


WISCONSIN NATURAL RESOURCES

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A LOW-SALT diet for roads

Adapting to changing climate

Tasty lessons on tap

Recycling roundtable

Winter heat in the hood



Once winter temperatures rise above freezing, skunk cabbage oxidizes starches stored in its roots. The biochemical reaction generates enough heat to melt surrounding snow and the plant gets a jump on the growing season.

GREGORY K. SCOTT

Skunk cabbage gets growing right through the snow.

Anita Carpenter

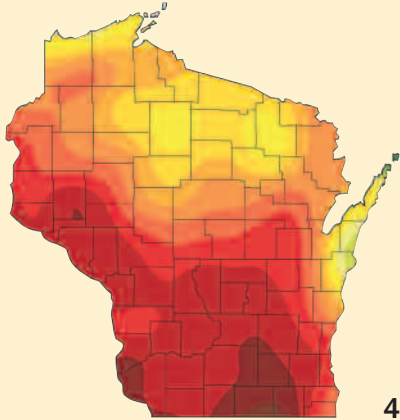
Winter reluctantly releases its grip on Wisconsin's swampy, shaded wetlands. In early March, the rich earth, still snow-covered and frozen, is an inhospitable environment for any growing plant, let alone a flowering one. Yet one plant defies the season. The wine red flowers of skunk cabbage poke through several inches of snow and are thriving, blooming and attracting early flying insects.

You have to seek out skunk cabbage (*Symplocarpus foetidus*) for it is not a dramatic "here I am, look at me" kind of plant. Its large leaves that are so obvious in June have yet to unfurl and its uniquely shaped, earth-toned flowers hug the ground. Once you find them, they are unmistakable and worth a closer look.

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WISCONSIN NATURAL RESOURCES

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FRONT COVER: Operators note the temperature and meter and time their applications of salt, sand and other de-icers when they plow. A combination of de-icing products and timing can keep roads safer while minimizing environmental consequences. Read our story p. 17-21.

SHANE RUCKER, Pittsville, Wis.

BACK COVER: Low-angled winter sun casts long shadows at Lower Tomahawk River Pines State Natural Area in Oneida County. Inset: Bark of red pine (*Pinus resinosa*). For more information, or to order a guidebook to State Natural Areas, contact the State Natural Areas Program, Bureau of Endangered Resources, DNR, P.O. Box 7921, Madison, WI 53707 or visit dnr.wi.gov/org/land/er/sna.

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Natural resource managers and university researchers are focusing on strategies to adapt to climate change in Wisconsin.

GREG GENT

Preparing to adapt

*Steve Pomplun, Richard Lathrop
and Alison Coulson*

Long-time Wisconsinites believe they've seen it, and new research proves them right: our state's climate is changing. A team of scientists at the University of Wisconsin-Madison's Nelson Institute for Environmental Studies has documented a significant shift in temperature and precipitation patterns over the past few decades — and what they've found might be a small taste of what lies ahead. The researchers say far greater changes are likely over the next 40 years — changes that could profoundly affect our natural resources, economy, health and sense of place.

Working as part of the Wisconsin Initiative on Climate Change Impacts, or WICCI, the UW-Madison climatologists analyzed a wealth of weather data collected across the state since 1950. Daily temperature and precipitation readings gathered from scores of cooperative weather stations show that temperatures have risen consistent with the global trend.

The numbers might seem modest. Statewide, the annual average temperature has risen by 1.1 degrees Fahrenheit over the past 56 years, and average precipitation has increased by about 10 percent. But the devil is in the details, with big differences across the seasons. For example, temperatures have risen fastest in winter and spring, while summer and fall have actually cooled a bit.

Add geography to the mix and you see even greater variation: winters in northwestern Wisconsin have warmed by as much as 4.5°F.

“We’re not seeing as many extended subzero stretches in our winters, and the nights have gotten milder,” says Christopher Kucharik, an assistant professor of agronomy and environmental studies at UW-Madison and one of the lead researchers on the project.

The increase in precipitation is concentrated in the south-central and western regions, while northern Wisconsin has been drier, especially in summer. “The increases in precipitation are generally due to an increase in the number of days each year with measurable rain or snow,” Kucharik explains.

Feeling the effects

Impacts of the changing climate are being felt in a variety of ways. Lake ice cover, for example, has been declining. UW-Madison limnologist John Magnuson, who co-chairs the WICCI Science

Council, has documented a steady decline in the length of time that Wisconsin lakes are frozen over. That can affect ecological conditions such as nutrient cycling and oxygenation within the lakes, as well as habitat for shoreline birds and other species. Ice fishing has also been affected by shorter ice duration.

Other indicators of climate change are seen in the earlier emergence and blossoming of native plants such as forest phlox and false indigo, and in the spring arrivals of some migrating birds, including the eastern phoebe, the rose-breasted grosbeak and Wisconsin’s state bird, the robin. These kinds of changes have been recorded by Nina Leopold Bradley, Aldo’s daughter, who is build-

haps the most obvious of the changes we’re seeing. Wisconsin has smashed records for the frequency and severity of floods in recent years, resulting in hundreds of millions of dollars in damage to property, crops and infrastructure. The most astounding and iconic of these recent events was the shoreline failure that emptied Lake Delton in June 2008 following a period of successive heavy rainstorms that fell on ground already saturated from record winter snows and excess rainfall in April.

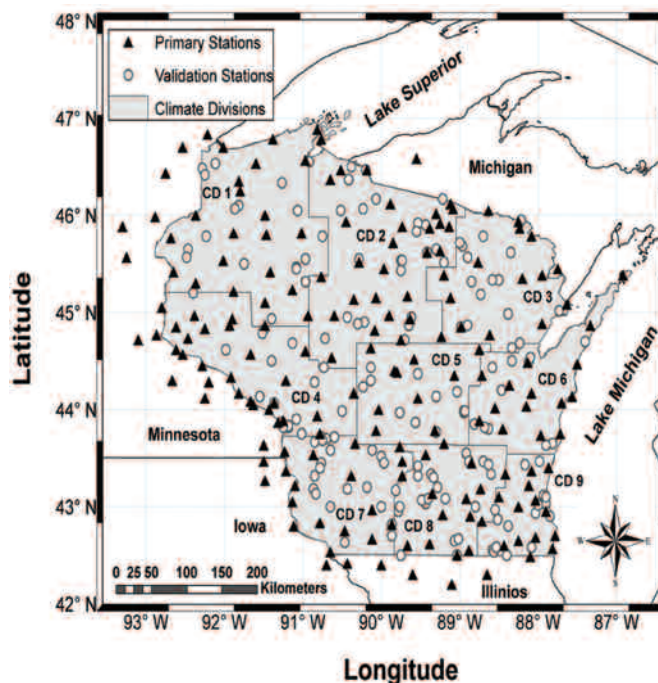
Although no single weather event can be attributed to climate change, climate models project an increase in the frequency of the most intense rainfall events as the world warms. Stormwater system designs throughout

the state have been based on hydrologic data that have not been updated in 40 years, and with “100-year” flood events occurring with greater frequency, the statistics, terminology and engineering to manage stormwater may need to be redefined and redesigned.

Modeling Wisconsin’s future

The climate researchers also developed a set of future projections as part of their state-based analysis. They used an innovative technique to “downscale” (localize) 14 global climate models used by the International Panel on Climate Change, or IPCC, in its fourth assessment report issued in 2007. The global models, while effective at depicting worldwide climate trends and projections, lack the high resolution needed to analyze regional or state impacts. The Wisconsin team overcame that limitation by combining the results from these global climate models with the same fine-scale weather information used in the histor-

Wisconsin Weather Station Network



SERBIN, S.P. and C.J. KUCHARIK. 2009. SPATIOTEMPORAL MAPPING OF TEMPERATURE AND PRECIPITATION FOR THE DEVELOPMENT OF A MULTIDECADAL CLIMATIC DATASET FOR WISCONSIN. J. APPL. METEOR. CLIMATOL., 48, 742-757. ©AMERICAN METEOROLOGICAL SOCIETY. REPRINTED WITH PERMISSION.

Long-term observations of daily weather conditions in Wisconsin have been recorded at volunteer weather stations since 1890. Analysis of the state’s past and future climate used reports from stations that recorded daily data since the 1950s. These observations gave researchers the data to do climate analysis at a scale relevant to Wisconsin decision makers.

ing a valuable collection of phenological observations at the Leopold Foundation in Baraboo. In simplest terms, spring is coming earlier, and while this might sound nice, it could upset the delicate balance of many important ecosystems.

And then there’s the flooding, per-

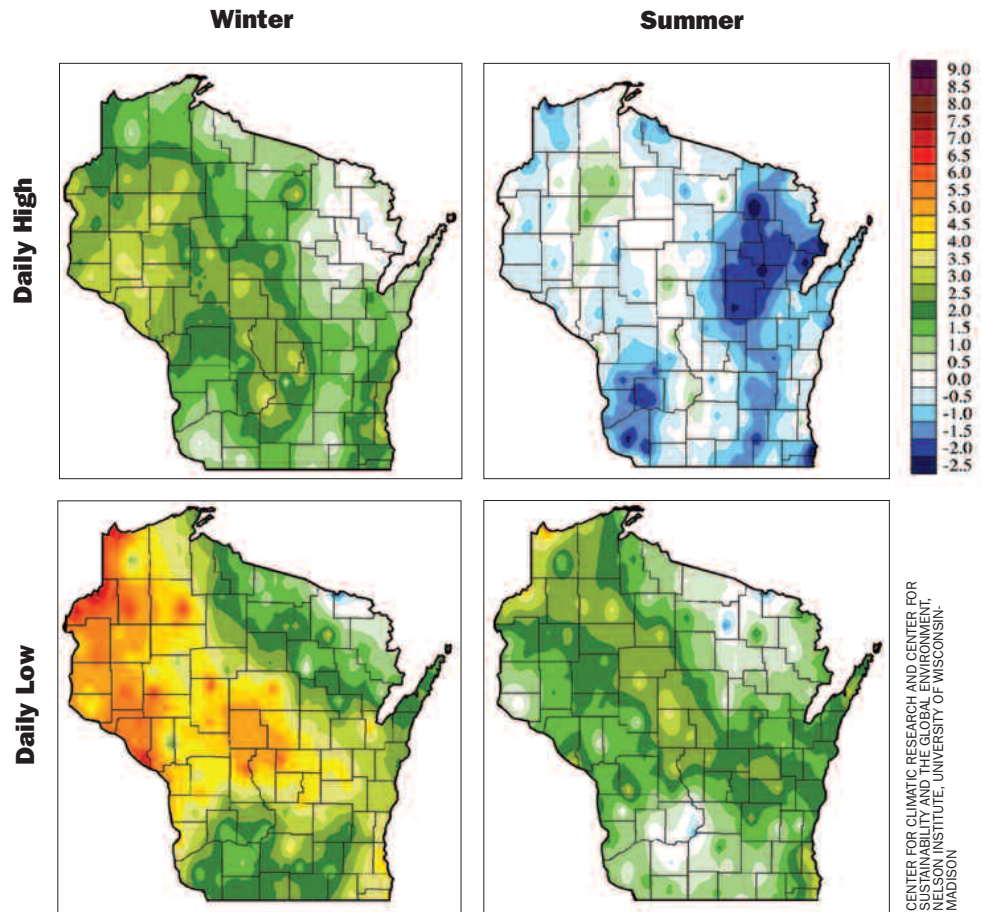
ical analysis to predict the range of probable climate change that can be expected in Wisconsin.

The goal was to produce analyses on a scale that would be useful to natural resource managers, municipal leaders, business planners and other decision makers. Both the recent trends and future projections are mapped to a five-by-five-square-mile grid. The historical data were used to validate the modeling and “ground-truth” the projections.

“We’ve produced a unique resource that combines the world’s best estimates of future climate change with historical data collected here in Wisconsin. The result is a remarkably flexible dataset that can be used in a wide variety of assessments,” says Daniel Vimont, an assistant professor of atmospheric and oceanic sciences and a member of the Nelson Institute’s Center for Climatic Research. “We need to take the next step now, and use these data to identify how our state’s natural and built environments can better adapt to the inevitable climate changes we will face.”

The projections themselves are stunning. Based on a carbon emissions scenario that assumes continued heavy reliance on fossil fuels well into the future, climate change is predicted to accelerate over the next 40 years. These findings predict the state’s annual

Change in Daily Minimum and Maximum Temperatures 1950-2006



Wisconsin warmed significantly between 1950 and 2006, especially in the winter, at night, and in northwestern parts of the state. Summer daytime highs changed little in most parts of the state, while nighttime temperatures warmed in certain regions.



Climate change may bring more intense storms. On June 9, 2008, a 400-foot portion of County Highway A serving as an earthen dam for the impounded Lake Delton failed, draining the lake and creating a new channel to the Wisconsin River (on the right). Four days of heavy rains dropped more than 12 inches of rain near Lake Delton on already saturated ground.

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average temperature will warm by four to nine degrees Fahrenheit by the middle of the century. Winter will continue to warm the most, especially in the northwestern counties, and nights will warm more than days, also mirroring a recent historic trend.

Precipitation changes are harder to model, and the projections are loaded with uncertainty. The researchers cannot say, for example, what summer rainfall will look like by mid-century; the models widely vary. But they can say that winter and spring precipitation is likely to increase across Wisconsin; the average of all 14 model predictions is 20 percent. Combined with the warming winter, this increase in precipitation points toward more frequent freezing rain events, and even rainstorms, in the middle of winter. Higher temperatures may also lead to more springtime thunderstorms and heavy downpours.

Facing big changes

These projections, when viewed alongside the changes of the last five decades, give a sense of the challenges Wisconsin could face. Think of it this way: If an annual temperature increase of a degree or two has already caused observable changes across the landscape in recent years, what will an in-

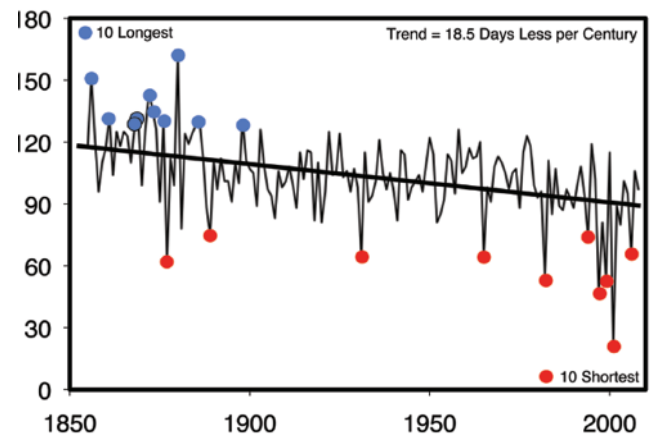
crease of four or seven or nine degrees bring? Models predict an earlier arrival of our last freeze in spring and delays in our first freeze in fall; that could translate to a longer growing season, potentially benefiting agriculture and other activities, but longer and warmer summers would have many negative effects, too. The models imply that winters in Wisconsin will shorten by an average of four weeks. What's at risk if we experience changes of this magnitude?

After all, natural resources and seasonality support a significant portion of Wisconsin's economy, including tourism and outdoor recreation, hunting and fishing, forest products and paper, Great Lakes shipping, agriculture and the dairy industry, and water-intensive manufacturing. Winter recreation, including snowmobiling, skiing, and ice fish-

ing, means economic survival for many northern Wisconsin communities, where the social fabric and sense of place is inextricably tied to our seasonal climates.

In addition, a wide range of plants, animals and ecosystems are adapted to our cold winters. As winters become milder, the natural boundaries of many plant and animal species in the region will be forced northward, and unfamil-

Lake Mendota Ice Duration Trend and Extreme Events

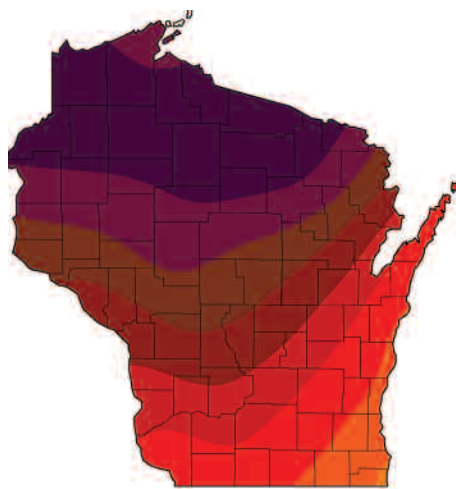


PREPARED BY JOHN J. MAGNUSON, UNIVERSITY OF WISCONSIN-MADISON CENTER FOR URMNOLOGY

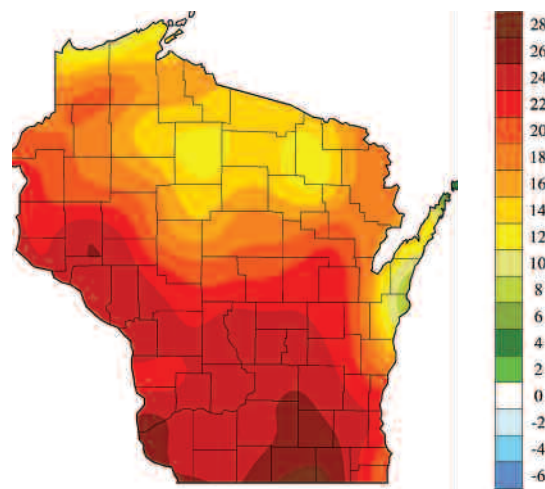
The straight line indicates an overall decrease of 18.5 days per century in ice cover during the 154-year period of record (through the winter of 2008-9). The winters with the 10 longest periods of ice cover (blue circles) occurred early in the record, while the winters with the 10 shortest periods of ice cover (red circles) mostly occurred in recent years.

Extreme Temperature Projections

Projected change in the frequency of 0°F nights per year from 1980 to 2055



Projected change in the frequency of $\geq 90^{\circ}\text{F}$ days per year from 1980 to 2055



Climate models project big changes in extreme temperatures by mid-century. LEFT: This map shows far fewer winter nights below 0°F , especially in the north. RIGHT: Days topping 90°F are predicted to be far more common, with up to four more weeks of very hot weather in southern Wisconsin.

CENTER FOR CLIMATIC RESEARCH AND THE CENTER FOR SUSTAINABILITY AND THE GLOBAL ENVIRONMENT, NELSON INSTITUTE, UNIVERSITY OF WISCONSIN-MADISON

iar species from farther south, including pests, could move in to replace them. Milder winters with less snow also allow deer populations to swell, meaning more deer browsing damage to forests and crops. Endemic pests such as ticks and harmful crop and forest pests could also proliferate as winter kills are reduced.

So a long list of questions emerges:

- How will our northern forests fare under much warmer conditions?
- How will climate change affect outdoor recreation, especially in winter?
- Does municipal stormwater infrastructure need to be redesigned?
- Will coldwater fisheries withstand increases in air and water temperatures?
- Will more invasive species migrate northward into the state and affect aquatic and terrestrial ecosystems?
- How will warmer weather and heavier rains affect air and water pollution and ultimately human health?

In an attempt to find answers to these and countless other questions, the Wisconsin Initiative on Climate Change Impacts (WICCI) was formed as a collaboration between the Wisconsin Department of Natural Resources and UW-Madison's Nelson Institute, both of which had begun to examine the issue of climate change impacts. Since DNR Secretary Matt Frank and then-Nelson Institute Director Lewis Gilbert signed an agreement to form WICCI in the fall of 2007, the initiative has grown to include representatives from other state and federal agencies, several UW System schools, tribal organizations, businesses and nonprofit groups.

The initiative is distinct from the Governor's Task Force on Global Warming, which was formed to recommend ways to mitigate climate change, primarily by curbing carbon emissions. WICCI, on the other hand, was established as an independent effort to identify and prepare for the consequences of climate change regardless of its cause. The operating principle is that climate change is underway and is gaining momentum. Even if we stop emitting all greenhouse gases tomorrow, changes that are already in the system will continue to develop for at least another cen-

tury. Adapting to these changes is critical to Wisconsin's future, regardless of how the state decides to reduce the causes of climate change.

"Wisconsin is taking steps to address the causes of climate change, including creation of the Governor's Global Warming Task Force and the signing of a Greenhouse Gas Reduction Accord with 10 other Midwestern states," says DNR Secretary Matt Frank. "WICCI complements these actions by helping communities, businesses and citizens prepare for climate change impacts, even as we work to reduce them."

WICCI is organized to combine scientific research with practical management. The initiative is governed by a science council whose 22 members represent the Department of Natural Resources, the University of Wisconsin system, and other state and federal agencies. A stakeholder advisory committee of utility companies, agriculture, tourism, forestry, public health, environmental organizations and Native American interests helps identify information decision makers will need to respond to climate change. An outreach committee recently formed to help develop ways to disseminate WICCI findings and recommendations.

Assessing the impacts

Key to WICCI's mission are "working groups" that have been created to assess and anticipate how climate change will affect specific Wisconsin natural resources, ecosystems and regions; evaluate potential impacts on industry, agriculture, tourism and other human activities; and recommend practical strategies and solutions

that businesses, farmers, public health officials, municipalities, resource managers and other stakeholders can implement. More than 200 scientists, resource managers, experts and practitioners participate in the 16 working groups that have formed so far to address soil conservation, water resources, public health, agriculture, cold-



RICHARD LATHROP, WISCONSIN DNR

Fallison Lake, Vilas County, August 2007. The downed trees and brush, which once provided important shallow-water habitat for fish and other aquatic organisms, lie high and dry along the lake shoreline due to prolonged drought in northern Wisconsin.



water fisheries, stormwater, wildlife, coastal communities, forestry, loss of winter, and plants and natural communities. Other work groups are investigating climate adaptation, Central Sands hydrology and ecology, Green Bay and Milwaukee community issues.

Some working groups focus on relatively specific questions. The coldwater fisheries group, for example, is looking at the potential consequences of warming for Wisconsin's 10,000 miles of trout streams as well as coldwater lake species such as cisco and lake trout. The group is not limiting its focus to issues of ecology. The health of these trout stream resources could influence the economies of scores of Wisconsin communities that depend on recreational fishing for income.

Other working groups are tackling a broader array of issues. One based in Milwaukee is considering stormwater management, beach contamination, air quality, heat wave emergencies and other factors unique to the urban environment. Another place-based working group focuses on Green Bay and its surrounding watershed.

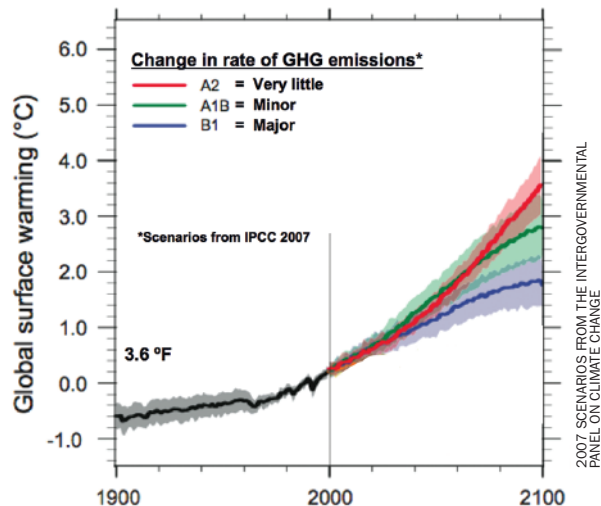
The release last September of

WICCI's study of recent climate trends and future projections is the first of several reports to come. The working groups are compiling their initial assessments this spring and will publish their results in a comprehensive assessment report this fall. It will show which resources are most vulnerable to climate change and suggest strategies for adapting to these predicted changes. The comprehensive assessment will be updated over many years to come, much as the IPCC updates its findings every few years.

Thinking regionally

Climate change does not stop at the state border, and Wisconsin is building relationships with neighboring states to work together on its impacts. WICCI participants are collaborating


Mitigation vs Adaptation



Increases in the rate of greenhouse gas (GHG) emissions over time are predicted in this temperature vs. time projection over decades. If we act aggressively now to limit emissions (blue line) we can limit the anticipated changes to some extent. If we don't limit emissions and projections shown in red occur, climate changes and necessary adaptations will be more severe.

with agencies, universities and organizations in Minnesota and Michigan, and they're seeking federal support to develop a regional version of the Wisconsin initiative.

And the idea is spreading. WICCI is widely viewed as a model for stakeholders to assess climate change, and requests for meetings and presentations have been coming in from across Wisconsin and from other states and Canada.

Nelson Institute and DNR staff members are working to develop new information tools, including print materials and online resources, to spread the word about WICCI and to educate the public about climate change impacts. The WICCI website holds a growing collection of reports and presentations, including a full and interactive set of detailed maps of recent and projected climate change in Wisconsin. To access these resources and to learn more about WICCI, visit wicci.wisc.edu. 

Steve Pomplun directs community and alumni relations for the Nelson Institute and coordinates outreach for the Wisconsin Initiative on Climate Change Impacts (WICCI). Richard Lathrop is a DNR research limnologist and co-chair of the WICCI Science Council. Alison Coulson is the WICCI program manager and is employed by both the Nelson Institute and the Department of Natural Resources.



The American Birkebeiner 2007 ski race had poor racing conditions during a winter with little snowfall. To adapt to these conditions, race officials began using an alternate loop on the snowiest portion of the trail system. Warmer winters with less snowfall in the region also affect race participation as participants have difficulty training for the internationally renowned winter event.

MARK MILFORD, AMERICAN BIRKEBEINER SKI FOUNDATION

A look back and ahead at recycling in Wisconsin.

RECYCLING ROUNDTABLE

Editor's note: For this 20th anniversary of recycling laws in Wisconsin, we invited a panel to recall how the law developed, discuss why recycling programs have been so successful, and speculate what recycling trends might create business opportunities in the future. Our panel included (in alphabetical order):

- **Kate Cooper**, DNR recycling team coordinator and the first recycling team leader when the recycling law passed
- **Karen Fiedler**, recycling coordinator for Waukesha County for nearly 25 years, who started the Wisconsin BeSmart Coalition, a statewide recycling and waste reduction group
- **Lynn Morgan**, consultant with Broydrick & Associates, who represents Waste Management, a provider of recycling, waste reduction, renewable energy and waste collection/disposal services in Wisconsin
- **John Reindl**, retired Dane County recycling coordinator and chair of the Council on Recycling
- **Rick Stadelman**, executive director of the Wisconsin Towns Association for more than 20 years. Towns operate more than 1,000 recycling programs in the state.
- **Joseph Strohl**, former state senator who chaired the committee that drafted the state recycling law
- **Kathleen Wolski**, DNR public participation specialist and the roundtable facilitator



We brought recycling experts together to reflect on the law's 20-year success and speculate on future challenges for recyclers.

■ **Wolski:** Thank you for taking the time to reflect on where we have come in the last 20 years, where we are now and where we are headed. Who knew that recycling programs would remain strong for so long? We want to look at how your experiences in those early years brought you to where you are. What was the tenor of the times and nature of the business to introduce this concept of recycling as a law?

Reindl: In 1969, I was in college at UW-Milwaukee. The whole issue of putting deposits on beverage containers was a big topic. I could go to any get-together and regardless of the group's age or so-

cial economic background, everybody could identify with their garbage somehow.

I recall an episode from 1987 where a small town in New York was trying to get rid of its garbage. In March, they put the waste on a barge that went down the East Coast into the Gulf of Mexico all the way to Belize and they could not get rid of that trash! It came all the way back up the East Coast in October, essentially ending up back in New York. The trash eventually was incinerated. That barge heightened public awareness, made a spectacle of waste problems and created a teachable mo-



Kathleen Wolski

ment. Things had to change.

At the same time the federal government finally implemented laws that required that landfills be built to certain standards. Wisconsin, I think partly because we have such strong town government, had a lot of landfills (more than 800). And people loved them in some respects — they were great meeting places. Politicians would go there before elections to meet everybody.

Wisconsin also had UW-Extension, which was unique in teaching local officials about solid waste management since the late '60s and early '70s.

Strohl: And incinerators were a popular means of getting rid of waste back in the '60s and '70s as well. So garbage, open burning and air standards came into play.

Reindl: Wisconsin also had a strong recycling infrastructure. We were the leading paper recycling state in the country. We still have lots of foundries that use scrap metal. And we are careful with our money and resources.

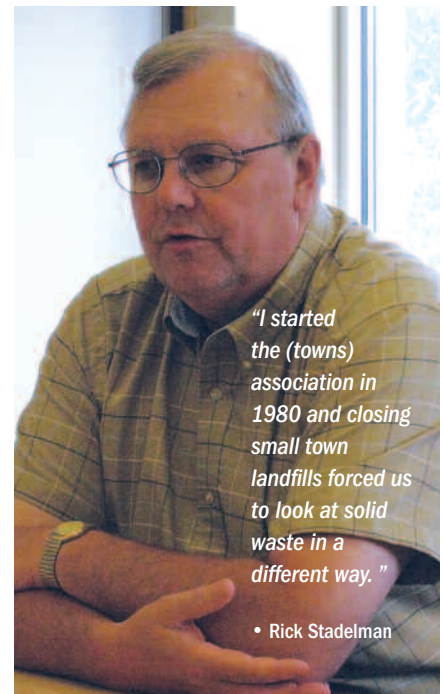
Strohl: Wisconsin environmental groups had pushed legislators for years to deal with solid waste problems by putting deposits on bottles and cans. Legislative session after session, that was their number one issue.

Michigan had passed a deposit law about that time so Wisconsin thought why can't we? Every two years that was a big issue and for political reasons, it never went anywhere whether Democrats or Republicans were in control.

Beer brewers argued that deposits on bottles and cans would curtail sales. They believed people would go to neighboring states (to get beer) or just wouldn't consume as much. The labor unions that worked in the breweries and can industries argued they were going to lose jobs because people were recycling and not using new materials. Passing recycling legislation was a goal for years and when I became majority leader, I finally decided that we were never going to pass deposit legislation in this state and we just had to get off of that. Spencer Black had previously authored a bill to ban yard waste from landfills, and no one seemed to balk at that idea. So that same session or the following one, I introduced a bill at the

end of the session that would have banned two or three items from landfills — bottles, cans and maybe newspapers. It was logical because people were already bringing back bottles and cans, and recycling newspapers.

Reindl: If I remember right, when the yard materials bill passed, Rep. Black had met with landfill operators and they said, "You know in summertime our landfills all turn green because we bring in all this mowed grass." Black said the next session he was going to introduce about 10 different bills. Then everybody said, "Whoa! We want to do a Legislative Council



"In 1969, I was in college at UW-Milwaukee. The whole issue of putting deposits on beverage containers was a big topic. I could go to any get-together and regardless of the group's age or social economic background, everybody could identify with their garbage somehow."

• John Reindl

study and do something comprehensive.”

Morgan: Another factor was a perception that what was realistic was changing. In San Jose, Calif., we saw a large-scale, citywide curbside recycling program. It was still voluntary, but the program was available to every household. And there were similar examples in Wisconsin. Fitchburg, most memorably, had curbside recycling. So we had realistic examples showing we could collect recyclables from every household.

Reindl: I think the City of Ashland was one of the first to pass mandatory recycling, then Dane County, and then the state built upon that.

Cooper: One thing I remember from that period was how many voluntary recycling programs already existed. We kept a directory and there were more than 400 programs. Some

were as simple as Boy Scouts coming around on a Saturday to collect newspapers. Others were bigger, but all involved community support and activism. I think local officials were beginning to see these voluntary programs take shape and say, alright, let's all do recycling the same way. Let's all get with one program that would be acceptable and welcomed by people.

Fiedler: I was hired in 1984 part-time in Waukesha County and the county figured that after a couple of years, recycling would all be resolved and I could go away, but here I am 25 years later.

At first, our solid waste management board studied the idea of a waste to energy facility. And some very astute people on the county board started asking how could we consider this when we didn't have a comprehensive recycling program? Wouldn't we want to first divert valuable materials and then consider whether energy recovery was feasible? Our recycling study concluded that the county should be responsible for processing materials, consolidating materials and education. Communities would retain their contracts for waste collection and could determine what kind of system they wanted. Ours was a grassroots effort between 1984 and 1991 when we built our facility. Initially, there wasn't any recycling equipment and we had to jerry-rig everything. We had a portable drop-off site — an aluminum trailer with dividers, and volunteers signed up each month as we pulled that trailer to four different spots around the county each Saturday. The volunteer groups would get half of the revenue and we kept half to operate the program. That's how we got started — with a grassroots effort.

Stadelman: I started the (towns) association in 1980 and closing small town landfills forced us

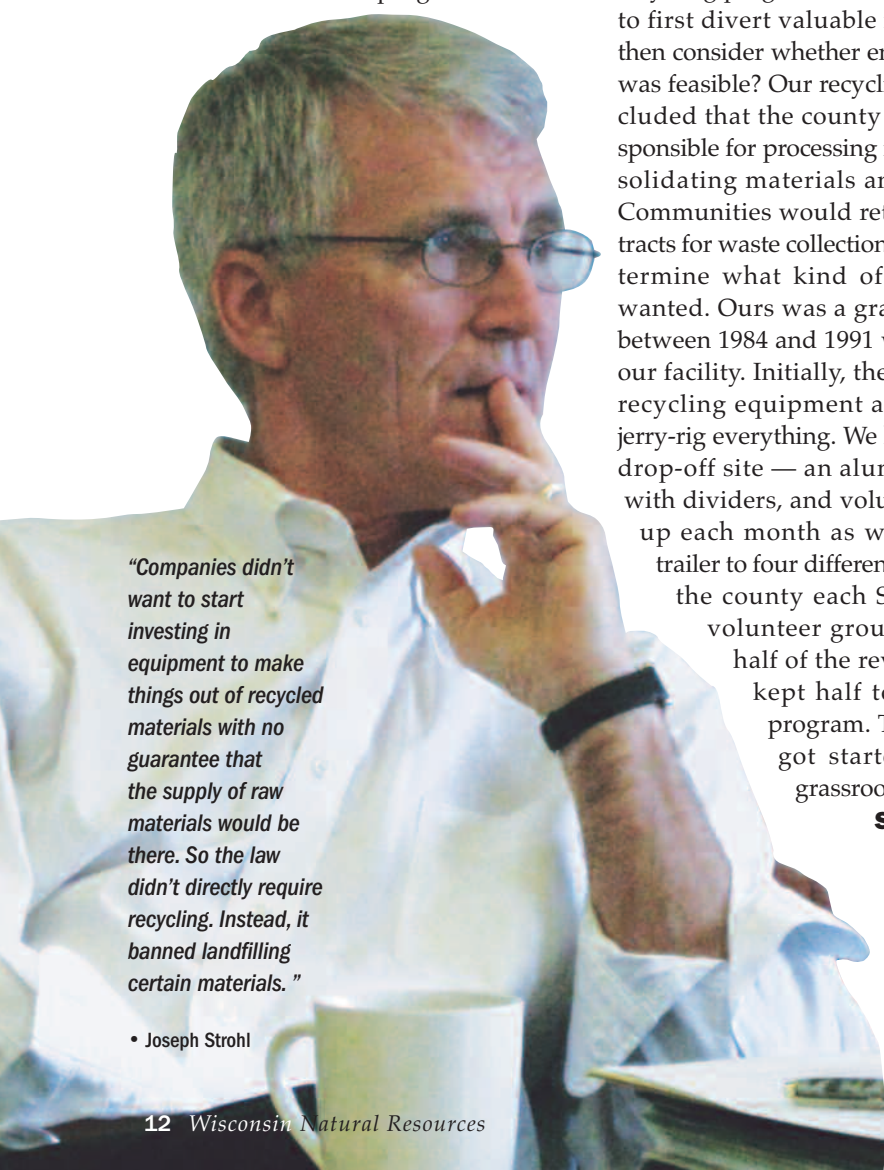
to look at solid waste in a different way. In most communities, new laws meant we were going to have [to either close or upgrade to] engineered landfills. At the same time we saw that the landfill siting law created tension among private waste haulers, private disposal sites and counties over waste management. That came to a head in legal battles like the lawsuit between the *Town of Ringle vs. Marathon County*. We lost the right to control county landfills under township zoning authority and we were going to end up with many kinds of county sites. The trade-off was that we could negotiate over these county sites, and towns wanted some local control in the negotiation process for landfills.

We saw the potential for having a lot of large landfills and the benefits of recycling. We supported recycling as a concept. One reason it was accepted was the Wisconsin law gave communities several years to prepare for recycling. It gave us a lot of time to prepare and set up recycling models around the state before the law was implemented.

■ **Wolski:** One of the things we realized was that we didn't have a real good idea of what to do with recycled materials. You needed markets. Twenty years ago, did you see the recycling law as helping create both this supply of materials and demand for recycled materials?

Strohl: Companies didn't want to start investing in equipment to make things out of recycled materials with no guarantee that the supply of raw materials would be there. So the law didn't directly require recycling. Instead, it banned landfilling certain materials. We didn't want to get into the position of requiring towns to set up recycling programs, though ultimately that's what they did.

Morgan: Looking back now, recycling seems very much a fabric of our society, but at the time this law passed, it was fairly radical. It was considered a huge change and a significant piece of legislation. There were risks, and “the market” was one of the risks people were focused on.



“Companies didn't want to start investing in equipment to make things out of recycled materials with no guarantee that the supply of raw materials would be there. So the law didn't directly require recycling. Instead, it banned landfilling certain materials.”

• Joseph Strohl

Reindl: I would say it is still a fairly radical concept. I don't know of any other state that has developed comprehensive mandatory recycling. A lot of states have banned tires or appliances or yard waste, but I don't think any other state has taken the lead and banned a broad spectrum of things.

Cooper: In fact, I used to get calls from reporters who would say, so what is the Wisconsin recycling goal? Is it 35 percent? 40 percent? And I would say, well, we didn't go that way. We don't have a number. We just said, "Do it." Recycle these materials. And that worked.

Reindl: We were looking at the recycling law as progress, not perfection. By saying the bans would take effect five years from now, the legislature provided five years to develop the infrastructure to collect, process and market recyclable materials. Legislators said we would give technical assistance and financial assistance. And it worked out so smoothly.

Fiedler: I want to point to the risk. We had a county recycling plan, then the state law passed, but nobody in the county really knew if this was going to work. We built this facility with a portable sorting line that you could pull bottles and cans off, then newspaper. Later we started pulling corrugated cardboard off the floor. Magazines and home office paper were added later. I am really proud of the risks Waukesha County took in building a facility that proved to be cost effective for the county's 25 communities and that privately-operated plant has been our model ever since.

Strohl: That was one of the fights. Should recycling programs be county-run or municipally-run? We didn't mandate which way communities had to go. If Waukesha wanted one facility, they could do it. If a couple towns or cities wanted to get together, we let them do it. Some went countywide, some towns wanted to keep waste collection, some cities went a dif-

ferent way, and the law let them do it.

Cooper: In 1995, recycling programs operated more smoothly than anybody imagined earlier. Paper markets went sky high. The mills were paying more than they had ever paid, so people were getting really aggressive about getting newspapers out of households and other places. People responded to that market price because there was money to be made. By late 1996, those markets plunged, so we began that roller coaster experience. Luckily, there often were trade-offs and when one market nose-dived, then steel would be high or eventually plastics became high, or something would offset the losses when the market went downward. That became important for the larger programs — to learn how to capture the proceeds from the sale of recyclables and become part of that market system. That was a new experience for local governments. They were not used to running an enterprise necessarily, and I think the more successful, enduring programs have figured out how to become players in that market system and that is very good.

Fiedler: Kate, you had figured that by recycling over a five-year period we had significantly reduced the number of landfill expansions or new landfills needed. That was a significant change in that whole industry.

■ **Wolski:** What do you think are some of the law's greatest accomplishments or surprises? For instance, I think anybody who had children in the 1980s was being educated by their children

coming home from school and talking about recycling.

Cooper: One success was how much emphasis and budget was devoted to education. I know DNR and municipalities took that responsibility very seriously. We did our level best to reach everyone and feed people's interests and willingness to participate in recycling rather than make it a dictate. For the most part through schools and by demonstrating what was possible, education was front and center those first five years from 1990-95. Now the tonnage of materials diverted by local governments has reached a plateau and we can't expect continuing activity without some encouragement. To learn from this experience, if we are going to promote diverting more food waste or electronics recycling, I think it would be very wise to have a really strong educational emphasis.



"Looking back now, recycling seems very much a fabric of our society, but at the time this law passed, it was fairly radical. It was considered a huge change and a significant piece of legislation."

• Lynn Morgan

Morgan: I think that is a very important point. I've often wished we had more sustained education. Folks weathered the storms of low markets and have continued recycling. Despite the current economy, we do not hear global challenges to end recycling. It has staying power. I think in large part that's because recycling is something practical that is practiced in the majority of Wisconsin households. We have the habit. It has touched every household, children and grown-ups. We've made local governments fans of recycling.

Reindl: A couple of years ago the City of Madison surveyed residents to

find out how well they thought public services were delivered and the highest ratings that people gave were for solid waste collection and recycling. When you think of all the services a city provides, this is one service that comes to your house every single week.

Fiedler: One of the unforeseen things for me is the level of recycling technology that is here 20 years later. Who would have thought that you could mingle wastes, have single stream collection and machines could sort the recyclables instead of people? To me, that is huge.

Stadelman: The issue that I would

raise where maybe we haven't done as well as we could, is getting beyond residential recycling in communities. One of the things I see around the state is very little recycling at events like county fairs, festivals and special events. We can do better.

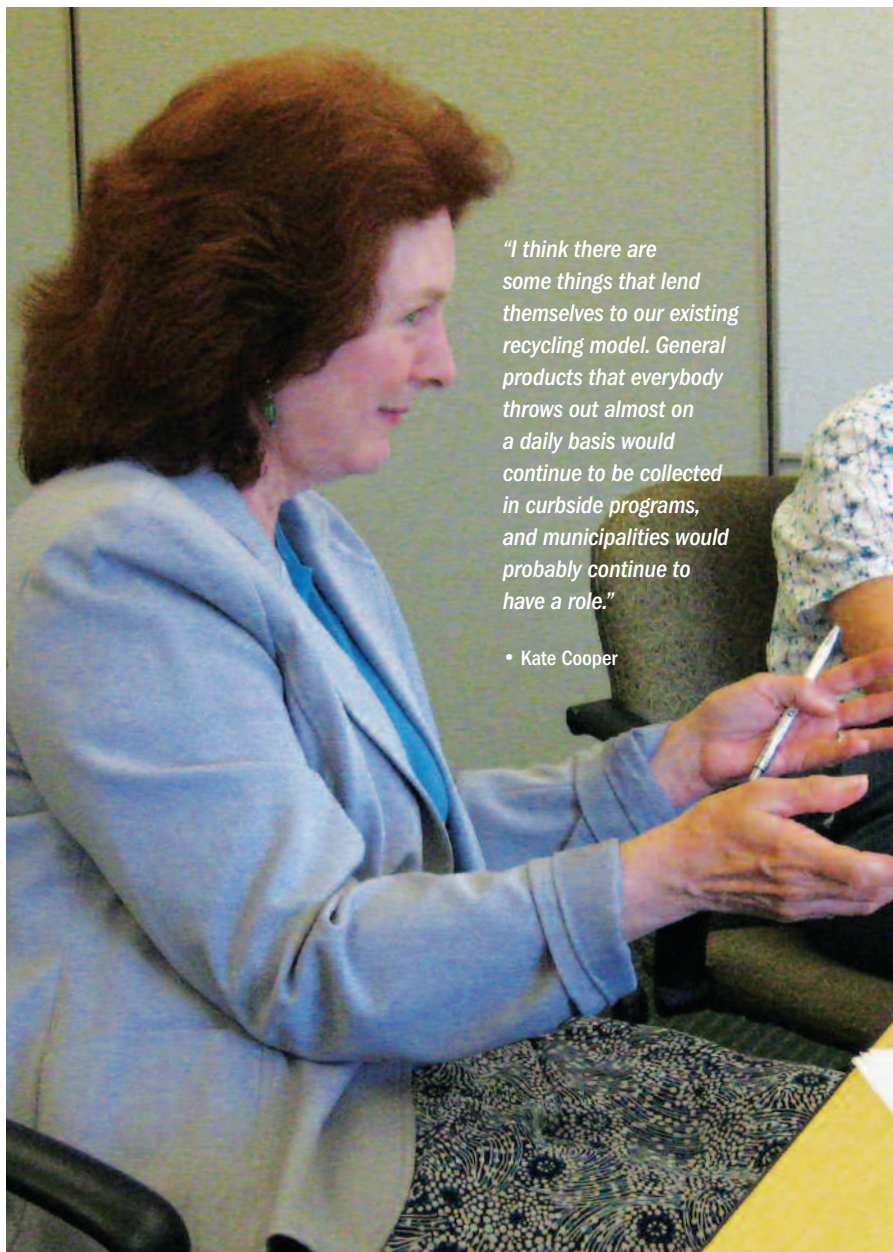
Fiedler: I was thinking about international impacts. Who would have thought that China would be buying paper from us in the Midwest. You can understand it on the coast, but exporting Midwest metals and plastics!

Cooper: Speaking of things we didn't anticipate. We consider asphalt shingles from roofs from single family home tear-offs very recyclable now and very valuable for the asphalt materials.

Reindl: And concrete, too. And recycling construction demolition materials without any requirement by the state. It was a long struggle and it goes back to what Karen was talking about with technology. It's kind of a chicken and egg situation — Can I reuse a material if there is no technology to develop it? Compared to — is there a reason to develop technology if there is no market? In some cases we have a parallel development and have found uses for the materials.

And the whole philosophy is changing whether municipalities should be doing the recycling or whether more of the responsibility really ought to lie in the private sector. We really ought to have more responsibility from product producers to collect pharmaceuticals or collect used electronic equipment or any of these other things. Municipalities didn't create the scrap material and they don't have the expertise to take it apart. People in the paper, drugs, electronics, glass, metal and tire industries are the experts and know what is in their products. They know how to best handle them. They really ought to be taking the lead.

Cooper: I agree with that strongly. And one reason I would like to see more products addressed by product stewardship is that the recycling cost should not fall on local governments. It should be manufacturers setting up systems that bring those materials



"I think there are some things that lend themselves to our existing recycling model. General products that everybody throws out almost on a daily basis would continue to be collected in curbside programs, and municipalities would probably continue to have a role."

• Kate Cooper

back. They are best qualified to deconstruct goods and make them into new products.

Fiedler: Part of what the product stewardship people are trying to figure out is what to focus on. Take the things that are more problematic and costly like electronics and pharmaceuticals. Ten or 20 years from now maybe the model [and mindset] will change. In a more perfect world there would be no waste, only resources; only materials that can be reused and remade into something else. The zero waste concept.

Stadelman: How do you handle contaminated goods?

Fiedler: When a company designs a computer or piece of equipment, they are going to want to encapsulate it in some way so it can be recovered and reused. Or make it so it can be disassembled more easily. Now we get stuff that is hard to take apart and potentially hazardous to the person handling it. But the manufacturers can design it differently. They have a lot of engineers who know how to design a computer or piece of equipment so it can be easily disassembled. Then third party groups can set up recovery systems and decide where they want broken, unusable products collected. Or if they want the county to continue collection, we will continue it. We just don't want to have to pay for it.

Stadelman: I was thinking more of household wastes — table scraps and things like that. I live in a rural area and we have a compost pile. But if you don't live in a rural area or you don't have that ability — it goes in the garbage and at some point this mix of wastes is not recyclable. You probably have some recyclable goods that might be contaminated in that process.

Fiedler: I'd think you might set up an organics collection program for those who can't or are not willing to compost. I live in a city and I've composted for as long as I can remember, more than 30 years. I've thrown meat scraps [in the trashcan], but I have not thrown out vegetables or the types of things that could be composted. You can do it in a city, but you have to use a

better system.

Cooper: I think there are some things that lend themselves to our existing recycling model. General products that everybody throws out almost on a daily basis would continue to be collected in curbside programs, and municipalities would probably continue to have a role. But Karen began talking about product stewardship for the newer items in the waste stream that take a great deal of technical knowledge to take apart — computers and electronics are a perfect example.

Reindl: I think product stewardship works really well on the hard to handle products and for parts containing toxics. One of my concerns is a lot of households and businesses have mercury thermostats even though nobody is making them anymore in the United States. They are coming off the walls [during renovations] and somebody has to handle them. Fortunately, industry has set up a program to fund taking back and recycling these things. Product stewardship for pharmaceuticals is another example. People talk to me about nanotechnology and whether products with nano ingredients may be toxic and may need product stewardship, too.

Fiedler: In terms of pollution prevention, we (government) can never keep up. We're not developing those nanotechnologies, so we can't anticipate what their recycling or disposal is going to mean for local governments in 10 years or 15 years.

Morgan: Karen, when you say the current system isn't sustainable, do you mean basic curbside collection?

Fiedler: I mean that local governments paying for trash collection the way we do now is not really sustainable into the future. Look at budget cuts. Look at what's happening to all of us in terms of staffing and collection costs.

Stadelman: But we're still going to end up with garbage collection because it is a public safety issue.

Fiedler: We are. But not collecting everything we are talking about now. We are not going to be able to keep adding things to what we are collecting

now. The costs are just going to be too high.

Strohl: Appliances, for example, which we ban from landfills, are not picked up on the curb as part of the regular recycling program. You have to pay extra for that. Oil and tires are not picked up on the curb. The government is sort of responsible for getting it done, but in some cities they are not the ones picking it up.

■ **Wolski:** We talked about food, composting and product stewardship. Looking forward, what other trends do you see in recycling?

Morgan: Some new motivations have emerged. We now know that recycling is making a huge contribution to reducing problems associated with greenhouse gases and climate change. That is going to open up a whole arena of reasons to recycle and reasons to recycle new items. That goes back to the staying power of recycling. We continue to discover new reasons why it makes sense. We stay enthusiastic because recycling is one of those rare things that we can do on a daily basis as individuals to benefit the environment. We can help solve problems that seem overwhelming and untouchable. Through convenient options, we can help reduce waste and benefit ourselves as well as someone across the world. Not just because it saves money locally, but by saving energy, using fewer resources and recycling more, we embrace that idea. In front of your trash can you renew that commitment every day. I think that's why people love it.

Fiedler: So what do we do about the e-waste bill and electronic scrap? Are we going to ban e-scrap from landfills?

Reindl: I think in this legislative session we are going to ban at least three different products from landfills — electronics, used oil filters and oil absorbents.

Morgan: I think there is also emerging interest in requiring recycling of construction and demolition waste. I think a real common thread in our discussions is that other things can be re-

cycled more widely than they are now, but they may not be handled as expansions of current waste collection. They may entail distinct collection and financing.

Cooper: We hope we see the day when composting organic material could earn money for local governments through carbon exchange/carbon credits or some other mechanism so companies that need those offsets would pay for composting services on a per ton basis.



"I see the next generation — the generation of my kids who are in their early 30s — asking the next level of questions and they are wondering why we have all this trash."

• Karen Fiedler

Morgan: The other prediction that would be safe is that not all of us will be at the next 20th anniversary. (Draws much laughter.)

■ **Wolski: How about a personal closing around the table?**

Morgan: There is something very powerful about a program that touches people in their homes, in their kitchens and at their trash cans. I think that everyone who has been involved in re-

cycling has been surprised by its overwhelming success. If I could wave a magic wand and give my state anything, I'd give it a little more gumption for innovation. We need to spend some time making sure that all of the players who can make that happen — local government, state government, businesses and private sector organizations — are free to help make that innovation happen.

Stadelman: I think recycling remains a very positive initiative that had a groundswell of public support. Though local governments resist change, the public pushed us to do it for a lot of reasons. We've reached a plateau in our recycling efforts and how we improve and trigger that next step is a concern.

Reindl: Solid wastes were resources for which we had not yet found a use. We need to change the status quo. And there are two ways to get people to change. One is to have a crisis, like the oil embargo, when people changed habits immediately. But sometimes when that crisis ends, people drift back into what they were doing. The other way to effect change is through slow, incremental education. And at times that pace seems frustrating. But when I look back over the last 40 years it's amazing to see the changes that we've made, and I don't wish crisis on anybody. I hope we can take the next

leap forward and use new tools to advance that spirit.

Strohl: When I look back at the success of the recycling law, I am very pleased with whatever role I played in that. Recycling is one of two things that state government has done in the last 20 to 25 years that I think are tremendously popular. The other is the "do not call" lists.

Back 20 years ago young people interested in doing things for the envi-

ronment were interested in recycling. And older people, the World War II generation, all remembered that they used to do it. So the timing was right. The markets just happened to come together and landfills were closing. It was a perfect time to do this law, and had we waited 10 or 20 years, it might not have happened.

Fiedler: I've been most astonished by the dedication of the people I work with every day. My staff, the people who are in this room today, people we meet when we go to conferences, and people who just took on recycling and dedicated their lives to making it work. That to me has been very fulfilling. I'm encouraged. I see the next generation — the generation of my kids who are in their early 30s — asking the next level of questions and they are wondering why we have all this trash. They are interested in what's going to happen in the future. So carbon trading will start forcing some things to happen that we couldn't make happen because the economy wasn't set up that way. And that's something to look forward to.

Cooper: I see a new generation coming in that seems very committed and driven to come up with an intellectually sound basis for the next step in recycling. And I have some hope for them. I think global environmental climate challenge is the next crisis and those young people are preparing for action in that area. One of the pleasant surprises when tools became available to calculate the environmental impacts of recycling was we found substantial benefits in reducing gas emissions and tying up carbon from our current recycling efforts. That was sort of unexpected — nobody was tracking that benefit at all, but we can point to that record and say at least matters are better than they would have been if we had neglected to recycle all these years. I think we are moving from the original concept of saving landfill space to larger environmental goals. And we have tools that John alluded to — the ability to calculate life cycle costs, social costs and benefits of diverting the materials.

This discussion has been a lot of fun. 



Keeping roads on a **low-salt** diet

SHANE RUCKER

Cautious drivers, new de-icers, carefully timed applications and calibrated equipment give road crews a chance to keep roads clearer and safer with less salt.

Theresa J. Lins

In Wisconsin, winter means snow, and in the last two winters, lots of it. To deal with snow and ice, municipalities use road salt to keep streets and highways safer for driving. But salt use comes with both a financial and environmental price tag.

Statewide, the total cost of winter operations (snow removal and salting) was \$86.3 million in 2007-8, about double the cost of an average winter reflecting the severe weather that dumped 60 percent more snow over the average of the previous five years according to the Wisconsin Department of Transportation (DOT).



CHERYL HILL

Attitudes, attention and actions behind the wheel are at least as important as salting and plowing to keep drivers safe and on the road.

“Road salt use is a sleeping giant,” said Roger Bannerman, DNR water resources management specialist. “The potential for chloride to damage our water systems is more inevitable than climate change.”

According to Bannerman, all the numbers related to chloride levels show increases. Monitoring by the Environmental Protection Agency (EPA) shows Lake Michigan’s average chloride level—currently at about 12 milligrams per liter—is increasing by about 0.1 milligrams per liter every year, largely due to road salt and other human activities.

High salt concentrations can harm fish by drawing moisture from their bodies altering their electrolyte balances. It can also cause long-term problems like reproductive failure and increased disease susceptibility. And in small, enclosed water bodies like ponds or lakes, salt can settle and impede water circulation and transport of needed oxygen to bottom-dwelling organisms.

In the state’s two largest cities, Madison and Milwaukee, the amount of salt used is carefully monitored. Municipal road crews prepare for winter by training personnel on salt usage and tightly calibrate spreading rates from trucks to control how much salt is dispensed.

Even with this close monitoring, University of Wisconsin-Milwaukee researchers have found chloride levels in local waterways are increasing by about 2 milligrams per liter every year. This amount of chloride is still within acceptable levels set by the EPA for human consumption. But higher chloride levels may contribute to the invasive species problem in Lake Michigan by making the water more hospitable to saltwater species that thrive in a slightly briny or brackish mix.

Bannerman contends that more information on what will happen in 50 years is needed. “We need to put numbers on the impact. When will chloride levels reach the point that indigenous species may not survive anymore?”

In Madison, chloride levels are generally increasing in the city’s groundwater aquifers. Between 1975 and 2004, increases of 246 percent, 551 percent,





A Caterpillar loader fills a waiting truck with road salt from one of the enormous stockpiles on Jones Island at the Port of Milwaukee. Salt is brought in by lakeboats and stockpiled for distribution to municipalities throughout southeastern Wisconsin. Even with a “sensible salting” policy, crews use about 40,000 tons of salt annually on Milwaukee County’s 2,400 lane-miles of interstate, state and county highways and another 55,000 tons keeping city roads and side streets safe for driving.

DAVID FASULES

Counties in the southern half of the state, where the winter was significantly more severe than average, had the greatest increase in salt use compared with previous winters.

Milwaukee County uses about 40,000 tons of salt annually to clear 2,400 lane-miles of interstate, state and county highways. Spread uniformly, that translates into more than 16 tons on every one-mile-long, one-lane-wide section of road each year. The City of Milwaukee uses about 55,000 tons of salt annually to maintain 7,000 lane-miles of main roads and side streets.

All of this salt has to go somewhere when it melts; that’s something the traveling public does not often think about, but various state and local officials monitor a lot. Milwaukee follows a practice of plowing as much snow and ice as possible before applying salt. A “sensible salting” policy is dictated by ice events, said Wanda Booker, a city sanitation services manager.

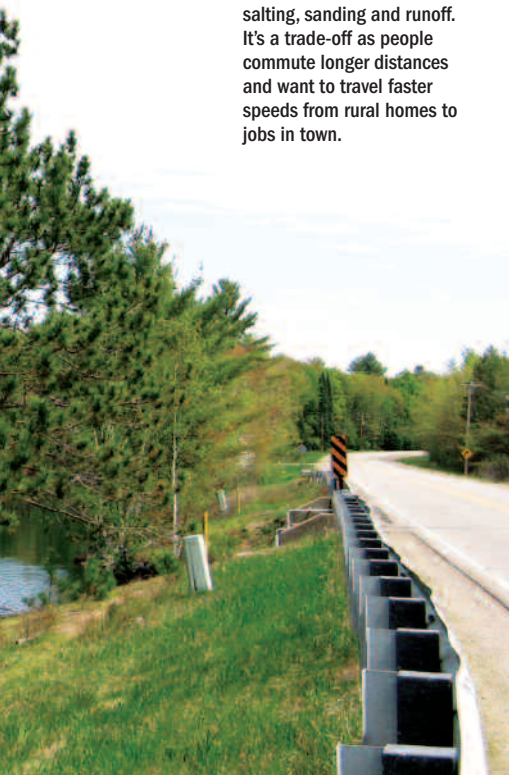
Cutting salt use by private services

The City of Madison has been cutting its salt use each winter since the 1970s and approved recommendations to regulate the amount of salt applied by commercial snow removal operators on private parking lots. Reports indicate the private parking lots may be receiving twice as much salt as is applied to city streets, but there is no formal monitoring of private snow removal contractors.

Al Schumacher, of the City of Madison’s Department of Public Works, wants to start a certification program which would train and monitor salt use by commercial operators. Since 1973 the city has only salted major arteries, connectors, schools, hospitals and bus routes. They use abrasives on minor routes. All Madison salt trucks have computerized settings so the amount of salt distributed is accurate and limited to 300 lbs. per two lane-miles of roadway.

Schumacher also sends his truck operators to training by the City of Madison’s Engineering Department. Commercial snow operators attend on a voluntary basis. “It’s a big selling point to our people to learn about the

Roadside trees, shorelines and waters take a hit from salting, sanding and runoff. It’s a trade-off as people commute longer distances and want to travel faster speeds from rural homes to jobs in town.



BRIAN SCHWINGLE, DNR

and 282 percent respectively occurred in three of Madison’s wells. Another well, now abandoned, had chloride levels greater than 100 milligrams per liter (mg/L), close to the groundwater preventative action limit (PAL) of 125 mg/L. Similarly high values have been found in some area springs and shallow wells.

The story is no better for plant species harmed by road salt. Exposures to wind and toxic contaminants deposited by traffic make roadsides a dry and harsh environment for plants. Salt adds to that stress. High chloride concentrations can interfere with moisture absorption from soil and cause browning or burning of leaves. High sodium concentrations may affect plant growth by altering soil structure, permeability and aeration. The harm varies depending on the amount of salt, type of soil, total precipitation, distance from the roadway, wind direction and plant species. In short, the impacts are highly site-specific.

DOT spent \$26.6 million on salt statewide in 2007-8 for 644,485 tons of road salt; the highest usage on record.

Communities are experimenting with less corrosive anti-icing and de-icing blends. Products like GEOMELT-55 are mixed with magnesium and calcium salts and brines to be applied to public highways.



negative impacts of salt,” he said.

“Everything has to depend upon education to reduce road salt,” said Bannerman. “We have to ‘educate, educate, educate’ because we can’t be looking over people’s shoulders all of the time.”

Adding sand to the road safety mix

If salt is so harmful, why isn’t more sand used? In other parts of the state, especially the hilly areas in southwestern Wisconsin, sand is applied to the roadways and critical locations like hills, curves and intersections, but it is not always an adequate substitute for salt.

Increased traffic traveling at faster speeds brings demand and expectations to keep roads clear. Sand helps provide traction, but it does not melt snow or ice. Also it is easily blown off of roadways and can blow or flow into nearby bodies of water contributing to sedimentation and carrying other pollutants absorbed from the roadways.

Sand and other abrasives are also wasted according to a recent newsletter by the Salt Institute, a nonprofit industry trade association. Excess sand can be

expensive to clean up and corrosion from sand-salt mixtures can damage vehicles as abrasive particles hit and rust metal or crack windshields.

All sand piles trap moisture and some salt needs to be added so the moist sand won’t freeze and will readily spread on the road. A mixture with about 2-4 percent salt by weight is recommended. Unfortunately, some plow operators mistakenly believe more is better when it comes to applying salt and sand mixtures.

In fact, salt and abrasives do different things and can oppose each other said Salt Institute newsletter author Don Walker. A common belief is that salt will anchor the sand, and/or sand will anchor the salt to the road. In fact, Walker explained, sand and dry salt particles are separate. As long as they remain dry, wind and traffic will quickly move both of them off the pavement.

Some salt may become brine, dissolved by moisture in the sand or from melting ice on the pavement. In theory, a small amount of moisture will help embed the sand in the surface of the snow and then refreeze to create a sandpaper effect. But this rarely occurs.

Research on friction on pavement treated with abrasives shows that there is little benefit when traffic is present. Traffic causes the abrasive to be quickly carried or blown off the road. If there is melting, it is not likely that the abrasive will float and stay on the surface. More likely it settles, or gets pounded into the melting snow mixture. When that happens, it is no longer “anchored” to the surface and provides little value for traffic safety.

That’s why weather and road conditions are carefully monitored during snowfalls to determine when and where it is most effective to apply abrasives. Sand is most effective when it is too cold for de-icing chemicals to work and in low volume traffic where it stays on the road surface.

Testing other de-icers

The most popular alternatives to common salt are other chloride salts. Calcium chloride and magnesium chloride melt snow and ice more quickly at lower temperatures, but they are far more expensive than sodium chloride. The search continues for more environmentally-friendly alternatives. Urea, a

fertilizer, can melt snow but adds nutrients to surface water and hastens oxygen depletion in receiving waters. Calcium magnesium acetate (CMA) can also reduce available oxygen. Recent research on CMA and a few other liquid de-icers indicate they are more toxic to fish than salt brine. Several municipalities around the state are trying beet juice mixed with salt to reduce the amount of chloride being used. This organic alternative has its own downsides. "It's expensive and messy," said Madison's Schumacher.

Managing where snow is piled and dumped

The practice of dumping snow removed from streets directly into waterways has largely been halted statewide because this snow contains so many contaminants including salt, nutrients, oil, sand, silt, litter, heavy metals and toxic chemicals. Spring melt water from large snow piles can also deliver

groundwater.

Playgrounds, ballparks and parking lots are poor places for snow dumping as they are heavily used by people after the snow is gone. Snow piles have to be monitored and cleared of debris after the spring thaw and before any potential flooding.

In the City of Milwaukee, excess snow is piled by the Port of Milwaukee to melt into the ground. The city sells permits to commercial snow removal companies to allow them to dump excess snow on this site as well.

What works

DOT's Road Weather Information System provides maintenance crews with accurate information about current weather conditions and detailed weather forecasts. Those forecasts are particularly valuable in helping counties decide when to apply anti-icing chemicals, which saves materials, cuts costs and can improve safety. The system includes automated reports from 59 weather and pavement sensors along state highways, detailed reports from a forecasting service, a winter storm warning service for county highway departments, and more than 500 mobile infrared pavement temperature sensors mounted to patrol trucks around the state. These systems are installed as part of new and renovated road building projects.


These systems are installed as part of new and renovated road building projects.

Pre-wetting and anti-icing to improve road safety — County highway departments and city snow plowing crews strive to work economically by using techniques like anti-icing and pre-wetting pavement, which can lower the amount of salting compounds that need to be applied. Liquid anti-icing chemicals sprayed on pavement before a forecasted storm or frost event are effective in reducing or preventing snow and ice from bonding

with the pavement surface, which can make cleanup more efficient. At least one anti-icing application was made in 52 counties around the state during the 2007-8 snow season. The use of salt brine for pre-wetting, another economical technique, is on the rise as well — counties used a record 968,000 gallons in 2007-8. Pre-wetting salt and sand with a liquid de-icing chemical can significantly improve the amount of material that stays on the road. In 2007-8, 90 percent of Wisconsin's counties pre-wetted their salt; 44 counties used salt brine for pre-wetting, which was an economical choice at about 15 cents per gallon.

In the City of Milwaukee, Department of Public Works crews use brine on bridges and overpasses before a predicted snow event. "The city started experimenting with salt brine in 2005, but the temperature doesn't cooperate with us every time. It usually works best at 25° F," said Booker.

Policies on when and how much road salt will be applied are regularly reviewed and updated with the aim to reduce use and find more environmentally safe, effective alternatives. As DNR's Bannerman asserts, there is no room for trade-offs; the driving public's safety is top priority.

"But we are thinking too short-term on this issue," he says. Increased expectations for clear roads in the winter have contributed to the increased use of road salt over the years. Trucks want to make it to the market on time, people do not want to spend more time driving to work, and people need to get to the store. All of these expectations are consistent with promoting a healthy economy, but they challenge our efforts to reduce road salt use. Keeping our roads safe for driving by using more and more road salt is not sustainable. At some point the benefits of driving during severe weather conditions might be outweighed by the damage to our lakes, streams and groundwater," he said. Both in terms of our salt use and our driving habits, part of the solution is to slow down. 

Theresa J. Lins writes from Milwaukee.



TORSTEN KJELLSTRAND

Cities have discontinued snow dumping in surface waters and storing large salt piles right next to open water. Now storage piles are often covered and bermed. Snow disposal sites are planned to drain to detention basins and are placed near low use areas where debris can be naturally captured by surrounding vegetation and cleared up after snowmelt.

large doses of pollutants directly to water bodies through nearby storm drains if the waters are not pre-treated. State and municipal ordinances recommend disposing of snow on land where contaminants and debris can be contained, collected or gradually released. The best disposal sites are on lands that drain to detention basins, which capture melt water pollutants that otherwise might reach storm sewers, surface waters or soak into



Regional reads

Kathryn A. Kahler

Kick back and enjoy books about Wisconsin's roots, routes and rituals.

If Trees Could Talk, by R. Bruce Allison, Wisconsin Historical Society Press, 68 pages, \$15.95.

Trees and the stories they tell are the subject of this children's book by arborist Bruce Allison, author of *Wisconsin's Champion Trees* and *Every Root an Anchor*. Allison relates the stories of 43 trees that grace Wisconsin's landscape, most in the southern half of the state. Some tell stories of events that took place under their branches, like the Neenah Treaty Elm, the Delavan Founder's Oak and the Civil War Sign-Up Tree. Others, like the Centennial Maple in Fort Atkinson, have been cherished and protected by families and communities as symbols of pride "in their ancestors, their home, their state, and their country."

One entry documents a grove of some of the only pure American chestnut trees left in the world — the Lunde Chestnut

Trees of Trempealeau. They stand tribute to vast forests of the American favorite that once covered much of the eastern U.S. before chestnut blight killed all but a few. Another remembers the beautiful arching elms that once shaded our streets and how a Wisconsin scientist, Gene Smalley, found a strain of elms resistant to Dutch elm disease that became famous around the world.

Many of the featured trees are still standing, while others are long gone. The Poet's Larch in Dodgeville was saved by Wisconsin poet Edna Meudt after a tornado swept through her farm and leveled her beloved larch. At the advice of a half Crow Indian, she tied strips of bed sheet to the roots, covered the roots with a blanket and watered it, to keep the tree's spirit from leaving. The tree was replanted and survived to put out new needles the next spring.

Young readers will love reading about and visiting the featured trees, to hear the stories they tell and the lessons they teach.

People of the Sturgeon: Wisconsin's Love Affair with an Ancient Fish, by Kathleen Schmitt Kline, Ronald M. Bruch and Frederick P. Binkowski, Wisconsin Historical Society Press, 320 pages, \$29.95.

Many of us know what the deer-hunting tradition means in Wisconsin, but it pales in comparison with the love affair that the "people of the sturgeon" have with the fish that they've helped bring back from the brink of extinction. This beautiful book introduces readers to a mix of people — Native Americans, scientists, policy makers and anglers — whose beliefs, traditions and vocations are intertwined with the ancient fish.

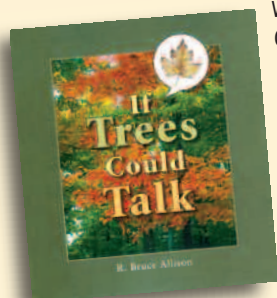
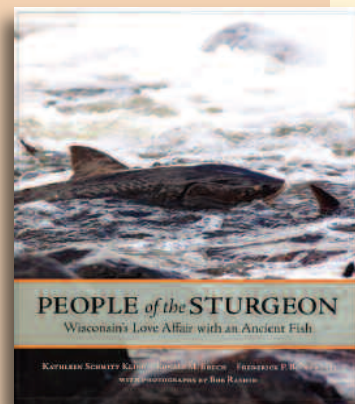
This excellent historical account traces the plight of the sturgeon from its near disappearance in the early 1900s due to overfishing, dams and pollution, to the place it holds today in the hearts of people dedicated to protecting it. Interspersed in the text are "fish tales" of some of the major characters along the way. These tales relate stories of people who advocated for fish laws in the early 1900s to halt the sturgeon's extinction, game wardens working the ground and air to uphold the laws, and spearmen who sometimes morphed from poachers to conservationists and helped establish groups like Shadows on the Wolf and Sturgeons for Tomorrow.

One chapter — "Beneath the Ice" — is devoted to the February ritual of sturgeon-spearing on Lake Winnebago. The fish tales in this chapter paint a picture of generations of sports enthusiasts who live for a few days each year when they can sit in a dark shanty and stare hour after hour into a hole in the ice for the chance to throw a spear at a passing shadow. Page through the photos, see the smiles of sheer pleasure and you'll understand what these huge ancient fish mean to the people who spear them.

Others who grew to love them were biologists and fish managers who spent entire careers studying this species that has survived since the age of the dinosaurs and grows to be the size and age of humans. Authors Ron Bruch and Fred Binkowski, along with "living fossils" like Dan Folz, Mike Primising and others, netted and tagged thousands of sturgeon, collected eggs and sperm (milt) to raise them in labs and hatcheries, and spent hours standing in icy streams while sturgeon spawned to learn the mysteries of their lives.

Above all, the book is testament to how people with diverse backgrounds and motivations can work together toward a common goal. The dedication of resource managers who studied the life cycle of a fish unlike all others; the realization by spearmen that volunteering time to guard spawning females would help build and sustain sturgeon populations to maintain their sport; and the educational efforts of tribes, resource agencies and sports clubs, are just a few of the keys to the success of this restoration program.

According to author Ron Bruch, "the book was a joint effort involving the DNR, Wisconsin Sea Grant, the University of Wisconsin-Milwaukee Great Lakes WATER Institute and Sturgeon for Tomorrow. Sturgeon for Tomorrow donated \$25,000 to help underwrite publication costs, and its members conducted many of the dozens of interviews to gather the data that are the heart of this book. Proceeds also will support the Winnebago lake sturgeon management program."





Sunday Rides on Two Wheels

(Second Edition), by Barbara Barber, UW-Press, 170 pages, \$19.95 (spiral bound).

I love a book that makes me itchy to get out of my chair and try whatever it's about. While it's unlikely I will take up motorcycling any time soon, this book gives a clearer understanding of why so many Wisconsinites — and many of our friends and neighbors — find it such an enjoyable pastime. You can almost feel the sun on your back and the wind in your hair as the author takes you on 18 rides covering 1,874 miles of the back roads of southern Wisconsin.

Each trip was meticulously planned, tells riders which way to turn at each juncture, where to stop for gas or a bite to eat, and offers advice that only those who ride on two wheels would appreciate — like which roads to avoid when spring rains slicken manure on roads through farm country, or which roads might end in dirt or gravel.

"Notes and Highlights" of each trip offer a bit of history, geology and tips on out-of-the-way spots to park and see the sights, stretch cramped legs or appreciate scenic vistas. Most trips are loops and each description includes a map, turn-by-turn directions and a listing of websites and phone numbers for more information on area attractions. The shortest trip — "Holy Hill Side Trip" — takes riders to the breathtaking site of the National Shrine of Mary in the Kettle Moraine of southwestern Washington County. The longest trips are each 182 miles. One — "A Tale of Three Rivers" — winds through Coulee country along the Mississippi, Wisconsin and Kickapoo rivers; and the other — "Look Out Above" — begins in the Baraboo Hills and includes stops at other high places like Castle Rock, Roche-A-Cri State Park, Quincy Bluff and the Air National Guard Gunnery Range near Findley.

The format is a no-frills, spiral-binding with black and white photos that slips handily into saddlebag or roll bag. Author Barbara Barber is an experienced rider; she bought her first motorcycle in 1997 and has since ridden over 200,000 miles on five different bikes.

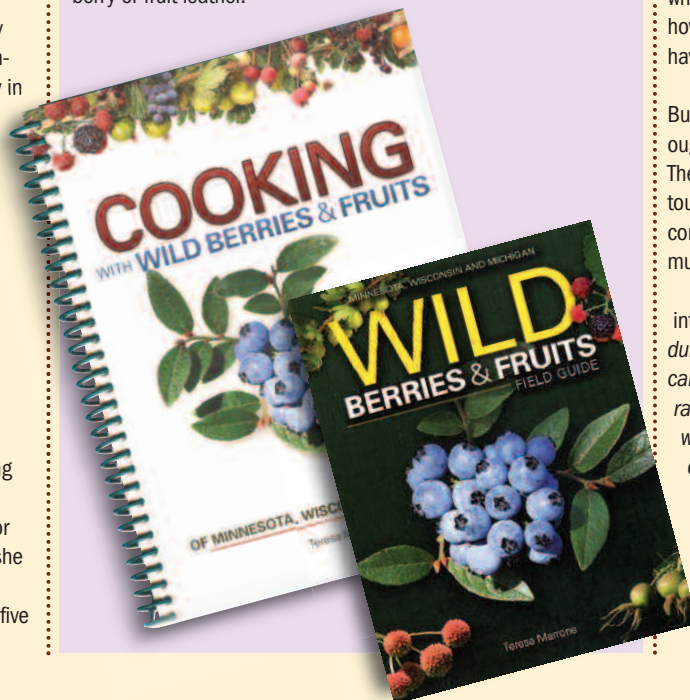
Wild Berries & Fruits Field Guide – Minnesota, Wisconsin and Michigan, by Teresa Marrone, Adventure Publications, Cambridge, MN, 280 pages, \$14.95.

This is an absolute gold mine of a field guide, with an abundance of well-organized useful information. Whether foraging is your latest hobby or you just want to check the edibility of that fruit you've seen on your forays in the field, this book is for you. Berry picking is a relaxing, worthwhile pastime and this guide will point you in the right direction at the right season to ensure a bucketful of juicy nuggets.

Not sure when to look for your favorite wild berry? Consult the "Ripening Calendar for Edible Fruit" in the front of the book. It lists all edible fruits with a May to October timeline of when they flower and ripen, or in some cases, persist through the winter. Each fruit has a two-page listing, organized by fruit color, with a full-page photo for each entry. Some include inset photos of similar species or other plant parts for better identification. A plant description opposite each photo includes habitat, range, how the plant grows, leaf and fruit description, ripening season, comparisons with other fruits and notes of particular interest.

The most useful indicator in each entry is the thumb tab at the top of the page that describes the fruit as delicious, edible, not edible or toxic. Once you've gathered your harvest, find out how to prepare it in the companion cookbook, **Cooking with Wild Berries & Fruits**. This delightful cookbook contains over 150 recipes featuring more than 40 edible fruits and berries found in the three-state region. You'll enjoy the more conventional jams, jellies, pies and muffins, or take some culinary risks with more exotic dishes and condiments. "Cherry Barbecue Sauce" is a sweet and savory sauce using wild cherries that works particularly well with duck and goose.

The cookbook includes several recipes for after-dinner liqueurs — like Crabapplejack, Currant Cordial and Elderberry Liqueur — as well as other treats like Sweet and Snappy Ground Cherry Salsa and Highbush Cranberry Sorbet. Several pages at the back of the book will help you sort out the mysteries of pectin and how to make adjustments for wild fruit or small batches. There are also tips for dehydrating wild fruit and making wild berry or fruit leather.



Out of the Northwoods: The Many Lives of Paul Bunyan, by Michael Edmonds, Wisconsin Historical Society Press, 288 pages, \$24.95.

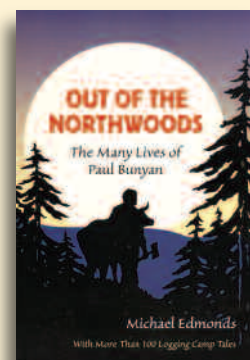
This is an interesting look at how Paul Bunyan folklore evolved from stories told around the lumberjack camp stove to children's storybooks and tourism marketing schemes. If you're too young to have heard or read a story of the fabled lumberjack and his blue ox, you'll find more than 100 of them in the appendix, as told aloud by Wisconsin lumberjacks between 1885 and 1915.

Michael Edmonds, author of several books and articles on literary and intellectual history, delves into the theory that, despite claims that Paul Bunyan tales originated with the logging industry in New England or elsewhere, the tales were actually first told in the Northwoods of Wisconsin. Edmonds' painstaking research points to timber cruiser Eugene Shepard, a colorful character and master storyteller, as the source of the Bunyan stories. Shepard's mastery of the art of storytelling by embellishing and amplifying on previous recounting was legendary.

Edmonds adds depth and color to his research by exploring life in the logging camp. A glimpse into the difficulties and dangers of their profession lends an understanding of what the tales meant to these tough men and how the oral tradition of their folk hero may have eased their lives a bit.

Edmonds explains his fascination with the Bunyan tales: "I was surprised at how thoroughly I enjoyed digging up Bunyan's roots. The early stories themselves, with ironic touches reminiscent of Mark Twain and logical contradictions worthy of Lewis Carroll, had much to do with it. They are, quite simply, fun."

Take this one, for example, about an interesting definition of cold: "It was so cold during one winter at one of Paul's logging camps that even the fire in the big camp range froze. When a lumberjack wanted to write a letter to his home, he just stepped outdoors and shouted the words he wished to write. These froze solid. He wrapped them up in a gunnysack and sent them home. When the sack arrived, all his folks had to do was to thaw them out in or on the kitchen stove, and they had the letter just as it was spoken."



On-the-Road Histories: Wisconsin, by Mark D. Van Ellis, Interlink Publishing Group, 235 pages, \$20.

If you are the type of traveler who likes to explore every aspect of the places you visit, check out this account of Wisconsin's history from its geologic roots to modern times. Learn how the glaciers molded the landforms with kettles, eskers, moraines and dells that grace your drives through the state, and where to find effigy mounds built by early inhabitants more than 1,200 years ago. Visit such French forts as Ft. LaBaye, Ft. St. Nicolas and Ft. LaPointe, remnants of France's quest for a worldwide empire in the early 17th century. Discover sites of ethnic significance like the Milton House where staunch abolitionist Joseph Goodrich helped runaway slaves in their journey to freedom, and Milwaukee's 16th Street Bridge where Father James Groppi and other 1960s-era civil rights activists marched for open housing rights.

The book is conveniently organized by historical era with sidebars highlighting significant points of interest from each time period. Plan an ethnic heritage tour or day trips to Little Norway in Blue Mounds, Norskedalen in Coon Valley, or Old World Wisconsin in Eagle. Or if Wisconsin's maritime, agricultural or beer-brewing customs are more to your liking, you'll find listings of

places and events to help chart your travels.

For out-of-state travelers, there are nine other books in this series — Alaska, Hawaii, Kentucky, Michigan, Minnesota,

Mississippi, New Hampshire, South Carolina and Texas. Each includes a wide-ranging account of the state's history, maps and historical photos, must-see sites, visitor resources and much more.



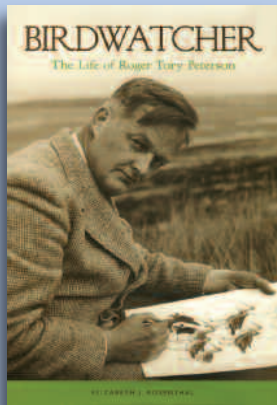
Birdwatcher: The Life of Roger Tory Peterson

by Elizabeth J. Rosenthal, The Lyons Press, 437 pages, \$29.95.

I have for several decades known Roger Tory Peterson as the author and artist responsible for the first birding field guide I ever purchased. I took for granted the detailed color drawings that point out what to look for to tell one species from another, and the roadside and flight silhouettes that distinguish common birds by their shape, posture and relative size. What I didn't know about the author was the revolutionary nature of his work, or the dedication and sheer genius that went into this guide and the dozens of other field guides and nature books he wrote and illustrated.

When it was first published in 1934, small, portable identification guides simply did not exist. Bird books in print then were heavy, sometimes multiple volumes, with drawings more attuned to artistry than scientific identification. Peterson's simple descriptions, written in lay language and illustrated by focusing on the diagnostic traits of each bird, revolutionized nature study and introduced generations to a new recreational pursuit. It was Peterson's early obsession with birds coupled with his "indefatigable energy and constant pitch of enthusiasm" for sharing that obsession that helped educate millions.

One source described Peterson as the type of genius who set goals, met them, then set new ones. He was never content, which explains his remarkable list of literary achievements. Among them are field guides (with several revisions) to eastern and western birds, wildflowers, mammals, butterflies, shells, trees, shrubs, amphibians and rocks. He wrote *Birds Over America*, *The Birds*, *Wild America*, and *The World of Birds*. In the 1950s he did for Britain, Europe and Canada what he had done for the United States by producing field guides for those parts of the world.



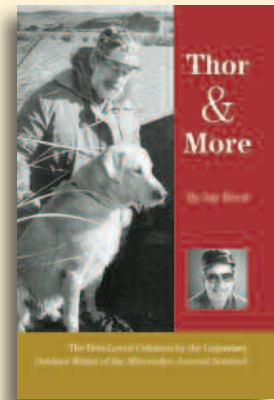
Peterson's field guides continue to be the standard by which others are judged. Rosenthal quotes British bird fancier Trevor Gunton: "Fifty years on, the standards that he set are still what field guides are judged by. In my opinion...the original book has never been beaten. It made the identification of birds so simple! It was really groundbreaking... Ordinary

people like me could actually start confidently going out in the field and identifying birds."

To her credit, Rosenthal doesn't omit less complimentary descriptions of Peterson. His perfectionism, work ethic, dedication and ability to focus on nothing but the task at hand did not always nurture family and other relationships. Readers of the biography come away not only with a respect for Peterson but for those — like his second wife Barbara, and sons Lee and Tory — who endured his idiosyncrasies and lived their own lives with an enduring respect for Peterson.

Elizabeth Rosenthal interviewed over 100 people and consulted hundreds of documents to give her readers insight into the life of this extraordinary man. Only by reading the anecdotes shared by his family, friends and colleagues from around the globe do we get to really know his personality, motivations and the depth of his contributions to the study of nature and environment. One account described Peterson as not being motivated by fame or money, but by mission. "He definitely wanted to change the world. And he wanted to educate. But I think he also wanted to prove that he was the best at what he did. That was very, very important to him," said literary agent Arthur Klebanoff. On the other hand, Peterson was described as a humble, quiet man who treated other people as equals and respected people for knowing something he didn't know.

I will forever consider my 35-year-old dog-eared Peterson field guide (the 44th printing of the third edition) with a different kind of respect.



Thor & More, by Jay Reed, published by Christine Reed, 312 pages, \$29.95.

More than 100 columns by the late celebrated outdoor writer for the *Milwaukee Journal* are compiled, chosen by Reed from his favorite pieces published from 1963-2002. His days afield took readers along on deer hunts, into his duck blind and into his skiff as he cast for muskies. In these short, quick reads we relive the adventures of his beloved yellow Labrador retriever, *Thor*, from his days as a seven-week-old pup through his last fall pheasant hunt 13 years later. We admire *Thor*'s dedicated concentration to retrieve ducks and shake our heads as Reed retells the dog's head-on run-in with a skunk while pheasant hunting. As readers, we are along for a ride that is all too brief in these pages.

The collection also includes columns from Reed's tours to Vietnam in 1967-68 and his return there 22 years later where he admits failing to make sense of the senseless losses or to shake free from the ghosts of war that killed, maimed and mentally scarred so many.

I think the book's strongest entries are the insights we get from Reed's formative years in Nelson just upstream of where the Chippewa River empties into the Mississippi. He recounts the hard life of tougher times for river people who scratched out an existence in simple homes raising a few crops, running setlines for catfish, paying out gillnets for carp, trapping in the sloughs and backwaters, and hunting ducks and deer to put some meat on the table. Those were definitely different times from the pleasure boats that now cruise the river for a little recreational fishing or a weekend family picnic.

Kathryn A. Kahler crafts feature stories and reviews from Madison.

A sweet treat in the season of melting snow

Maple syrup time offers a chance to cook up a mix of science, culture and good eats in a hands-on day outdoors.

Story and Photos by David L. Sperling

Some of the trees are banded with bright yellow marking tape and a few have yellow wooden boxes with handles you can crank. There's a light warm breeze and the air smells clean this early spring day as we shuffle our feet through piles of last fall's leaves drying out under foot. Gordon Dunn, volunteer tour guide, greets Janice Uhrig's fourth graders from Waunakee who are piling off the yellow school bus on the hilltop parking lot of the MacKenzie Environmental Education Center in Poynette.

"We bring our class to MacKenzie every year to study maple syrup making," Uhrig says. "It's sugar time!"

The students will spend about three hours outdoors in the fresh air visiting various stops on a tour, gazing at trees, tapping into maples and soaking up a blend of science, culture and history. It's

a hands-on story that appeals to all the senses and ends with a sweet treat. In this short stay the students will see for themselves how trees are tapped, how the sap is collected and then cooked and finished in front of their eyes.

Dunn starts with a few questions asking why we grow and use trees. The

eager students raise their hands and talk about providing shade and having wood for products like pencils, paper, toothpicks, furniture, fuel and food. Dunn guides the friendly conversation into an appreciation that trees give off oxygen, absorb carbon dioxide, and harness the sun's energy through photosynthesis. The group talks a bit about other values like providing a home for wildlife, growing landscaping around houses, anchoring the soil and controlling erosion.

We learn why maples were tapped to make syrup and why at this time of year. Many hardwood trees yield a slightly sugary sap in spring. Walnut, birch, hickory, sycamore, ash, basswood and butternut all have sap that contains about one percent sugar. And many types of maples can be tapped too, like box elders, silver and black maple, but the sugar maple's sap is particularly prized because it contains 3-5 percent sugar. Dunn says most people can recognize maples just fine once they leaf out, but how do you recognize them in winter for tapping? Good question. Just as we can recognize people by features like height, shape, facial features, skin and hair color, tree types have different features too. He shows the students the distinctive branching, bud and bark characteristics of the sugar maples, then he points out that the sugar maples in this area of the proper-



A tour stop at the Wallen shack shows students how sap is boiled over a wood stove in a really big, flat pan with high sides to evaporate water. Sap is reduced to syrup over several hours to concentrate the sugar content from about 3-5 percent sugar to a little more than 60 percent sugar. Then the syrup is filtered and finished on a gas stove. When it reaches 66 percent sugar, the syrup is canned and sealed in sterile jars.



Throughout the tour students learn how maple syrup collection and processing has changed over the years. Here the students feel what it's like to be weighted down with buckets of sap that would have been carefully toted to the sugar shack using a shoulder yoke.

ty have all been wrapped with a bit of yellow marking tape.

Trees are tapped in a short season from late winter when nighttime temperatures still dip below freezing but the daytime temps rise into the low 40s. This season of melting snows had many names in Native American culture. *Sisibaskwatokan* is an Ojibwe word for the maple sugarbush where concentrations of maples in the forest (*Manakiki* in Ojibwe) were ripe for the tapping.

"It's been said that to make maple syrup, you need mud," Dunn says smiling. The freezing temperatures at night alternating with daytime thawing create pressure in the xylem and phloem layers — the sapwood sandwiched under the bark and the thin growing cambium layer before you reach the dense heartwood in the middle of a tree. The sap provides nutrients to carry food up, down and around the tree to stimulate early growth. As the weather warms up and trees get ready to leaf out, the sap turns bitter. Trial and error proved that once the tree buds swell to about the size of a squirrel's ear, it's time to stop tapping and the sugaring season is over.

Time to tap

As the students move downhill toward another area with maples, Dunn explains how maple sugaring was done in outdoor camps near large groves of sugar maples. You look for healthy trees that are free of dead branches, rotten areas and cracks. You seek big trees that will produce a lot of sap and older trees that are at least 10 inches in diameter (about 40 years old). A 10-inch diameter tree can accommodate one tap; a 15-inch tree, two taps. Bigger trees can accommodate more taps. Dunn says an easy way to tell if a tree is big enough is to give it a hug. If your hands reach your elbows when you wrap it around the tree, it's still too young to tap.

Tree taps, called spiles, were whittled from branches of basswood trees or elderberry shrubs whose soft, pithy centers could be poked out to form natural pipes that were pounded into holes drilled into maples. Dunn demonstrates how holes used to be drilled by hand with a brace and bit about four feet up the tree. Tap too low and animals can get into the buckets; too high and the full buckets are too hard to remove and empty without spilling. Similarly the holes are drilled about three to four inches deep angled toward the tree crown so gravity will help the sap flow through the spile. Each child is given a chance to make his or her own spile and take a turn twisting the bit and drilling into the maple before a spile is tapped in with a small hammer. Today, the sap starts flowing right away and everybody lines up to catch a drop or two of sap to see what it tastes like fresh from the tree — pretty watery with a very slight sticky sweetness. A lid is replaced over the pail, the tools are cleaned up. The dripping sap is collected in buckets that are covered to keep out animals, water, bugs and potential contaminants. He also explains that holes in the sapwood from tapping won't open the tree to infection or bugs.

"The holes heal very well," Dunn says. "We don't use Band-Aids."

Collecting and boiling down sap

As we head to the next station, Dunn explains how commercial syrup mak-

ers use both plastic tubing and plastic bags to collect sap these days. He contrasts that with the birchbark containers and clay pots that Native Americans crafted to collect and transport sap in days past. He also talks about the division of labor in the sugaring camps for each task like tapping trees, hauling sap and boiling it down. Native Americans used birchbark containers and colonists, wooden buckets that they carried on shoulder yokes to a central cooking area. Dunn explained that sap naturally contains bacteria and as daytime temperatures rose above freezing, it had to be processed fairly quickly to avoid spoilage. The students learn that Native Americans often kept reducing and concentrating the maple syrup until it formed a solid maple sugar that could be stored as granulated crystals, a hard candy, or gum-like form that would last without spilling or spoiling. Maple sugar was used in foods as seasonings, in medicines and was traded for other goods.

On the east side of the road, we approach a sugar house and finishing house where students will see how the sap is processed into the liquid goodness we so enjoy on pancakes and waffles. Outside, two demonstration areas show historical methods of processing syrup. There is a series of three metal kettles heated over a bed of wood coals that show how sap was boiled, stirred with wooden paddles and reduced to a thicker solution. As the syrup thickened up, it was transferred to smaller kettles over lower heat so the hot liquid could be carefully tended so it would form syrup and would be removed from the heat before it scorched, burned or boiled over. The smaller kettles ensure that the heat is more evenly distributed to the syrup from the bottom of the kettle to the rim. Similarly, there is a demonstration of a backyard syrup evaporator you can make where a wood fire is contained in a brick barbecue pit of sorts that is topped with a cooking grate. Old cake pans are used to boil off the thin sap into a syrupy mix that can be finished on an indoor stove when the syrup is almost done.

We learn that maple sap with 3-5


percent sugar has to be boiled down and concentrated to form a sweet, stable maple syrup. When a batch reaches 219° F and 66 percent sugar content, it is done, but concentrating that syrup requires a lot of boiling, constant stirring, careful attention and periodic testing. Also, we see that one has to be really careful as the fires are hot, the bubbling sap gives off clouds of swirling steam and the product is boiling hot. It takes huge quantities of sap to make syrup.

At MacKenzie in the Wallen sugar shack, a wood fire burns in the belly of an arch stove that has a big, flat top to hold a large metal evaporating pan with about four inch sides. The “sugar makers” tending the bubbling liquid keep adding more sap and measuring the percent of dissolved sugar in the watery solution. A handheld device called a spectrometer is a combination of a hydrometer and a refractometer that measures the density of the sugars

sugar content (Grade A) so less boiling is needed. Longer boiling later in the season produces darker syrup (Grades B and lower). Some people prefer the richer, more caramel-like taste in the darker grades of syrup. The length of the syrup-making season depends on the weather and how fast it warms up in spring. It may run for 20 days or more. In 2007, the season only lasted 12 days as warmer spring weather came on very quickly.

remaining in the syrup. Under ideal conditions the crew aims to keep the syrup at a rolling boil and a depth of 1.5 to two inches in the evaporator pan. That seems to evaporate about 10 gallons of water an hour from the sap as the sugars concentrate. The highest quality syrup is produced when the sap is processed as soon as possible after collection and it takes several hours of evaporating each day. As the syrup gets thicker and the possibility of scorching the final product becomes a concern, the hot syrup is drained out of the pan when it reaches about 62 percent sugar and strained through filter paper and clean felt to remove any wood ash, other impurities and small sugar “sand” crystals. Then the amber liquid is taken into the finishing house where the syrup is heated in big pots under controlled conditions on a gas-fired range to more slowly drive off the last bit of water until it reaches exactly 66 percent sugar content. The finished syrup is canned and sealed in glass jars. The color and taste of the syrup vary a bit each day depending on the presence of natural bacteria and how early in the sugaring season the trees were tapped. Early tappings tend to produce lighter colored syrups with higher

At the last tour stop, the students visit a replica of a Ho-Chunk longhouse called a Che-PO-ta-kay, an arch-shaped hut formed from bent slippery elm saplings that are lashed and covered with fleshed skins and birch bark. These temporary structures provided shelter for Native Americans when they remained in the sugarbush during the syrup-making season. During our visit, volunteer Jon Langsdorf of Dekorra Township talked with students about the Native American ways of life, respect for Earth and elders, and a bit about the nature of Native American culture.

“I give them no more than it appears they can handle,” Langsdorf says. And after a few questions and a taste of the finished syrup, the students head back to their buses with a sweet reminder of an interesting morning afield. 

David L. Sperling edits Wisconsin Natural Resources magazine.

Concentrate now!

| Percent sugar in sap | Number of gallons of sap needed to make a gallon of syrup |
|----------------------|---|
| 2% | 48 gallons |
| 3% | 28 gallons |
| 4% | 21 gallons |
| 5% | 17 gallons |

The sweet math of reducing sap to syrup

Let's take the math lesson one step further. Let's say you have sap with about 3% sugar tapped from sugar maples. How many drops of sap would it take to make a gallon of syrup?

50 drops of sap = one tablespoon
 16 tablespoons to a cup
 16 cups to a gallon
 About 30 gallons of sap to produce a gallon of syrup

Total - $50 \times 16 \times 16 \times 30 = 384,000$ drops of sap to make a gallon of syrup

Maple math challenge #2 - Assume one spile drips a drop a second day and night. How long would it take to drip enough sap to make a gallon of syrup?

One drop x 60 seconds x 60 minutes x 24 hours = 86,400 drops per day.

$384,000 / 86,400 = 4.44$ days at one drop per second. Of course, sap flows during the day and flows best as the tree warms up, so the rate is not constant and it would actually take many more days to collect enough sap from one spile in one tree to make a gallon of syrup.

BOOK A SWEET TRIP

More than 1,200 fourth-grade students book a trip to the MacKenzie Center's maple program each March and it takes time from 60-70 volunteers to make the program happen. A Maple Syrup Festival is held the first Saturday in April each year (April 3 in 2010) where the general public can enjoy an all-you-care-to-eat pancake breakfast, live music, demonstrations, tours of the grounds and guided tours of the sugarbush. To book school tours or find out more about the festival, contact (608) 635-8105. Reservations for school group tours are booked on a first-come, first-served basis starting on a call-in date set in mid-February.



COMMENT ON A STORY?

Send your letters to: Readers Write, WNR magazine, P.O. Box 7921, Madison, WI 53707 or e-mail letters to david.sperling@wisconsin.gov

TAKES EXCEPTION TO DEER MANAGEMENT PRACTICES

Once again, I take exception to the DNR's lack of accountability for low deer numbers and for seeming to place responsibility on hunters ("Sizing up the herd," October 2009). I realize that we are a vital component of the herd estimates, but it seems more than ever that the onus is being placed on our shoulders, not the agency's.

In terms of the SAK [sex/age/kill calculation], the DNR says, "This data is combined with information gathered during field studies..." What "studies?" Hunters — especially in northern Wisconsin — have been saying that deer sightings during the gun season have decreased for at least six years. Historically, SAK has not taken into account what the hunters actually see in the woods as part of their herd estimate. Granted, the agency plans to implement this into the 2009 season at registration stations, but why has it taken so long for hunters' voices to be heard? "Our deer management program is also exploring opportunities to take full advantage of field observations by hunters, landowners and other citizens to better monitor the herd." Finally! We are the eyes and ears about what is actually going on in the woods. But don't expect much input from landowners who seem more interested in keeping the deer on their property than having concerns about the overall size of the deer herd.

On a final note, the DNR needs to stand up and ban baiting once and for all. No one

can dispute that baiting has altered deer movement, and in the end, deer harvest. Your story states "encourage other hunters to stop baiting in the area you are hunting." Why doesn't the DNR finally take a stand on this issue and ban it, instead of once again, placing the responsibility on hunters?

Brian Murphy
Waterford

I read "Sizing up the herd" as well as the various links that were available. I would submit that if the estimates and data used to come to the conclusions held by the DNR are accurate, then we need to reassess what is an appropriate size herd. If what I have seen in the woods for the last couple years is a sign of the state of Wisconsin's deer hunting future, then my hunting career will be cut short. I can find alternate, more productive and gratifying ways to spend my money than throwing it away watching squirrels. I know that I am not alone having read a letter to the editor tonight in my local paper expressing similar sentiment.

Richard Helgeson
Bloomer

DEER BROWSE DAMAGES FOREST ECOSYSTEMS

After reading the October issue ("Sizing up the herd"), I was a little surprised that author Keith Warnke did not mention forest habitat damage in his detailed article about estimating deer herd numbers. DNR used to take that factor very seriously. Writing in 1946 Ernie Swift observed, "too many deer will over-browse valuable species of forest growth so that they will be mutilated, stunted, deformed or even killed." The problem has not gotten any better since. I have seen almost all the pine and balsam regenera-

tion on my forest land halted in the past 30 years by ever increasing deer numbers.

I would love to see an article about deer damage to forest ecosystems in your fine magazine. This summer I tried but could not find a single instance of American yew growing wild in northern Wisconsin, although it was abundant here historically. High deer numbers have just about wiped it out on the mainland, and I hear deer have now reached the outermost reaches of the Apostle Islands and it's in danger of extirpation there too. Thanks and keep up the good work.

Herb Wagner
Minong

We published a story in our October 2007 issue ("Appetite for trouble") on the effects that browsing deer have on forests, croplands and around our homes. The story documented research showing an 18 percent decline in native species over 50 years of deer browsing, and the estimated \$115 million impact on crops, property and personal injury.

TIME TO BAN BAITING

If enough hunters express their viewpoint on baiting, maybe the powers that be will put an end to the practice. Deer baiting, legally or illegally, is getting out of hand. I live in Deer Management Unit 16 and it seems everyone I know is baiting deer for hunting purposes. My family is about to quit hunting altogether because of the practice. It has become a game as to which landowner has the best attractant to his land. We are teaching a whole generation of hunters not how to hunt, but how to bait. Time has come to make a change. I'm in favor of a complete stop to this practice statewide.

Mark Wick
Comstock

AZTALAN FANS

Thanks for the article about Aztalan State Park in your October issue ("Who were they and why did they leave?"), written by Natasha Kassulke. We visited the park in early September and were just blown away by its historical significance.

Jim Troxel
Chicago, Ill.

I recently read the article "Who were they and why did they leave?" The article is well researched, well written and very informative. It is an example of what those of us with interests that include hunting and fishing but go well beyond are looking for. Kudos to Ms. Kassulke.

Jerry Apps
Madison

OUR HEMLOCK "ISLAND"

I recently read your December article about Patterson Hemlocks State Natural Area. I own a woodlot in Marathon County that contains six groves of hemlocks mixed with maple, birch, red oak, white pine and cherry. There is very little undergrowth as little light gets through and the smaller trees are topped off. We call one grove "the island" because it is isolated by two streams. On cold hunting days we can sit on "the island," eat our turkey sandwiches and be as warm as if we were sitting in front of a fireplace. I should cut the mature hemlocks, but for now I let my wood cutter harvest them when they fall. Our hemlock "island" is worth seeing.

Roger Gehrke
Brainerd, MN

Winter heat in the hood

HERP LORE

I just finished reading a reader's comments, "Bull Snake Tales," where he referenced a previous WNR article about bull snakes that I somehow missed (April 2007, "More bluff than bite"). For years, I've been trying to locate a book or a short story I remember that was narrated by a bull snake about the events in his everyday life. I read it many years ago and would like to see it again as it was so fascinating. Perhaps another reader recalls it. Thanks.

Chuck Sauer
Gleason

RECREATION ON WISCONSIN RIVER SANDBARS

The magazine's October response to a letter asking about sandbar use on the Wisconsin River near the Dells of the Wisconsin River State Natural Area needs clarification. The Department of Natural Resources does not prohibit use of the beaches/sandbars on DNR-owned land in the stretch of the river within the Dells of the Wisconsin River State Natural Area, roughly from Stand Rock downstream to the dam in Wisconsin Dells. The master plan specifically states that "sandbars will be open for public use with restrictions." Those restrictions include no overnight mooring of boats, no camping, no glass containers, no charcoal grills (per NR 45). However, the cliffs adjacent to the sandbars ARE off-limits to the public, as are the lands "behind" (landward of) the sandbars. These areas are posted as "closed areas." The DNR recognized the long history of the public's beach/sandbar use at the Dells, and worked to craft a reasonable solution to accommodate it.

The University of Wisconsin has its own regulations for public use of its sandbars and beaches at Blackhawk Island and Camp Upham Woods and is certainly within its legal rights to prohibit public use or impose restrictions.

Thomas A. Meyer, DNR
Conservation Biologist

Unlike typical flowers with colorful petals and sepals, skunk cabbage produces a spiral, sculpted hood called a spathe. This is really a single, highly modified leaf, which wraps around itself. Enclosed in the five-inch hood and visible through its narrow side opening is a spherical, yellowish head of tightly packed individual flowers, called a spadix. The flowers have no petals but have four inconspicuous yellow sepals. When they bloom, the stamens grow up between and above the sepals to release pale yellow pollen. Then a female style grows out from the middle of each flower, ready to accept the pollen that is delivered by insects.

How can skunk cabbage grow in frozen soil and blossom in cold weather when others can't? It produces its own heat and creates a warm microhabitat where it can grow. When the springtime temperatures first start to rise above 32 degrees F, the spadix begins to oxidize starches that were stored all winter in the roots. A by-product of this biochemical reaction is heat; hot enough to thaw the immediate area surrounding the plant and encourage the hood to grow and open. The plant warms and retains heat in the space inside the hood that has a thick, spongy texture and acts as a good insulator.

Although the surrounding ambient air temperatures fluctuate, the spadix adjusts its respiration rate to maintain a fairly constant 70 degrees within the hood. For about two weeks, the internal toasty temperature keeps the spadix from freezing and enables the sensitive reproductive structures to develop and blossom. The heat also vaporizes foul-smelling substances that attract pollinators like flies, beetles and honey bees.

After pollination is complete, the hood slowly disintegrates. The spadix bends over and grows along the ground. By mid-June, the mature red fruiting heads, now two inches in diameter, contain round, berry-like fruits, each with a single half-inch di-

ameter seed inside.

Observant flower watchers will notice a green, cigar-like leaf bud nestled next to the hood. In March, this bud bides its time waiting for warmer days. When the spadix tips over, the tightly rolled leaf bud starts to grow. From late April into May, bright green leaves



In spring, skunk cabbage grows large light green leaves as big as rhubarb or tobacco leaves. These leaves have a characteristic skunky smell if crushed.

unfurl and expand into large tobacco or rhubarb-sized leaves. Most people become aware of this plant when its leaves are large and showy in May. Crush a leaf and you'll appreciate how the plant earned its name.

By late June into July the watery leaves sort of dissolve and disappear. By August, the mature fruiting heads start to fall apart and the fruits on the ground are eaten, decompose or may germinate in the fall or spring. Skunk cabbage is a perennial, and individual plants may live a decade or more. Newly sprouted plants take at least seven years to produce their first flowers. In late autumn, you may see the next year's leaf buds and hoods already poking above ground but unopened. They will wait until late winter to make their own heat and reclaim the distinction as Wisconsin's earliest flowering native species. ❧

Anita Carpenter gets an early start on her flower gazing every winter, her favorite season.

PAUL PEETERS

Comforts

Kiera Wiatrak



Tiny radio frequency ID tags can be implanted painlessly in seconds.

HOMEAGAIN.COM

Road ready

You and Fido have been cooped up all winter and it's time to plan a road trip. Whether it's for only a day or a week, here are some tips to consider to make the trip easier on you and your pooch.

In case of emergency

Make sure your dog's tag has up to date information with your name, home phone and cell phone, in addition to your vet's name and number.

Consider carrying a photo of your dog to show to the locals in case he gets lost, or have your vet implant a radio-frequency identification (RFID) chip in your dog to track his whereabouts. Carry your dog's medical records and consider getting your dog

vaccinated for Lyme disease if there could be ticks in your planned area of travel. Ask your vet for further vaccination recommendations specific to where you are going.

Make your pet at home on the road

Consistency and routine are essential for a smooth traveling experience. Bring along a few of his favorite toys and maybe a blanket he likes to sleep on at home. Not only will these objects keep your pet busy, they also contain the scent of home and provide additional comfort for your pet.

Consider investing in either a carrier or crate, or canine seatbelt system to keep your pet safe in a car accident. Line the carrier with blankets from home so it feels like a personal haven for your pet on the road. Never leave your dog alone in the car. Temperatures

rise quickly in the enclosed space and can lead to heat stroke or even death.

Get him used to the car

If previous car trips were a visit to the vet, your dog may not understand that car rides can result in new and exciting adventures. A few days before your road trip, take your dog for a few short trips in the car that end in a walk in the park or a fun visit with a family friend. Your dog will learn that car rides aren't necessarily stressful experiences, and you will learn whether or not your dog gets car sick or nervous. If that's the case, you can purchase ginger capsules for car sickness or spray products for comfort. Spray these products — which contain natural canine pheromones that cause them to feel calm and relaxed — in their crates or on their blankets.

Longer trips

Car trips that last for more than a few hours involve extra consideration for your pet. Stop every 2 to 3 hours so he can go to the bathroom and stretch his legs. Keep feeding schedules the same. If you expect your road schedule to vary from your home schedule, put your dog on the expected feeding schedule a few days before you leave to ease him into the transition. While many hotels or motels allow pets, some charge extra for canine guests or require deposits that are returned if your pet does no damage. Make sure to call hotels or motels in advance and speak to a manager about their specific rule regarding pets.



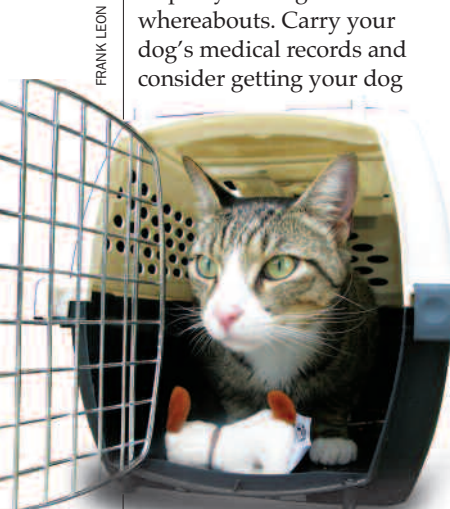
Burying meds in a little treat often makes pilling easier.

A spoonful of dog food helps the medicine go down

When your dog is sick and pills seem to be more than he can swallow, consider these tips to make the experience go more smoothly.

- Check with your vet to see if it can be given with food, or if it can be crushed or cut.
- If it can be crushed (or if it's liquid), disguise it in some smelly, tasty morsel you know your dog will gulp right down. After it's down, finish with the rest of his meal.
- If the pill can't be taken with food, put your left hand (if you're right-handed) over the top of your dog's muzzle and gently grab her lips.
- Tip up the nose and with your right hand put the pill in the back of the throat.
- Close the mouth and hold the nose up, blowing gently in the nose or stroking the throat to encourage him to swallow.
- Watch your dog for a minute to make sure the pill is down and follow with a treat to make the experience a positive one.

To watch a video of this routine, visit www.video.about.com/vetmedicine/How-to-Give-a-Dog-a-Pill.htm



FRANK LEON

Get pets used to their carriers before your trip to reduce anxiety.

Kiera Wiatrak worked as an editorial intern with Wisconsin Natural Resources magazine.

LEENA ROGERS

Traveler

David L. Sperling



When the spirit moves you

We're gaining daylight and there's less of a bite in the air. Time to get outside, shake off the doldrums and get pumped for outdoor doings. Traveler says get the spirit and get going.

RJ & LINDA MILLER

We'll start in Spirit, northeast of Medford on the Price/Taylor county line where on Saturday, Feb. 13 they host an **Ice Fishing Jamboree** on Little Spirit Lake along Hwy. 102 from 6 a.m. until 3 p.m. They'll be cooking up good times, brats, and the calls that it's getting "chili" will bring out a bowl of red. (715) 427-3778, spiritalakeassoc.org

Not far away later that day, join the fun at **Rib Mountain State Park**, 4200 Park Drive in Wausau, where you can strap on snowshoes and take an **evening candlelit hike** on the quiet park trails from 6-8 p.m. Refreshments and snowshoe rentals are available. Call (715) 359-9166 or check online at ribmountain.org to get in touch with the Friends of Rib Mountain group that organizes the romantic hike.

Practice your swing and warm up for spring at the **Ice Tee Classic**, a golf outing on Saturday, Feb. 20 held on the 400 Block of downtown Wausau where you can pitch and putt tennis balls through a course of novelty holes and

obstacles set up by local organizations. It's fun for the whole clan from 10 a.m. until 3 p.m. Call (715) 845-1966 or a straight shot to neighbors place.org/events.cfm for more details.

In the mood for a squeal of a deal? Head over to Sheboygan County Broughton Marsh Park on Saturday, Feb. 20 for the fifth annual **Pig in the Ice Winter Festival**. It's a mixed bag of

treats all day including races on vintage snowmobiles, an Ice Fisheree sponsored by the Crystal Lake Sportsmen's Club, an ice cube hunt with prizes for



This fun barbecue is nice on ice.

THREE GUYS & A GRILL

both adults and children, and the sweet smells of a community pig roast wafting through the crisp winter air. What better way to pay homage to the barbecue

gods than with the first big barbecue of the season? The park is located near the intersection of County Highways J and P at W7039

County Road SR in Elkhart Lake. Call (920) 893-0989 for more details.

If that doesn't get your spirit soaring, glide over to Prairie du Chien on Saturday, Feb. 27 for



HERBERT LANGE

Bald Eagle Appreciation Days. Events, held from 9 a.m. through 3 p.m. at the Chamber of Commerce Building, 211 S. Main St., include interpretive programs with live eagles, exhibits and displays about raptors, talks by birding experts, and short field trips to watch eagles along the Wisconsin and Mississippi rivers. For program details, call (608) 326-8555 or toll-free (800) 732-1673. E-mail info@prairieduchien.org

Finally, may we note two great cultures that found common ground in celebrating the exodus of slithering, hopping infestations from their shores. In Brantwood, (Price County near the junction of Price, Oneida and Lincoln counties), the Finns and Irish share steaming plates heaped with corned beef and cabbage (perhaps with a rutabaga for good measure) in a joint **St. Urho/St. Patrick's Day Celebration** on Saturday, March 13. Legend holds that St. Urho cast the frogs and grasshoppers out of Finland just as St. Paddy chased the snakes from Ireland. In these days of herptile and insect appreciation, it's hardly a reason to celebrate, but one is forgiving where good food and a bit of brew raise the spirits at the table. An early dinner will be served from 4:30-6:30 p.m. followed by a 7 p.m. program at the Brantwood Community Center, N4888 Stadium Road. Call (715) 564-2525 or e-mail cen95870@centurytel.net



RJ & LINDA MILLER



Wisconsin, naturally

LOWER TOMAHAWK RIVER PINES STATE NATURAL AREA

Notable: Lower Tomahawk River Pines features mature stands of dry-mesic pine forest, a natural community historically prevalent over large portions of this ecoregion, which is now rare. Understory plant species include pipsissewa, bunchberry, trailing arbutus, wintergreen, twinflower, shining clubmoss and bracken fern. The Tomahawk River, which bisects the natural area, provides clean, fast-flowing stream habitat for the larval form of the state-threatened pygmy snaketail dragonfly. Wetlands in the river floodplain include patches of northern sedge meadow, alder thicket and tamarack swamp, along with scattered groves of silver maples. Golden-crowned kinglet, yellow-bellied sapsucker, pine warbler and yellow-rumped warbler are among the resident bird species found here.



How to get there:

From the intersection of County K and Highway 47 north of Rhinelander, go west on K 12.8 miles, then continue west on Swamp Lake Road 2.2 miles, then south on Prairie Lake Road 1.7 miles to the north-west corner of the site. The site is also accessible by canoe via the Tomahawk River. See dnr.wi.gov/org/land/er/sna/index.asp?SNA=588 for a map and more information.

