Umweltpakt" since 1995 has called for greater industry responsibility instead of regulation, more voluntary action instead of controls, more cooperation instead of confrontation, and upfront environmental protection instead of end-of-pipe solutions.

In five years, 900 companies and 50 trade organizations have signed on. In return, the state offers reduced emissions fees; streamlined permitting and monitoring for participating companies; and continued program funding. Other financial incentives help small businesses hire consultants to develop an environmental management system.

The public keeps up too. More than 60 measurement stations throughout Bavaria monitor air quality around the clock. Readings are broadcast on the Internet and as video text.

Delegates toured coal and gas-fired plants in four German regions that featured innovative technology to reduce nitrogen oxides, precipitate 99 percent of dust particulates, and remove more than 90 percent of sulfur dioxide emission.

Land is at a premium, and most German power plants are sited on the grounds of outdated plants. Many use cogeneration to provide local heat and hot water in addition to electricity.

Delegates also learned about the Germany energy grid — a high-voltage transmission network that runs from north of Norway to Portugal. If one plant shuts down, another can step up without a flickering light.

Grid operators constantly review the energy balance. A power company is fined if it fails to contribute the contracted amount or for producing too much energy. E-mails and phone calls tell a power station to adjust its load. Companies may close plants that can't cover costs. Plant maintenance is scheduled when another plant can pick up the slack.

German power plants bring taxes as well as jobs to communities, whereas in Wisconsin, local government is barred from collecting property taxes on power plants. According to the Assembly Energy and Utilities Committee, during 2000–2001, Wisconsin power companies paid \$137.9 million in taxes of which just \$26.2 million went back to the communities housing these power plants.

Perhaps most impressive to delegates was the German emphasis on public awareness of energy issues. They invest in public relations and engage the public early through letters, brochures, books, videos and town meetings. The newest plants have state-of-the-art visitor centers.

Yet, Germany also wrestles with energy dilemmas. Nuclear power will be phased out in the next 20 years. The country's 19 nuclear power plants will be shut down after a lifespan of only 32 years under the deal. Since nuclear power provides 30 percent of Ger-

many's energy supply, replacing that source may force the country to import electricity.

Overwhelmingly, Germans support a diverse mix of energy sources for safety, security and reliability.

Munich makes creative use of its trash

In Munich, the city utility is burning its trash and sewage to create energy and support public transportation.

Enno Ihnken, manager of district heating and electricity generation for Stadtwerke München (a city-owned utility serving 1.3 million people), says the company supplies electricity, local heat and water. Its power operations subsidize \$150 million for city buses and commuter trains, as well as the public pools (baths).

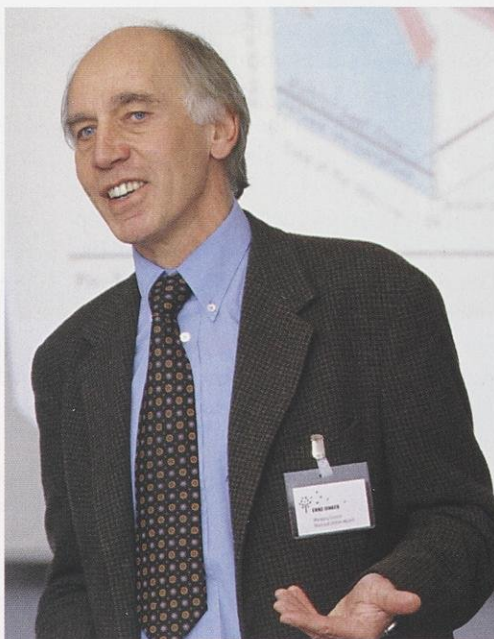
In Wisconsin, this kind of a contribution is unlikely since shareholders, rather than cities, own the biggest power companies.

Munich also annually burns 675,000 tons of its garbage to produce 10 percent of the city's electrical demand. In Wisconsin, garbage is not typically incinerated because it contains more heavy metals.

Munich also incinerates dried sewage sludge surpassing environmental standards for that practice while disposing of more than 50 percent of the city's refuse and sludge.

Many of the byproducts — slag, fly-ash, gypsum and scrap metal are sold for reuse. Ammonia is recovered from treated wastewater.

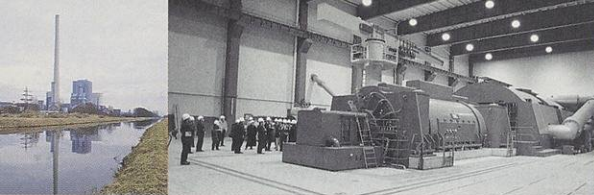
Customers pay 13.5 cents per kilowatt-hour for electricity and the average electric bill for a Munich household



(left) In Munich, Enno Ihnken explained how "waste" heat from generating electricity provides local heat and hot water.

(below) Captured byproducts are made into gypsum. Customers pay a little more for such greener energy.





(left) The Zolling plant in a nature preserve runs clean, quiet and efficient.

(right) Josef Pflugler, who runs a bakery and organic farm, calls the power plant next door "a good neighbor."

is almost \$108 a month plus a \$9 monthly fee. Wisconsin customers paid about 7.6 cents per kilowatt-hour for electricity in 2000.

Ihnken says the German public knows environmental protection comes at a price. But in return, power plant emissions have been dramatically cut and they haven't experienced a black-out since 1972.

Power plant at home in a Zolling nature preserve

E.ON Kraftwerke, a division of Europe's second largest privately-owned power company, operates a coal-fired power plant in Zolling outside Munich. At Zolling, electricity has been produced from hard coal for more than 40 years.

In 1985, the old 365-megawatt plant was replaced with a 449-megawatt modern coal-fired plant at a cost of about \$2 billion. The plant, sited in the Amper Valley Nature Preserve that is home to deer and wild boar, is painted light blue to blend with the sky. Between 300,000 and 600,000 tons of coal are annually fired here to supply electricity to about five million homes.

Raw coal is crushed to a fine powder to ensure optimum burning. Heated air dries the coal and 20 burners blow it into a boiler where it is burned at 1,500 degrees C (or 2,732 degrees F). Pressurized water passing nearby in steel tubes turns to steam that is fed into a three-stage turbine to generate electricity. The steam returns to a condenser, cools back into water and is pumped into the boiler to be reheated and reused.

Flue gases get full environmental treatment. Nitrogen oxides are reduced to nitrogen and steam. Electrostatic precipitators remove 99 percent of dust and gases pass through scrubbing towers that react with crushed limestone and oxygen to remove 90 percent of the sulfur dioxide emissions. The resulting fly ash and gypsum of cookie-dough



consistency is sold for use in construction projects.

Given this increased efficiency, today, the Zolling plant can produce twice as much electricity from a kilogram of coal as it could in 1950. Further, automation means it takes just six people per shift to operate the plant.

The plant is so quiet that from the outside it seems the plant isn't running. Power plants in Germany tend to be quieter than American plants because of acoustic shielding around noisy processes. In Zolling, the plant is not allowed to produce more than 34 decibels of sound so as not to disturb neighbors. (Normal speech is about 60 dB.) Running at full load, you can barely see a puff of smoke from the stack.

The Zolling plant also plans to add a biomass plant to burn waste wood. Residents in the region currently pay steep fees to dispose of wood in landfills. Though electricity costs about twice as much to generate from biomass as coal, German law guarantees a price and requires grid operators to buy 100 percent of the electricity produced from renewable sources such as wood.

Josef Pflugler, 67, runs a bakery and organic farm adjacent to the plant. He has lived here all his life and worked at the old plant from 1957 to 1960. He says there was less discussion about building the new plant because people knew it

would be more environmentally sound and safe.

"The plant is a good neighbor," Pflugler says.

Marianne Haimerl, a cleaning woman for a local church, can see the power plant chimney from her backyard. She agrees with Pflugler and says the plant brings jobs into the area.

"I am satisfied now that they have made it cleaner," she says.

Lippendorf lignite plant impresses

The most impressive plant for many delegates was a 933-megawatt capacity plant at Lippendorf, near Leipzig in East Germany. Its history is as interesting as its technology.

The plant burns lignite (brown) coal, which is often rejected in the United States because of its high sulfur content. Lignite has been extracted from Leipzig for over 300 years. Large-scale strip mining ended in the late 1980s, but a strip mine near the plant delivers coal via conveyor belt directly to the plant.

After reunification, the region redeveloped, changing from a series of scarred open pits to recreational and industrial areas with lakes. Jobs have been created in the arts and ecology; and publicly subsidized environmental protection has since come to the fore as

an antidote to unemployment rates as high as 25 percent in parts of Eastern Germany.

Viewing the region today, it is difficult to imagine that this area was "behind the curtain" 12 years ago or that more than 11,000 bombs were dropped in the region during World War II. Power plants here supplied gas for the German war planes.

"Back then, you could wear a white shirt and it would be grimy by the end of the day," explains translator Bernard Weismann. "You could smell the chemicals in the air." Switches had to be cleaned on railroad tracks because the ash became so heavy at times that it piled up like dirty snow. People didn't paint their homes white because they wouldn't stay white for long.

Today, from a rooftop observation deck you can scan the Leipzig landscape and clear skies. Emissions at the

coal-fired plant have fallen by more than 90 percent. "It is like night and day now, the air is so much cleaner," Weismann said.

The plant took 3½ years to build right next to the retired power plant that could not be economically retrofitted to meet environmental standards. The plant burns 10 million tons of raw lignite annually and uses new high temperature technology with 42.4 percent design efficiency. In colder weather, when the plant can provide heat to local housing, the fuel efficiency will increase to about 46 percent. (By comparison, the 1970s-built Columbia Power Plant near Portage in Wisconsin operates at a 34 percent efficiency level.)

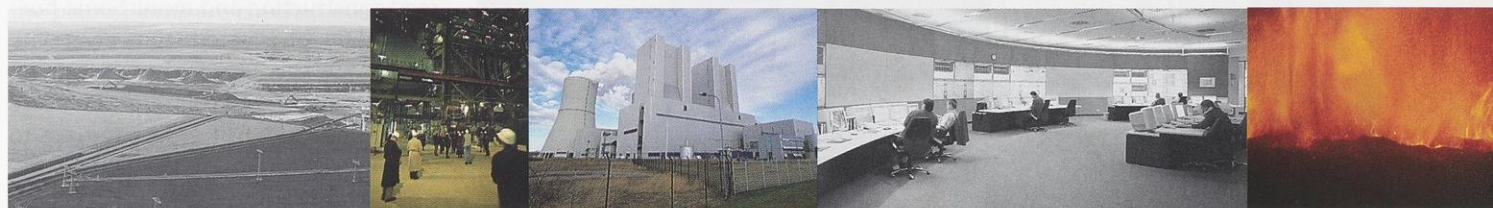
The fuel efficiency comparisons can be a bit misleading, explains UW-Madison Professor of Mechanical Engineering Ken Ragland. European firms use lower heating values of fuel to calculate

overall efficiency while U.S. companies use higher values. The difference is that water from moisture and hydrogen in the fuel is condensed recovering the heat of vaporization in the higher value. So 33 percent efficiencies in the United States are about the same as 40+ percent efficiencies in Europe for the same coal and technology. Special firing measures ensure low nitrous oxides emissions. Flue gases pass through two ducts equipped with an electrostatic precipitator and a desulfurization system. Over 99 percent of dust and more than 95 percent of sulfur dioxide are filtered out and gypsum is produced.

Though lignite coal is notoriously sooty and dirty to handle, the plant has eliminated smokestacks and instead, exhausts are directed through shortened cooling towers making the plant more visually pleasing. Heat and water will be delivered to Leipzig through un-

(left to right) Strip mines convey coal directly into the Lippendorf plant. Note the interior, exterior, automated control room and high-efficiency furnace.

(below) Bernard Weismann describes how coal and flue gases are routed and burned several times to extract heat value and limit emissions.



derground pipelines. The plant is clean. Floors are washed and vacuum cleaners remove residue dust, which is moistened and returned to the combustion unit.

Emission levels are constantly monitored and environmental authorities have access to plant computers and emissions printouts daily. There are fines when the plant exceeds emission level limits.

"The fines are imposed not on the plant, but on the person at the plant who is found to be at fault," explains Bernard Hauschild, plant public relations manager. "It can be a few months salaries down the drain."

Other costs to the plant include taxes, mining royalties and license fees. If the plant remains in compliance, though, it pays a lower fee for its emissions.

The plant has been designed so that it will need little additional investment over the next 40 years.

"People are asking us why we have

customers with electricity and heat. In 5,000 hours of full-load operation the units feed 4.5 billion kilowatt-hours of electricity into the grids of RWE, one of Germany's major utilities.

"All of the old power plants here that weren't retrofitted have been gone for 10 years now," explains Wolfgang Benesch, a specialist in planning and constructing power plants for STEAG. "Laws set emissions limits, but it is up to the companies how they want to achieve those."

Each plant must find the right technology for its fuel mix, Benesch says.

The Herne plant meets the electrical needs of about 800,000 people. Advanced methods of cleaning flue gases, protecting surface water and abating noise are needed since the plant is next to a residential area. Acoustic insulation reduces noise emissions.

"We have six to 10 complaints a year by phone about the power plant," explains plant manager Gerhard Howe.

"Our policy here is to hear out the complaint and try to talk it out. The complaints vary from questions about the power plant operations to noticing that leaves from our trees are falling on neighbors' lawns."

Green space and a park-like atmosphere surround the plant. There is bicycle and motorcycle parking for employees. The roof has an observation deck for tour groups. The control room is state-of-the-art.

Authorities can show up and take samples at any time of the day. Noise levels, measured at five points surrounding the plant, are limited to 60 decibels during the day at 50 meters from the cooling tower; 45 decibels at night.

An on-site wastewater purification plant treats water from the plant. Up to 800,000 tons of coal filter ash, slag-tap granulates and gypsum accumulate annually. Because of their quality and ecological compatibility, these materials see new life in building construction, road construction and more. Some fine-grained fly ash is used to remove graffiti.

Creative new uses for its waste materials combined with communication are key elements in STEAG's progress to gain public acceptance.

"We need public acceptance because



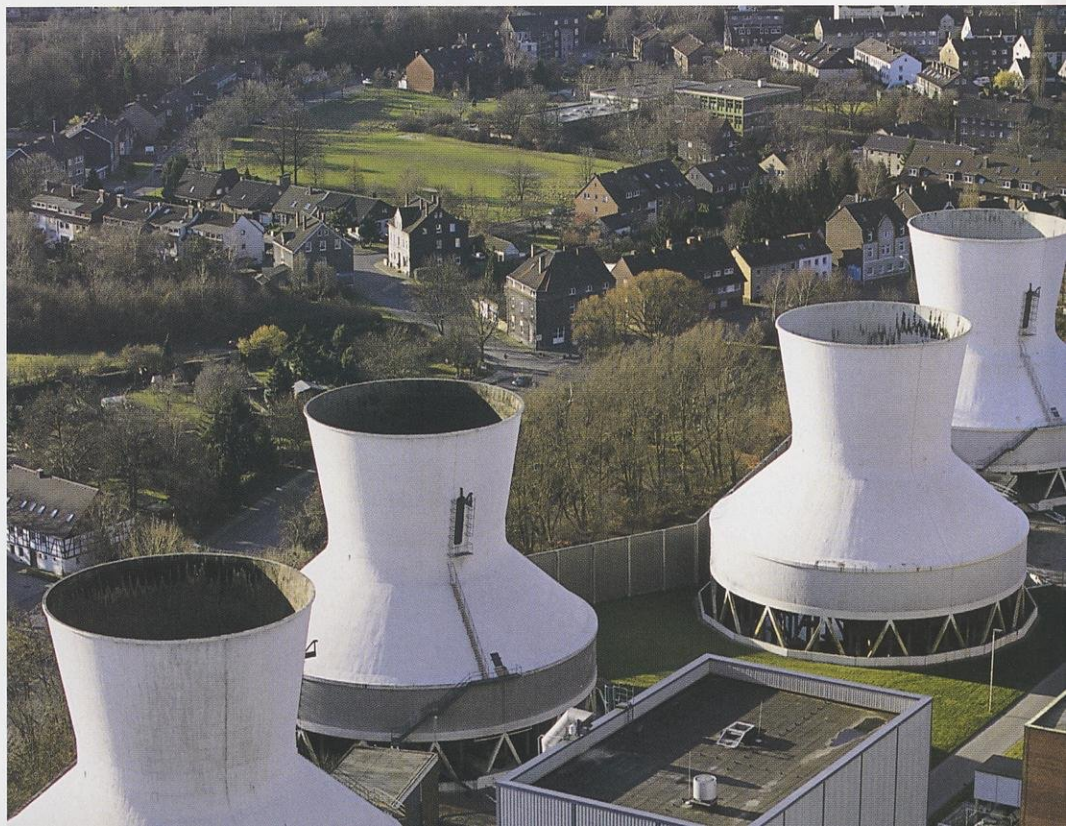
(above, left to right) Conveying coal at STEAG, manager Gerhard Howe, monitoring the energy grid.

(right) STEAG produces power in a park-like setting near homes.

lower emissions than our permit allows for," Hauschild says, "but we've grown up in a way that taught us that if you can do it a better way, you should do it a better way. It costs more money upfront, but the bottom line is that it is more profitable to be more efficient and environmental."

STEAG cleans up the coal act

STEAG uses 2.4 million tons of hard coal at its 950-megawatt Herne cogeneration plant — three power stations to supply



it influences the timing of construction and long-term project success," says Jorn Vogel, a permitting expert. "We not only want people to accept the plants, but even support them."

Vogel says acceptance comes from building "columns of trustworthiness" — contributing to the local economy, creating public awareness materials, hosting meetings, creating jobs and using environmental protection measures. End of pipe and smokestack monitoring results are made public.

Permitting in Germany has largely been streamlined. The German emissions control act demands that companies provide public information and give people a chance to react, explains Vogel.

"Usually there is just one hearing before an agency is granted a permit," Vogel says.

New projects may take 1–1½ years to get the necessary licenses and permits. One license is granted for construction. Facility licenses last for the lifetime of the plant. Plants are checked every few years to ensure that they are state-of-the-art.

Dresden delivers political change and ideas about transmission lines

In Dresden, delegates learned about political changes and transmission lines. Dresden, capital of the Free State of Saxony, is located on the River Elbe and has developed over 800 years as an important center for culture and science in Germany.

"Twelve years ago, the socialist system left a disfigured landscape, pollution and inefficient energy use," explains Gerd Ellmer, business manager for industry in Dresden. "Today, we have an efficient power sector and all power plants have been refurbished or replaced. We have the most effective lignite plants worldwide, co-generation plants, wind parks, plus smaller hydro-electric plants."

With higher efficiency and top-notch technology, power plants here have reduced their emissions up to 95 percent. "Four million fewer tons of CO₂ are emitted annually, but we have main-



In Dresden, delegates discussed ways to route transmission lines and learned how refurbishing or replacing power plants in the last 12 years cut nationwide emissions from power generation by 95 percent.

tained the same level of energy production," Ellmer says. There is little potential to further reduce emissions at the power plants. So we are now concentrating on lowering emissions in transportation, private home use, businesses and industry."

Power lines and transmission strongly factor in a reliable energy supply here.

"There is a legal planning process, strict environmental rules and lots of negotiations for power lines," Ellmer says.

Gerd Kaulfub, power plant manager for municipal utilities in Dresden, says landowners were offered monetary compensation when a power line was built on the outskirts of Dresden.

"We negotiated with landowners. They realized that building the lines there would be a safe and secure power supply," Kaulfub says.

But he also admits that having a power line cross your property has a "clear negative effect" on property values.

"It's mostly agricultural land where the new lines are built," Kaulfub says. "So property values are not as affected as they would be if the land was zoned for residential construction."

Many power lines follow existing railroad lines, Kaulfub says. Landscape preservation rules define steps to avoid ecological damage and offer compensation during power line siting.

Mitte CHP in the heart of Berlin

Homes line the street just 16 meters from a natural gas plant in the heart of Germany's capital, Berlin.

The modern 380-megawatt Mitte CHP plant has operated since 1997 along the River Spree on the site of a closed facility that used to spew intense emissions from a 140-meter chimney. The new plant is considered a showcase as a good neighbor that is good to the environment.

Its central location and short routes to customers keep transmission losses to a minimum. In winter, when it provides local heating, the Mitte plant reaches 90 percent heat utilization efficiency from its gas and steam turbines that are tied into underground utility lines.

"In the city people don't like overhead lines," says Andreas Naumann, public relations specialist for the plant. "So we built underground lines."

Sensors in the insulation layers of underground pipes monitor for potential leaks. The four-mile long main tunnel runs 25–30 meters underground. Constructing a network of connecting tunnels was closely coordinated with public works utilities, city parks, road and traffic projects, the Berlin parliament and neighbors. The project was completed on schedule in July 1999.

Plant tours are a mix of science and culture. Visitors clad in hard hats and earphones follow tour guides and find artwork, modern sculpture and murals from worldwide artists. Public benches along the River Spree were designed by a Turkish artist and are heated in winter with waste heat from the transformers. A large-scale model of the plant offers lessons in German and English. Two-seat electric cars are tested in the parking lots. Naumann says the owners spend nearly \$1 million annually for public relations campaigns (not including advertising).

"In Germany, environmental motivation is high," explains Anders Heden-



Power with artful style. At the Mitte CHP plant — testing electric cars, a model of the facility, tasteful architecture in this urban neighborhood plant and heated public benches along the River Spree.

stedt, a member of the managing board. “There are strict environmental rules, but also a culture where you’re always trying to do the best and be the best.”

Insurance, security and climate change

Delegates were briefed on how climate change affects investment decisions by the insurance and banking sectors.

Dr. Gerhard Betz, Munich Reinsurance Company’s director of GeoRisks Research, described how global warming has measurably changed the number of natural catastrophes worldwide. Munich Re is the world leader in insuring other insurance companies against catastrophic losses attributed to natural disasters like flood, earthquakes and hurricanes.

“From 1992 to 2001, the number of disasters has increased by three percent and we need to think of the reasons behind this,” he says. Some of the change is attributable to clearing of wooded areas and altering the chemical composition of the atmosphere.

In a world with constant climate, weather-related losses would be easier to calculate over long periods, but when climate is more variable, it is more difficult to estimate weather risks. For the insurer, this means an increased risk of being ruined by a sudden high loss. The industry reacts by either limiting the benefits paid when losses occur or by raising premiums.

Munich Re views the increased frequency of extreme weather as a sign of changed climate. The firm has reduced the upper limits per claim. According to Munich Re, in the 1970s, 19 large storms worldwide caused \$10.4 billion in claims. By the 1990s, some 39 major storms resulted in \$71.4 billion in claims. Betz says estimates of global warming damage point to potential annual losses of \$300 billion in the United States due to catastrophic weather.

Other claims can be costly too. For



instance last August, the Friends of the Earth, Greenpeace and the City of Boulder, Colo., sued the United States government, on behalf of people who contend they are global warming victims. Litigants include a North Carolina couple who fear that their retirement property will be lost to storm surges, erosion and rising sea level; one of the largest maple syrup producers in Vermont who believes his business will be ruined as maple trees disappear from the area; and a marine biologist whose life’s work is in jeopardy because coral reefs are disappearing due to rising ocean temperatures. The suit alleges that two U.S. government agencies — the Export Import Bank and the Overseas Private Investment Corporation — provided over \$32 billion in financing and insurance for oil fields, pipelines and coal-fired power plants over the past 10 years without assessing their contribution to global warming.

The challenge continues

After returning to the United States, delegates met to review what they’d learned.

Germany is not Wisconsin, but Germans saw reunification as an opportunity to change and replace outdated, polluting power plants. Some lessons — especially cooperation among partners in making environmental-energy decisions — may be useful here.

In Berlin, delegates saw a top federal regulator and business leader sit side-by-side explaining how *they* achieve better results from businesses. *They* dis-

cussed incentives like lower fees and quicker reviews for firms exhibiting superior environmental performance.

The Association of Germany Industries is one player that lobbies and actively promotes sustainability — a balance of the environment, social needs and economics. People are offered real incentives to buy less energy-consuming, less polluting cars and services.

Germany also looks elsewhere for ways to improve its climate control policies — to the Netherlands, Spain and even to a pilot program in Chicago that offsets CO₂ emissions by planting trees.

“The direct use of German energy/environmental experience may not transfer directly because of different political, social and cultural systems,” reminds Pat Eagan, a delegate, and program director and associate professor for the University of Wisconsin-Madison’s Department of Engineering Professional Development and Institute for Environmental Studies. “You have to move ahead using our unique American system. Maybe the most important lesson is that working together can achieve results.”

But overall, delegates agreed that their world views have changed since visiting Germany where people are living quality lives while creating less pollution by using energy more efficiently.



Natasha Kassulke is the associate editor of Wisconsin Natural Resources magazine.



Get the big picture

Two maps help you see and feel
the character of Wisconsin's
geographic features.

Bob Gurda, Mindy James and David L. Sperling

How do we sense the lay of the land?

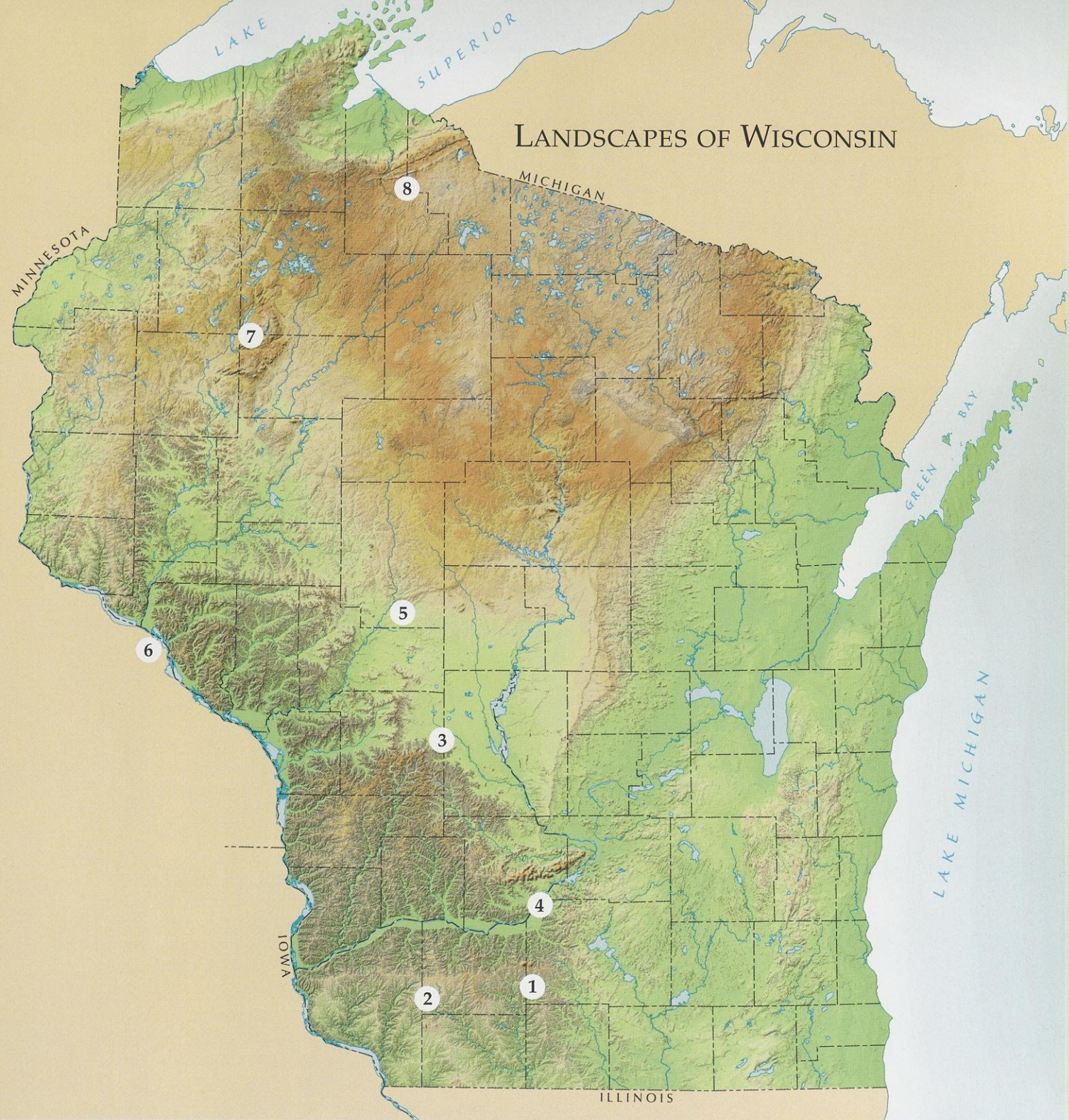
We make mental maps of our daily travels: the streets, routes and turns we need to negotiate by car or on foot. We note the bends of the river, the rock bars, stump fields and shoreline on the water. We hike the ridges to get a view from the top. On longer trips we note the gradual transitions from farm fields to woods. Trips through eastern Wisconsin skirt the edges of eskers, kettle lakes and limestone outcroppings. To the southwest, we snake across ridge tops and wiggle through river valleys. Heading north, we cross the great marshlands and central sands before reaching deep woods country. To the northwest, we see forests, birch groves and dense groves of conifers.

We know the landscape is full of patterns but we are often too close to see them. The landscape changes in ways too subtle to be obvious when viewed up close. Sometimes, we just need to step back — *way* back — to get a sense of what we can't see for ourselves.

Two relatively new maps do just that. One, *Landscapes of Wisconsin*, profiles the highs and the lows of the Wisconsin terrain. It depicts changes in elevation and the geological features of the land surface. A companion map, *Wisconsin Land Cover*, depicts what covers that terrain — the forests, wetlands, farmlands and cities. It's as if the first map describes the size and shape of the face and the second, the detailed facial features that flesh out Wisconsin's physical character. The maps are interesting to study and hang on the wall as references. Both maps provide landscape details at a 1:500,000 scale, where one inch represents approximately eight miles on the ground.

We recommend starting with the *Landscapes of Wisconsin* map to get a sense of the shape, forms and relief of Wisconsin's landforms. Through the use of color and shaded relief, the map has a three-dimensional textural feel simulating the appearance of sunlight and shadow on a clear day. Wisconsin Geological and Natural History Survey staff developed the map by analyzing digital elevations derived from U.S. Geological Survey topographic maps that note roads, lakes and other land features.

You can clearly see the big differences on this 42 x 42-inch picture of the state. The depictions make it easy to see the lands to the southwest that were spared the crushing weight and abrasive power of glaciers that moved through



1. You can see the lower Wisconsin River Valley skirting Highway 151 and see the twin Blue Mounds.

2. The Military Ridge, which the present Highway 151 parallels east of Dodgeville, thereafter forms a thin brown line through Iowa and Grant counties.

3. It is no accident that I-94 runs through the flat country just east of the unglaciated hills at least as far as Black River Falls.

4. The Baraboo Hills of Sauk and Columbia counties rise 700 feet like a rough dinosaur's back with a swishing tail.

5. As your eye scans northward, you can pick out where the edge of the icy glacial shield dropped off near Neillsville and the meltwaters formed the Black River, wiggling its way between the hills to settle in bottomland plains just west of La Crosse.

6. It's even more noticeable where the Chippewa River south of Durand forms a delta that washes into lowlands on the Mississippi River near the Buffalo and Pepin line.

7. A trapezoidal region 600 feet high rises in the Blue Hills of northwestern Rusk, southwestern Sawyer and northeastern Barron counties. Here the tough quartzite rock refused to wear away and beds of softer red catlinite rock were quarried and carved into pipestone.

8. Two parallel ridges run roughly from Hurley in Iron County southwest into Ashland County. The southern ridge, the Gogebic Range, was mined for iron for 80 years and the northern ridge, the Trap Range, is composed of a basaltic-lava rock that arcs under America for 1,200 miles to the southwest and northeast.

WISCONSIN LAND COVER



1. You can see the vast low wet areas of former glacial Lake Wisconsin radiating from Wood, Juneau and Jackson counties.

2. Rich and widespread wetland areas dapple the map, and it's easy to trace the terminal edge of the glacial reach we are now trying to mark in the Ice Age Trail. Again the great river systems and deltas are easy to spot.

3. Take a close look south of the red cluster around Baraboo and you can pick out the grasslands of the former Badger Army Ammunition Plant complex as well as the wooded Baraboo Hills.

4. South of Stevens Point and Wisconsin Rapids you'll note the bright greens of pine forest plantations and yellow irrigated croplands.

5. Menominee County appears as a cool sea of green stippled with blue marking extensive forests, waters and wetlands.

6. A triangle of yellow northwest of that green oasis marks where the silt loam blanketed over the glacial till around Antigo and formed rich farm soils.

7. Striated blue wetlands sweep across Taylor, Rusk and Price counties, clearly showing the path and direction of healed glacial "scars" that gouged through the land, leaving wet remnants in farmlands and forests.

8. Similarly, wetlands parallel to the drumlins and hills south of Lake Winnebago in Fond du Lac, Winnebago, Green Lake and Dodge counties look like blue paint splattered from the north and east.

Wisconsin from the northeast some 9,500 to 20,000 years ago. That tremendous force scoured and flattened lands, changed the course of rivers, built and deposited huge hills, and left plenty of evidence in its melting wake. The hills, valleys and drainage patterns all pop up from the map surface to show each ridge and rocky run.

Landscapes of Wisconsin does a good job of letting the visuals tell Wisconsin's story while offering small blocks of commentary to describe the Northern Highlands, the Central Sand Plain that is now the heart of our potato, cranberry and vegetable growing region, the drumlins and kettles of southeastern Wisconsin and the Green Bay/Fox River lowlands. It lays a good foundation for mentally overlaying the map of current land cover.

The two maps in tandem make a truly dynamic duo for understanding the present landscape and its potential. The terrain and the current vegetative cover are tightly linked. Elevation, drainage and soil type affect the vegetation. In other cases, geologic formations like the rocky ends of moraines are so choked with stones and boulders or the slopes are so steep that the soil is impractical to till. Those areas could grow trees instead of crops.

Wisconsin Land Cover uses computer and satellite technology to take a long view of the land. The details came from Landsat satellites in orbit 438 miles above Wisconsin in the summer of 1992. The satellite took pictures using electronic technology that sensed ranges of both color and near-infrared energy reflected by leaves, pine needles, sand, rock, water, crops and urban areas. The data was collected in a grid that precisely located each 100 x 100-foot cell as pictures were taken statewide. The satellite computer data stored 160 million cells of information about Wisconsin. DNR field staff then made field observations using GIS equipment and aerial photographs to categorize the land cover in 15,000 places. Finally, computer analysis of the satellite images assigned a



The sandstone buttes of Mill Bluff were once islands and reefs in Glacial Lake Wisconsin.

land cover category to each cell. Information from the 15,000 ground observations was compared to gauge the accuracy of the categories assigned by the computers.

DNR geographic information specialists interpreted the satellite data from start to finish. That data is now available for land use planners, environmental scientists and other cartographers. Then, working with the State Cartographer's Office and the Wisconsin Geological and Natural History Survey, the database was plotted and combined with text and other elements to create the 42 x 50-inch printed *Wisconsin Land Cover* map.

You can see in an instant that the *Wisconsin Land Cover* map tells a very different story. It's more colorful in representing current land uses. The *Landscapes* map was presented in natural shades of green and brown to help non-geologists by simulating an aerial look at the underlying rocky landscape. The *Land Cover* map appeals to our flashier sense with brighter colors to distinguish areas. The "hot zones" in cities where people are more packed together are shown in red grading to a lighter pink as we spread out a bit in the 'burbs. Cropped agricultural land is shown in pleasing yellow, grasslands in an olive brown, and shrublands in a darker brown hue. Forests of three types are depicted in shades of green, open water in light blue and forested/unforested wetlands in contrasting shades of purple and lavender.

Because each tiny cell is only 1/400th of

an inch at map scale, each dot and spot of color merges on the page and in the mind's eye like a Seurat painting to form an impression of the landscape. Some of the patterns are easier to see. We note where cities give way to grasslands and farming. We can clearly sense that most regions are not purely devoted to one activity or cover type but are mixtures of forests, grasses and ag lands.

Other patterns take more of a trained eye to see, and the narrative gladly leads the

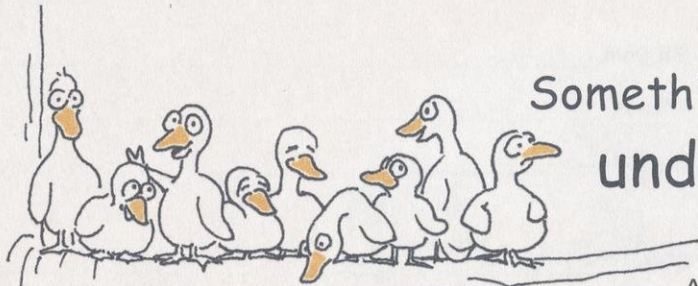
way. Yellow farmlands of western Wisconsin yield to shrubby forests and grasslands in the hilly lands and coulees.

The map's vast green areas do a good job of defining the edges of the great Northwoods. But the story of Wisconsin's glacial runs are better told in depictions of wetlands than on traditional road maps that show only lakes.

For a closer look than we can supply here, you can order these maps by mail or phone and can print order forms from the web. *Landscapes of Wisconsin* is available for \$10 plus shipping, handling and sales tax from the Wisconsin Geological and Natural History Survey, 3817 Mineral Point Road, Madison, WI 53705-5100; or by telephone, (608) 263-7389. For order blanks, visit www.uwex.edu/wgnhs/landscapes.htm on the web.

The *Wisconsin Land Cover* map is available for \$10 from the State Cartographer's Office, UW-Madison, Science Hall, 550 N. Park St., Madison, WI 53706; by phone, (608) 262-3065. See www.geography.wisc.edu/sco/pubs/order.html to print an order form. ■

Bob Gurda is the assistant state cartographer at the State Cartographer's Office. Mindy James is publications manager for the Wisconsin Geological and Natural History Survey. David L. Sperling edits Wisconsin Natural Resources. All work in Madison.



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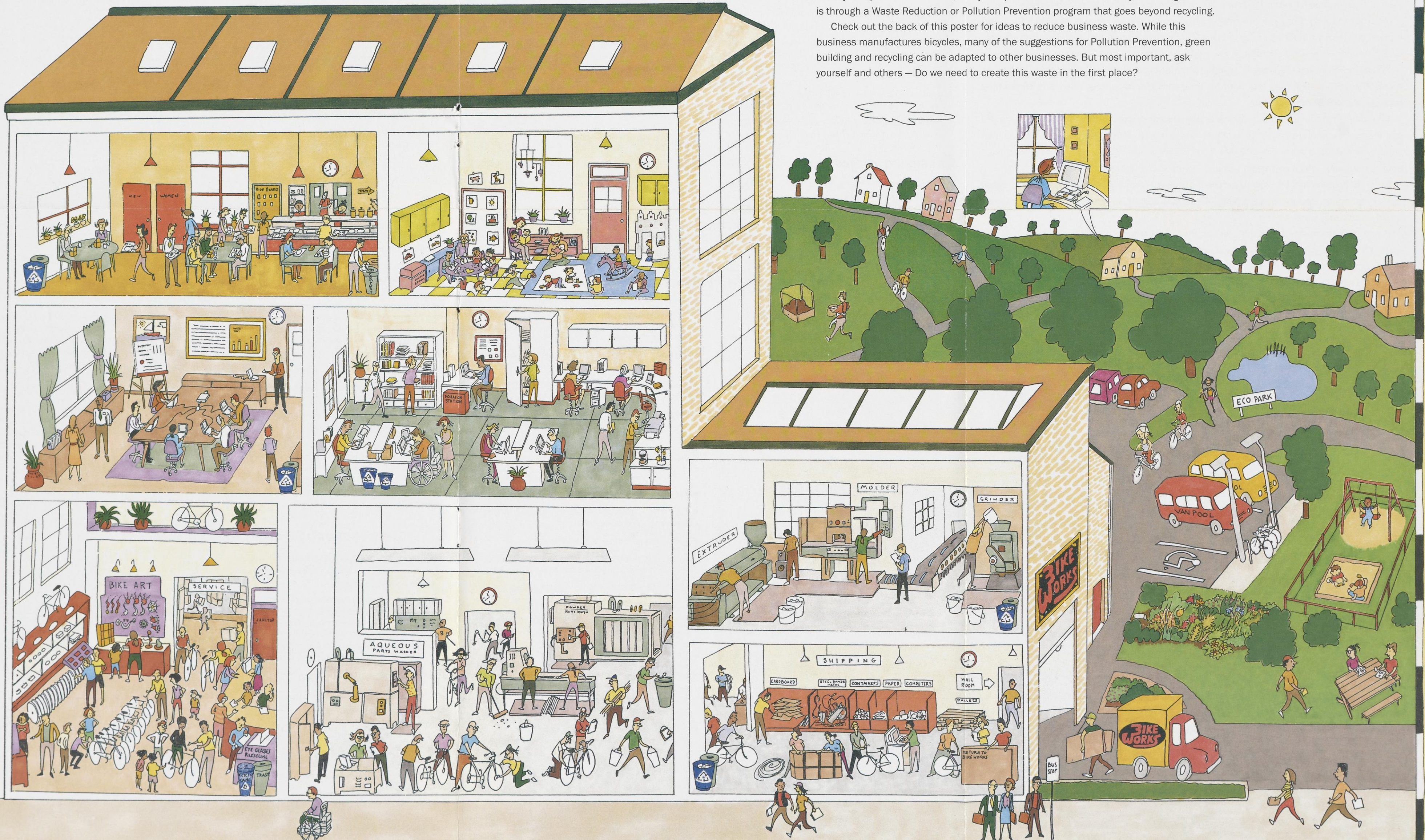
PRODUCTION and REDUCTION

Build a better business for a better tomorrow

Product Production is what keeps a business running. Waste Reduction helps keep a business profitable and a good neighbor. Waste costs. It costs in terms of raw materials wasted, inefficiency, disposal and tipping fees, liability, energy consumption and the environment.

With increasing public concern over environmental quality and worker safety, as well as liability for spills and accidents, many companies find that the best way to manage waste is through a Waste Reduction or Pollution Prevention program that goes beyond recycling.

Check out the back of this poster for ideas to reduce business waste. While this business manufactures bicycles, many of the suggestions for Pollution Prevention, green building and recycling can be adapted to other businesses. But most important, ask yourself and others — Do we need to create this waste in the first place?



Production and Reduction

Build a better business for a better tomorrow

In 2000, Wisconsin businesses recycled 700,000 tons of material and threw away 1.3 million tons of trash — enough trash to bury a typical city street five feet deep, curb to curb for over 80 miles. And due to increased waste generation and a decrease in recycling, this street of trash is 24 miles longer than it was in 1995.

You may be relying on e-mail more often. But if you print e-mails, you aren't saving paper in the long run. In fact, paper waste generation in offices in Wisconsin increased 22 percent (about 30,000 tons) between 1995 and 2000, according to Wisconsin DNR reports.

If you aren't recycling, you are making matters worse by wasting landfill space and money. Waste costs in terms of waste disposal, the environment and customer and employee satisfaction. One way to combat waste and save a lot of money is to stop generating it.

Pollution Prevention (P2) means using raw materials, water, energy and other resources more efficiently, substituting less harmful substances for hazardous ones, and eliminating toxic substances from production.

Adopting P2 practices often lowers operational and environmental compliance costs. P2 can reduce or eliminate long-term liabilities and clean-up costs. Disposal costs are reduced when waste volume decreases. P2 can lead to a reduction in workplace exposures to hazardous materials, which can affect workers' health and productivity.

Green building is another way to reduce a business's footprint. Green building addresses five areas: siting, energy conservation, building materials, indoor air and environmental quality, and water conservation.

Finally, as community pillars, businesses shoulder a responsibility for environmental protection for their own good as well as that of society.

Production and Reduction: Build a better business for a better tomorrow. Try to match the items in each room with the items in the illustration.

1 BUILDING

- The building is constructed with properly insulated windows and green building (sustainable and high performance) features such as recycled building materials. Windows overlook native landscaping and the building is mostly daylighted. Daylighting is the use of natural lighting through skylights and perimeter windows. Daylighting reduces the demand on electrical lighting and cooling loads. Daylighting reduces lifetime utility costs 30 to 70 percent, according to the Energy Center of Wisconsin.

- High efficiency air and heating systems may cost more initially but can be justified by savings over time.

- Blocks are made from recycled flyash. Framing products include timber from certified sustainable forests and recycled steel. Sheathing and wallboard is made from 100 percent recycled newsprint and reinforced gypsum. Insulation is 100 percent recycled newspapers (cellulose in roof and fiberglass for walls).

- A louvered gutter system allows rainwater to soak into the ground rather than run into storm sewers.

- When buying light bulbs, computers and appliances, the company purchases energy-saving models with "Energy Star" or "Green Lights" labels. These bulbs are 75 percent more energy efficient and last ten times longer than a standard bulb.

- Containers are labeled for recyclables and trash (with trash being considerably smaller). Recycling bins are located throughout the building.

- All rooms have occupancy/motion and photo-sensors for the light switches that turn off lights when rooms are not in use.

2 GENERAL OFFICE AREA

- Nontoxic adhesives are used on tile and carpet. Walls are painted with low-VOC paint. Carpet is segmented so that only worn squares are replaced — the carpet company takes back old carpeting to recycle.

- Employees donate clothing/toys for charities or host a garage sale.

- Books are taken home or borrowed during lunches and breaks. Magazines are donated to hospitals, libraries and nursing homes.

- The company uses an internal network for e-mail, scheduling, announcements, record keeping, inventory management and faxing. Accounting uses electronic billing and payment. Editing and document proofing is completed on the computer and information is stored on the

hard drive or network to lessen the need for discs. Staff who travel use docking stations for their laptops so they can carry their work electronically. Employees turn off computers and monitors when they leave. Computer stations are ergonomically designed for wellness and productivity. Screensavers are prohibited; they use more energy than a blank screen.

- Staff has embraced the "paperless office" concept so the copy machine is less elaborate and smaller; fewer printers are needed. The office uses refillable, reusable toner cartridges.

- The company buys supplies that contain recycled content and nontoxic office products such as markers, trash bags and desktop accessories.

- The company's "Green Team" educates employees about cost-saving recycling and waste reduction. The team leader monitors a suggestion box, posts bulletins and writes articles for an electronic newsletter about the recycling programs progress.

- Some employees "telework" at home and use shared office space when in the office. Telecommuting means that the employee or contractor works at home one or more days per month during normal business hours. Broadband technology such as DSL and cable modems plus phone conferences and online instant messaging make it easier to stay in touch when working offsite. Teleworking limits air emission, saves gas and allows flexible schedules.

- The company keeps its mailing list current to avoid sending unnecessary mail.

3 DAYCARE

- The facility's daycare saves employees time and energy commuting to and from daycare. It's a family friendly environment.

- Play equipment is made from recycled material such as plastic bottles and tires.

- The daycare uses a service for diapers, cleaning rags and hand towels.

- The floor is made from 100 percent recycled rubber flooring. Carpet is made from 100 percent recycled plastic soda bottles.

4 MEETING ROOM

- The meeting room is set up for, and staff is trained, to give electronic presentations. Projection screens are used for electronic presentations and wipe-off message boards and non-scented markers are used for those who aren't prepared to present electronically.

- The room has laptop connections and computers are used to share notes.

- Participants wear reusable name tag holders and use meeting binders that are collected as they leave for reuse at the next meeting.

- The meeting planner asks participants to comment on the environmental aspects of the event and suggest improvements.

5 CAFETERIA

- A ride board encourages ride sharing to meetings and work.

- The company offers a discount to customers who bring their own mugs.

- Reusable trays, plates and silverware cut down on disposable trash. Energy-saving appliances are used.

- Condiments are served from refillable containers.

- Company offers cloth lunch bags for employees who want to bring their own lunch. Employees use sandwich keepers and cloth napkins.

- Cafeteria sells half-orders for those trying to trim waste and waistlines.

6 CUSTOMER SALES/SERVICE AREA AND STORE

- This company has borrowed the "doll hospital" idea and offers customers a bicycle, stroller and wheelchair parts repair/exchange area. Broken and old parts are fixed in the factory or recycled. A company website directs customers on how to fix some parts themselves or where to find a local bike shop where they can exchange parts or have parts repaired.

- Bike donations are accepted and bikes are restored for community bicycle programs, kids groups or for shipping to Third World countries.

- The customer service area is an eyeglass recycling drop-off site for the Recycle for Sight Program.

- A real time monitor shows visitors how green building and other conservation practices save money and energy.

- Bike parts may be recycled as artwork or furniture. Over 30,000 pounds of used bicycle parts are recycled annually by Resource Revival, a bicycle parts recycling company in Portland, Ore. The company sells bike chain picture frames, cog candleholders, bike chain keychains, wheel

PRODUCTION AND REDUCTION: Build a better business for a better tomorrow

rim business card holders, compact disc holders, wine racks, tables and valve core earrings.

- The floor is recycled wood from the old high school gym floor.

7 RESTROOMS

- Sinks and toilets are properly maintained and equipped with automatic flushing and low-flow devices. Dripping faucets are quickly repaired. Employees report repair needs.

- Toilet paper is made from recycled materials. Bathroom stalls are wheelchair accessible.

- Low-flow showers and lockers are provided to encourage employees to ride bikes and walk to work.

- Bathroom wall tiles are made from recycled glass.

8 JANITOR'S CLOSET

- Cleaning staff uses nontoxic cleaning products. According to the U.S. EPA, indoor pollutants can reach 100 times that of outdoor air. Chemical sensitivity is on the rise, occurring in 15 percent of people.

9 METAL PRODUCTION AREA

- Solvents and chemicals that emit VOCs have been replaced with nontoxic substances. When making a purchase, the company asks if there is an environmentally friendly substitute available that is less toxic or hazardous than the product it has been purchasing (for example, cleansers without phosphates).

- Work station floor mats are recycled rubber, which is more comfortable for employees on their feet all day.

- Inventory is carefully controlled so that products are used within their allotted shelf life. Raw material dimensions and quantities are matched as closely as possible with manufacturing requirements.

- Equipment is properly maintained to reduce wear and extend the machinery's life.

- Metal is cut using a saw. Employees dress for safety wearing goggles and other protective clothing. Cutting oil lubricates and helps keep the saw from becoming too hot. Collection pans with a line to a filter collect unused materials and return them to the spray container for reuse.

- Employees collect machine chips, oil and coolants for recycling.

- Scrap goes into a barrel to be returned to a steel mill.

- Metal is washed with an aqueous parts washer to rid it of oil residues and filings. Soapy water is recycled and oil is collected making this a zero discharge wash facility.

- A baking oven adheres the powder coating/paint to the clean metal. The company may opt for mechanized spray painting, which also avoids human error and gets the exact thickness needed. Human operated spray guns with laser beams help control the distance from the part being sprayed to maximize paint coverage.

10 PLASTICS PRODUCTION AREA

- Bike fenders are manufactured from recycled plastic material delivered in pellet form. Used trimmings go to a grinder or are melted and can be put back into stock.

- Plastic pellets are melted and shaped using an extrusion process. Extrusion molding takes less energy than injection molding because it operates at lower temperatures. The process is fume-free. Fenders and seats are remolded and replaced rather than replacing a whole bike when they wear through.

11 SHIPPING, RECEIVING AND LOADING DOCK

- The company requests reusable packaging from vendors and asks them to minimize packaging. It buys products in bulk (unpacked) when possible to reduce packaging.

- The company purchases high-quality pallets, which last longer and are repairable. Nonrepairable pallets are sent to a lumberyard and shredded for mulch, or employees take them home for kindling.

- Shipping containers for bicycles are reusable and contain built-in packing. Delivery drivers bring containers back for reuse after delivery and unloading. Other items are shipped in reusable envelopes or containers made from recycled materials. Notes enclosed in packages ask recipients to reuse packaging materials.

- Recycle bins are provided for cardboard, paper, containers and more. The boxes and smaller cardboard containers are available to staff for moving/gift-wrapping.

- Computers are recycled and/or donated. Over 315 million computers in the U.S. are expected to be retired by 2004. The average lifetime of a personal computer is five years.

- The company contracts to recycle metal scraps, floor sweepings, pallets, sawdust, scrap wood and strapping bands.

- The company uses recycled envelopes and prints addresses on them avoiding a need for labels.

- To avoid unwanted mail, the company sent a letter with its name and address to Mail Preference Service, Direct Marketing Association, P.O. Box 9008, Farmington, NY 11735-9008, and asked to be removed from their members' mailing lists. For organizations from which they do wish to receive mail, they've requested that their address is not shared or sold.

12 PARKING LOT

- Parking spaces are appropriately sized, spaced and made from porous pavement. There are recessed islands for infiltration and stormwater filtration-retention areas. Parking spaces are reserved for car-pool vehicles.

- A pond filters and acts as a detention pond for excess water runoff.

- Shade trees make the parking lot more pleasant and absorb some water runoff.

- Fuel-efficient cars get prime parking spaces.

- The company hosts a Bike-to-Work Day and supplies bike racks.

- Modest lighting is more energy efficient and directs light downward.

- The company uses fuel-efficient vehicles and contracts for vehicle servicing including recycling antifreeze and oil. Vehicles are maintained for top performance — regular tune-ups, brake adjustments and tire pressure checks.

13 GROUNDS

- A rain garden collects runoff water from the roof. Flowers, trees and the lawn offer windbreaks and shade around the facility for energy saving. Native flora has been planted that adapts to the local climate and requires less maintenance, water and chemicals.

- Picnic tables and playground equipment are made from recycled high-density polyethylene plastic that came from milk jugs.

- The company is located in an ecopark where supply/demand are close. The building is sited on a brownfields site that has been cleaned and redeveloped. It also is strategically located so that employees and customers can live nearby and don't have a long commute.

- Food service composts food waste; fat from cooking is rendered.

14 CITY STREET

- Employees use mass transit. The company offers a credit to help pay for bus or train tickets.

- Sidewalks make it easier to walk to work.

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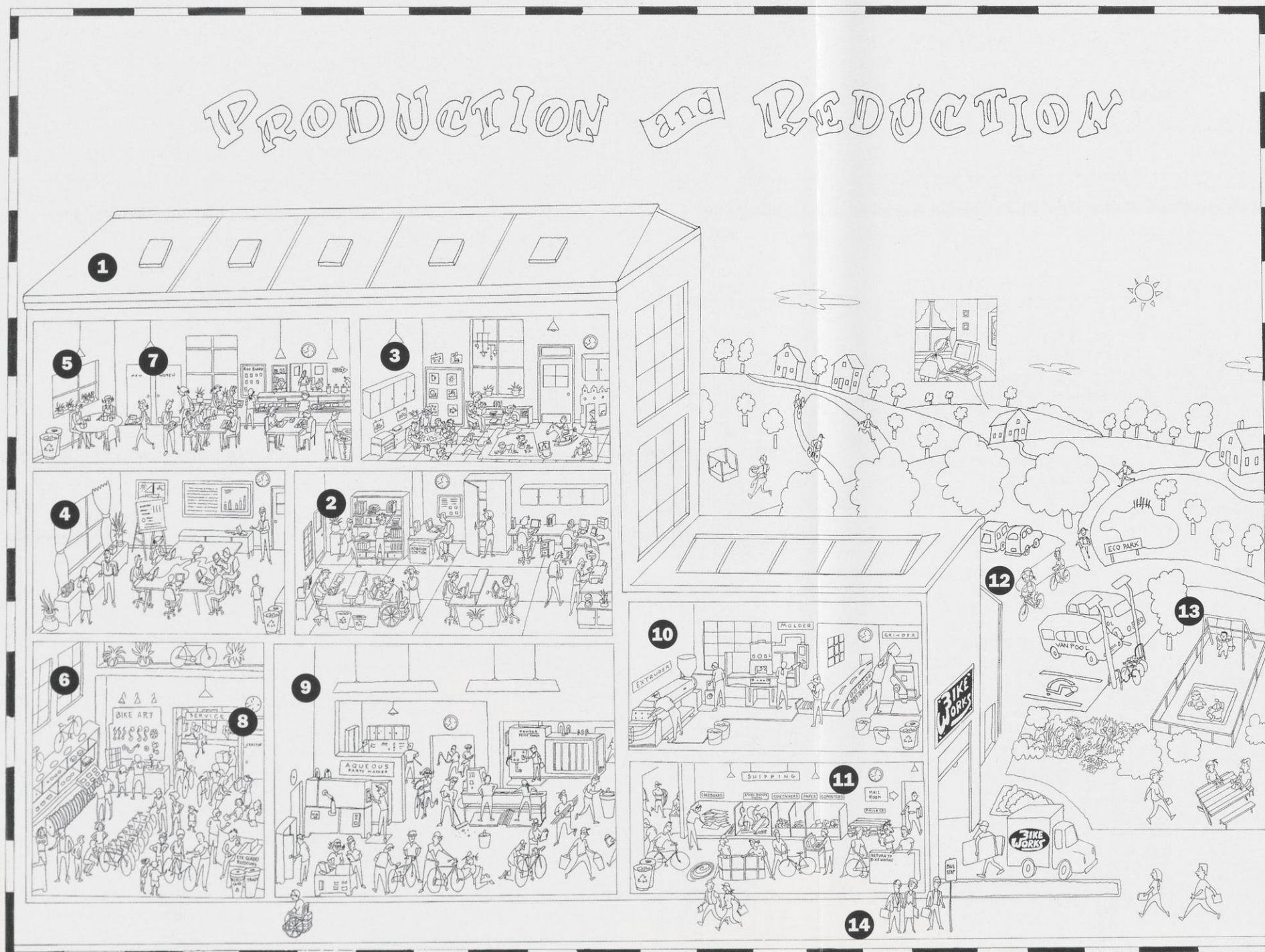
For copies call (608) 266-2711.

Some information adapted with permission from Recycle City
(www.epa.gov/recyclecity/).

Wisconsin DNR waste, recycling and business sector specialists can suggest ways to prevent pollution, cost effectively reduce waste and move beyond recycling compliance. Visit the Waste Management and Cooperative Environmental Assistance pages at www.dnr.state.wi.us or call:

| | |
|---------------------------|--------------------------|
| Eau Claire (715) 839-3700 | Green Bay (920) 492-5916 |
| Madison (608) 275-3266 | Milwaukee (414) 263-8500 |
| Rhineland (715) 365-8900 | Spooner (715) 635-2101 |

To learn more about P2 visit <http://wip2.uwex.edu/>. The site was developed by the Wisconsin Pollution Prevention (WIP2) partnership, a collaboration of the Department of Commerce, Department of Natural Resources and UW-Extension.





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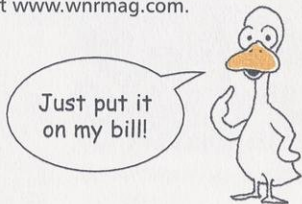
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UDO24

Nature as near as your back door

Urban nature centers open the door for the curious, the serious and the novice nature watchers in town.

Theresa J. Lins

Story photos courtesy of the Urban Ecology Center, Milwaukee

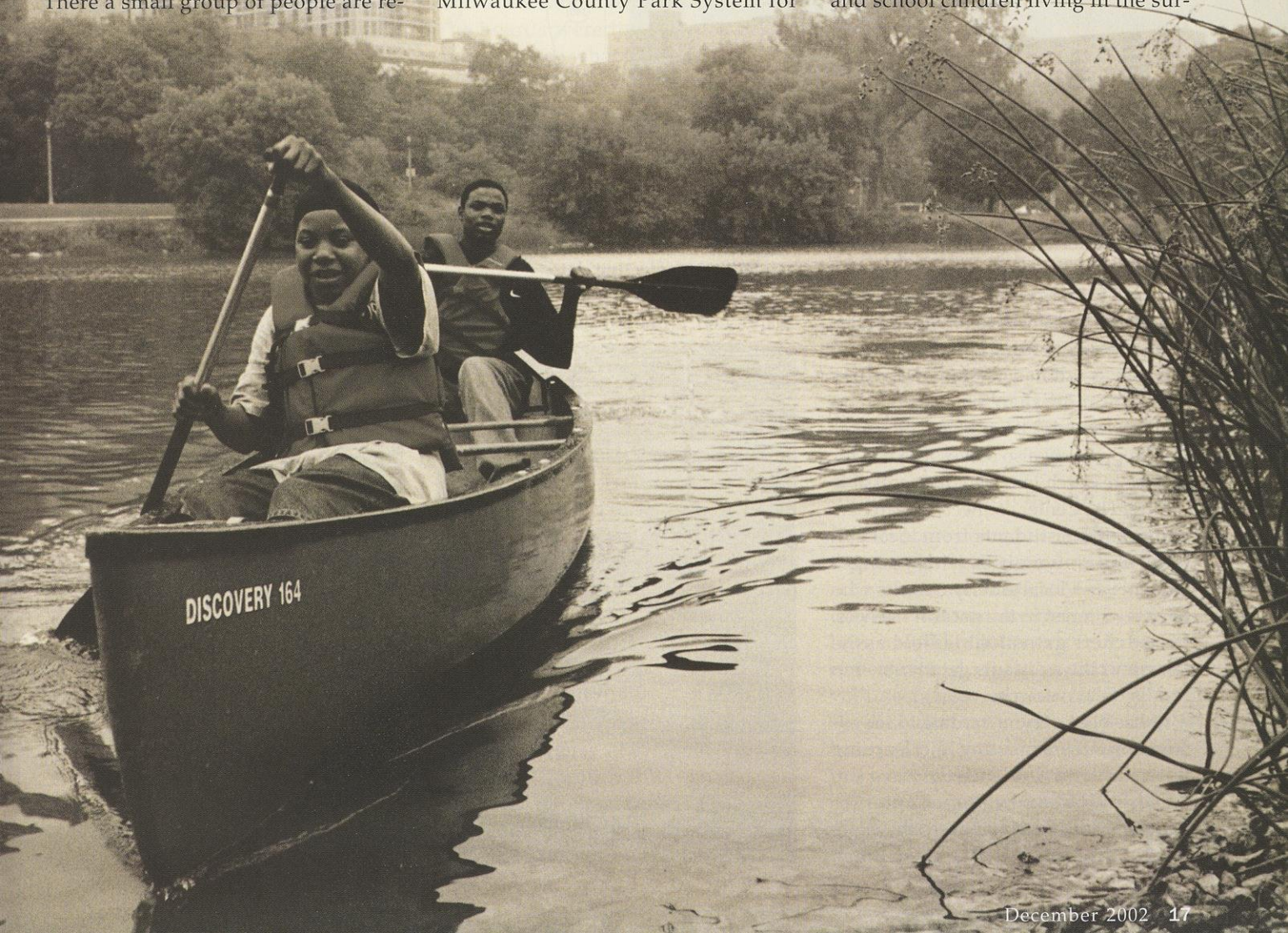
You're floating down a glistening river shaded by tall willows. Blue herons step slowly through shallow water in search of a meal. A salamander slips off of a rock as you glide by. Along the banks a bullfrog croaks. You beach the canoe and walk to the top of a bluff. There a small group of people are re-

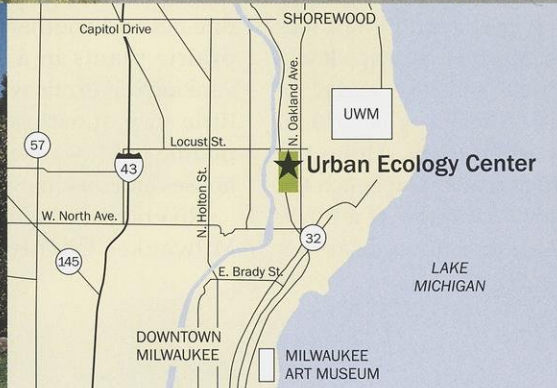
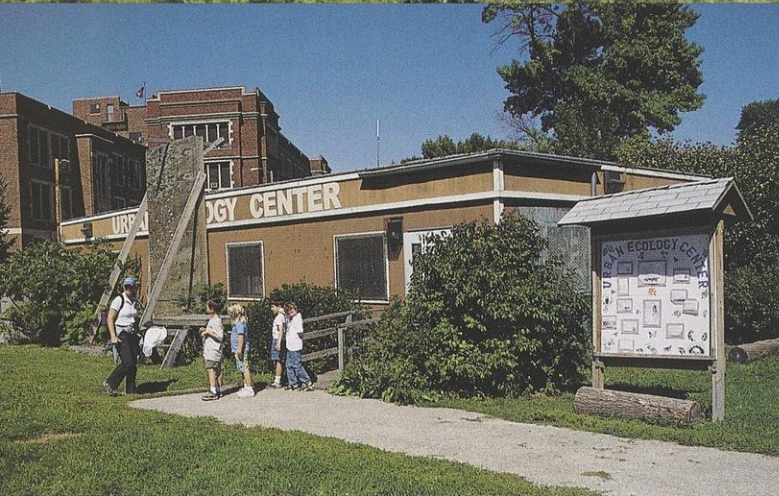
moving small songbirds from a very fine net and another group is planting prairie plants in a small area while yanking out exotic weeds. Where is this little slice of natural paradise? In the middle of Milwaukee, just blocks from houses and bustling traffic.

Riverside Park has been part of the Milwaukee County Park System for

more than 100 years. Situated at the end of stately Newberry Boulevard, the park provides a green buffer between a busy commercial corridor and the Milwaukee River. In addition to providing three acres of traditional park complete with softball fields and playground, Riverside offers 12 acres of natural outdoor classroom with prairie plantings, oak groves and aquatic plants.

The park is also home to the Urban Ecology Center, a community-based environmental education center working to enhance the park as a research laboratory and as a classroom for residents and school children living in the sur-





The Urban Ecology Center lies within Riverside Park on 12 acres adjoining the east bank of the Milwaukee River just north of downtown Milwaukee. The Center serves 12 neighborhood schools and adults who want to get involved in outdoor research projects, recreation or nature observation.

rounding neighborhoods. Over the course of the school year, the Center conducts programs for more than 10,000 student visitors from 12 neighborhood schools as well as classes and workshops for more than 3,000 adults and families who visit the park every year.

The property also serves as a site for science research in a friendly, accessible setting. The Center connects researchers and graduate students from local colleges and universities with younger students and local elderly citizens who have an interest in the natural sciences. Researchers get valuable field assistance and the assistants get involved in real life field research.

It has been very rewarding to see citizen volunteers meeting and learning from university scientists," says Jim McGinity, Urban Ecology Center research liaison. Both gain from the experience, and the scientists get much

needed help collecting data.

Not long ago Riverside Park was an abandoned, crime-ridden eyesore in the community.

Field research

Last spring, the Urban Ecology Center laid the framework for conducting longer-term research by marking off grids every 50 meters in the more natural portions of the park. These grids will permanently mark study plots where plants and animals can be inventoried and changes can be tracked over time.

For instance, volunteers come to the park from 4-7 a.m. to take part in a bird banding study. They learn to set up and take down mist nets, safely extract the birds, handle birds delicately, apply the bands and record data. The up-close look at birds helps them identify species they subsequently see flying through

the area. Over the course of eight mornings last spring, the banders caught 85 birds of 27 different species including seven warbler species and four species of sparrows. The continuing project helps volunteers appreciate that this urban green space less than a mile from the Lake Michigan shore is a way station for long-distance migrating songbirds and a year-round home for other species. Weekly surveys note the diversity of the birds in the park and the phenology, or timing when the birds arrive and leave the park each year. This year, staff led bird walks every Thursday morning and the early risers tallied 145 species, including four species recorded here for the first time.

"I began bird watching a few years ago, but I had never seen a wild bird so close and certainly had never held one in my hand," says Eva Rumpf, a bird banding volunteer.

"I was astounded that so many species migrate through Riverside Park, a small area in the heart of Milwaukee, and this experience has reinforced my concern for protecting their habitats."

Last fall, in another research project, 50 monarch butterflies were tagged by Center staff and volunteers. The specially designed tags were obtained from the Monarch Watch program through the University of Kansas and all information gathered was submitted to the university. One of the tagged monarchs was recovered in central Mexico this past winter. Thanks to the project, researchers documented this butterfly traveled 1,768 miles on its annual migration! The center hopes this fun research continues each fall.

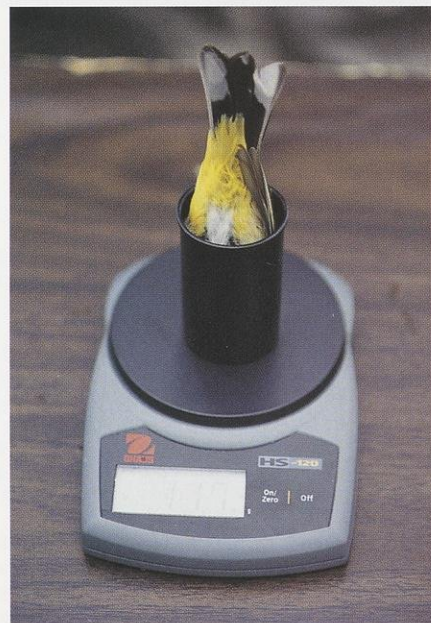
Another exciting find came last spring while doing weekly surveys of snakes living in the park. Four-by-four pieces of plywood (snake cover boards) were numbered, mapped and distributed in the natural parts of the property. The boards were lifted and checked quickly to see what had slithered, dug or burrowed underneath. In May, two Butler's Garter snakes (*Thamnophis butleri*) were found. Although this

threatened species is quite rare, they are at home in disturbed, urban areas. The discovery was even more thrilling when researchers realized one of the snakes was a pregnant female, as verified by Milwaukee Public Museum herpetologist Gary Casper. The snake survey by Kathleen Manke, an intern from Alverno College, working with neighborhood children and adults, also found the more common brown snakes (*Storeria dekayi*) here.

One other research project in the park takes a really long view forward, if it works. Center staff and interested neighbors developed a 100-year biotic plan to manage plant life on the property. It lays a continuing plan for prescribed burns on the prairie portion and a parcel adjoining the river to begin ridding the park of invasive exotic species before native species will be planted. A committed team of volunteers, the Burdock Brigade, will do hand-to-root combat with the alien species. The plan focuses on maximizing diverse plant communities in the park using native species to try and replicate the pre-settlement environment as much as possible. As many as ten different plant communities may be developed including the prairie and a southern mesic forest. Volunteers will first catalog the types, conditions and locations of trees and plants currently found in the park. Invasive species will be removed and native ones replanted. "The long time-frame in our plan is giving local citizens a sense of ownership and responsibility for this urban park," says Kim Forbeck, Urban Ecology Center land steward.

(left) Early morning birders set up mist nets to catch, measure, band and release songbirds. Twenty-seven species were banded over the eight-day spring study.

(below) Volunteers try their hand using research equipment like a digital scale sensitive enough to weigh birds.



Supporting urban nature centers

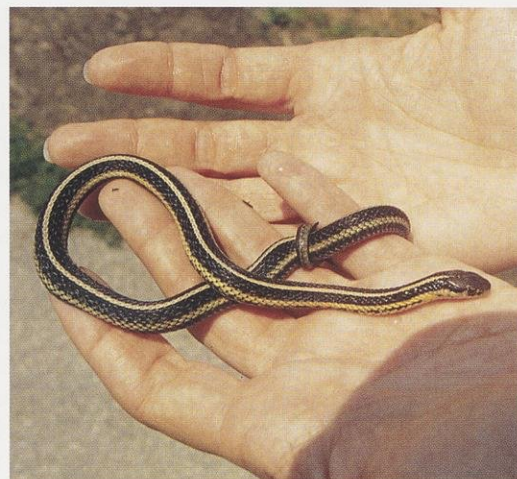
It takes some doing to convince people they can find real opportunities to interact with nature in town. Many believe they have to venture to rural areas to have natural experiences. Programs at centers statewide offer participants and volunteers new-found knowledge and appreciation for what's in their own back yards. If you can make the mental jump beyond the mown grass on the edge of a busy intersection, even small green spaces have natural stories to tell in the hands of curious learners and en-

thusiastic teachers. Creatures and plants make their homes there, and even rare or threatened species may feel quite comfortable in urban settings if conditions are right.

Urban green spaces also make an excellent outdoor classroom for students of all ages and backgrounds. Once you get away from the mindset and expense of busing students to more pristine areas for field trips, you may inspire people to more regularly take a close look at the environment. Where nature is accessible, people visit more often and can appreciate changes as they follow natural cycles. The mission of places like the Urban Ecology Center is to connect learners of all ages to the natural aspects of their neighborhood. The hope is that with repeated exposure, these people will better connect to the natural world and will be better stewards of it.

These open spaces surrounded by teeming neighborhoods present some interesting challenges as well. Given that the most densely populated space in Wisconsin lies within a mile of River-

The Milwaukee park takes part in the University of Kansas Monarch Watch to tag monarch butterflies and verify their migration routes to Mexico. From a summer range of millions of acres in the eastern U.S., 100 million monarchs migrate to about a half dozen oyamel fir tree groves on five to six acres of Mexican forest.



Many of the state's nature centers offer chances for community research and exploration.

(left) Under this snake board at the Urban Ecology Center, (right) researchers found the threatened Butler's garter snake.

side Park, these 15 acres could be in danger of being loved to death. Public parks are viewed as fair game, and mountain bikes, dogs and hikers all have their own needs. A key is getting some neighborhood consensus about the range of activities one parcel can handle.

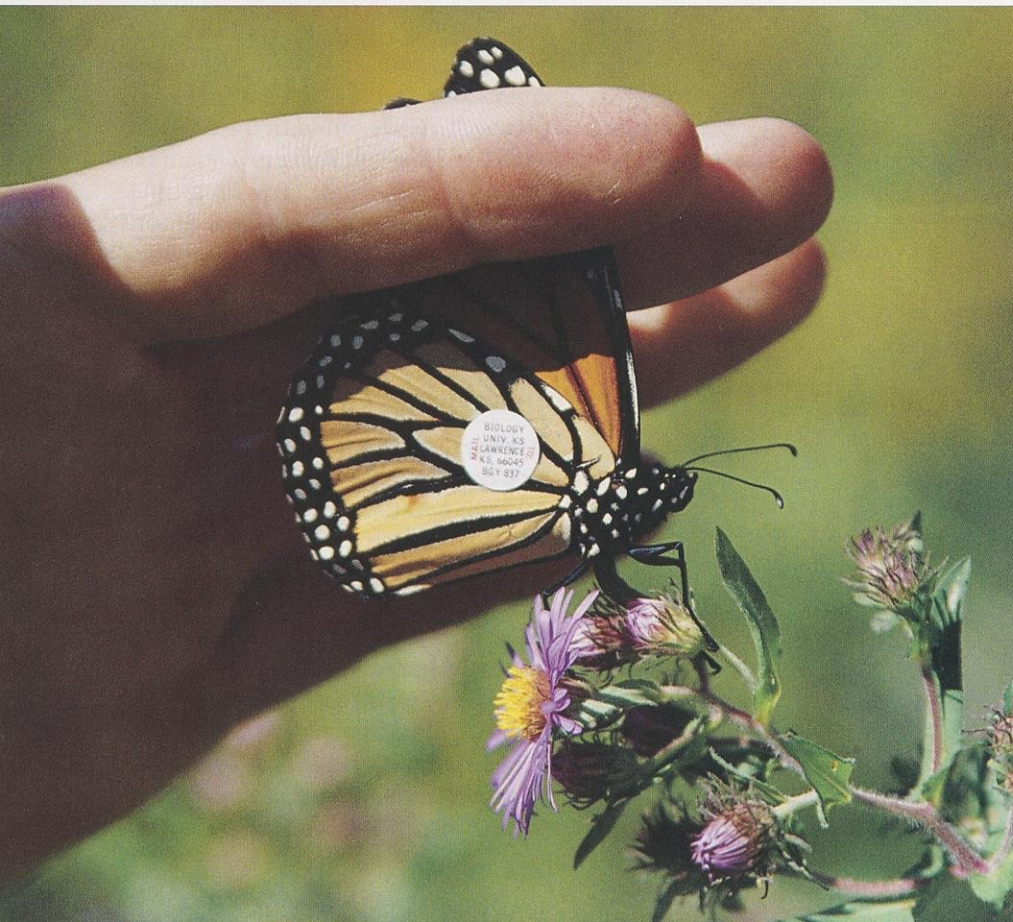
Though most people view parks as

places to get exercise, one program at the Urban Ecology Center is designed to provide more of a mental workout than a physical one. The Citizen Science forums provide an outlet for city residents who want to study science more seriously. Students and adults are encouraged to develop research projects examining plant, animal, habitat and human conditions in the Riverside Park area. Research results are shared through monthly presentations at the center and throughout Milwaukee. Citizen Science lectures have examined nature-based wastewater treatment, identified wildlife corridors in the neighborhood, and have discussed life histories of animals living in the park. Updates on current research projects are also presented. On December 10 at 7 p.m. researchers will share results of the spring snake survey.

To discover more about family outings, lectures and opportunities at the Urban Ecology Center, contact us at (414) 964-8505 or check out our website at www.urbanecologycenter.org. But by all means, follow our advice and discover opportunities to explore nature in town near your back yard. Check out similar opportunities for nature study, skills classes, research and fun at state parks, state forests, museums and the centers nearest your home listed here.



Theresa J. Lins is on the publicity committee of the Urban Ecology Center at Riverside Park in Milwaukee.



1000 Islands Environmental Center
1000 Beaulieu Ct.
Kaukauna, WI 54130

Aldo Leopold Nature Center
300 Femrite Dr.
Monona, WI 53716

Bay Beach Wildlife Sanctuary
1660 East Shore Dr.
Green Bay, WI 54302

Beaver Creek Reserve-Wise Nature Center
S1 County Hwy. K
Fall Creek, WI 54742

Bethel Horizons Nature Center
4651 Hwy. ZZ
Dodgeville, WI 53533

Brillion Nature Trails Center
315 S. Main St.
Brillion, WI 54110

Bristol Woods-Pringle Nature Center
9800 160th Ave.
Bristol, WI 53104

Cable Natural History Museum
P.O. Box 416
Cable, WI 54821

Calumet County Ledgeview Nature Center
W2348 Short Rd.
Chilton, WI 53014

Camp 5 Museum
Rt. 1
Laona, WI 54541

Central Wisconsin Environmental Station
10186 County Rd. MM
Amherst Junction, WI 54407

The Clearing
P.O. Box 65
Ellison Bay, WI 54210

Collin Marsh Nature and Educational Center
862 Lawton Terrace
Manitowoc, WI 54220

Crex Meadows DNR Wildlife Area Visitor Center
Box 367
Grantsburg, WI 54840

Devil's Lake State Park Nature Center
S5975 Park Rd.
Baraboo, WI 53913

Durward Glen Retreat
W11876 McLeisch Rd.
Baraboo, WI 53913

Ellwood H. May Environmental Park
3615 Mueller Rd.
Sheboygan, WI 53083

Fallen Timbers Environmental Center
10 Circle Dr.
Seymour, WI 54165

Florence Natural Resources and Wild Rivers Interpretive Center
HC 1, Box 82A
Florence, WI 54121

Glacier Hills Nature Center
1664 Friess Lake Rd.
Hubertus, WI 53033

Glacier Hollow
P.O. Box 7, 8269 Pavelski Rd.
Nelsonville, WI 54458

Gordon Bubolz Nature Preserve
4815 N. Lynndale Dr.
Appleton, WI 54915

Havenwoods Environmental Center
6141 N. Hopkins St.
Milwaukee, WI 53209

Hawthorn Glen Outdoor Educational Center
1130 N. 60th St.
Milwaukee, WI 53208

Hawthorn Hollow Nature Sanctuary
880 Green Bay Rd.
Kenosha, WI 53144

Heckrodt Wetland Reserve
P.O. Box 554
Menasha, WI 54952

Henry S. Reuss Ice Age Visitor Center
Kettle Moraine State Forest
N1765 Hwy. G
Campbellsport, WI 53010

High Cliff State Park
N7630 State Park Rd.
Sherwood, WI 54169-9615

Hixon Forest Nature Center
2702 Quarry Rd.
La Crosse, WI 54601

Hunt Hill Audubon
N2384 Hunt Hill Rd.
Sarona, WI 54870

International Crane Foundation
E 11376 Shady Lane Rd.
Baraboo, WI 53913

Interstate Park Ice Age Interpretive Center
Box 703
St. Croix Falls, WI 54024

Jordan Park Nature Center
1516 Church St.
Stevens Point, WI 54481

Kaytee Avian Education Center
585 Clay St., P.O. Box 230
Chilton, WI 53014

Kemp Natural Resources Station
8031 Kemp Woods Rd.
Woodruff, WI 54568

Kienitz Nature Center
Council Grounds State Park
N1895 Council Grounds Dr.
Merrill, WI 54452

Lac Lawrann Conservancy
West Bend Park Dept.
300 Schmidt Rd.
West Bend, WI 53095

Living Waters Nature Center
Rt.1, Box 86A
Westby, WI 54667

MacKenzie Environmental Education Center
W7303 County Hwy CS
Poynette, WI 53955

Marsh Haven Nature Center
W6431 Sunset Rd.
Juneau, WI 53039

Mecan River Discovery Center
W3281 Dixie Ave.
Neshkoro, WI 54960

Mosquito Hill Nature Center
N3880 Rogers Rd.
New London, WI 54961

Nature in the Parks

Falk Park
2013 W. Rawson Ave.
Oak Creek, WI 53154

Nature-wise Outdoor Education
3962 Hillside Rd.
Egg Harbor, WI 54209

Navarino Nature Center
P.O. Box 606
Shawano, WI 54166

Norskedalen Nature and Heritage Center
P.O. Box 225
Coon Valley, WI 54623

Northern Lakeland Discovery Center
P.O. Box 237
Manitowish Waters, WI 54545

Northwoods Wildlife Center
8683 Blumstein Rd.
Minocqua, WI 54548

Outdoor Skills Center
P.O. Box 84
229 Fairview Dr.
Plymouth, WI 53073

Perrot State Park Nature Center
P.O. Box 407
Trempealeau, WI 54661

Pigeon Lake Field Station
RDI Bldg., UW-River Falls
River Falls, WI 54022

Retzer Nature Center
W284 S1530 Hwy. DT
Waukesha, WI 53188

Ridges Sanctuary
P.O. Box 152
Baileys Harbor, WI 54202

River Bend Nature Center
3600 N. Green Bay Rd.
Racine, WI 53404

Riveredge Nature Center
P.O. Box 26
Newburg, WI 53060-0026

Sanderling Nature Center
Kohler-Andrae State Park
1520 Old Park Rd.
Sheboygan, WI 53081

Sandhill Wildlife Area — DNR Outdoor Skills Center
Hwy. X, Box 156
Babcock, WI 54413

Schlitz Audubon Center
1111 E. Brown Deer Rd.
Milwaukee, WI 53217-1999

Seno Woodland Education Center
County P
Burlington, WI 53105

Sheboygan County Outdoor Skills Center
P.O. Box 522
Sheboygan, WI 53082

Sinsinawa Mound Center
County Rd. Z
Sinsinawa, WI 53824

Snake Road Adventure Center
1724 Main St.
Lake Geneva, WI 53147

St. Croix Environmental Center
532 County Rd. F
Hudson, WI 54016

Teaching Drum Outdoor School
7124 Military Rd.
Three Lakes, WI 54562

Trees for Tomorrow
P.O. Box 609
Eagle River, WI 54521

Twin Oaks Environmental Center
D C Everest High School
6500 Alderson St.
Schofield, WI 54476

Upham Woods 4-H Environmental Education Center
N104 County Trunk N
Wisconsin Dells, WI 53965

Urban Ecology Center
Riverside Park
2808 N. Bartlett Ave.
Milwaukee, WI 53211

Wehr Nature Center
9701 W. College Ave.
Franklin, WI 53132

West Shores Interpretive Center Barkhausen Waterfowl Preserve
2024 Lakeview Dr., Box 187
Suamico, WI 54173

White Cedar Nature Center
Peninsula State Park
P.O. Box 218
Fish Creek, WI 54212

Whitefish Dunes State Park
3701 Clark Lake Rd.
Sturgeon Bay, WI 54235

Woodland Dunes Nature Center
P.O. Box 2108
Manitowoc, WI 54221-2108

Long live the

KINGS



A catch-and-release ethic and sound management are restoring strong populations of big muskies to many Wisconsin waters.

Lisa Gaumnitz

Half a century after anglers pulled the last of four world-record fish from Hayward area lakes, monster musky are again prowling Wisconsin waters.

Restrictive size limits, a catch-and-release ethic, and a hatchery system hitting its stride have succeeded in rebuilding musky populations that teetered on collapse due to three decades of frenzied fishing following those world-record catches in the 1950s.

"We've done a phenomenal job of rebuilding the population to trophy quality," says Frank Pratt, the Department of Natural Resources fisheries biologist for Rusk and Sawyer counties for 28 years. "Thirty years ago there was virtually no such thing as a 40-inch musky in Wisconsin waters and 10 years ago there was virtually no such thing as a 50-inch musky.

"Well, we've broken both those size barriers — we've smashed them — and I think we'll be back to the historical potential for world-class muskies within the decade."

Muskies, once famed as the fish of

10,000 casts, are now being caught in Wisconsin in an average of 3,000 casts. As one indicator, every year for the past 13 years Muskies, Inc. members have landed an average of 29 fish larger than 48 inches and nine muskies larger than 50 inches from Wisconsin waters.

Although the ranks of musky hunters has swollen to an estimated 360,000, nearly three times the number in the late 1950s, anglers are releasing 98 percent of the fish they catch to grow bigger and fight another day.

This turn of events, exceeding even the most optimistic expectations, is spurring an evolution in Wisconsin's approach to musky stocking. Fish biologists hope a change in the public's view of stocking will come around, too.

"Stocking is often viewed as a panacea," says Steve AveLallemant, DNR fish expert for northern Wisconsin, "but it is only one of many management tools. The key thing to remember about any stocking is it only addresses poor natural reproduction [in a fish population]. It doesn't do anything to address the many other reasons a fishery may be

declining, including harvest."

Stocking musky is a relatively intensive, expensive process. Costs run about \$70 per stocked fingerling that survives for 18 months in the wild. DNR research has shown that stocking can actually work against a fishery: artificially high densities of stocked fish can slow fish growth. Musky catch rates tend to be better on waters with natural reproduction that receive little or no stocking.

"We have good science on how many fish are being taken out by angling and spearing, and we have a better idea than we did about the abundance of adult fish," AveLallemant says. "What we don't have a good handle on is how much was put there by Ma Nature, and how much was put there by stocking? The goal is not to stop stocking musky, but to stock them in a manner that's of the most benefit, biologically and financially."

For decades, DNR fisheries staff have captured, aged and measured muskies each spring to learn about growth rates, size distribution and population structures in lakes where muskies are stocked or reproduce naturally.



TERRY MARGENAU



COURTESY OF TERRY MARGENAU

In the early decades of the 1900s, a catch like this wasn't uncommon. If you guess these big fish are 20 years old and the smaller ones at least 10, then a harvest like this cropped better than 170 years of growth in one day. No fishery can sustain or replace that loss quickly.

A glacial relic

Wisconsin's state fish is both a relic and a legacy of glaciers that scoured Northern America. As the last glacier receded about 12,000 years ago, the meltwater flooded lakes and rivers, creating common highways that species in the lower Mississippi River basin traveled to repopulate the Great Lakes, upper Mississippi River and Hudson Bay basins.

Little was known about the abundance of musky in Wisconsin at the beginning of the 20th century, but they were apparently confined to lakes and streams at the headwaters of the Black, Chippewa, Flambeau and Wisconsin rivers. About 20 counties were believed to contain musky at the time. Stocking has since extended that range and muskies are now found in 711 lakes and 80 river and stream segments in 48 counties. Except for extreme southwestern Wisconsin, there is musky water in just about every part of the state.

Fish biologists now know that musky densities are very low, even in the best waters, because muskies are large top predators (world-record specimens push 70 inches and 70 pounds) that tend to choose vulnerable spawning sites, such as silted areas in shallow water where the eggs may suffocate or be disturbed by boat traffic or other human activity. Good musky waters av-

erage about one adult fish for three surface acres; that compares to up to 20 adult walleye per three surface acres in a really good walleye lake.

Absent such knowledge in the late 1800s and early 1900s, state fisheries officials and some sportsmen worried about musky populations. "Pen cannot chronicle the unspeakable butchery which took place over all the Wisconsin wilderness when the railroads first penetrated that virgin country... The merest novice might take a dozen, a score, indeed two scores of magnificent muscullunge in a day's fishing," stated an article from the August 1901 Outing magazine reprinted in *A Compendium of Musky Angling History*.

In 1899, Wisconsin started to replen-

ish lakes with musky fry, grown from eggs incubated in glass jars at Woodruff, and eventually at 18 seasonal hatcheries in northern Wisconsin. Fry, which were less than an inch long, were transported in milk cans over rutted lanes and primitive logging roads, and then released into lakes.

That practice continued until the 1940s, when techniques for rearing fish in ponds enabled Wisconsin to start raising fingerlings seven to 12 inches long at the Woodruff Hatchery and the Spooner Fish Hatchery.

Sport fishing grew in the 1940s as World War II soldiers returned home and people turned to peacetime pursuits. By 1958, an estimated 107,000 anglers were catching and keeping an estimated 47,700 muskies a year, based on a license survey.

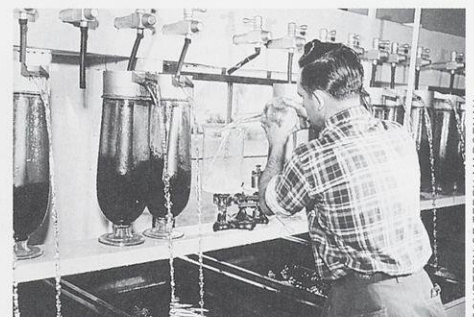
"If it was a legal fish, it was getting harvested," says AveLallemant. "It had to do with angler perception at the time — it was cool to have a couple hanging on the board."

Fisheries managers feared the annual take of musky was exceeding the fish's ability to sustain itself because so many adults were being taken out of the population, but there was little documentation to support this hunch. Few creel surveys had been done, and sampling for adult populations wasn't widespread or consistently conducted on the same lakes over time.

Catch-and-release catches on

The growing perception that musky populations were declining due to over-harvest and poor spawning habitat

Musky propagation has changed a lot from these days. Hatchery workers developed techniques to reduce fish stress and disease spread before stocking. Now, incoming water is treated with UV light to kill off bacteria and fungi before it reaches fertilized eggs.



COURTESY OF TERRY MARGENAU

spurred state fisheries officials to action in the late 1970s. Projections indicated that by 1990 increasing numbers of anglers and a growing musky harvest would exceed levels needed to sustain the fishery. Resource managers launched a strategic planning process to short-circuit that possibility.

The resulting musky management plan called for more restrictive harvest regulations that included raising the 30-inch minimum size limit statewide, increasing data collection, encouraging voluntary catch-and-release, and protecting spawning habitat. Increased stocking was a focal point.

"The analysis saw demand for muskies going up and supply going down. Managers felt the best way to address the matter at the time was to get into a fairly extensive stocking program for that critter," says AveLallemant. "[The Woodruff and Spooner hatcheries] geared up to start pounding out the musky."

In 1985, the hatchery system produced 200,000 muskies for stocking. The rule of thumb was to stock lakes at twice the annual harvest rate. Because they didn't have good information on the harvest, fisheries staff assumed the harvest rate to be one fish per acre, according to Tim Simonson, the DNR's long-time warmwater species specialist. Most lakes were getting stocked at two fish per acre, regardless of whether the lake had naturally reproducing muskies.

"That stocking rate was very high given present conditions," Simonson says. "We know through creel surveys that the harvest is so much less — .02 fish per acre, or 2 fish per 100 acres now."

The stocking formula didn't anticipate the popularity of catch-and-release fishing, nor the impact it would have on reducing the harvest. "Muskies, Inc. came in and said, 'let the fish go' — and anglers did," says Simonson. "They were way ahead of their time."

In the early 1980s, the projected harvest from 356 Class A, or "trophy waters," was 38,318 fish statewide. By 1990, that total had dropped to an estimated 8,541 fish, and by 2001, only 1,987 muskies were kept.

"It's a huge change," says Pete



(above) Hatchery foreman Phil Neubich and Jim Shipman seine some muskies from plastic-lined ponds at the Thompson Hatchery. Drawdowns can also drain muskies into catch basins for transfer. In the old rearing ponds sediment, algae and wastes stirred in the mix as fish were transferred for stocking.

(below) State hatcheries raise bigger fish than nature can produce in the same time period. Ryan Luell stocks bigger, healthier fish that have a competitive advantage and a better chance of reaching adult size.





TERRY MARGENAU

Muskies need a fierce nature because the odds of survival are so small. Very few eggs hatch and fewer than four percent live one year, even fewer reach adulthood. Fortunately, anglers realize the thrill is in the catching and release most muskies.

Maina of Hayward, who started a total catch-and-release guide service a decade ago and is well known for his musky fishing columns, books and videos. "When I started guiding at 14, we killed every single legal fish we got. Fishing was a lot tougher then. It was amazing to kill a 40-incher. I was told that was the way it was...you killed them and didn't think about it."

DNR biologists, including many who had been active in fisheries work since the 1970s, started to see the harvest decreases brought about by the catch-and-release ethic. Population and creel surveys verified the trend. More data flooded in as DNR ramped up sampling programs in the mid-1980s to help set tribal spearing quotas for musky and walleye and to assess those fisheries.

"Catch-and-release started getting rolling among the faithful, and we knew harvest rates were declining," AveLallemant says. "We knew too that since we started gearing up to raise muskies, the hatcheries were putting out a really good product. They were big, and survival rates were good."

The surveys and research revealed that increasing minimum size limits helped rebuild the populations. Statewide, the size limit increased from 30 to 34 inches in 1984, and even more protective limits were set on 25 percent of musky lakes. "We manage muskies lake by lake," Simonson says. "We look at biological potential, growth rates, historical information and the public's desire for higher size limits."

Managing musky by the numbers

Biologists like Frank Pratt took those changes into consideration and started

to throttle back on stocking some waters that showed improved natural reproduction.

"I started downgrading some of my quotas 10 to 15 years ago," says Pratt. "When I started here in 1974 at the top of the maximum sustained yield era, we were pushing them right to the edge of extinction without pushing them over."

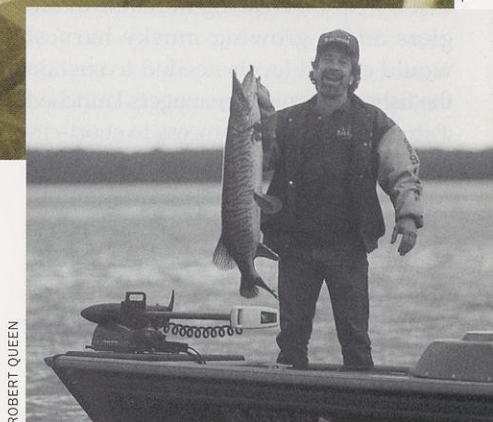
"We needed lots of little fish coming in because we were turning them over so quickly. In those days anglers were keeping muskies once they reached an average of five to seven years. Now it's 15 to 20 years. All a musky has to do is replace itself once in a lifetime. If a portion of your population is hanging around to 15 years, you don't need to stock that many."

Pratt discovered that whether he stocked or didn't stock, whether he put in a thousand fish or two thousand fish, the results seemed to be the same: the only real change was in the size and age structure of the population. "There's some type of feedback loop going on," he says. "This is a beast that has an innate carrying capacity."

Even as one-month-olds, muskies are top predators. Raising them is especially challenging because they only eat live food and keeping them stocked with "groceries" of the right size is costly.



TERRY MARGENAU



ROBERT QUEEN

A musky lake with good natural reproduction will have one young-of-the-year per mile — about .25 per acre.

Many of these findings were starting to come together when the Legislative Audit Bureau (LAB) reviewed the DNR's fish propagation program in 1997. The LAB concluded DNR's system was inadequate to meet the growing demands for fishing. In response, DNR fisheries biologists recommended establishing a management framework to protect the genetic integrity of native fish, and to make stocking of musky and other species less expensive and more effective.

In general, stocking fewer fish but larger fish has proven to be more economical than stocking lots of small fish. Only .004 percent of fry stocked shortly after hatching in the spring survive to fall, and only four percent of



(above) Fall surveys temporarily shock fish to assess how many young fish survive from stocking and natural reproduction.

(below) On the other hand, spring netting tracks the weight, growth, age and population structure of adult musky populations. (left to right) Fish Technician Dave Brum and Musky Expert Steve AveLllemant.



STEVE HEITING, MUSKY HUNTER MAGAZINE

those survivors make it to the next year. Consequently, 588,235 fry would need to be stocked to result in one surviving musky at a cost of about \$800 per musky, according to figures from work done by University of Wisconsin-Stevens Point professor Michael Hanson and DNR researcher Terry Mergenau. Survival and cost rates for stocking fish as 10- to 12-inch-long fingerlings would require 25 fish to yield one surviving musky at a cost of \$70.75 per musky.

The new framework enters its second year this fall. Each of the 220

stocked musky waters in the state has been assigned to a specific stocking practice for 10 years based on its reproductive status. Biologists will assess the fisheries through continued surveys.

- Category 0 waters, those in which the reproductive status is unknown, will be stocked at one or two fish per acre.
- Category 1 waters, those lakes with self-sustaining populations will not be stocked.
- Category 2 waters, those with some natural reproduction and some stocking, will be divided into four treatments; some won't be stocked, some will be stocked at a rate of .5 muskies per acre, some at one fish per acre, and some at two fish per acre.
- Category 3 waters, those in which stocking is required to maintain the fishing, will be stocked at .5 per acre, one and two fish per acre.

The framework can be adapted as needed. "We will hold things constant for a period of time, then look at the results, and change it if we need to," Si-

monson says. He sees no real danger that musky populations in the lakes would decline — the harvest is just not that high, the fish can live 30 years, and they have plenty of time to reproduce and "replace" themselves.

"The worst-case scenario is that people will have somewhat lower numbers but bigger muskies in a water," Simonson says. "The best-case scenario is that we'll be able to stop stocking some lakes altogether. That would be good news and a real sign of success. It would imply that something really good is happening in those waters." ■

Lisa Gaumnitz explains and presents fisheries and water quality issues for DNR's Water Division.

WISCONSIN NATURAL RESOURCES

We annually publish a subject index of our stories each December. A cumulative index of our stories 1977–2002 is also available as a file you can download from our website: www.wnrmag.com. Please note this is a large file (more than 350,000 bytes and in excess of 100 pages), so browse before you print!

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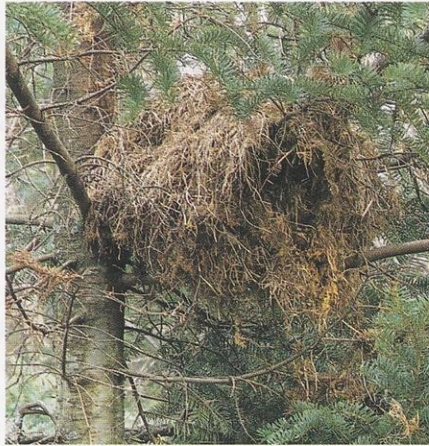
Woodland deer mice prefer to nest in elevated cavities — often in woodpecker holes, birdhouses, or knotholes. In the case of my cabin mouse, it is happy to live in the insulation between the drywall and roof. I can always find its nest by the presence of Owens-Corning's finest fiberglass strewn about the floor below her new home. Nests in the woods are almost as easily found. If you happen upon a 10- to 12-inch high pile of grasses, leaves and moss built on an old bird nest, you have undoubtedly found a deer mouse home. A pregnant female builds the spherical pile when the young are about to be born. She will use the nest for about a month while she rears her young, then move on to another site.

Males build nests throughout the year as well; changing sites as their abode becomes fouled with feces and urine, which all deer mice deposit in the nest. Male and female nests can be distinguished, if you have a little patience. Over the course of a week or two, listen for the tiny, almost imperceptible squeaks of the babies coming from the cavity. It's not uncommon for the adult mouse to sense your presence and silence the newborns, so you'll probably have to wait quietly for at least ten minutes before you'll hear anything. If you don't hear anything from the nest after two weeks of listening, you most likely have a male nest or an abandoned nest left behind for a less odiferous site.

Prairie deer mice prefer to reside on or slightly under the ground. You'll find their nests beneath a log or board, in an old tire, or inside an abandoned chipmunk burrow. The prairie deer mice also live among piles of rocks left along farm fields where the little critters hunt and store food for winter.

Deer mice are omnivorous, feeding on both plants and small bugs. In winter, deer mice feed on the insect larva, pupa and dormant adults as well as oak acorns, hickory nuts, beech nuts, pine cones and hazelnuts that are stockpiled in winter caches. These root cellars sometimes contain huge quantities of food, up to two gallons, although a pint or quart is more common.

The stored larder is gone by spring



This deer mouse nest in a balsam fir was about two feet long and more than a foot in diameter.

or summer when the rodents turn to a diet heavier in insects. They even tackle grasshoppers, which are large if you are the size of a deer mouse. The mouse at my cabin will sometimes sit outside the window at night waiting until a particularly delectable moth is attracted to the light.

A little later in the season, fruits including pin cherries, blueberries, raspberries, blackberries and partridgeberries are eaten. I even discovered a mouse-sized supply of gooseberries in a floor crevice when I was remodeling

last summer.

While the deer mouse in my cabin is safe eating her gooseberries, mice living in less domestic haunts are eaten by a host of predators. Mammals like weasels, striped skunks, raccoons, foxes, coyotes and domestic cats prey heavily on the small cricetids. A variety of hawks and all owl species in Wisconsin feed on unwary mice. At the cabin, a great horned owl often perches in the spruce tree next to the mouse's favorite feeder.

So far the four-legged creature has safely gathered seed from the tray outside the window. Seemingly fearless, she isn't even bothered by my face pressed against the glass as I watch her antics. As if she knows there's a barrier between us, she darts out of a small gap in the sill, grabs a seed, and returns to the space between the walls. I suspect she piles the provisions there, waiting for me to go to sleep before filling my boot liners. It's only when I stir that she becomes alarmed and rapidly stamps her feet against the floor in a warning to all before vanishing into a crevice. ❧

John Yost writes from a rustic cabin in the Wausau area.

Watch those droppings

Though deer mice are cute to see, be careful when sweeping up their droppings. Deer mouse feces, urine and saliva can carry a variety of Hantaviruses that can cause a respiratory illness that has sickened and even killed people. Symptoms of Hantavirus exposure include fever, chills, occasional headaches and possibly digestive problems. A few days later, breathing problems can start including coughing and a shortness of breath. The actual number of people affected since this disease was first described is quite low, but take these precautions.

If you are cleaning out a cabin, garage or room, particularly one that has been closed up for some time, open the doors and windows to get plenty of fresh air flow *before* you start your cleaning. Don't vacuum or sweep mouse droppings; which might suspend the infective organism. Wear rubber gloves, thoroughly wet the area with a disinfectant, and then carefully wipe up the droppings with a paper towel and dispose of them in the trash. If you are kicking up a lot of dust during your cleaning, please consider wearing a facemask or respirator as well.

Animals are not known to get sick from this virus and, other than the rodent species directly involved, no other animals are known to spread it. For example, a cat that eats an infected deer mouse will neither get sick, nor will it spread the disease.

COMMENT ON A STORY?

Send your letters to Readers Write, WNR magazine, P.O. Box 7921, Madison, WI 53707 or e-mail letters to sperl@dnr.state.wi.us.

BLUEBIRDS IN THE BURBS

Regarding all the letters about bluebirds in the August Readers Write, when we moved onto our three-acre property in Richfield five years ago, my husband carefully built and installed bluebird houses based on DNR specifications. Pairs of bluebirds and tree swallows immediately graced our boxes, and we've had nesting pairs every year since then.

Unfortunately, less than half of the hatched chicks survive to fully fledge each year due to the activities of feral and wandering cats. We have spoken to neighbors; we've set live traps and taken feral cats (and donations) to our area humane society. Many of these cats are suffering from disease. We have contacted our town constable to request that a nearby farm spay, neuter or contain their cats so that litter after litter of unwanted, ill cats will stop appearing in our yard — all to no avail. We still see cats hunting in our yard and we witness nest damage and death of baby birds.

This year, not one nest of bluebirds or tree swallows survived.

The moral of my tale is that it is quite easy to encourage bluebirds to nest in suburban areas, but getting them to grow up without mishap is another story. Until leashing laws are incorporated in suburban areas, songbird populations will continue to be affected. Here in Richfield, we aren't allowed to keep chickens, goats or sheep on our three acres, yet the neighboring farm does not have to comply with any regulations that view cats as pets rather than livestock. They aren't required to

control their populations, register them or ensure their health in any way.

In the meantime, we will continue to trap strays and take steps to protect our nest boxes, but that won't protect the little ones as they leave the nest and can't fly properly for a week or so.

*Mrs. Jeffrey Wussow
Colgate (Richfield)*

GREEN XMAS TREES

I have a 20-acre choose-and-cut Christmas tree farm with mostly scotch and white pine, spruces and firs. We have not chosen to use chemicals or herbicides much, though overgrown, diseased scotch pines depress me. Your article ("That perfect tree," December 1997) helped me realize that I can look beyond the mess, eke out as much income as possible on the decent trees and know that we are helping the environment.

*Cornelia Ahrens
Rockport, Ind.*

For those readers who have only been with us a few years, please note that the text of all of our stories since 1996 is available free online at www.wnrmag.com. You can search by topic, author or date for stories. We also maintain an online index of all stories we have carried since 1977 if you are interested in a particular topic. Most of our back issues are available for sale through our editorial office, WNR magazine, P.O. Box 7921, Madison, WI 53707.

A BIRD I.D.

I believe in Peter Nelson's comments in the August Readers Write column "Bird on the wing" that he is describing the common flight patterns and physical characteristics of the American sandhill crane (*Grus canadensis*). They migrate to North Dakota and Minnesota in

the spring of each year after wintering in the southeastern United States. The community of Blair, Wis. where he saw them is on the migration route to the north central breeding grounds.

*David Maren
La Grange, Ill.*

MORE CREHORE TALES

I enjoy reading many of the articles I've seen on your website. They are very informative, off the beaten track for most outdoor-related magazines, and sometimes just calming to read. Keep up the great work and please tell Dave Crehore to write more stories about his father, Clifford, the shipyard, and himself!

*John Gerckhardt
Menomonee Falls*



Water Witcher! I'm responding to your August story "The celebrated water witch of Door County."

I used to build homes for a living, and after some years of building, I brought in a water witcher who could not only tell you by the power of the pull on a willow stick if there was a lot of water, but also how deep to drill. I watched that willow stick bend down in his hands. I watched him hold this six-foot-long stick out in front of him. It bobbed once for each foot the well had to be drilled. This gentleman never moved his hand the whole time. When the stick stopped bobbing and went sideways, you just knew how deep

to dig. My father and I both thought this was a special blessing to some people.

I had to laugh as I watched my nephew watching a witcher. He still has a hard time believing what he has seen with his own eyes as the bark peeled off the willow stick while the witcher sought water. The water witcher my nephew saw couldn't tell you how deep to drill, but he sure could tell you if he has a good strong pull on the stick. Only one of that witcher's five children was similarly given the gift to find water with a stick.

I have never met a well driller who believes in well witching, but even though I have had some failures with some witchers, I still will have my wells witched.

*Ralph Lang
Marshfield*

OF CACTI AND EXOTIC SPECIES

I just finished reading the August issue and found many interesting articles, as usual. The "CWD update" was important information for us in Minnesota.

I also noted that prickly pear cactus grows in Wisconsin. It is not unusual in the western Minnesota prairies and we see it on the national wildlife refuge near the Minnesota River, but it was interesting that it occurs farther east.

You also talked about exotic organisms. This year two fairly large alligator or caiman-like critters up to three-feet long were found in Twin Cities area lakes. Also a piranha-like harmless relative type of tropical fish was found in another lake around the Twin Cities. Maybe an article warning about dumping exotic animals might make a good idea.

*Diane Christianson
Elko, Minn.*

Kites and pies

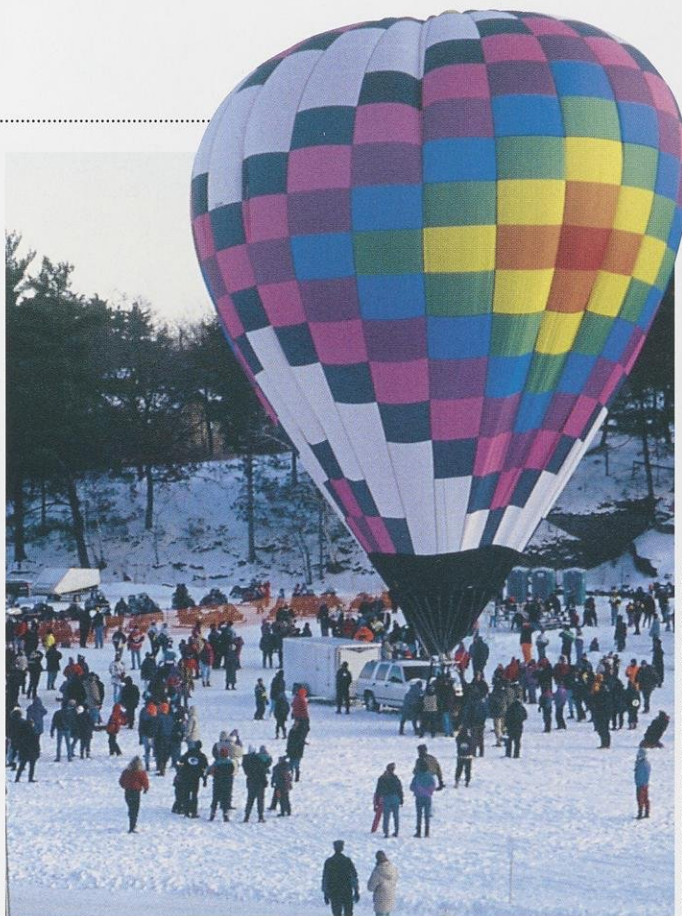
Winter — when innumerable layers of wool and Thinsulate constrict the body, and early-onset darkness cruelly compresses the soul — is the best time of year to expand your mind. Take a look at what folks around the world do for fun, or re-examine your view as to what constitutes a winter sport. Wisconsin offers ample opportunities to do both.

Each year the **International Arts Festival** in Milwaukee celebrates a different culture. Last year, the Scandinavian countries took center stage. This year? More Scandinavian culture! Rest assured you'll be able to enjoy musical performances, art exhibits, films, and food at different locations all around the city. Organized by the Marcus Center for the Performing Arts, the festival runs from Feb. 1–March 31.

Call (414) 273-7206 or visit the www.marcuscenter.org for a calendar of events and ticket information.

Madison's annual **Kites on Ice** will brighten the winter sky with colorful flights of fancy kites on Feb. 1–2 at the Monona Terrace Convention Center. This year's kite fest focuses on the different styles of kites crafted across the globe in China, Japan, Germany, New Zealand and other countries. Create your own high-flier in a kite-making workshop and get tips on flying kites not only outdoors, but indoors as well. (Watch out for those ceiling fans.) The synchronized kite flying performances promise to thrill all visitors with breathtaking feats of aerial dering-do. See www.madfest.org or call (608) 241-1930 for the festival schedule.

The residents of Gilman in Taylor County don't let the snow drift around their ankles, no sir. TRAVELER suspects this



WISCONSIN DELLS CONVENTION & VISITORS BUREAU

(left) Warm up in winter at the torchlight parade at Sniegfest in Gilman or take to the air and Flake Out in Wisconsin Dells (above).



SNEGFEST

On course



Make snowshoes and learn how to use them. Track a wolf. Learn how to light a fire without matches or a Zippo. Brush up on the basics of botany, or bring yourself up to speed with the latest developments in urban forestry. UW-Extension publishes "Environment 2002/2003," a biannual listing of environmental education courses, events and workshops for adults held around the state. For a copy, write Environmental Course Opportunities, Environmental Resources Center, School of Natural Resources, University of Wisconsin-Cooperative Extension, 1450 Linden Drive, Room 216, Madison WI 53706.

doughty little community hosts its **Sniegfest** simply to chortle in the face of Old Man Winter. This is the place where you can roll a few frames in an ice-bowling tournament, spank a spike in a snow volleyball match, and compete in a blind snowmobile race. (Yes, you read that correctly.) More prosaic events include snow sculpting, horse-drawn sleigh rides, a scavenger hunt, and a grand torchlight parade. Join in the fun on Feb. 1–2. (715) 447-8285.

Not to be outdone by Gilman, Elkhart Lake invites all to **Schnee Days**, Feb. 1–2, featuring winter golf and downhill bowling (Tip: Don't stand at the bottom of the hill...you might be mistaken for a pin.). Feast at the chili cook-off, make a couple of visits to the dessert table, and don't forget your skates — an ice rink will be open for you

to throw that perfect triple axel. See www.elkhartlake.com or call (877) 355-4278.

Gilman and Elkhart Lake, step aside for Wisconsin Dells, where the 13th annual **Flake Out Festival** on Jan. 18–19 will host the most challenging, demanding and inspirational of all the new winter competitions: The Eskimo Pie-eating contest. (Someday this one is going to be an Olympic sport. You read it here first.) Mitten football, turkey bowling, snowman making, hot air balloons, pony rides, snow and ice sculpting and more will be available for those who do not scream for ice cream, especially in January. For festival details and information on the nutritional content of an Eskimo Pie, visit www.wisdells.com or call (800) 223-3557. ❧

Wisconsin, naturally

DELLS OF THE EAU CLAIRE RIVER STATE NATURAL AREA

Notable: A scenic, narrow, rocky gorge and waterfalls where geologic forces resulted in an unusual vertical tilting of the bedrock. On this stretch of the Eau Claire River, water cascades over rock outcroppings of very hard, Precambrian-age rhyolite schist. The water flow through the dells is strong enough to produce potholes, formed by the grinding action of swirling sand and gravel. The surrounding uplands are wooded with hemlock, sugar maple, yellow birch, and Canada yew. The spring flora is rich in ephemerals.

How to get there: Within the Dells of the Eau Claire County Park. From the intersection of Highways 52 and Y in Hogarty, go west and south on Y about 3.3 miles to a parking area south of the river and west of the road. Hiking trails lead through the site. Wisconsin Atlas: page 77, grid D6.



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