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WISCONSIN

NATURAL RESOURCES

December 2004 \$3.50

Wisconsin's
land trusts

Ice diving
in Wisconsin

Breathing easier —
state air quality

Where sleeping
bears lie



Treetop ornaments

Like kids on holiday, red-breasted nuthatches poke and probe around evergreens looking for winter goodies.

Anita Carpenter

Trees have long since shed their colorful leaves. The milkweed pods are empty and grapevines are stripped of purple fruit. Life on this once-bustling landscape is now on hold, but not for everything.

From atop a towering balsam fir, a thin, high-pitched, *eeen, eeen, eeen* gently breaks the winter silence. I look up to find a diminutive blue and rusty bird clinging to a snow-dusted bough, looking much like a holiday ornament. This ornament, a red-breasted nuthatch, is actively attacking what is left of a disintegrating cone. Using its long, tapered bill, this bundle of energy probes the cone for seeds. Cone bracts rain down as discovered seeds are quickly eaten. Then with a couple of quick wingbeats, the ornament flies off to another cone-laden branch.

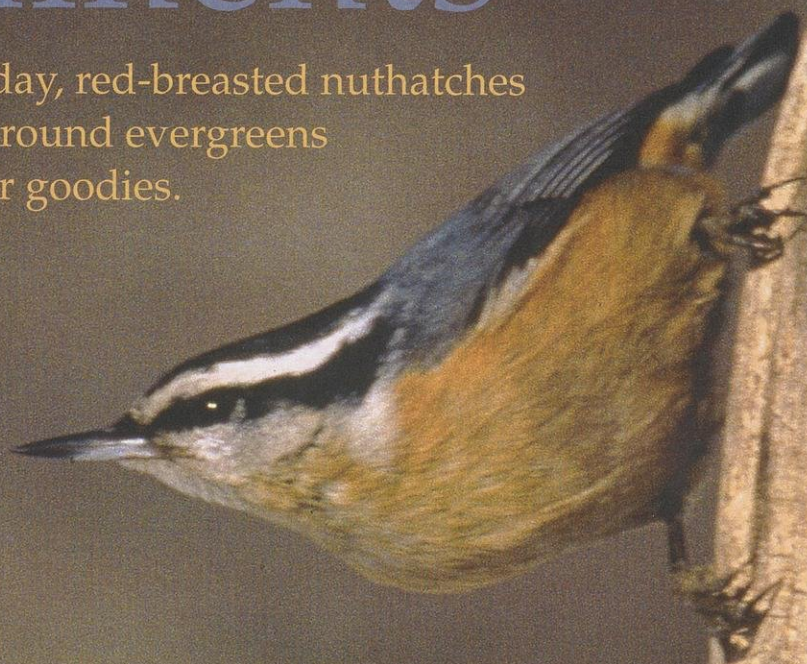
I'm always delighted to see red-breasted nuthatches as they only visit us in winter. Some years bring many while in other winters the nomadic birds are scarce. Whether or not they arrive to entertain us depends upon the cone supply in the northern conifers. If fir and spruce cones are abundant, the tiny sprites stay up north and dine

well. If the cone crop is inadequate, the birds move south searching for food. Some years they may migrate only as far as central and southern Wisconsin to satisfy their needs, while other years they may bypass us and leave the state to delight bird watchers to our south.

When not dining on cone seeds, red-breasted nuthatches spend their time twisting, turning, spiraling up, down, around, behind and under conifer tree trunks and branches, gleaning for insect eggs and larvae, and stored seeds. Unlike woodpeckers, red-breasted nuthatches are equally adept at hitching up a tree trunk as they are at moving headfirst down the trunk.

Red-breasted nuthatches, *Sitta canadensis*, are fairly easy birds to identify. On their stocky, 4½-inch frame, they sport a short tail and neck, proportionately large head and long, black bill. Each red-breasted nuthatch has rusty red on its breast that extends to under its tail. Its blue-gray back is the color of ominous storm clouds. The most definitive characteristic is its black eye line topped with a white stripe. The only species likely to be confused with this bird is its larger

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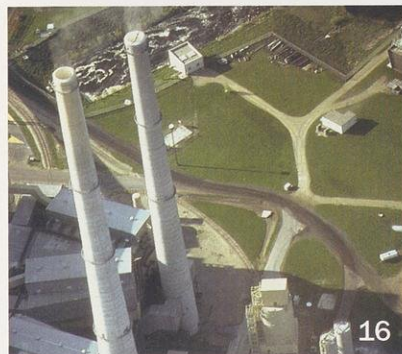
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A man in a red jacket and a grey cap stands on a grassy bank, fishing with a rod and reel. The lake is calm, reflecting the surrounding forest. The background is filled with tall evergreen trees and a dense stand of deciduous trees with autumn-colored foliage. A light mist or fog hangs over the water, creating a serene atmosphere.

The CORE of

What does Wisconsin most need to do to protect, restore and enhance its waters in times of diminishing funds and increasing pressure on natural resources?

recovery

Lisa Gaumnitz

The heated discussions of last summer were not about hot weather, but shorelines and shallow water.

Who would need permits for piers and boathouses? Would permits be needed to dredge or grade a shoreline? Would top musky and walleye waters maintain the habitat scientists say they need for good fishing?

Similarly, during the cool, wet summer, readers were flooded with stories about sewage bypassing, construction site erosion, toxic algae and mercury in fish. Manure spills, fish kills and beach contamination were front-page fodder. A season that is supposed to be about fun in the sun instead seemed to say "stay out of the water and don't eat the fish."

The cold, wet summer put a damper on good news as well. Todd Ambs, Wisconsin's top water official, can cite many achievements obscured by the summer's bad headlines, including new state rules to reduce mercury contamination in lakes and rivers; growing partnerships to stop the spread of zebra mussels and other invasive aquatic species; and successful projects to reclaim lakes, for starters.

In fact, Ambs sees a silver lining to the water woes.

"The headlines drive home how important water resources are to Wisconsin people," he says. "They raise awareness about what government is doing to protect these resources and what individuals can do."

Ambs sees such broad awareness and public actions as one leg of a three-legged stool. The other two legs are a shared vision for Wisconsin's water resources and strong goals to reach that vision. That solid foundation gives DNR staff direction to protect waters, it provides a game plan to involve the public in water protection and should

provide a report card on how we're doing in reaching those goals.

"Protecting Wisconsin's water resources is arguably one of the most important tasks in state government, not only for the environment, but for our economy, particularly our \$12 billion tourism economy, and our quality of life," Ambs says. "Here, we hold water resources in trust for everyone. We are expected to balance competing uses and private property rights as well as providing public recreation while preserving waterways for future generations. It is a difficult task."

Ambs, appointed DNR water division administrator in January 2003, was struck by three things in his first six months on the job: "We've got great people, doing great work under great pressures," he says. "But we need to work smarter, not harder, to do the best we can with the staff and funding available to us."

Working smarter is increasingly important as DNR's responsibilities for Wisconsin's abundant water resources grow ever larger and available funding and staffing decrease.

The big picture shows that water resources themselves may be more vast than we had imagined. New satellite and mapping technology more accurately calculates waterbody sizes and suggests that Wisconsin has 84,474 miles of streams, not 57,000 as previously thought; more than 15,000 lakes totaling 1.2 million acres; and 1,000 miles of Great Lakes coastline. Add to that 5.3 million acres of wetlands and enough groundwater to cover Wisconsin to a depth of 100 feet. Those statistics help anchor the state's status as one of the nation's wettest.

Yet, tight state tax dollars and less federal money means Water Division staffing and funding have been pared back in recent years and will be pared

again. Thirty-two jobs were cut in the last two years and more cuts could occur if state revenues don't improve.

Goal one: protect the Public Trust Doctrine

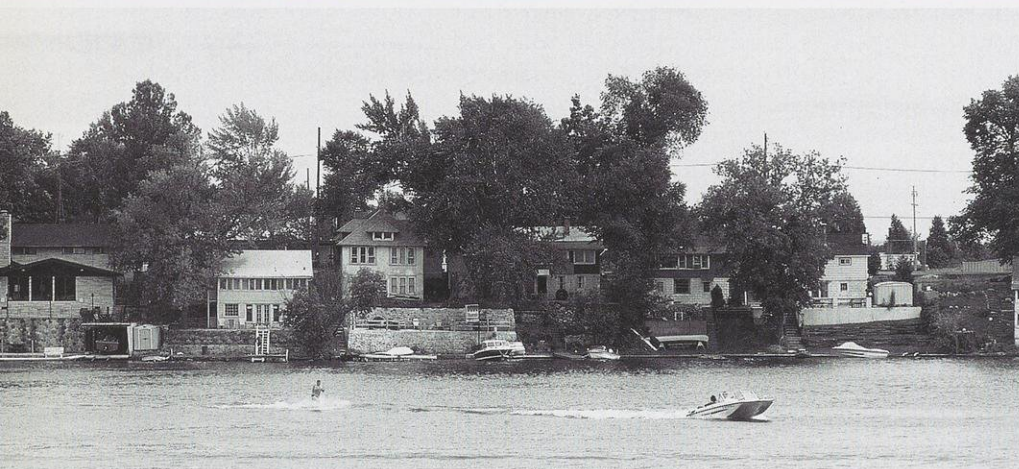
Given those realities, Ambs and DNR's top water leaders statewide took a step back and asked what we most needed to do to protect, restore and enhance the waters that remain the birthright of all Wisconsinites, the lifeblood of our ecosystems, and the economic engine and beacon for yet another century?

They looked to the state's figurative headwaters for their first goal: protect lakes and rivers that belong to all Wisconsin citizens by enforcing the Public Trust Doctrine.

That doctrine flows from the state Constitution and more than 150 years of court cases and laws that interpret how and where all citizens have the right to use and enjoy public waters. Private landowners have a right to reasonable use of their waterfront, including a pier, but those private rights are clearly secondary to public rights.

This revolutionary, egalitarian concept was incorporated into English law in the Magna Carta in 1225, and was brought to colonies in America and became part of the laws of the original 13 states, according to Mike Cain, a student of the doctrine and a DNR lawyer who has represented water programs since the 1970s. As settlement marched westward, the Northwest Ordinance of 1787 declared: "The navigable waters leading into the Mississippi and St. Lawrence...shall be common highways and forever free..."

Wisconsin's founding citizens enshrined those words in their state Constitution. Since then, the state Supreme Court, the Legislature, the Department of Natural Resources and private citi-



What's right for the shoreline depends on your point of view.

(above) Riparians want access from their property.

(below) On-water users want space to play.

Conservationists want undeveloped shorelines that filter runoff, protect spawning habitat and provide both pleasing views and quiet outdoor experiences.

removing native plants.

Today, the Public Trust Doctrine is more important than ever, Cain says. Development along lakes and rivers continues to boom even as research in Wisconsin and elsewhere documents the cumulative damage to lakes, rivers and wetlands from thousands of small projects at the water's edge, just what the Supreme Court alluded to in its 1966 decision in *Hixon v. PSC*: "A little fill here and a little fill there may seem to be nothing to be excited about. But one fill, though inconsequential, may lead to another and another and before long, a great body of water may be eaten away...Our navigable waters are a natural heritage. Once gone, they disappear forever."

As plants and downed trees are removed from many developed shores, lakes and rivers are losing their songbirds, frogs and loons. New research suggests that nongame fish, important as part of a balanced ecosystem and as a

zens have been very aggressive in upholding the trust doctrine and broadening the interpretation of public rights to include a variety of water uses like hunting, fishing, boating, skating, swimming, natural scenic beauty and good water quality.

For decades, DNR has carried out its responsibility to protect public rights in public waters in part by reviewing and issuing permits for erosion control measures, grading, boathouses, and other projects along shorelines and shallow waters. The permitting program aims to assure that projects are properly designed, built and located to minimize

environmental damage and to avoid interfering with boating.

In 1966, lawmakers worried that a post-World War II building boom was harming the state's lakes and natural scenic beauty and decided to further protect the state's water resources. They passed the nation's first law requiring shoreland zoning in unincorporated areas to reduce the density of development and provide a natural buffer along lakes and rivers. DNR sets statewide minimum standards that counties must enforce along lakes and rivers for lot sizes, how far buildings are set back, and limits on cutting down trees and

JOSEPH KING

foodsource for game fish, are vanishing from Wisconsin waters as water quality degrades due to shoreline development. Game fish reproduction hangs in the balance.

"Good fishing in Wisconsin absolutely depends on having good aquatic habitat and good water quality in every lake and stream," said Mike Staggs, who leads DNR's fisheries management and habitat protection program. "Construction of docks, riprap, seawalls and boat-houses, dredging, filling, removal of aquatic plants and woody cover, and the installation of more impervious surfaces all can degrade aquatic habitat if not done properly.

"If we destroy the natural shoreline habitat then fishing will get worse, and we cannot fix that situation simply by stocking or changing fishing regulations. If you want great fishing, you have to protect fish habitat," Staggs said.

He recounted recent research in Wisconsin and elsewhere to amplify the point. Muskies reproduce best on lakes where less than 20 percent of the shoreline is developed. Bluegill production is two and a half times higher on undeveloped lakes compared with developed lakes. Trout populations disappear in watersheds where more than 11 percent of the land becomes built and paved. "Cleaning up the shoreline" to remove wood and aquatic plants that fish rely on for cover reduces fishing exponentially. The amount of woody cover, plants and bank cover is 30–600 percent higher on natural shorelines as compared to riprapped shores.

Fewer permits and quicker reviews

Wisconsin's program for regulating shoreline projects must protect the habitat but also be supported and accepted by the public, Staggs says. "We've heard two concerns about the program: decisions take too long and they're inconsistent, and that the program isn't working to protect our environmental resources."

A new law aimed at streamlining the permitting program sought to address time and consistency concerns without

weakening environmental protection. DNR's temporary rules to help carry out the law enabled half of the projects submitted in 2004 to be exempt from permitting and comprehensive DNR review or to qualify for a general permit and 30-day review.

Continuing to issue timely, consistent decisions is one of the goals Staggs and his staff have set. The second goal seeks to ensure that the permitting program is protecting the environment by requiring DNR habitat protection staff to make random checks of projects to ensure they meet the applicable environmental rules for designing, building

and locating their projects. Previously, DNR inspected projects only after receiving citizen complaints. Early results from compliance checks of 68 projects completed in summer 2004 were encouraging, Staggs says, particularly with the confusion over changes to the temporary rules.

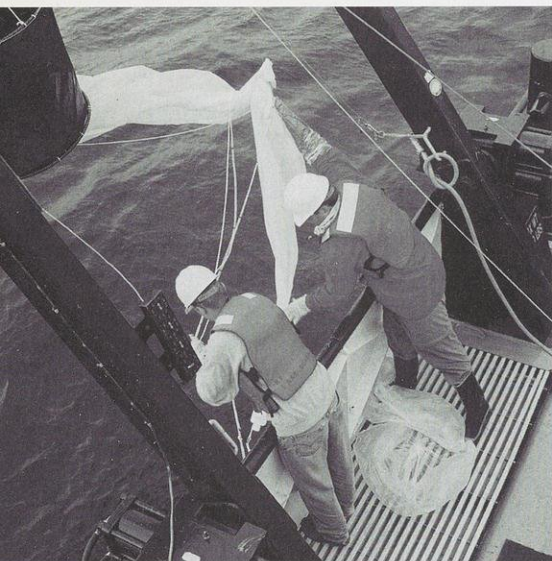
Goal two: enforce the Clean Water Act

By the late 1960s, Wisconsin had a slew of laws on the books designed to keep people, cities and industry from polluting state waters, but the reality was it

(below) Enforcing clean water goals includes a commitment to monitor and adjust human actions that change waters and affect the organisms that live there.

(bottom) Ordinances, permits and incentives can reinforce community resolve to curb practices that carry polluted runoff to waterways.





GORDON BLUM

Monitoring how diffuse toxic pollutants like mercury drift long distances, settle and recirculate in waters, sediments, plants and animals is key information for setting regional and national policies.

took decades to upgrade treatment plants and enforce those laws in a meaningful way. The state's major rivers were choked with poorly treated wastes from municipal treatment plants and factories. The Wisconsin Legislature set up The Wisconsin Fund to make treatment plant improvements affordable for communities and by 1983, Wisconsin became the first state nationwide to meet the law's interim clean water standards. While we've made significant, visible progress we haven't reached the overall goal. Due to polluted runoff, airborne pollution, dams and other habitat alterations, and sedimentation, many of our waters are still not fishable and swimmable, but it's a work in progress.

The challenges include containing ubiquitous pollutants like mercury. All Wisconsin stream miles are considered impaired by mercury contamination — some from sources in Wisconsin and some from airborne pollutants that drift in from other states and across the nation, including small amounts that are by-products from coal-fired power plants.

Addressing problems like mercury contamination will require help from beyond Wisconsin's borders, notes Russ Rasmussen, who leads the DNR program charged with carrying out the

Clean Water Act. He and staff will focus on activities that most directly affect the environment. Even the relatively few waters that won't reach fishable and swimmable conditions due to rapid community growth can improve.

"Rather than just pushing out permits, we're stepping back and making sure our requirements are really the most important ones to protect the environment," Rasmussen says. "We're also going to do more to make sure businesses and communities are meeting the terms of those permits."

Rasmussen and staff have created seven targets to gauge their progress, including:

- completing rules to decrease bacterial loads in wastewater
- reducing wastewater temperature to better protect coldwater trout streams and public health in recreational waters
- tightening standards on discharging phosphorus and other nutrients
- drafting rules that explain the policies DNR uses to tell the EPA when Wisconsin waters are impaired and don't meet clean water standards
- setting a timetable to evaluate the stormwater management plans that more than 1,200 municipalities and industrial sites are developing
- completing rules to reduce sanitary sewer overflows into state waters as well as investigating those occurrences and taking enforcement actions, where appropriate.

Finally, Rasmussen and staff set a goal of issuing permits to industrial and municipal wastewater dischargers in a timely fashion while ensuring that plants are meeting standards and using current technologies. Permit reviewers are aiming to keep their current record of having the most efficient permit processing times of any midwestern state. They aim to reduce the time it takes to process permits to large-scale farming operations while stepping up environmental monitoring of those businesses to prevent manure spills and runoff that can harm water quality and fish.

"We're not going to be able to do as many things as we did in the past, but what we do, we're going to work to do better," Rasmussen says.

Goal three: meet drinking and groundwater needs

Wisconsin's come a long way from the days when contaminated drinking water was a leading killer, "but we can't grow complacent or lose ground," says Jill Jonas, who leads the Drinking Water and Groundwater program. The state has a long history of legislation, well codes, training and inspections to provide safe drinking water and protect the groundwater aquifers that supply nearly 70 percent of state residents with water.

Sustaining ample supplies of healthy drinking water is particularly challenging as the state and many public water supply systems struggle to find affordable means of reducing the levels of arsenic, radium and other contaminants in public drinking water supplies, Jonas says.

Where populations continue to grow rapidly, water demand is increasing faster than our water supplies naturally recharge. As a consequence, community costs to dig deeper wells are rising. Water drawn from deep aquifers may release contaminants like radium and arsenic. Withdrawing more water potentially changes long-distance aquifer flow, and it takes delicate, international negotiations to determine which communities and businesses should have the rights to withdraw Great Lakes water.

"Prevention, prevention, prevention," Jonas emphasized. "It's important to be on-site when a well is going in, whether it's a municipal well or a private well. Because once the well's in, it's difficult to assess whether it's been constructed properly to keep contaminants out or avoid contaminating the aquifer. It's also important to inspect facilities and water supply systems to make sure they're operating properly to prevent problems," she says.

Goal four: enhance and restore outstanding fisheries

Good habitat and clean water are key ingredients for good fishing. But those two alone aren't enough. Managing fish and the people who pursue them is criti-

cal in a state where fishing is a treasured tradition and an economic engine.

Nearly 1.4 million people buy fishing licenses and spend 22 million days each year on Wisconsin lakes and streams — numbers that swell when you add in kids and others who don't need licenses. Fishing generates \$2.3 billion in economic activity, supports 26,200 jobs, and provides \$95 million in state tax revenue. Fishing is a key draw for out-of-state tourists and Wisconsin attracts more nonresident anglers than any state except Florida.

"Fundamentally, any time you have two million people try to use a resource and many of them harvesting fish, you have to make choices on how to allocate that resource or you will collectively use the resource to death," Staggs says. "So we develop fishing regulations, habitat management programs, stocking pro-

grams, and others to provide for a sustainable fishery that meets as many of our customers' needs as possible."

Staggs and his fisheries management staffers in the late 1990s created a strategic plan to guide their work for the next decade. In 2004, they dug into that same plan, assessed what they had accomplished, what was left undone and came up with several dozen goals to achieve in the next two years.

Among those goals are:

- improving trout habitat in impaired waters to 30 stream miles a year (up from 25) while maintaining past improvement projects.
- maintaining fish stocking by implementing the long-term hatchery development plan to rebuild and continue maintenance of the state's aging fish hatcheries. The first project? Completing renovations at the Wild


Rose State Fish Hatchery by 2007. The facility is the state's production king for Lake Michigan trout and salmon, a \$200 million fishery that is almost totally dependent on stocking.

- removing dams and improving the associated stream habitat where sport fisheries and aquatic diversity can be improved, where the local communities are willing partners, and where external funding is available.
- continuing to implement the court-mandated requirements for monitoring, assessing and managing the joint sport and tribal fisheries in the ceded territory.
- restoring naturally reproducing native brook trout in four streams statewide per year.
- rehabilitating 500 to 700 acres of Mississippi River habitat each year using federal environmental management funds.
- managing for a stable commercial fishery within the productive capacity of Lake Michigan, Lake Superior and the Mississippi River.
- increasing trophy fishing opportunities for muskies greater than 45 inches and doubling the catch rate of trophy musky by 2007.
- boosting to 50 percent the proportion of stocked trout that are the progeny of wild fish.

These targets are just a few of the goals fisheries management folks have set for themselves, and for achieving the Water Division's goal of enhancing and restoring fisheries.

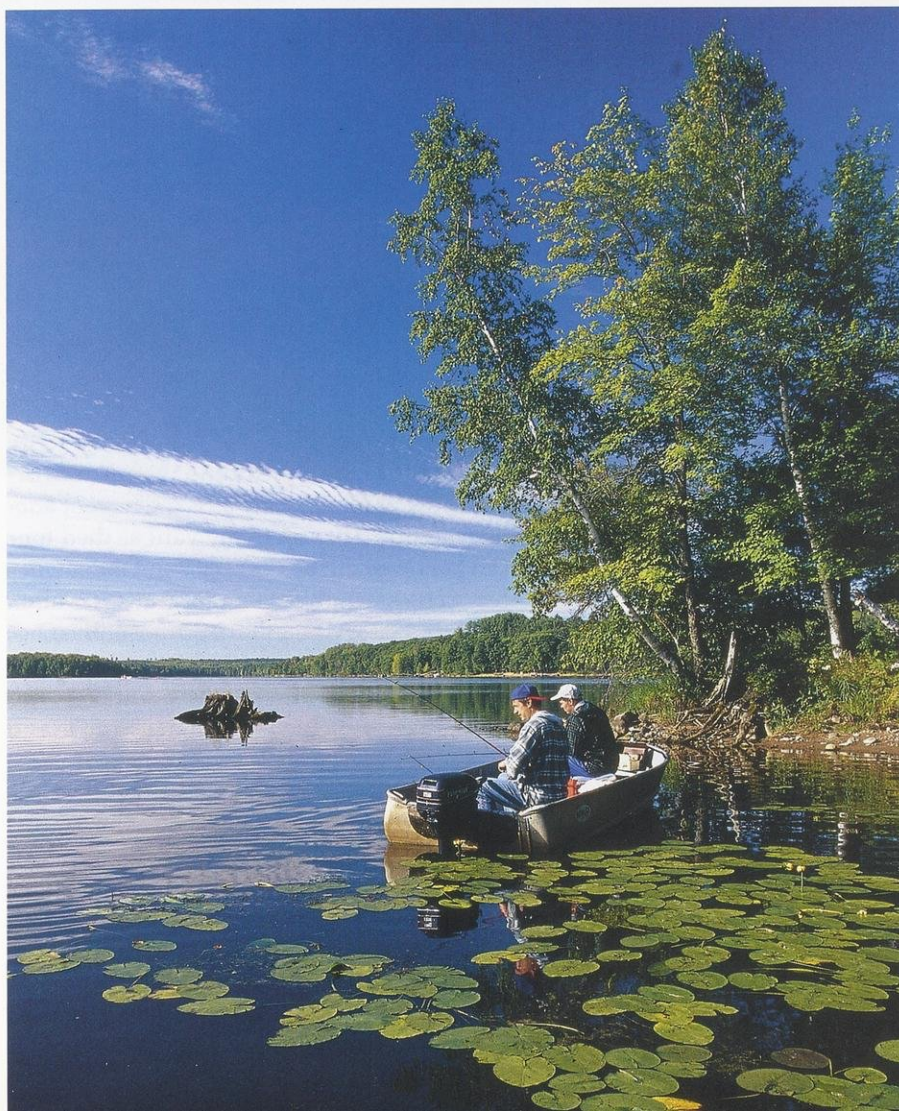
Ambs is careful to stress that the fisheries goals — like those in the three other areas — are near-term starting points, not the end-all, be-all of DNR programs to protect lakes, rivers, wetlands and groundwater.

"We're not done," Ambs says. "What you see here is a snapshot of some of the goals we have identified. For instance, we will add water monitoring and shoreland strategies later this year.

"We'll periodically step back and review those four goals, measure our progress in meeting them, and adjust and adapt as necessary." 

Lisa Gaumnitz is public affairs manager for DNR's water programs.

Good fishing depends on our abilities to maintain good habitat and good water quality. Fish need natural shorelines, plants and woody cover to sustain their populations.



RJ & LINDA MILLER

The pleasure of DEAD TREES

For natural drama and entertainment,
there's nothing quite as good as dead wood.

Justin Isherwood



DON BLEGEN

The woods where I dwell is of oak, these to the high ground; maple do poke away here and there. It is well known a maple will out-race an oak for the new hold in the canopy but suffer for this the same disadvantage as wide receivers whose quarterback throws high out of fear of interception. No more terrible moment is there for wide receivers than going after a high pass

knowing their knees are at the same height above ground as the tackling dummy.

New maples in a determined oak woods also seem almost to teeter, standing on tiptoe to reach for sun. They are easily dismembered for daring to keep the company of black and humorless oak; cut off at the knees by the next hard westerly wind.

A few years ago a hard blow toppled numerous oaks in my woods. It was mid-summer when this happened; I had other chores. The following winter my brother divorced causing a hemorrhage of epic proportions to our shared farm; we manned the bilge pump at the lawyer's office most of that winter. The winter after was spent in another woods, pine saw logs mostly. By the time I got around to the downed oak in my own lot, the wood was punky, not to mention that a bramble of cane and new maple had grown up. It was easy to find better places to cut firewood.

Wasting oak, even if a little punky, is a gawd-awful sin in the eyes of the farmhouse. No wood kept back the tide of winter better than oak 'cept hickory, and we are too far north for hickory. We're even lucky to have oak at 45° north latitude. God help those who must fight off winter using no better sticks than popple and white pine.

Two years ago a catch of oak wilt killed off a nice group of trees standing along the trail as it went around the car barn. It took out the swing tree and a couple others. I have, consequently around my biggins, an array of dead trees, which to some suburban patriots look disheveled, if not third-worldly.

Ever notice how as soon as someone moves into what was a nice patch of woods and builds there a house that the very reason they moved to the woods in the first act is displaced by a passion for lawn? Soon after every vagrant bush, every elderberry and thornapple, every dead tree is removed, with tulips planted where once were Indian pipe and anemone. Dead trees are not often countenanced in gardening magazines; landscapers do not coolly advise of the benefits of dead oak. Instead they are cut down, the stumps ground out by noise, and what is left given to grass and those damnable tulips.

Nature is otherwise. Nature done well, done devotedly with unfettered charity, is messy. And no temple is worshipped more devotedly or so earnestly as is the fervent adoration given to a dead tree. The oak in my yard as died four years ago has been hollowed out by deer mice and the cavities enlarged by generations of squirrels. Summer ants stream in and out as if from franchises, who in turn attract nuthatches and downies. Yesterday morning a pileated woodpecker danced around the dead stem pursued by a squirrel who thought it alone held the deed. There is nothing so alive and abundant in nature as a dead tree. It reminds me of a frat house overcrowded, unkempt and prone to late night parties, not to mention the local cops who know the address by heart.

In the cause of nature, it has been a major accomplishment of the environmental movement to convince the body public that wetlands are a true womb of life, both mantelpiece and cornerstone, despite the fact that wetlands are not so beautiful as woods and running rivers. Everybody now knows the ore's real worth is in wetlands; industry, suburbs and road builders



STEPHEN J. LANG

Catch the daily drama as tunneling ants, marauding birds and chiseling cavity nesters vie for food and shelter in the confines of dead trees.


now know this well enough to go around, not over them.

Dead trees hold a similar reservoir and yet-unknown worth. I once lived, as most farmkids did, under the edict of the woodpile that a tree belongs to the hearth as soon as it dies. This was the supreme rite of winter. Hard was it to bypass a dead tree and not reduce it to stove wood and kindling.

The maple on the corner of the house trail is dying. Truth is I notched it a time or two with the tractor axle. The top died ten years ago. Trees it seems die the same as we, inch by inch, length by length. Ichneumon flies laid it with eggs several summers ago; ants have happily turned the exposed wood into a Hindu temple complete with shrines and niches. Woodpeckers see this as an invitation for their tourism.

I will not tell you that I have pulled my La-Z-Boy into the

driveway on Sunday afternoon to watch this tree die, though I am tempted. It is a vivid spectacle, though I suppose Broadway isn't particularly interested, and neither is Spielberg. Never mind that a universe or two is collapsing and colliding in that tree, a hundred Attilas are at the ramparts, the crown jewels are hidden away in dungeons, the eggs of the princess are guarded by mailed gladiators, a nation is at war, and it is terrible and wonderful to watch.

A dead tree, I have learned, is better to watch than a live tree. If you want art and drama in the front yard, all the passion and the pathos of ruined civilizations, tend a dead tree. As for firewood, cut something green. 

Justin Isherwood farms and crafts essays in Plover.

The glass ceiling

Winter diving opens a window to life under the ice.

Alan W. Pahnke



(top) The view up above from down under.
(bottom) Trout circle the waters in a winter quarry dive.

With a couple of friends, I pulled the blue plastic sled piled with equipment across the frozen lake, calculating where the best spot would be. I had been here during the summer and knew we wanted to be in about 25 feet of water, so I picked a spot straight out from the boat landing. This would give us the needed depth, but still provide access to the weed beds where the bluegills had been in warmer weather.

Drilling the first hole through the ice is always exciting and all anticipation. Once the auger cut through, we judged the ice thickness, water clarity and depth to the bottom.

We drilled two more holes each 10 feet apart to form a triangle. There were five of us, but three holes were enough: Instead of angling, we were there to dive below the ice and swim with, not catch, those 'gills.

Preparing the surface

Good ice conditions and careful pre-dive preparations contribute to successful outings under the frozen ceiling. We like to have at least six inches of solid, clear ice to stand on. When divers don all their gear and a support team is stationed at the surface there's a fair amount of weight concentrated in a small area; we feel a half-foot of ice is the minimum thickness necessary to safely support the weight.

Everyone has a job to do. We start by shoveling snow away from the area where we drilled the holes. One person starts laying out and inspecting nylon safety lines. Another keeps shoveling snow. Two of us set up the diving equipment. The last person starts "connecting the dots" by carefully cutting through the ice between the holes with a chain saw. After the icy triangle has been cut loose, everyone pitches in to pull the block of ice from the water. Some divers push the block under the ice and retrieve it later to replug the surface.

Clearing the snow off the ice provides light to the divers underwater. A ring around the entrance hole is shoveled in a 100-foot radius to give the divers a point of reference while underwater. Radiating spokes are shoveled

from the outer ring toward the entrance hole with arrows pointing towards the open water exit. These spokes and arrows are visible while diving underwater and show the diver the way out should he become unhooked from his safety line.

My buddy and I start suiting up and checking our equipment. A third diver also suits up and stands by with all his scuba gear at the ready in case of emergency. This is standard practice and part of the dive plan we always follow.

Before entering the water, we don either wet suits or dry suits. Wet suits allow a very thin layer of water to seep under the neoprene, to be warmed by your body heat. While a wet suit will keep one relatively warm during a short 20-minute dive, most ice divers in Wisconsin prefer dry suits. A dry suit traps a layer of air between the suit and your body. Air is a better insulator than water, so a dry suit is warmer than a

like a vest over the dry suit and under the scuba gear. Metal rings on the safety harness provide a secure place to attach the safety rope with a locking carabiner. A 100-foot safety rope is hooked onto the diver. This rope will be payed out by the line tender, who stays in communication with those under water. The other end of the safety rope is attached to a non-movable object above the water, preferably a stake that can be screwed into the ice as opposed to a car bumper that could give the divers a pretty quick and dangerous ride to the surface should the vehicle be driven away.

Taking the cool journey

With a safety diver standing by and our gear all checked out, we're ready to go.

Your perspective changes immediately as you first enter the water. On top of the ice, you get long vistas across expanses of snow and lots of sky, but once you slip into the water and are floating at the surface, you are confronted and surrounded by a wall of ice. You can't help but look at the ice in cross section, noting how small bubbles were trapped as each small layer formed.

Then, as you start to descend, your own air bubbles slide along just under the ice like rolling pools of mercury.

The first sensation is the cold on the exposed part of your face. It stings a little, but that feeling slowly gives way to the same type of numbness you get whenever you are outside on a cold day. Next, you sense the light and clarity of the water. As the ice forms, the water settles down and particles suspended in the water sink to the bottom; visibility is often better than in the summer. There are no boats to roil the water.

There's a surprising amount of light beneath the surface; we can see about 20 feet. Since there isn't any wave action, the water remains clear and greenish. We take along flashlights in case there's something we want to investigate in dark shadows, but for the most part there is plenty of light from above. My buddy, attached to me by a 10-foot rope, kept an eye out for the bluegills that were so abundant during the summer.



There's plenty of light under the ice, but an underwater flashlight will highlight a find like a nearby bass.

wet suit. Dry suits keep you bone dry, and you can wear thin layers of clothing underneath. Clad in a full, hooded suit, booties, fins and dive gloves, you have only a small amount of skin exposed around your dive mask. You stay quite comfortable, even while swimming in 33°F water.

Safety harnesses are a must. Ours are made of nylon webbing and are worn



ALAN W. PAHNKE

Safe ice dives take teamwork.

(above) Clearing the snow in a pattern that can be seen from below pointing toward open water.

(right) Checking equipment before a dive.



ALAN W. PAHNKE

We dive in pairs, tethered together to a safety line. We check in with our line tender on the surface once a minute, using standard signals to communicate. One pull means we are OK. Two pulls means give me some more line. Three or more pulls means “bring me back in,” which can be fun, a bit like water skiing under water.

While divers are under the ice, another rope is attached to a safety diver. In the unlikely event of a problem underwater, that diver is ready to help out.

Should a diver get lost, the safety diver is attached to a rope that is twice as long as the sport diver’s line. If a diver becomes unattached from a safety line, he or she is instructed to ascend to the surface and stay put. The safety diver will then swim out as far as his rope allows and begin a sweep just under the ice. This will bring the rope to the lost diver who can use it to find his way back to the hole.

As we descend deeper, the water pressure starts to squeeze the air in my dry suit. I add air pressure using the valve hooked up to my tank to compensate for the added water pressure.

After orienting ourselves with a compass, we check the underside of the ice, the safety rope, and the bottom before we begin slowly swimming around. If the bottom is silty, we stay above it so our leg kicks and fins won’t stir up sediment and cloud the water.

We look for obstructions that might tangle the safety rope and we take visual bearings to stay oriented.

A normal ice dive lasts 15 minutes to an hour. The duration is based on the comfort level of each diver. Divers in wet suits will get cold faster than those in dry suits.

If you’ve had any dive training, you will remember that there are established time/depth limits for all scuba dives. All ice divers begin with a full tank of compressed air, typically an 80 cubic foot tank filled with 3000 psi air. Divers practice the “rule of thirds” — one-third of the air is used for the dive, one-third for the ascent and one-third as a back-up safety precaution. On some river dives, the bed may only be six feet or so down, while in deeper quarries it may drop 60 feet or more. We adjust ascent times accordingly.

An ice dive actually begins in a classroom. A certified ice diving instructor leads the student in planning and carrying out each dive. All of the rules of normal scuba diving must be adhered to, and special consideration must be given to what’s going on above the ice as well as below. For instance, the number of divers in the water at any one time determines the size of the hole; there has to be enough room so all divers in the water can surface at any time during the dive.

Additional safety rules and more

planning apply to cave diving and penetrating shipwrecks; you have to allow for the fact that you simply can’t swim directly to the surface for air.

In the classroom, the instructor explains the technical issues that apply to the dive. Training emphasizes safe techniques for both the diver and the surface support team. The instructor must ensure everyone understands his or her various job duties while on the ice. Students venture out onto the ice only when the instructor is confident they know the procedures for conducting a safe dive.

Exploring a quiet winter world

Not seeing any bluegills, I looked back over my shoulder toward the entrance hole. Our safety line was visible all the way to the hole, but I couldn’t see the line tender who had just signaled me with a pull on the rope. I gave a pull back to let him know we were OK. I used a hand signal to my buddy to let him know we were going to swim south to a deeper part of the lake. I wanted to check out the bottom composition to be sure it was suitable for a fish crib we were going to put in after the dives.

As we descended, the line tender paid out all 100 feet of our safety line. Having reached the end of our rope, we began a sweep of the lake bottom to see

the terrain. We swam in an arc proceeding to shallower water where weeds grew in the summer providing bluegill habitat. I was hoping to see some, but nothing was moving during this dive.

I checked the air pressure in my tank and signaled to my buddy that it was time to return to the surface and let the other divers have some fun. We decided to ascend to the underside of the ice and swim back to the hole. Scuba divers are taught to ascend slowly, look up and hold their hands above their head as they rise. There are times when divers forget to put their hands up and bump their heads on the ice. There's some good-natured teasing when that detail of the dive is shared with the others.

Approaching the ice I looked up and saw my bubbles flatten out like liquid

silver as they hit the smooth underside. I ran my hand through them and they scattered into smaller bubbles before regrouping to form large pools of air.

Looking up from down below offers other interesting perspectives. You can actually see the shadows of people standing on the ice, especially over the shoveled spokes and rings.

Following the safety line back, we surfaced in the hole. After getting help to get out of the water and taking off our equipment, we answered questions from onlookers who stopped by to see what was going on. As I explained what the next team was doing, we made sure their safety lines were attached and the lines were not tangled. Then it was my turn to handle the ropes and communicate with the two divers underwater.

We usually dive on warmer winter days, but sometimes we'll have a shanty with a propane heater, a nearby van or some other shelter for changing back into boots, jackets and hats.

When all the divers have had a turn and all our gear is packed up, we slide the ice blocks back

into the hole, shovel snow into the cracks so the water will freeze, stick boards into the sides of the cracks, mound snow around the boards and mark the site well so it will be seen by others traveling on the ice. We'll come back after the ice has frozen, remove the boards and level out any rough spots.

Diving for pleasure and "treasure"

Our diving group begins the year with a New Year's Day dive in the Fox River in Menasha, to look for old bottles from days when the river was used as a dump. We end our dive year in December with the Pearl Harbor Day dive in Fish Creek, gliding between the marina piers in search of anything that may have dropped overboard.

Ice divers also explore rivers, quarries, lakes and manmade ponds. There's a shipwreck in Little Sturgeon Bay that is accessible to ice divers, as are many marinas in Green Bay and Lake Michigan. It's fun to find items that went overboard during the warm boating months. A friend of mine found a small Mercury outboard motor in the Menominee River and is using it to this day on a lake in northern Wisconsin. Towels,



COURTESY OF ALAN W. PAHNKE



(above left) Divers cut a triangular hole that is easy to enter yet narrows so they can get in and out of the water more easily.

(left) A hooded dry suit, insulated booties and gloves keep author Alan Pahnke comfortable on winter dives.

(above) A safety line tethers ice divers together and they regularly send signals to those on the surface.



ALAN W. PAHNKE

The world from the bottom up provides a view of floating fish, air bubbles that look like rolling balls of mercury and looming diving buddies above the water.

boat brushes, flags and small anchors are more common finds. We also help out and remove any hazards we can safely lift, and notify authorities when we find heavier or more dangerous items — like the time a friend found an old unexploded artillery shell.

Wild sights under the ice are always a pleasant surprise. Some of the largest trout I have ever seen are in a private quarry in Amberg. The quarry owner comes out after the hole is opened and feeds the trout hot dogs. The fish will actually swim onto the ice to get at the food. These trout are really curious and will swim right up to your mask to see what is going on. They seem a little slow in the cold water, but once the divers get into the water the fish loosen up a little and will take food right out of your hand. This same quarry bed is littered with mining tools. You can find an old ore cart and the rails used to haul out gray granite.

Rescue and salvage dives

Most ice diving is done for adventure, but it is also a serious business. Many times divers are called in when a car or snowmobile breaks through the ice. Speed is of the essence and certified rescue ice divers must work quickly to save lives. Usually rescue diving is

done solo to keep safety lines from tangling. I can tell you the cold water can be a lonely place when the visibility may be as little as four inches and you know at any time you might come upon a body. As a law enforcement officer, I've been on a number of dives looking for both bodies and evidence of crimes. This type of diving takes a special person, and fortunately there are men and women who volunteer for this duty with their local sheriff's department.

We apply the same safety rules for emergency night dives, only we try to shine as much light as possible onto the ice. This might include angling car lights onto the ice, bringing in portable generators and light banks from fire departments, or employing underwater flashlights and strobes attached to the diver. The highly trained diver has to stay focused. Despite the tension of an underwater night emergency, you can't afford to panic and you need to stay safe and systematic if you are going to help someone.

Pulling an empty car, snowmobile or other property out of the water may lack the urgency of a human rescue, but safety is still important for salvage divers. There's usually more time to set up and attach hauling lines. Special wreckers equipped with pontoons can safely handle the job if the ice gives way.

Some commercial diving is scheduled in winter when the ice provides a steady platform to set up equipment over an opening. For instance, one of the best times to clean zebra mussel infestations from municipal water supply intake pipes is in winter. Pile driving for piers, bridges and other over-water construction often starts in winter, and divers are employed for some phases of these projects. Winter work may also include clearing frozen intake pipes at power plants, inspecting ship hulls for damage and checking for breaks or damage to underwater cables. For these longer dives, commercial divers may wear special warm-water suits, which circulate heated water from the surface through a hose attached to the suit to insulate the diver from the cold.

Taking the plunge

Ice diving opens up a whole new world in winter. After they complete a couple of training dives, most divers who take the plunge become less apprehensive and are more relaxed. Like any new experience, there are a lot of unknowns. As long as you stay safe and safety conscious, these concerns quickly dissipate once you are in the water, weightlessly swimming or lying on your back on a lake bottom watching your air bubbles rise to the surface. It can feel just as relaxing as if you were in 80°F water on a tropical Caribbean reef.

Don't believe me? Well, don't hesitate to have a chat with ice divers should you see a group of people standing on a lake or pond with brightly colored scuba tanks lying about in February. Divers are very friendly people and will be happy to explain their sport to anyone who asks — even if you don't think a brisk dunk in the frozen drink is your cup of tea.

Alan W. Pahnke is an ice diving instructor from Suamico and a Lieutenant in the Brown County Sheriff's office.



- ✓ Katy's science teacher
- ✓ Sue, the scout leader
- ✓ Alec, the paper boy
- ✓ friends who've moved from Wisconsin
- ✓ the Hills, who let me hunt on their land
- ✓ Jerry, who watches our pets . . .

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DEC20041

BREATHING EASIER



Forecasting air quality in Wisconsin

Meeting clean air challenges

PROTECTING HEALTH AND THE ENVIRONMENT.

In the course of a day, we each breathe over 22,000 times, day in and day out, mostly without thinking about it, and mostly without knowing whether that air is healthy for us or plants and animals.

"The Air Management Program's goal is to maintain Wisconsin's outdoor air quality so that it adequately protects public health and prevents harm to the environment," says Lloyd Eagan, DNR's air program bureau director.

The past 10 years made us more aware of air toxics in town, the long distances pollutants travel and honed our ability to share pollutant monitoring results. Both industries and cars are cleaner today and Eagan says she is proud that the state is leading the way in several air quality protection initiatives.

Streamlining

Wisconsin is working aggressively to revise and improve air quality regulations for new and existing businesses that will ultimately save time, money and work for DNR staff and businesses. Permit streamlining will help DNR staff become more efficient in issuing air permits without compromising environmental quality.

Mercury

Rules regarding atmospheric mercury emissions and hazardous air pollutants were revised in 2003 and commit Wisconsin utilities to reduce their mercury pollution by 75 percent by 2015.

"Now it is important for us to advocate for stronger federal mercury rules," Eagan contends.

Mercury is particularly dangerous to children and pregnant women. Mercury is emitted into the air when fossil fuels are burned in power plants and other large industrial sources. Through precipitation, it ends up in lakes, rivers and streams

and is converted to a more toxic form called methylmercury. Because it persists in the environment, mercury enters the food chain, bioaccumulates in fish and is eventually consumed by people and animals.

Partnerships

The Voluntary Emissions Reduction Registry provides an opportunity for companies, governments and individuals to register reductions in greenhouse gases and air pollutant emissions. These voluntary reductions may offset future regulation and protect baseline emissions.

"We are making it more efficient for businesses to get technical help to meet clean air standards rather than force penalties after pollution occurs," Eagan says.

Wisconsin's Partners for Clean Air (WPCA) is a coalition of over 260 businesses, community organizations, schools and government agencies committed to voluntarily improving air quality. WPCA formed in 1996 after six southeastern Wisconsin counties were shown to have one of the most severe ground-level ozone problems in the United States. WPCA educates businesses and residents on how to improve air quality and reduce harmful air emissions by changing their daily habits.

Cleaner Air Faster is a voluntary program involving public and private partners in Dane, Fond du Lac, Winnebago, Brown and Jefferson counties, seeking short and long-term reductions in emissions causing ground-level ozone and fine particulates. For instance, on Clean

The Air Management Program's goal is to maintain Wisconsin's outdoor air quality so that it adequately protects public health and prevents harm to the environment.

Lloyd Eagan,
DNR air program bureau director



WOLEGANG HOFFMAN

Air Action Days in Dane County, the City of Madison offers free bus rides.

The State of Wisconsin is a full partner in this process. Governor Jim Doyle's Executive Order 56 calls for voluntary reductions in emissions from state agencies in 20 southern and eastern counties on Clean Air Action Days to protect air quality.

Other partnerships make people aware of air pollution through medical providers, schools and youth groups. At the Sixteenth Street Health Center in Milwaukee, health educators teach about asthma and other air-related illness.

"Try breathing solely through a small cocktail straw to find out what asthma feels like," says Sara Burr, DNR's air quality educator. "We join with partners in the health professions to get our message out: Protecting air quality means protecting the health of our children."

Education

"Where's the Air? It's Everywhere!," "Easy Breathers" and "Air Defenders" are three successful programs to carry clean air messages to youngsters.

Using "Where's the Air," students, ages 10 and up can boot up and learn about air chemistry and how people affect air quality by the choices they make.

"Easy Breathers" links car use and air quality for high school students (www.

easybreathers.org).

"Air Defenders" links air quality and respiratory health for children, ages 8 to 11 and is the outcome of DNR's partnership with the Wisconsin Environmental Health Association. The multi-media training kit "deputizes" children for their mission: to help clean the air and protect community health.

"Teaching about air quality is challenging because air is 'invisible,'" Burr says. "So we have invented wonderful visual and audio aids to help children and adults discover what air pollution is, how it is formed and easy ways each of us can do our part to protect air quality. Our elementary and high school packets on air quality help students in the areas of math, language arts and environmental education."

Nonattainment areas

We continue to maintain an intensive program to monitor for ozone as the nation moves to an eight-hour standard.

EPA identified 10 counties in Wisconsin — Door, Kenosha, Kewaunee, Manitowoc, Milwaukee, Ozaukee, Racine, Sheboygan, Washington and Waukesha — that can't routinely meet ozone standards.

As a result of control programs, five of

these counties — Door, Kewaunee, Manitowoc, Sheboygan and Walworth — restored healthier quality air. Air quality in the Milwaukee area also dramatically improved. Control strategies include reformulated gas, a motor vehicle inspection and maintenance program, gas pumps that trap vapors, industrial process controls and voluntary measures.

Within the nonattainment areas, any new business that will emit air pollutants or expansions of existing operations will face additional requirements. For instance a new source emitting 100 tons/year of volatile organic compounds in a nonattainment county will have to find someone else to reduce VOC emissions by at least 100 tons/year.

In addition to requirements for new sources, the state's air quality plan will establish a cap on emissions from highway vehicles. EPA has set in place national control programs for highway vehicles, off-road engines, some industrial sources and household products.

Tighter car emission controls started with model year 2004 vehicles and low sulfur gasoline went on sale nationwide on January 1, 2004. New vehicle limitations begin in 2007 for heavy-duty highway diesel trucks and low sulfur diesel fuel will be sold nationally in 2006.

Monitoring

Monitoring efforts are finding their way online as we move toward continuous, real-time monitoring where results are posted on the Internet.

"Having information available on the web is a tremendous service to parents of kids who have asthma," Eagan says. "We have a hazecam network that people can access online and while we've always done a good job of monitoring, now we are doing a better job of getting that information to the public in forms they can judge for themselves. Real-time and continuous monitoring is exciting."

Wisconsin's air monitoring network focuses on providing timely data to the public for EPA's list of the most serious health-related air pollutants (ozone, particulate matter, sulfur dioxide, nitrogen dioxide, carbon monoxide and lead). Measurements of the ambient air quality data for these pollutants are available from the Wisconsin DNR website (www.dnr.state.wi.us/org/aw/air/wisards/state.htm) and EPA's AIRNow webpage (www.epa.gov/airnow/).

The primary goal of the DNR's air monitoring program is to increase public access to air monitoring data and to strengthen its network of continuous monitoring sites.

"Continuous monitoring enables us to

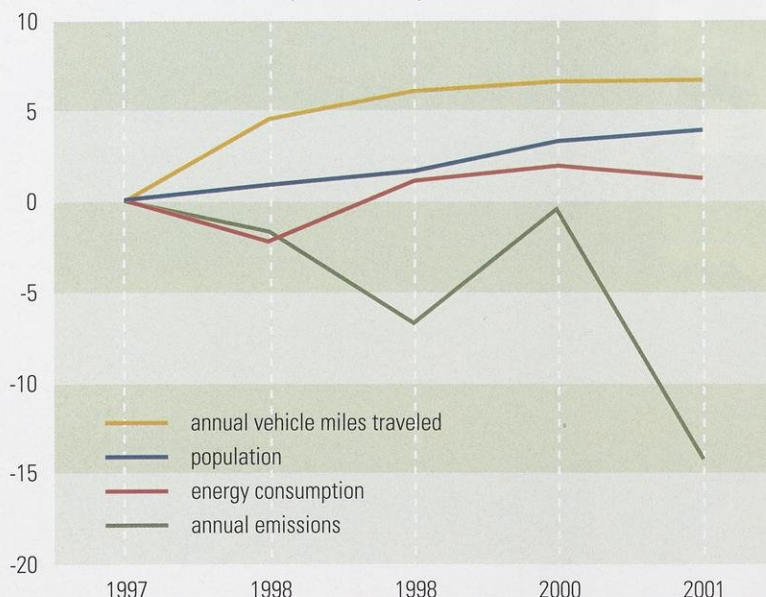
(below) Air emissions of some toxics are diffuse and are carried long distances. Tiny amounts of mercury can settle out of the air and be detected in Great Lake sediments.

(right) Air pollution controls are needed as vehicle miles traveled, population and energy use all increase over time.

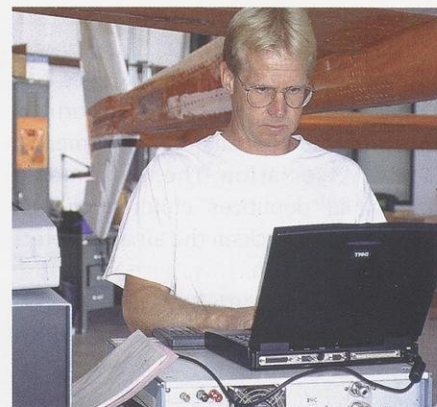
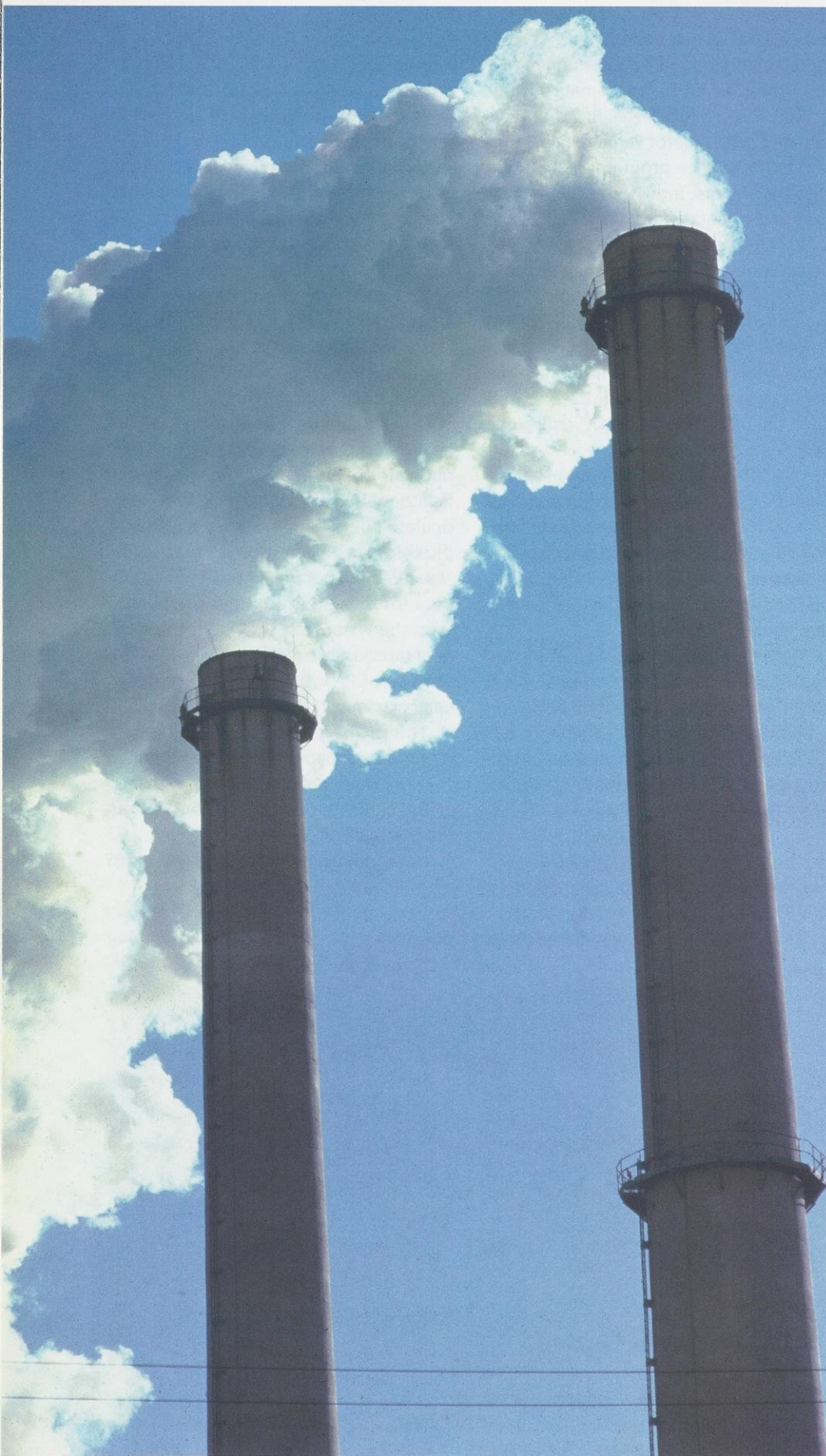


ROBERT QUEEN

Annual industry emissions vs. economic indicators
percent change from 1997



(ALL CHARTS) MOONLIT INK FROM DNR DATA



SHERRY SANFORD

(left) Ambient air quality can be monitored at stacks and remote locations.

(above) Technology tools now give us the capacity to share monitoring results as they are collected so the public can know the air quality in real time.

provide timely public notice of when air pollution concentrations rise,” says Eileen Pierce, DNR’s air monitoring section chief. “Based on such notice, those who are sensitive to air pollution may adjust their daily activities to minimize adverse impacts to their health.”

The state’s ambient air quality monitoring network provides the public with timely access to air quality information, supports planning for air quality improvements and establishes a mechanism for program accountability. Measurements of air quality are essentially a measure of the success of our air program efforts. Do our programs and regulations result in cleaner, healthier air? Is the program working?

“The answer lies in our air monitoring data,” Pierce says. “In addition, the data we collect is useful to scientists and researchers working on studies of public health and ecosystem assessments.”

Operating within funding constraints, the state’s air program continues to consolidate sites, increase automation, eliminate redundancies, upgrade to higher sensitivity monitors for reactive nitrogen and carbon monoxide, and enhance the air toxics monitoring network.

“We continue to work toward expansion of network coverage in Wisconsin through partnerships with industry, Native American tribes and other entities,” Pierce says.

Annual network review provides opportunity for public input into decisions about what pollutants to monitor where. ♦

DEAN TVEDT

Air Quality Index

LINKING AIR QUALITY TO HEALTH CONCERNS.

How concerned should you be about the air you will breathe while walking, running or biking today? There is a colorful tool to tell you.

The Department of Natural Resources and the EPA use the Air Quality Index (AQI) to provide timely and easy to understand information on whether air pollution levels pose a health concern. Some newspapers and TV stations in Wisconsin provide AQI information, along with The Weather Channel and USA Today.

An "Ozone Action Day" is called when the forecast indicates that ground-level ozone concentration could reach unhealthy levels the next day, and actions are recommended to help prevent ozone. Air quality health advisories are issued when conditions have reached levels that are considered unhealthy for sensitive groups.

Air quality varies from place to place and, like the weather, from day to day. Air quality is measured by a network of monitors that daily record concentrations of major pollutants at more than a thousand locations across the country.



DNR PHOTO

When monitoring indicates air conditions may be unhealthy, a variety of broadcasts, signs and announcements can quickly share that information with the public.

For each of these pollutants, EPA has established national air quality standards to protect against harmful health effects. Ozone and particle pollution (PM) are of significant concern in Wisconsin. Ozone is likely to have the highest value on a hot summer day, while PM might be highest on a cold, still winter night.

The AQI numerical index runs from 0 to 500 and is also expressed on a color-coded scale.

"The higher the AQI value, the greater the level of pollution and the greater the health danger," explains Lloyd Eagan, director of DNR's Bureau of Air Manage-

ment. "AQI values below 100 are generally considered satisfactory. AQI values above 100 move into the level of being unhealthy, at first for certain sensitive groups of individuals and as the values get higher, increasingly unhealthy for more people."

It's like a stop-and-go light. Green means go, yellow is caution and red means stop.

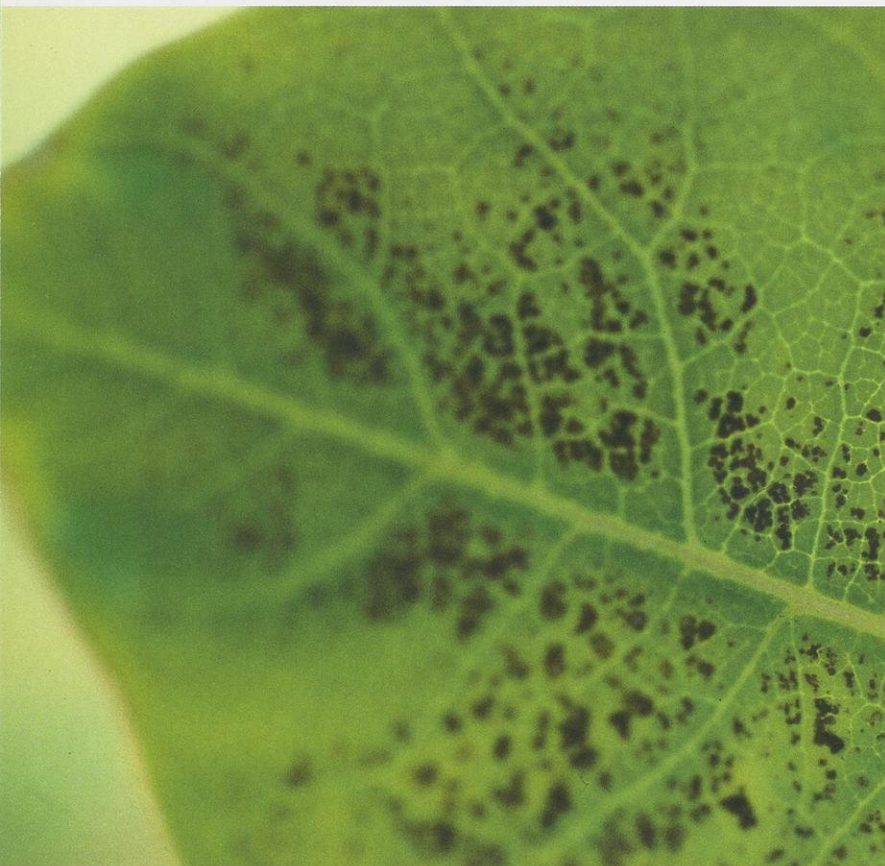
To access the AQI report in Wisconsin call 1-866-DAILY AIR (1-866-324-5924). Or visit the Internet: www.epa.gov/airnow/ ♦

The AQI provides an easy to understand key on the rare days when pollution concentrations make air quality unhealthy for sensitive individuals. Most days are "green" and healthy. The scale shows yellow, orange and red if conditions get progressively unhealthy for people.

Index Values	Air quality descriptor	Possible health effects and advice
0 to 50	Good	No health effects expected.
51 to 100	Moderate	Unusually sensitive people may have respiratory effects from prolonged outdoor ozone exposure. At-risk people should consider limiting outdoor exertion.
101 to 150	Unhealthy for sensitive groups	Sensitive people may experience respiratory symptoms (coughing, deep breath pain) and reduced lung function. Active people and those with respiratory disease should limit prolonged outdoor exertion.
151 to 200	Unhealthy	Sensitive people have a greater chance of experiencing respiratory symptoms and reduced lung function, causing difficulty breathing. But at this level, anyone could experience respiratory effects. Active people and those with respiratory disease should avoid prolonged outdoor exertion. Others should limit prolonged outdoor exertion.

The six principal pollutants

TRENDS TOWARD IMPROVEMENT.



ROBERT QUEEN

Natural monitors of air quality include milkweed leaves that stipple brown when exposed to ozone. Graphs at right show the ozone trends (percent of monitored days with a particular air quality level by year) using the colors of the AQI as explained on p.5. Note the top graph has a slightly different scale to better demonstrate trends over time.

The Environmental Protection Agency has set national air quality standards for six principal pollutants (also called criteria pollutants): nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), particulate matter (PM), carbon monoxide (CO) and lead (Pb).

Each year, EPA looks at these pollutant levels and the amounts of emissions to see how both have changed over time. Nationwide monitoring has found that concentrations of most criteria pollutants improved from 1983 through 2002. Monitoring sites are established near areas of high pollution or near pollution sources.

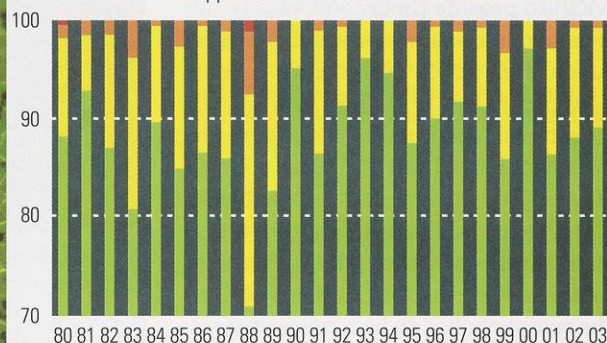
Continuous monitors measure ozone

(O_3), carbon monoxide (CO), sulfur dioxide (SO_2), fine particle matter in the size of 2.5 microns ($\text{PM}_{2.5}$), particulate matter as big as 10 microns (PM_{10}) and nitrogen oxides (NO_x). These monitors produce hourly readings and also measure wind speed and direction, temperature, solar radiation and barometric pressure.

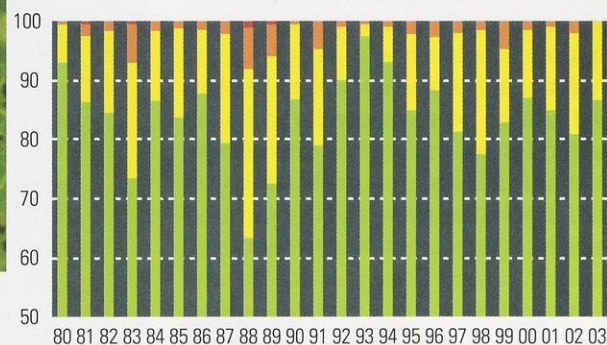
Ozone (O_3):

At ground level, ozone is created by a chemical reaction between nitrogen ox-

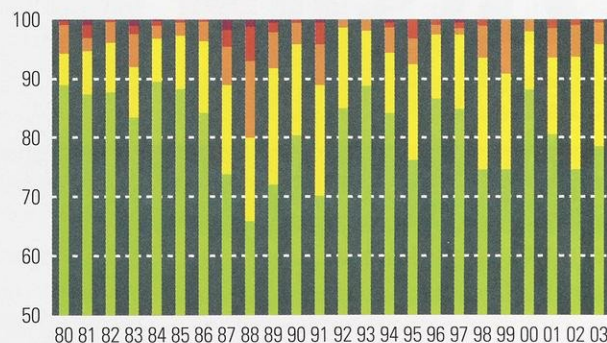
Appleton-Oshkosh ozone trends



Janesville-Beloit ozone trends

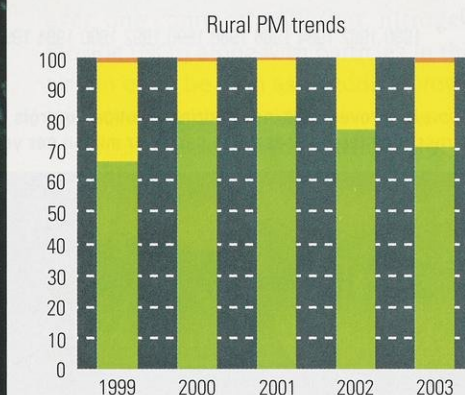
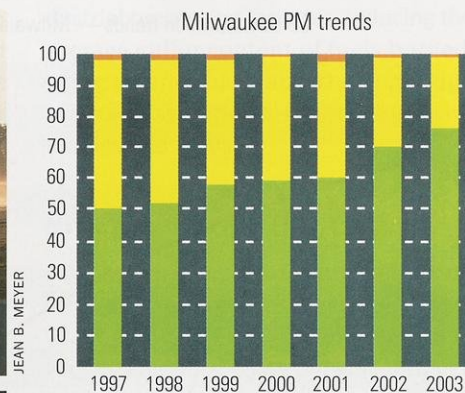


Milwaukee-Waukesha ozone trends



ides (NO_x) and volatile organic compounds (VOCs) in the presence of heat and sunlight.

Ozone can be good or bad depending on where it is located in the atmosphere. Good ozone occurs naturally in the stratosphere 10 to 30 miles above the



Fine particles of metals, soils, liquids and plant allergens can suspend in the air as haze, soot or dust. Some travel long distances on wind and in water droplets. Very small particles can be deeply inhaled in our lungs adding to health concerns. Note above that pollution sources in the country and city both release fine airborne particles. Graphs above show fine particulate trends (percent of monitored days with a particular air quality level, by year) for the Milwaukee Metro Area and a rural area using the colors of the AQI as explained on p. 5.

earth's surface and forms a layer that protects life on earth from the sun's harmful rays. In the lower atmosphere, ozone is considered bad.

Vehicle exhaust, industrial emissions, gasoline vapors and chemical solvents are some major sources of NO_x and VOCs that form ozone. Wind can carry ozone hundreds of miles from its source. Ozone may damage plants and trigger health problems even at low levels — people with respiratory illnesses such as asthma are most affected. Peak ozone levels typically occur during hot and dry summer-time conditions.

To reduce ozone, some communities are reducing NO_x emissions from power plants and industrial combustion sources as well as introducing low-emission cars and trucks, using cleaner gasoline and improving vehicle inspection programs to reduce VOCs.

Particle pollution (PM):

Although particulate matter emissions from industrial sources have decreased

significantly since the Clean Air Act was enacted in 1970, EPA found that in 2002 over 15 million people still live in areas with PM concentrations above the national standard.

As a result, efforts have stepped up to reduce PM, the main ingredient of haze, soot, and airborne dust. Particle pollution occurs year-round and is a mixture of microscopic solids (metals, soil, dust and allergens) and liquid droplets (including acids and organic chemicals) suspended in air.

The particle size is linked to its potential for causing health problems. Particles less than 10 microns in diameter pose the greatest problems because they attach to toxins, are inhaled deep into your lungs and even get into your bloodstream. Larger particles are less of a concern, but can irritate your eyes, nose and throat. Small particles of concern include the fine particles 2.5 microns in diameter and coarse particles of 2.5 to 10 microns in diameter.

People with heart or lung disease, asthma, and older adults and children are

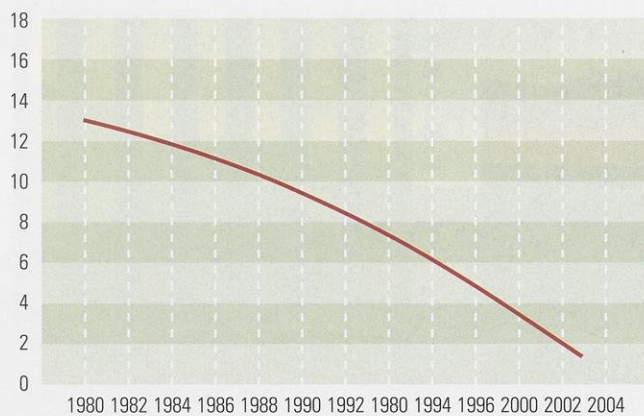
at the greatest risk. PM also is the major source of haze that reduces visibility. Atmospheric deposition, particles that are carried over long distances by wind or water, can make lakes and streams acidic, damage forests and crops, and change the nutrient balance in coastal waters.

PM sources include cars, trucks, buses, factories, construction sites, tilled fields, unpaved roads, stone crushing and wood burning. Other particles may be formed in the air as gaseous chemicals combine.

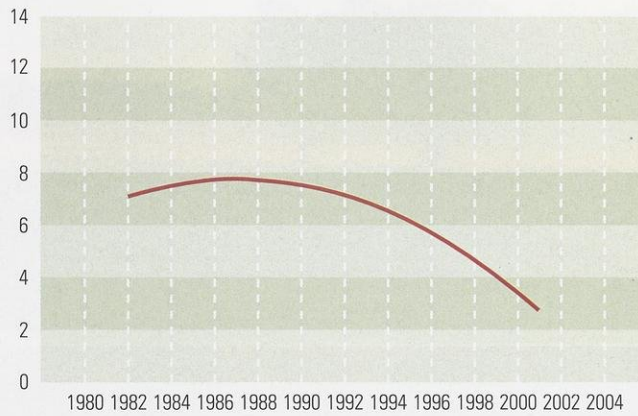
Carbon monoxide (CO):

Carbon monoxide is a colorless, odorless gas formed when carbon in fuels is not burned completely. Motor vehicle exhaust contributes about 56 percent of CO emissions nationwide. Other sources in-

CO concentration trends — Milwaukee



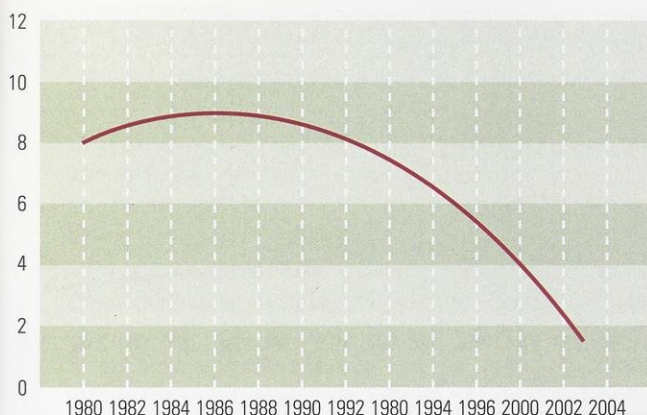
CO concentration trends — Madison



(above) Improvements in industrial pollution controls and vehicle emissions have led to a decrease in hourly maximum carbon monoxide concentrations across the state expressed in parts per million per year, (below) but the number of vehicles from boats to cars has doubled in the same period.



CO concentration trends — Racine



clude off-road vehicles (construction equipment and boats), industrial processes and forest fires.

The highest levels of CO in the outside air typically occur during cold months when air pollution becomes trapped near the ground beneath a layer of warm air. Carbon monoxide at high levels is poisonous even to healthy people.

Improvements in vehicle and emissions control technology have greatly reduced emissions of carbon monoxide over the past 20 years, but the number of cars and trucks on the road and the miles they are driven have doubled in the same period.

Approaches to reduce CO have included establishing national ambient air quality standards, requiring national controls for motor vehicle emissions (including tailpipe emissions, new vehicle technologies and clean fuels programs) and requiring reductions from large industrial facilities.

Sulfur dioxide (SO₂):

Sulfur dioxide easily dissolves in water to form weak sulfuric acid, the main ingredient in acid rain. Sulfur is prevalent in raw materials including crude oil, coal and ore that contains metals like aluminum, copper, zinc, lead and iron.

Over 65 percent of SO₂ released to the air — more than 13 million tons per year according to EPA — comes from electric utilities, especially those that burn coal. Other sources are petroleum refineries, cement manufacturing, metal processing plants, trains, large ships and some off-road diesel equipment.

SO₂ contributes to respiratory illness, acid rain formation and haze as it is transported over long distances by wind.

Wisconsin's early research and negotiations with utilities and industry crafted acid rain law and policy to reduce SO₂ emissions years before tighter federal standards.

Over the past 30 years, sulfur dioxide emissions have decreased by more than a third by installing pollution control equipment at coal-fired power plants, reducing pollution from in-

dustrial processing facilities, reducing the average sulfur content of fuels burned, using cleaner fuels and crafting tough acid rain law through negotiations with utilities and industry.

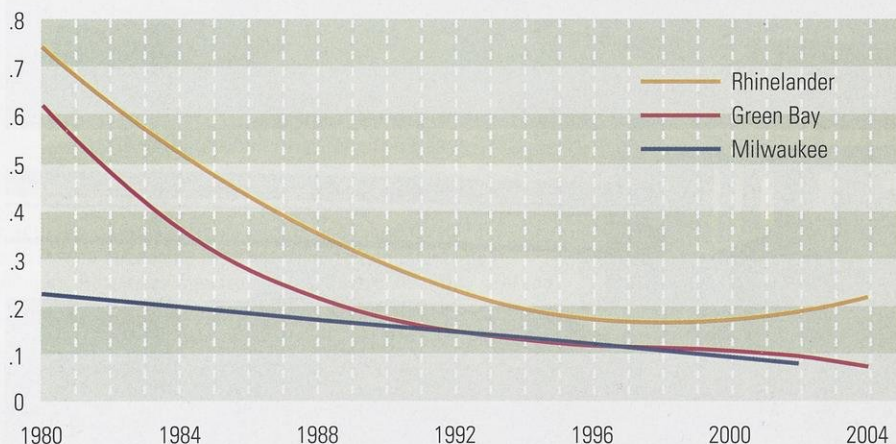
Nitrogen dioxide (NO₂):

Nitrogen oxides (NO_x) is a generic term for a group of highly reactive gases, all of which contain nitrogen and oxygen in varying amounts. Many of these nitrogen oxides are colorless and odorless. However, one common pollutant, nitrogen dioxide (NO₂) along with particles in the air can often be seen as a reddish-brown layer over many urban areas.

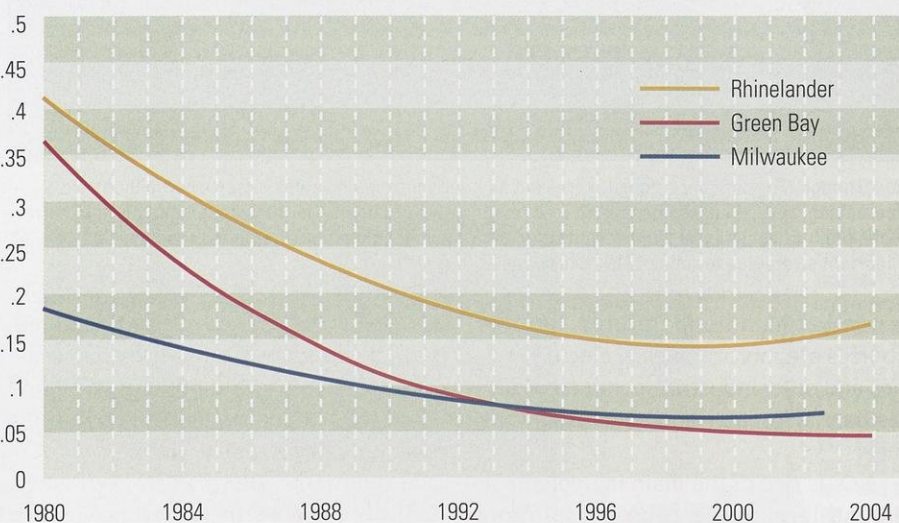
Nitrogen oxides form when fuel is

Pollution controls and the use of low-sulfur coal at power plants and other industrial facilities led to a reduction in sulfur dioxide concentrations across Wisconsin over the past 24 years.

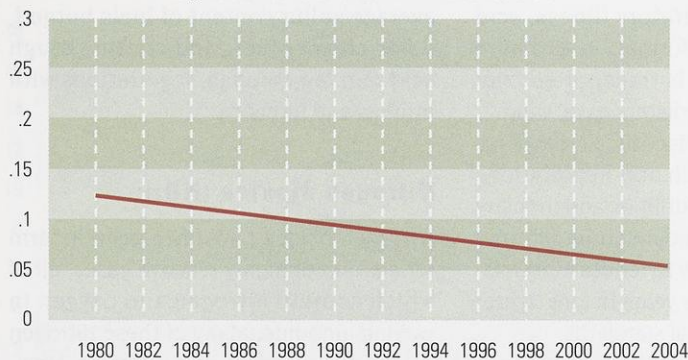
SO₂ one-hour maximum concentration (ppm) trends



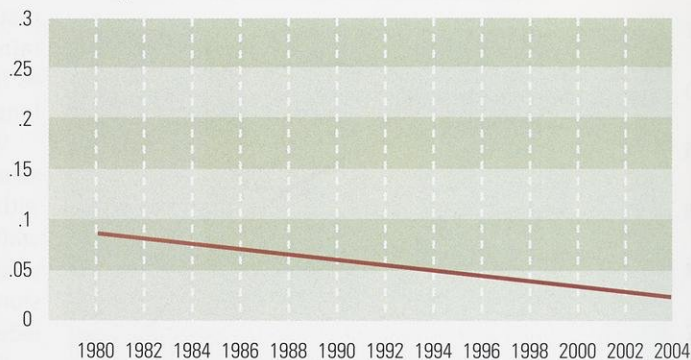
SO₂ three-hour maximum concentration (ppm) trends



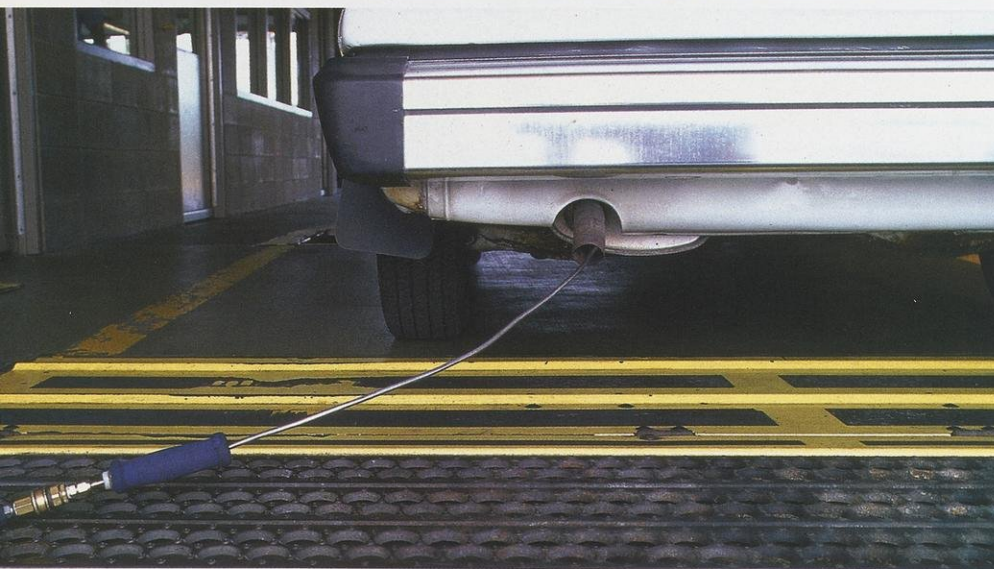
NO₂ concentration trends — Milwaukee area



NO₂ concentration trends — statewide other than Milwaukee



SHERRY SANFORD



DNR PHOTO

(top) Though NO_x concentrations (expressed as hourly maximum values in parts per million) are decreasing, overall emissions remain significant as we are driving more vehicles and burning more fuels. Cleaner vehicles, mass transportation alternatives and tailpipe emissions testing (above) are all important strategies to reduce NO_x emissions.

burned at high temperatures. Primary sources are motor vehicles, electric utilities and other industrial, commercial and residential furnaces and boilers that burn fuels.

NO₂ is one of the main ingredients in ground-level ozone, causes respiratory

problems, contributes to acid rain formation, deteriorates water quality and causes haze. NO_x and the pollutants formed from NO_x can be transported over long distances by prevailing winds.

Since 1970, EPA has tracked emissions of the six principal air pollutants.

All have decreased significantly except for NO_x, which has increased about 10 percent over this period. To reduce emissions, EPA requires motor vehicle manufacturers to redesign car and truck engines and install pollution controls. To reduce acid rain, EPA devised a strategy to cut NO_x emissions from coal-fired power plants. Since NO_x can be transported long distances, the Clean Air Act also requires “upwind” states to implement programs that will help “downwind” states meet ozone standards.

Lead:

Lead levels in the air have decreased dramatically since 1978, primarily due to emission reductions from cars and trucks with the phase-out of leaded gasoline. Today, metal processing plants are responsible for most lead in the air, according to EPA.

Children and infants are at the greatest risk of lead exposure. They can be exposed to lead through air, paint chips and lead-contaminated food or water. Lead causes damage to kidneys, liver, brain, nerves and other organs. Lead exposure also may lead to osteoporosis and reproductive disorders. Excessive exposure can lead to mental retardation, behavioral disorders, memory problems and mood changes. It causes high blood pressure, increased heart disease and anemia.

High levels of lead are still of concern in urban areas with high levels of traffic, trash incinerators, or other industry, as well as areas near lead smelters, battery plants or industrial facilities that burn fuel.

Hazecam

SEEING IS BELIEVING.

The Midwest Hazecam network (www.mw-hazecam.net) is bringing air quality information into homes from rural and city locations across the upper Midwest.

With hazecams, video cameras mounted high in the air, you can literally see the effects of air pollution on visibility. Impaired visibility has been a problem throughout the United States for years, and especially in national parks and wilderness areas. In 1999, EPA created rules to address haze caused by man-made pollution that is carried hundreds of miles by winds.

A hazecam is a web camera that posts photos on a website, displaying a visual image of the skyline. Images are updated every 15 minutes and then archived. This information along with real-time ozone and fine particulate matter concentrations, ambient temperature, wind speed and direction and humidity, is posted on the hazecam website.

There are two hazecam sites in Wisconsin — in Milwaukee and Mayville.

Daniel Nickolie, an environmental special-

ist responsible for the hazecam operation sites in south central Wisconsin says, "We decided to compare the visibility between Milwaukee, our largest metropolitan area, to a more rural area such as Mayville."

Mayville, in east central Wisconsin (Dodge County), is located near the Horicon National Wildlife Refuge. Here, the camera looks to the north. Air pollution issues include infrequent high eight-hour ozone levels during the summer. Visit www.mwhazecam.net/mayville.html.

In Milwaukee, the camera (www.mwhazecam.net/milwaukee.html) also looks to the north. Milwaukee experiences occasional high eight-hour ozone levels during the summer. Health advisories also are issued due to elevated concentrations of particulates in the air.

The Midwest Hazecam is part of a national air visibility national network. The Lake Michigan Air Directors Consortium (LADCO) formed the Midwest network and funds the system.

"Seeing is believing," Nickolie says.

Haze is caused by fine particles in the air, such as sulfates, nitrates, organic carbon and more. A regional network of video cameras (hazecams), including two in Milwaukee and rural Mayville (Dodge County near Horicon), post fresh images on the web every 15 minutes. Here's the view from Mayville on a clear day (*top*) and on a hazy June day just five days later (*bottom*).



DNR HAZECAM

DNR HAZECAM

Open and outdoor burning

A TRADITION TO DISCARD.

If you've ever burned a pile of leaves in your backyard, you've likely walked away coughing and rubbing your red eyes. Now consider what happens to the air quality around you if your neighbors next door and across the street do the same thing.

Burn barrels and open burning are major contributors to air pollution. In Wisconsin, they are the number one source of uncontrolled dioxin emissions and the number one source of citizen air pollution complaints, explains Kevin Kessler, DNR's Open Burning Team leader.

"While burn barrels themselves aren't illegal, burning most waste materials is illegal," Kessler says.

The problem is huge. For many Wisconsin residents burning garbage continues to be a tradition, even though it's been illegal for over 25 years. The Department of Natural Resources estimates there are about 500,000 burn barrels in Wisconsin. Nationally, there are up to 20 million. Wisconsin residents generate 4½ pounds of garbage per person per day. Nationwide, 1.8 billion pounds of household waste is burned every year.

Burn barrels operate at low temperatures (400 to 500° F), resulting in incomplete combustion of wastes and the for-

mation of cancer-causing dioxin and furans. Burning trash also produces other toxic chemicals such as arsenic, benzene and formaldehyde. An EPA-funded study found that a single household that burns trash daily in a burn barrel can produce more toxic air emissions than a medium-sized municipal waste incinerator with air pollution controls. Ash left behind in a

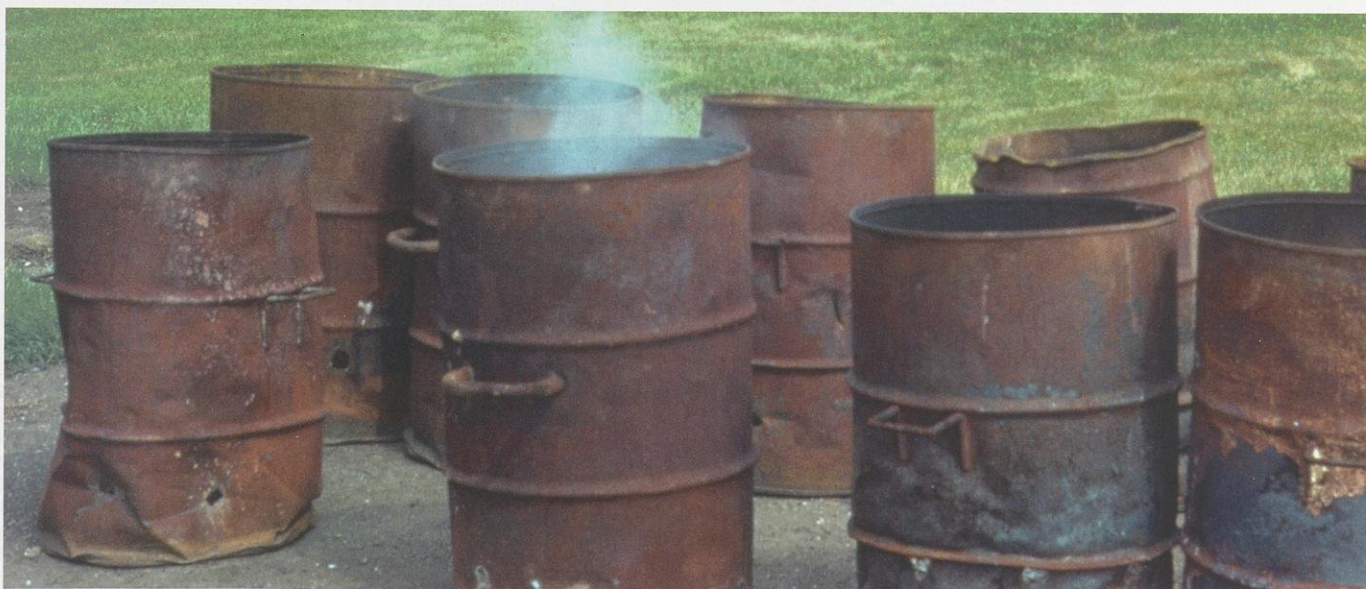
burn barrel contains heavy metals and other toxic chemicals that can contaminate the soil.

Open burning regulations are a combination of state air pollution laws, solid waste rules and local ordinances. Local ordinances may be more stringent than statewide law and in some localities may prohibit open burning altogether. Under

Dried vegetation on wild lands is periodically burned to restore the landscape, but the open burning of trash, plastics and other household wastes in 500,000 locations releases an unhealthy mix of toxic chemicals and metals right next to where people live, plant their gardens and raise their families. Many communities and townships ban open burning outright, others strictly limit what can be burned and when burning can occur.



CHARLIE KILIAN



DNR PHOTO

statewide law, burning the following materials is prohibited under any conditions:

- wet, combustible garbage or rubbish including wet cardboard or paper
- oily substances, including oily or greasy rags, oil filters, etc.
- asphalt products such as shingles or tar paper
- plastics of any kind, including plastic bottles, packaging materials and plastic bags
- rubber products, including tires and hoses
- treated or painted wood

Local recycling ordinances prohibit burning sorted recyclables such as plastic containers, newspaper, cardboard and magazines. Penalties can be assessed to individuals and businesses for improper recyclables disposal. Currently, every state resident has access to a community recycling program.

While most open burning has been illegal for more than 25 years in Wisconsin, the legal procedures for enforcing the state's open burn regulations are very cumbersome. DNR hopes that the Legislature will soon review that problem.

Open burning also is the number one cause of wildfires in Wisconsin, explains Kessler. Because of the danger, burning in designated forest fire protection areas requires a DNR permit. Permits may be obtained at a DNR Service Center or from volunteer fire wardens in the community. Local ordinances may require a burning permit in incorporated municipalities and areas not subject to state permits.

Solving the trash-burning problem will be a major task. Nearly two years ago the Department of Natural Resources formed several stakeholder groups to collectively work on the trash-burning issue. Their report recommended education, developing a model ordinance for local municipalities, legislation and developing better alternatives for agricultural plastics like silage bags.

There's definitely a need for better education and enforcement at the state level, but there's also a role for local governments. In response to stakeholder recommendations, the Department of Natural Resources recently published a new model ordinance on open burning that's been endorsed by the League of



DNR PHOTO



TRACEY TEODECKI

Most communities encourage healthy options to burning yard wastes including backyard composting and brush chipping. Compost and mulch turn these wastes into valuable gardening and landscaping resources.

alternatives are included in a new open burning model ordinance for local governments that have received complaints and want to address the issue.

To change the widespread practice of burning trash, education is going to be key.

"A lot of waste burning is the result of people not knowing that it's illegal or not knowing that they have other options," Kessler says.

DNR education efforts are teaching what's illegal and what the alternatives to burning are. Plastic containers, paper, cardboard and tires should be recycled. Leaves, brush and grass clippings can be composted. Many communities have local collection programs and backyard composting information is available at local DNR Service Centers.

"We know it is hard for people to change their ways and open burning has been a tradition for many," Kessler says. "Some habits are worth keeping but open burning definitely isn't one of them." ♦

Wisconsin Municipalities, the Wisconsin Towns Association, the American Lung Association of Wisconsin and the Wisconsin Counties Association. Although local municipalities can't be less stringent than state law, the model ordinance contains many suggestions and options for local governments to regulate open burning to meet local needs.

A closely related emerging issue is the use of outdoor wood-fired boilers (tin sheds with boilers inside) that some people use to heat homes. Wood-fired boilers can smolder, people sometimes burn other things in them and the boilers have low stack heights so they create smoke closer to ground level. Complaints can occur, Kessler explains, when neighbors are located too close. Suggestions and

Emerging innovations

SCHOOL BUS RETROFITS AND GAS CAP WRENCHES ARE HEALTHY SOLUTIONS.

School buses have been touted as the safest way for kids to get to school, but from an environmental perspective that may not be the case.

The majority of the nation's 450,000 school buses run on diesel fuel and emit particle pollution, toxic substances, carbon monoxide and ozone precursors into the air, especially affecting the health of children at bus stops and on the buses.

"Children spend an average of 1½ hours per day riding a school bus," says Jessica Lawent, an air management specialist in Milwaukee.

Recognizing the serious environmental and health implications of diesel exhaust, the Department of Natural Resources was awarded a \$1 million federal CMAQ grant (Congestion Mitigation Air Quality) to install emission control devices (retrofits) on about 375 buses in southeast Wisconsin. And recently, the program received even more grant money through savings achieved due to a change in the Vehicle Inspection Maintenance Program. This funding may bring the total number of buses retrofitted to 600.

"Retrofit devices don't decrease fuel consumption or power, but reduce diesel pollution 20 to 50 percent," Lawent explains. The retrofits used in the program are Diesel Oxidation Catalysts that work like a combination of a muffler and catalytic converter. They take less than two hours to install.

One challenge, though, is that CMAQ

grants require a 20 percent match. Lawent says donations totaling about \$20,000 have already been received from businesses in the Wisconsin Partners for Clean Air Program and from DNR Air Management staff and others.

Donations are tax-deductible and recognized through certificates of appreciation. Send a tax-deductible donation payable to WDNR-Diesel School Bus Retrofit Project to:

Wisconsin Department of Natural Resources
School Bus Project AM/7
101 S. Webster St.
P.O. Box 7921
Madison, WI 53707-7921

Contact Jessica Lawent (414-263-8653) or Jerry Medinger (414-263-8659) for more information.

Getting a grip on the Gas Cap Wrench

In Southeast Wisconsin, the Department of Natural Resources also received a CMAQ grant to provide free Gas Cap Wrenches to motorists with arthritis and weak or injured hands and wrists.

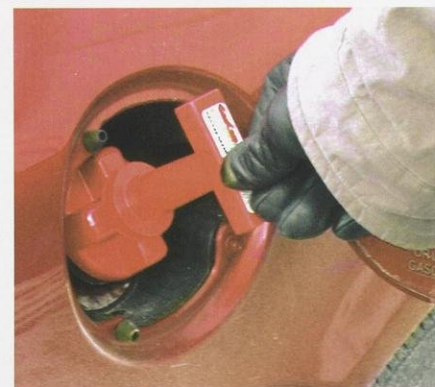
The Gas Cap Wrench helps ensure your gas caps are properly tightened and sealed to save money, conserve gas and reduce air pollution. When fully implemented, the program can save up to one million gallons per year of gasoline that normally evaporates as fumes. A loose or

missing gas cap can cause up to 30 gallons of gas to annually evaporate from your tank.

The Gas Cap Wrench has a long handle that provides extra leverage and removes your hand from a tight refueling spot. Its grip sits in the palm of your hand giving you a firm grasp and allowing you to use your arm strength instead of finger strength. To keep gas where it belongs, a gas cap needs to be tightened until it clicks four to five times.

Lawent says about 30,000 wrenches have been given away at senior fairs, health fairs, and promoted through hospitals, clinics, senior organizations and the Wisconsin Partners for Clean Air website.

"The Gas Cap Wrench is a great idea," Lawent says. "Not only is it a great way to reduce air pollution, but it saves gas, money and gives people back their pride when they can tighten their gas cap on their own again." ♦



SHERRY SANFORD

(below) School bus retrofits and (right) Gas Cap Wrenches are examples of how communities can help get a grip on improving air quality by reducing emissions from our actions and daily habits.



SHERRY SANFORD

Air pollution adds up

HOW YOU CAN HELP REDUCE SURGES IN ASTHMA AND ALLERGIES.

Asthma rates in the United States have nearly tripled in the last two decades resulting in particularly severe problems for urban youths. Asthma is the leading serious chronic illness for children. One-third of all individuals affected are under the age of 18. Culprits include ozone, particle pollution and climate change resulting in increases in atmospheric CO₂ (due to fossil fuel combustion) that prompt above-normal growth levels for molds and ragweed pollen.

The outlook is that more children will end up with asthma, particularly in urban areas, unless steps are taken to curb air pollution.

Asthma, characterized by shortness of breath or wheezing, commonly begins in childhood, and the U.S. Centers for Disease Control and Prevention estimate that 16 million adults in the United States have asthma. The estimated cost of treating asthma in patients under 18 is \$3.2 billion per year.

Allergies also are a leading cause of chronic illness, affecting about 17 percent of the population and costing the health care system about \$18 billion annually. Nearly 40 million Americans suffer from hay fever.

When weather forecasts indicate ground-level ozone could reach an unhealthy level, officials may call for an Ozone Action Day. In 1996, Partners for Clean Air, a coalition of businesses, local governments, schools and community organizations in southeastern Wisconsin joined with a Partners program in Chicago and northwestern Indiana to combat the region's ozone problem.

Ozone Action Days, one of the Partners' programs, encourages people to take voluntary actions to reduce their contributions to ozone when the weather is likely to produce dangerous smog levels. Health advisories are issued when ozone or particle pollution reach unhealthy levels.

On Action Days and every day, people are encouraged to practice these habits:



SHERRY SANFORD

Our collective decisions about everyday habits can help keep the air clearer and healthier in every community.

(above) Employers and communities can offer incentives for employees to bike to work or use public transportation.

(below) Innovative design and consumer demand could just as easily persuade car manufacturers to produce small, efficient, clean and even electric cars.



WOLFGANG HOFFMAN



DAVID L. SPERLING



ROBERT QUEEN

Changing consumer habits can play a large part in improving healthy air, cutting energy use and saving resources.
(top) Choosing from an array of energy-efficient compact fluorescent bulbs.
(below) Fueling up at pumps that recover vapors and fumes as gasoline is dispensed.

- Combine errands. Plan your trip ahead of time to get things done efficiently and in one trip. Minimize vehicle idling time.
- Minimize travel. Consider holding meetings via conference call, videoconference, or postponing them. If travel is imperative, use public transit or energy efficient cars.
- Fuel cars the day before an Air Action Day or at night. Refueling during the evening and tightening your gas cap can reduce the amount of harmful fumes that escape.
- Delay using gas or diesel-powered equipment (lawn mowers, chain saws and leaf blowers) until the Air Action alert has expired or at least postpone their use until evening to keep fumes from baking in the sun.
- Properly inflate tires. Regular maintenance and tune-ups, changing the oil and checking tire inflation can reduce your car's emissions by half and improve gas mileage.
- Carpool, bike, walk or ride the bus to work and school. This saves you money and reduces traffic congestion and air pollution.
- Conserve energy by using energy-efficient light bulbs and appliances, and turning lights off when you are not using them.
- Avoid open burning. Reduce waste, reuse and recycle.
- Defer use of household consumer products that release fumes or evaporate easily.



Air links

DNR Bureau of Air Management

dnr.wi.gov/org/aw/air/

DNR Open Burning

dnr.wi.gov/org/caer/ce/ob/

"Easy Breathers"

www.easybreathers.org

"Air Defender"

www.airdefenders.org

"Where's the Air"

www.dnr.state.wi.us/org/caer/ce/eeek/teacher/wtair.htm

Eco-driving skills

www.extraordinaryroadtrip.org

EEK! (Environmental Education for Kids)

www.dnr.state.wi.us/org/caer/ce/eeek/

Voluntary Emissions Reduction Registry

dnr.wi.gov/org/aw/air/registry/

Wisconsin Partners for Clean Air

www.cleanairwisconsin.org

AQI and ozone mapping AIRNOW

www.epa.gov/airnow/

Federal programs underway to improve air quality

www.epa.gov/air/

Wisconsin Clean Cities

www.wicleancities.org/



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(inset photos l to r) Robert Queen, Robert Queen, Sherry Sanford, Sherry Sanford

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Where sleeping bears lie

For 20 years, Maggie Heino has tracked the roving black bear population across northern Wisconsin.



JAMES C. BISHOP, JR.

James C. Bishop, Jr.

At the base of a snow-covered hill a few miles west of the village of Clam Lake, a group of bear researchers waited for a tranquilizer drug to take effect. A few minutes earlier they had injected a sow bear with just enough drugs to put her to sleep. The team of an Ashland schoolteacher, a DNR wildlife specialist, two University of Wisconsin-Stevens Point students and Margaret "Maggie" Heino, quietly stood by.

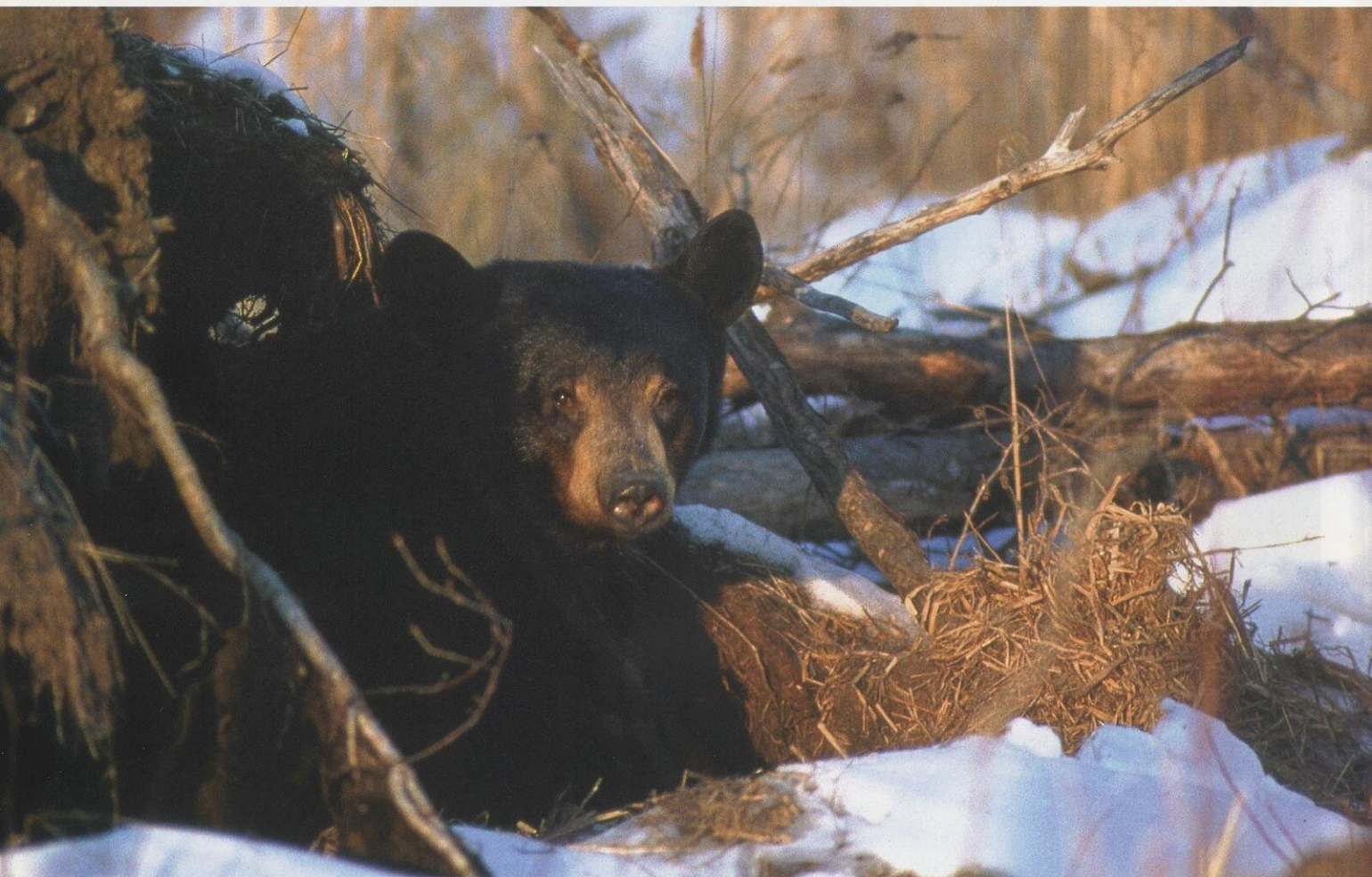
Fifteen minutes later the snoozing sow and her two cubs were removed from their hillside den, weighed, measured, given health checks and tucked back into their winter home. The animals were in good hands.

The team leader, Maggie Heino of Sanborn, has been researching bears since 1985 as a volunteer. Following the passing of researcher and mentor Professor Ray Anderson of UW-Stevens Point in 2000, Heino was named Field Coordinator for black bear research throughout northern Wisconsin. Her willingness to work helped ensure that Anderson's many projects would continue.

"At the time, DNR's Big Game Specialist and the Wildlife Bureau Director (Tom Hauge) supported the decision for me to lead the winter research," Heino said. "They knew that I had the equipment, the frequencies for the radio-tagged bears and I knew the resource."

DNR Wildlife Specialist Bruce Kohn, who has since retired, served as the interim bear project scientist working with Heino and Tim Ginnett, an incom-

Maggie Heino has tracked bears in fall and winter for 20 years. She coordinates the northern Wisconsin black bear research program.



A black bear emerging from a winter den under an uprooted tree. Since bears don't arouse in winter to urinate, medical researchers are studying how their kidneys process waste. It may offer clues for treating kidney disease and preparing astronauts for long-term space travel. Similarly, the bear's ability to maintain healthy bones following long periods of inactivity may offer hints for treating osteoporosis or helping bedridden patients whose bones deteriorate.

ing Associate Professor of Wildlife. They decided to take on a big task — removing collars from the Stockton Island bears in the winter of 2001 and replacing collars on the mainland bears under study.

The college's Associate Dean of Academic Affairs, Professor Christine Thomas, met with state agencies to discuss removing radio-collars from bears on Stockton Island and removing or recollaring denned bears on the mainland that were tracked in long-term research.

She was also dedicated to continuing this invaluable work. Heino has handled bears in more than 500 den sites in Wisconsin. The collective research has examined the role bears play on our landscape including habitat use, population growth, survival rates, effects from translocating bears and the effects of activities like hunting bears with

hounds. Such research is valuable in determining how to sustain bear populations while reducing conflicts in areas where they live close to people. Regulated bear harvests have increased the state bear population mainly in northern Wisconsin even as more people move into rural areas.

Nuisance encounters, like bears tearing down bird feeders, getting into garbage cans and breaking into cabins for food, have been on the rise too. Heino's research data along with other surveys, are used by wildlife managers to determine harvest quotas and maintain a healthy bear population. Heino along with state and federal agencies continues to educate people on how to reduce conflicts with bears around homes and cabins.

At this particular bear den, where you can hear the roar of vehicles from

Highway 77 only a short distance away, Heino is concerned about a particular sow. In a check last year this sow was missing a front leg and infection had set in. The injury could have been from a bullet or a vehicle collision.

For this year's checkup, Heino brought along a veterinarian, who gave the animal an injection of antibiotics.

"Last year the sow weighed 115 pounds, down from 165 pounds when we checked her in 2002. We were all delighted to find her today at 235 pounds with two healthy cubs," Heino happily reported.

This research and similar projects on the Hanson Forest near Mellen and in the Ashland area are supported by a host of donors and volunteers including the UW-Stevens Point, the Wisconsin Bear Hunters Association, Safari Club International, the Rocky Mountain Elk



Bear tracking research offers insights about successful ways to minimize conflicts like dumpster diving as human civilization encroaches and bear ranges spread.

Foundation, the Paul Family Foundation, the Whiskey Jack Camp, Ashland High School, the Department of Natural Resources and some anonymous donors.

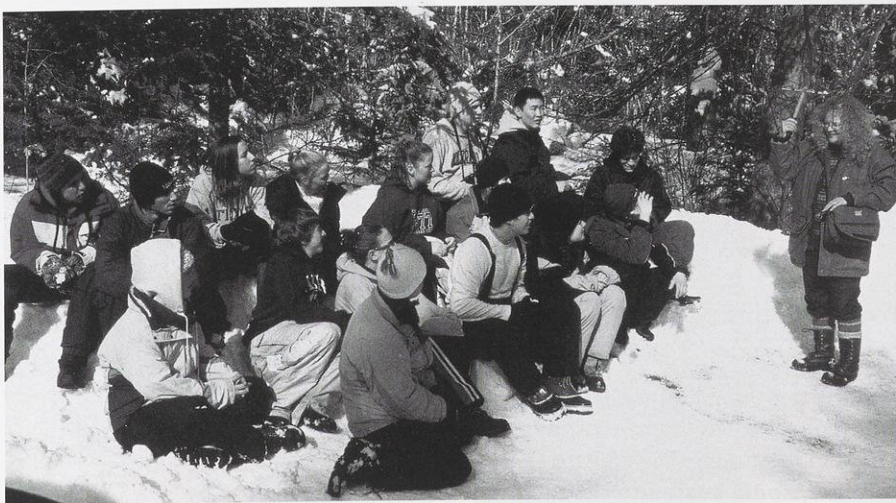
Heino is reimbursed by the university for her expenses and receives a small honorarium. She owns a bit of the research equipment, but the bulk of it belongs either to the DNR team or the university.

The annual fall and winter routine

On any particular winter hike into a den site, the bear researchers may invite a small group of observers to tag along. These might include school groups, members of the nearby Whiskey Jack Camp or the media. The team moves in on snowshoes and prior to heading out, Heino briefs the visitors.

She explains that bears are only handled or processed during the denning season or as newly captured animals. The scheduled visits begin in October

School groups get practical lessons in wildlife management by accompanying Heino in the field. They also help haul in the gear to work on the tranquilized bears.



when bears start getting drowsy and look for a place to hibernate.

Heino monitors radio-tagged bears during the hunting season in September to determine which ones survived, where they are located and whether they left their home ranges. After reviewing hunting harvest reports, she locates remaining bears then tunes in their radio collar frequencies again after the November gun deer season to determine if bears have settled into their winter dens. Once Heino locates a bear in the same spot three times during her travels, she considers it "denning up" for the season.

After Christmas, she walks into the sites and marks them. Dens with sows that are expecting to have cubs are visited last. Heino listens closely for whimpering cries and other vocal clues.

Once all the dens are checked, she sets up a handling schedule based on the numbers of dens, locations, and den type (single bear, sows with yearlings, or sows with cubs). Heino will come back later in the winter to ensure the transmitters are functioning properly and the bears are still at their den sites.

Moving on

The bears leave their dens in spring, usually after a heavy rain or thaw. They will be on the move until mid-October, and Heino's crews periodically tune-in to follow their ramblings.

Sows are a bit easier to track. Re-



JOSEPH BUTSICK

Tuning-in the sleeping giants. Radio-collared bears can be tracked with hand-held antennas up to a mile away.

search shows their home ranges average about eight square miles. Boars move in a wider swath covering about 61 square miles on average.

The females leave a scent trail that the males can follow. As three-year-olds, both males and females sexually mature and mating takes place in June and early July.

At about four years of age, sows produce their first litter of cubs in late December and January. Cubs den with their mothers until they are yearlings in the following spring, when Heino says the sows "kick them out." Yearlings can stay in the same vicinity and share the same home range, but the sow won't allow them to stay with her. This cycle continues and sows go into estrus, breed and produce cubs every other year.

Tools and timing of the bear research trade

A sample of yearlings and sows get radio collars when they are captured or found in their dens. During spring and summer, some bears are captured in



JAMES C. BISHOP, JR.

Each collar has a radio transmitter that emits a unique frequency for 18 months or so. The collars are sized to break away to prevent injury as the bears grow.

barrel traps or snares for research or are removed if they become a nuisance to people.

Collars are sized to the animal and equipped with leather spacers designed to break away after 18 months. This prevents injury when researchers are not able to recapture the bear before it outgrows the collar.

Each collar transmits a unique frequency so individual animals can be followed with either a hand-held antenna or a larger antenna mounted to a vehicle. Depending on the terrain, bears

Getting bears out and back into dens means working in tight quarters.



ROBERT QUEEN

can be detected up to a mile away with hand-held devices and longer distances with a vehicle-mounted antenna on flatter terrain.

The animals will be followed by radio until they are harvested, their collars fall off, the units quit transmitting, or the bears die of natural causes.

In a typical year up to a dozen active dens are found and revisited as part of the research project. For example, in 2000, thirteen dens were visited in three weekends. A total of 39 bears were processed including 10 adult sows, three sub-adult females, 17 yearlings and nine cubs. Depending on the project Heino's workload can get even busier.

During a population dynamics study from 1984 to 1994 up to 50 dens were visited. "That was every weekend and sometimes three-day weekends processing three dens per day," she recalled. "It was exhausting." A total of 133 bears were captured, collared and followed year-round.

The dens, like the one outside of Clam Lake, may consist of dug holes or be nothing more than a pile of brush. Research shows that 34 percent of the dens were total excavations, 26 percent

were brush piles, 17 percent were partial excavations, nine percent were rock caves, and four percent were hollow trees as well as other types. Only about four percent of the dens are reused and rarely by the same bear.

Boars and sows do not den together although Heino observed there have been instances where boars denned in the same area as sows that produced cubs that year.

Most dens are located away from human habitation making travel into them a "healthy walk," especially with equipment, so having a few other "assistants" can be handy.

Once visiting observers are briefed, Heino and the core team share the load of hauling two weighing poles, antennas, saws, and bags of gear to the observers. Most enjoy taking something in as part of the team.



Reaching the dens often requires a "healthy walk" by ski or snowshoe lugging heavy equipment through rough terrain.

JAMES C. BISHOP, JR.

The weighing poles are about five feet long and made of aluminum. When the poles are assembled, four people can lift a bear in a net off the ground. A scale suspended between the poles provides an accurate reading of the animal's weight.

Before the entourage gets within 150 feet or so of the bear, the researchers leave the observers behind and approach the den quietly. Bears are not true hibernators and have been known to flee.

"On one occasion, after a 20-minute snowmobile ride, we hiked in on a boar for 1½ hours on snowshoes in the Bibon Swamp near Mason," Heino recalls,

(left) Heino checks respiration, temperature and takes blood samples and measurements on a cub.

(below) Others have a fun job keeping the cubs warm as the sows are examined.



JAMES C. BISHOP, JR.



JAMES C. BISHOP, JR.

"only to have him get up and walk away. He was in a nest bowl on top of the ground. Two weeks later with the temperature well below zero, we made another attempt. He had moved a quarter-mile away and again when we were within 50 yards of him, he got up and left. We were unable to change his collar that year. The next year, he was in a normal den — a dugout under an old snag and we processed this 400-pound male without any problems. It's pretty disappointing when they flee, especially when you're carrying all that gear."

Fortunately the three-legged sow near Clam Lake stayed put. Bruce Prentice, a high school biology teacher from Ashland, took aim with a flashlight in one hand and dart gun in the other, found a fleshy spot on the animal, and shot.

When the sow was safely sedated the observers were called in. Prentice and the students gently withdrew the cubs and handed them to waiting arms. The lumps of black screaming fur were kept warm inside coats until Heino placed them into a wool hat to be weighed. They were also sexed and a hair measurement taken.

Cubs weigh about eight ounces when born. These two weighed between four and five pounds. Yearlings can weigh up to 40 pounds and must be sedated like their mothers.

Cubs weigh only eight ounces at birth and typically put on 40 pounds during their first year.



JAMES C. BISHOP, JR.

"Handling cubs in the winter dens has no effect on their fear of humans in subsequent meetings," Heino said.

Whether working on small or large bears, following routines keeps the job pretty safe. In all her years as a researcher Heino had only one incident where a large bear scratched a researcher. "The incident was pretty minor and no one was hurt," she said. At most, small cubs scratch a bit or may nip a chin.

Observers get a choice of assisting or simply watching the researchers work. Visitors may help weigh the bear or observe as researchers take a stethoscope and monitor the sow's heart rate, respiration rate or take the bear's temperature. Like a thorough tailor, a team member uses a flexible tape to measure and record each bear's chest and neck girth, total length and footpad size.

Ear tags and lip tattoos serve as permanent identification numbers. Once collars drop or if ear tags fall off, a bear that's recaptured or killed during a hunting season can be identified with the lip tattoo.

"In 1989 we trapped and collared a 400-pound boar," Heino said. "During den processing in 1991, it weighed over 500 pounds. We lost track of it when its collar fell off in the Bibon Marsh during the winter of 1992. Then on September 24, 1998 a hunter harvested the bear and it weighed 678 pounds! It was the largest bear we ever processed and we determined it was 24 years old."

Over the years, she has followed generations of bears as the sows and yearlings are collared and marked. "We captured sow number 105 many years ago, her granddaughter number 241, and great-granddaughter sow number 75. They all are still on the air," Heino said. Bears can live to be 35 years old.

When the bear management program started in 1985, the state's bear population was estimated at about 4,750 animals. Their range and population have been rising steadily and now



Bear researchers take the time to replace a protective cover over each den so the sleeping ursines are less likely to be noticed or disturbed.

number between 11,150 and 14,000 bears.

Keith Warnke, DNR big game ecologist, said that prior to 1985 anyone could harvest a bear with a big game license. That year the Legislature let the department set seasons, sell special bear hunting licenses and regulate harvests.

By 2004, nearly 4,700 permits were sold with the goal of harvesting 2,500 bears. Over 56,000 hunters applied for harvest permits using a cumulative preference system. This is a far cry from a time when Heino was growing up on a farm south of Ashland.

"Even though we had fewer bears back then, farmers shot nuisance bears nearly at will," she said. "It was one of the reasons for the declining populations that led to more protective management."

Today she lives outside of Sanborn with her husband Jerry, a few miles from where she spent her youth. Last April she retired from the U.S. Park Service where she worked full-time as a budget technician and volunteer coordinator.

During her 20 years as a wildlife research volunteer, Maggie Heino has

worked on state and federal studies of white-tailed deer, bald eagles, elk, woodcock, ruffed grouse, gulls, cormorants, and amphibians.

"In Bayfield, they called me the 'Frog Lady,'" she said, referring to an independent three-year study she did on frogs and toads of the Apostle Islands National Lakeshore. Her data provided the baseline information on eight frog species and Wisconsin's one toad species. She wrote the monitoring plan, conducted surveys and submitted the final results in a report to the National Park Service.

But it is bear research that Heino still finds most fascinating. She enjoys knowing that the background information the collared bears signal can be used to benefit the animal.

"At den sites like this or following bear around a forest, basic biology leaves the text-

books and becomes a real experience," she said. "I'll keep doing it as long as I'm needed, I'm healthy, and there is work to be done."

The three-legged sow soon begins to come out of her drugged state. Researchers quickly finish their work. Before sliding her into the hole, they dab a little Vaseline on her nose, covering any remaining human scent from the recent handling because the tranquilizing drug affects her short-term memory. The sow will remember nothing of the experience as she is tucked into the den next to her cubs.

Branches, pine boughs and grass are placed over the entrance to hide it and keep out light. After the next snow, few people passing by will know that a sleeping bear and her two kids are awaiting spring's arrival.

But Maggie Heino would know. A little beep from a radio signal will help the researcher keep an eye on this sleeping crew.

James C. Bishop, Jr. is public affairs manager for DNR's Northern Region in Spooner.

ROBERT QUEEN

The perfect partner

Wisconsin's land trusts connect the conservation goals of individuals with the landscape at large.

Althea Dotzour

On a crisp winter morning, wild turkeys forage in a meadow. A spring bubbles past icy rocks, feeding clean water to the river. The future is bright on this landscape: with the help of a local land trust, the family that has owned the land for generations has protected it with a conservation easement.

Across the state, people who value the outdoors are turning to land trusts to protect special places where future generations can enjoy the natural areas that make Wisconsin such a wonderful place to live. "Land trusts are the fastest growing segment of the conservation community," says Vicki Elkin, executive director of Gathering Waters Conservancy. A statewide coalition, Gathering Waters works with its member land trusts and conservation-minded landowners to save our lakes and rivers, wildlife habitat, scenic areas, working farms and other vulnerable areas from development.

"In the ten years since Gathering Waters was founded, we have seen Wisconsin's land trusts grow from a handful of groups to over 50," Elkin notes. "Together, these organizations and their more than 40,000 members have protected over 125,000 acres of special land."

Land trusts are private, nonprofit conservation organizations formed to protect natural resources such as working farms and forest land, lakes and rivers, natural areas, historic structures and recreational areas. Land trusts pur-

chase property, accept land donations and negotiate land preservation agreements (called conservation easements) with property owners. They educate the public about the need to conserve land, and some provide land use and estate planning services to local governments and individual citizens. Because they often are locally based, land trusts tend to enjoy a close connection with the landowners with whom they work. "Local land trusts work to protect land important to their communities — hiking and ski trails, lakes and beaches, favorite fishing spots, scenic views," says Elkin. "I believe that in the future, land trusts will be integral community fixtures, like the local YMCA or library. Our goal is to ensure landowners are as familiar with their ability to preserve their land as they are aware of their option to sell it for development. Unless we act now, the places we love may be lost before our children and grandchildren can enjoy them."

Land trusts work with private land owners to safeguard fragile ecological resources, but they also increasingly partner with government, other community organizations, and businesses to protect valuable outdoor resources and to provide a variety of recreational opportunities to the people who live, work and play in Wisconsin communities. Much of the property land trusts protect is open to hiking, hunting and fishing, bird watching and educational tours. In areas of high ecological signifi-



ROBERT QUEEN

...we have seen Wisconsin's land trusts grow from a handful of groups to over 50. Together, these organizations and their more than 40,000 members have protected over 125,000 acres of special land.

Vicki Elkin, executive director of Gathering Waters Conservancy

Gathering Waters Conservancy celebrates its 10th year as a resource center and statewide advocate for land trusts in Wisconsin.

cance, land trusts complement the efforts of the Wisconsin Department of Natural Resources by working with landowners who are not interested in selling their land to a government agency. "The conservation goals are the same," explains Elkin. "A strong land trust community is an excellent partner to the Department of Natural Resources. We're also able to leverage private, local and federal dollars to build a legacy of protected lands in the state."



DOOR COUNTY LAND TRUST



MISSISSIPPI VALLEY CONSERVANCY

(top) The Door County Land Trust partners with private landowners to secure conservation easements on scenic, ecologically important lands. More than 3,000 acres are now protected.
(above) Blufflands and bottomlands near La Crosse are among the spectacular vistas and properties protected through the efforts of the Mississippi Valley Conservancy.

Governor Jim Doyle has proclaimed 2005 The Year of Land Conservation in Wisconsin. "This is a wonderful opportunity to celebrate the strides that have been made by public and private groups working to promote land conservation," says Elkin. "2005 is also the 15th anniversary of the Knowles-Nelson Stewardship Fund so it is a particularly fitting time to highlight state and local land conservation efforts."

In anticipation of The Year of Land Conservation, here are a few snapshots of some spectacular land trust projects across the state:

DOOR COUNTY LAND TRUST:

Setting a standard for excellence

The winner of Gathering Waters Conservancy's 2004 Land Trust of the Year award, the Door County Land Trust, exemplifies a land trust serving as an enduring institution in the community. When driving through the Door County peninsula, you will see signs on areas the trust has protected...over 3,000 acres to date. The Door County Land Trust is working in close partnership with the DNR, The Nature Conservancy, and The Ridges Sanctuary to develop and implement a county-wide land

conservation strategy. Like many land trusts, the DCLT owns and manages property and continues working with private landowners to place conservation easements (permanent development restrictions) on areas of high ecological or scenic importance.

BAYFIELD REGIONAL CONSERVANCY:

Protecting the orchard industry in northern Wisconsin

Toward the northern tip of Wisconsin, a peninsula of land juts out into Lake Superior. The microclimate on the Bayfield peninsula is perfect for orchards, and apple and berry farming thrive in the region. The orchard industry is emblematic of the area, and Bayfield Regional Conservancy works hand-in-hand with local governments and citizens to ensure orchards will continue to be a part of this community in the future. For example, in 2002, with the help of the Bayfield Regional Conservancy, the local community voted to raise their own taxes to buy easements on active farmland.

THE NATURE CONSERVANCY:

Leading land conservation

The Nature Conservancy, an international organization, has protected 85,300 acres of critical natural lands in Wisconsin. The Conservancy has undertaken regional conservation site assessments and has acquired especially rare or fragile properties such as Baxter's Hollow in the Baraboo Hills, Lulu Lake in the Mukwonago River watershed, and Caroline Lake in the Chequamegon Bay watershed.

MISSISSIPPI VALLEY CONSERVANCY:

Enhancing the bluffs of the Mississippi River

In a unique partnership with the city of La Crosse, the Mississippi Valley Conservancy is protecting the bluffs surrounding and overlooking the community. In addition, the Conservancy recently worked with a private landowner to protect over 330 acres in Grant County, including a bird effigy mound with a wingspan of 270 feet. This beautiful site, rich in species diversity, is a favorite hot spot for birders. Through partnerships with the Department of

Natural Resources and the Natural Resources Foundation, this site has been designated a State Natural Area. The Mississippi Valley Conservancy continues to protect blufflands in six southwest counties bordering the Mississippi River.

KINNICKINNIC RIVER LAND TRUST:

Developing innovative partnerships

The Kinnickinnic River Land Trust is both a land trust and a river advocacy

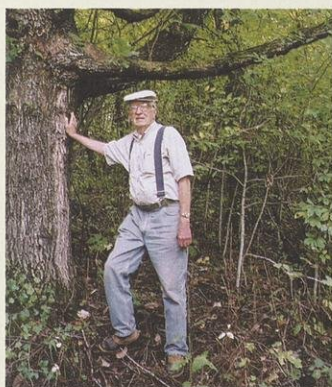
group. The trust won the River Alliance of Wisconsin's 2003 award for their work protecting the Kinni. The Kinnickinnic River Land Trust has brought together a diverse group — including the Department of Natural Resources, the City of River Falls, Trout Unlimited, Pheasants Forever, and local counties — to maintain the Kinnickinnic as a valuable recreation resource that attracts many anglers to the region.

MILITARY RIDGE PRAIRIE HERITAGE PARTNER GROUP:

Protecting a wide area of habitat

A diverse set of organizations work with landowners to protect over 40,000 acres of prairie, savanna and grassland in Dane and Iowa counties as well as sustain farmland. The Partner Group includes conservation organizations like The Nature Conservancy, the Driftless Area Land Conservancy, Pheasants Forever, Blue Mounds Area Project and

Healing the land



My first professional job, at the age of 24, was District Game Manager at Viroqua. I quickly fell in love with the coulee country. The river valleys, steep wooded slopes and the vast prairie-like uplands made up a beautiful landscape completely new and exciting to me. I hoped I would someday own a small piece of this magnificent region.

Some 18 years later our family achieved that goal. We acquired a badly abused farm and began the long process of rehabilitation, tackling the incredible mess with plenty of hard work and effort from family members young and old. Now — 35 years later — the land is slowly regaining its health. One-third of the 220 acres have naturally reverted to forest, ponds have been built, erosion controlled and new prairies grow on what were once badly eroded crop fields.

Our aim was to protect the land in perpetuity — to protect it from resource exploitation and more importantly, the pernicious escalation in land values which, in the decades ahead, could result in enormous pressures to sub-divide. A conservation easement accomplishes these goals admirably and yet permits the family to build several small cabins around the old farmstead. If forestry is practiced, big trees



Harold "Bud" Jordahl and his farmstead where forests, ponds, prairies and fields have been restored over 35 years. Land trust assistance will protect it in perpetuity.

will be the goal along with maintenance of forest openings and shrub borders so important to wildlife. Forest and soil plans are required. Moreover, the easement allows future owners to adopt a "hands-off" approach. The land will evolve and change through natural forces.

The land gives back to us rich rewards — tranquility, an evolving forest/prairie ecosystem, diversity in plants and animals, and great satisfaction in witnessing the incredible changes as the land slowly heals.

— Bud Jordahl

Founder and past-president of Gathering Waters Conservancy

From "In Their Own Words," a Gathering Waters Conservancy publication featuring stories of land conservation from people who chose to protect land in Wisconsin for future generations. Contact them to order a copy at www.gatheringwaters.org or (608) 251-9131.

COURTESY OF BUD JORDAHL



GERALD H. EMMERICH, JR.



CALEDONIA CONSERVANCY

(top) Landowners, conservation groups and land trusts in Dane and Iowa counties are collectively working to manage nearly 40,000 acres to provide habitat for grassland birds, mammals and insects by maintaining their lands in pasture and fallow fields.
(above) Horseback riders started the Caledonia Conservancy to preserve trail rights and access. The group subsequently grew to protect rural parcels, hiking opportunities and open spaces in northeastern Racine County.



KEN W. OLSON

The Kinnickinnic River Land Trust works to preserve recreation on the shores and in the waters of this scenic western Wisconsin waterway.

The Prairie Enthusiasts; government agencies including the Department of Natural Resources, the U.S. Department of Agriculture, and the U.S. Fish and Wildlife Service; and economic development groups like the Southwest Badger Resource Conservation & Development Council. Almost 39,000 of the 40,000 acres are owned by individuals who are helping provide a safe zone for grassland species by keeping their land in pasture, hay, or fallow fields.

CALEDONIA CONSERVANCY:

Preserving rural character

In 1994, Caledonia Conservancy was started by equestrians interested in connecting the trails in the area. Since


that time, Caledonia Conservancy has grown and expanded both its reach and its mission; today the group also aims to preserve the town's rural character and protect a maple-beech woods where townspeople enjoy hiking. The conservancy has become a strong voice in the community for smart growth planning and has helped the Town of Caledonia create an innovative Conservation Subdivision Ordinance, which requires new developments to contain up to 60 percent open space.

Take action

If these images of groups working together to protect the natural wonders of

Wisconsin have inspired you, consider contacting Gathering Waters Conservancy. From volunteering at stewardship days to protecting your family's land, you can get involved to ensure the places that make Wisconsin special are protected for the future. Contact Gathering Waters Conservancy at (608) 251-9131 or visit www.gatheringwaters.org on the web. Gathering Waters Conservancy can then put you in touch with groups in your area that mesh with your interests.

Althea Dotzour is Outreach and Policy Coordinator for Gathering Waters Conservancy in Madison.



The Stewardship Fund: Partnerships on a grand scale

In 1989 the Wisconsin State Legislature created the Knowles-Nelson Stewardship Fund to protect recreational lands, wildlife habitat, state parks, trails, forests and other natural areas. Named after two of Wisconsin's great conservationist governors, Republican Warren Knowles and Democrat Gaylord Nelson, the Stewardship Fund has helped protect more than 225,000 acres in 71 of Wisconsin's 72 counties. The program is funded at \$60 million a year through the year 2010.

In addition to funding land purchases by the state, the Stewardship Fund provides grants to local governments and nonprofit organizations to acquire conservation land. To receive a grant, communities and nonprofit groups must raise a matching amount of money, effectively doubling the funds available for land and water conservation. To date, Wisconsin's private land trusts have raised more than \$30 million from private and public sources to directly match the state's investment. At the same time they have leveraged an additional \$90 million of conservation through donations of land and conservation easements from landowners. Here are two examples of how land trusts have used Stewardship grants to leverage big bucks for conservation:

Ozaukee Washington Land Trust and the Lion's Den Gorge Natural Area

Site: Lion's Den Gorge State Natural Area. Identified both by the Department of Natural Resources and by the Southeastern Wisconsin Regional Planning Commission (SEWRPC) as a high-priority site for protection.

Action: The Ozaukee Washington Land Trust purchased the site, protecting 75 acres and one-half mile of Lake Michigan shoreline for \$1,280,000.

Funding: A \$450,000 Stewardship grant, matched in part by \$26,000 from private donors and leveraging an additional \$404,000 from the Wisconsin Coastal Management Program, \$300,000 from Ozaukee County and \$100,000 from the Town of Grafton.

The Nature Conservancy and the Spring Green Preserve

Site: 120 acres of high quality oak woodland and dry prairie at the Spring Green Preserve State Natural Area in Sauk County.

Action: The Nature Conservancy purchased the property in a bargain sale to protect this rare habitat type and the grassland birds that live there.

Funding: A \$151,000 Stewardship grant was matched by the landowner's gift of \$100,000 in land value and by additional donations from private individuals.

Lion's Den Gorge is a beautiful 75-acre parcel with a half-mile of Lake Michigan shoreline preserved by private donors, the county, the township and the land trust with the help of state Stewardship Fund grants.

WISCONSIN NATURAL RESOURCES

Each December we publish an annual index of our stories. A cumulative index of our stories from 1977–2003 is also available as a file you can download from our website: www.wnrmag.com. Please note this is a large file (more than 350,000 bytes and in excess of 100 pages), so browse before you print!

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See also WILDFLOWERS
"Two hearts in three-four time."
Anita Carpenter, June, p. 2, 29

WILDLIFE MANAGEMENT

See also BEARS
"Where sleeping bears lie."
James C. Bishop, Jr., December, p. 17–22

WISCONSIN TRAVELER

"Stand up and be counted."
Maureen Mecozzi, December, p. 31
"Stage fright."
Maureen Mecozzi, October, p. 31
"Scuba do!"
Maureen Mecozzi, August, p. 31
"A grand event."
Maureen Mecozzi, June, p. 31
"Spring delights."
Maureen Mecozzi, April, p. 31
"Get real."
Maureen Mecozzi, February, p. 31



STEPHEN J. LANG

When bird watching, note that the white-breasted nuthatch has no black eye line or white stripe above the eye.

cousin, the white-breasted nuthatch, *Sitta carolinensis*. White-breasted nuthatches are year-round residents preferring habitats associated with deciduous trees, not conifers. The 6½-inch-long white-breasted nuthatches have white breasts and a bit of rusty red on the belly and under the tail. They also have blue-gray backs, but their white cheeks and chin stand out for they lack the black eye line and white stripe.

Although red-breasted nuthatches like to frustrate us by staying in treetops or quickly disappearing from view as they spiral to the tree's far side, they are also eager to accept hand-outs at sunflower seed and suet feeders. They zip in, grab a seed, pivot and zip out. They may either cache the seed in a tree crevice or hammer on it to extract the kernel. Their energy level, like that of chickadees, is on fast-forward and definitely livens up a winter scene. These nuthatches may linger until spring's warmth lures them back to their preferred northern boreal forest of spruce and fir.

In the short northern summer, a pair of red-breasted nuthatches excavates a nest cavity up to eight inches deep in a dead snag or tree branch. The cavity is lined with grasses and mosses. The tiny entrance hole is often smeared with conifer resin, a behavior thought to prevent insects, small mammals or other birds from entering the cavity. After an energetic courtship of much talking, pivoting and wing flapping, the female lays four to seven white eggs, each decorated with red-brown spots. Eggs hatch after a 12-day incubation period with the young leaving the nest about 20 days later. The young stay with their parents in a noisy family group for several weeks. One brood is raised per year.

Of the four nuthatch species found in the United States, the red-breasteds are the most migratory. In winter, they frequently join the company of chickadees, woodpeckers and finches as they move through the forest. Although the tiny nuthatches blend in with the trees, they are fairly vocal in winter, so I know they are about, even if I can't see them. I hope the treetop ornaments grace us with their lively presence this winter. ■

For birding and tromping about, winter is Anita Carpenter's favorite season outdoors.

READERS write

FISHING ALDER FORK

I last walked the environs of Alder Creek (Alder Fork of the Potato River) nearly fifty years ago but memories of it are still vivid in my mind, including those of some harebrained pressure to turn it into "Alder Creek Flowage" in the early '60s.

Like Mr. Peterson, I am a fly-fisherman and a follower of Aldo Leopold, and like Aldo Leopold, I dreamt of the "sheep meadows" of Mt. McKinley (Denali) and all of Alaska. Nearly 40 years ago I left northern Wisconsin and came here to Alaska. My cabin here in Cantwell sits less than a mile outside the boundary of Denali National Park and I can see both Denali and Dall sheep from here. I am immensely grateful for the opportunity to call this home, but still do have many ties to and fond memories of northern Wisconsin.

Dave Snarski
Cantwell, Alaska

ECO-SPUDS

My family and I enjoyed "A spud in the spotlight," in the August 2004 issue. It is refreshing to read about farmers in our area taking a new approach to crop management that ultimately reduces the use of pesticides.

In our little corner of Shawano County we take great pride in growing our own produce and maintaining our yard without the use of chemicals. Many years ago we stopped using chemical pesticides to control the Colorado potato beetle (and other insect pests) in our garden. We resorted to picking potato beetles by hand. What we discovered is that the rose-breasted grosbeaks who visit our bird feeders also scavenge for potato beetles in our garden. I'm sure that pesticide-free insects taste better. This year I handpicked bugs one time. The birds took care of the rest! What a beautiful means of pest control!

Hats off to the potato and vegetable farmers participating

in the eco-potato project.

Thanks to WNR magazine for highlighting their work. Increasing awareness of the positive results these farmers have had is important. As more individuals are informed of the results of "farming practices in harmony with the natural environment" we can expect that the balance of nature the Creator intended will ultimately be restored.

Kay Blum and family
Caroline

All crops, including potatoes, can produce abundant food without poisons such as pesticides. My father farmed from 1914 to 1930 when all those intelligent ambitious farmers tilled the soil and planted crops using crop rotation, cycles of matter and Nature to produce pure food for the people. Unlike today, those farmers of yesteryear farmed with absolute minimum cost of operation and were thereby able to sell their pure food at a minimum cost.

Manure is the absolute best and most practical fertilizer. It quickly converts into the finest porous topsoil. Earthworms thrived in it and when it rained, those gifts of Nature arose to the surface leaving holes for the rainwater to descend and nourish thirsty roots. Today, without manure, the fertilizers harden the soil causing flooding and runoff and the poisons used in modern agriculture killed all the earthworms, causing even more runoff.

I vividly recall my brother Paul and I removing the manure from the huge two room chicken house in springtime and, using a spreader pulled by two horses, we spread the manure on the land and tilled it in where the potatoes would be planted. In those days farming was conducted with precision and excellent timing.

Luther Burbank, then of the University of Wisconsin in Madison, developed the Burbank potato that was the greatest ever. It's now grown in Idaho and

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@dnr.state.wi.us

marketed as the Idaho potato.

Paul and I also used to hand pick the potato bugs from our potato patch and put them in a small tin can. It took us all day to complete the work in our patch that was big enough to feed eight. Our potato crop was always abundant and so large that the spuds had a hollow center, but no dry rot or scabs. It was as pure as food should be.

I think agriculture today violates the Laws of Nature. Your article showed concerns for cranes, but how about people? Farm wells and farm town wells have been poisoned. I know an area of northwest Iowa where deep wells supply farmers with water that is piped to a tank on the farm with a water meter. The farmer has to pay for that water. The poisons used in agriculture have caused chaos.

Sherman Milton Helland
Greenfield

WHERE CARDINAL FLOWERS GROW?

Anita Carpenter's story, "Red in the yellow month" (August 2004), intrigued me. I have trout fished in several northern counties from May through September for many years and never observed this flower. What areas of the state produce the cardinal flower?

Betty M. Duebner
Medford

Cardinal flowers (Lobelia cardinalis) range from southern Canada in Ontario and Quebec, all the way to the East Coast, west at least as far as the Mississippi River and south to Florida. It is clearly found statewide in Wisconsin and should be at

peak bloom from August through early September. It's a member of the bluebell family, grows two to four feet high and likes "wet feet" — along streambanks and wetland edges. It has been over-picked in some areas and likes full sun, but will grow in semi-shade.

MORE ON SQUIRRELS

I laughed when I read about people's problems trying to keep squirrels out of their bird feeders. About 15 years ago I bought a house surrounded by woods at the end of a dead end street — no neighbors, no traffic, a half-acre of garden, an acre of grass and a bird feeder only 20 feet out the back porch were already there for me to enjoy. Ten feet east of the feeder was an old 30-foot high fruitless pear tree; 20 feet to the west of the feeder was a 60-foot hardwood with branches that hung about 8–10 feet above the feeder. An innocent-looking Christmas tree grew about 10 feet south of the feeder.

After filling the feeder for the first time, I settled into a lawn chair on the porch and watched three squirrels jump from the pear tree to the feeder to eat. They scattered and trashed \$3 worth of seed in about 15 minutes scratching through the food for the few kernels of corn they liked best. I thought I could use the pear wood for smoking fish, so I cut and sawed that tree to pieces.

The next time I filled the feeder to watch birds I got to observe the squirrels jumping from the branches of the oak and crashing into the feeder with some really acrobatic leaps. Over the next two weeks I think I cut 4–5 branches from one side of the oak until it seemed to lean starboard a few degrees. I filled the feeder with another three quarts of bird food and went inside for lunch. Twenty minutes later I chased a squirrel who was making a mess off the feeder and sat down to watch

how he got up there. After five minutes, he wrapped his four legs around the pole and shimmed up to the platform, crawling up and flipping himself onto the platform. I thought I would fix him and greased the pole with Vaseline. He came to the pipe three times, sliding back to the base. Then he stood back, surveyed the situation, rolled in the dirt from the flowers planted near the house, and in three or four tries was back on the platform.

After a trip to the hardware store for two lengths of six-inch galvanized stovepipe, he was toast. I poured a cup of coffee and watched the birds for a few hours.

The next day after supper, I watched the birds and the feeder was empty! My furry friend climbed to the very top of the Christmas tree and got it swinging to and fro until he created enough momentum to gain access to the feeder. It took me until two weeks before Christmas until the tree was stiff enough that I was only feeding birds.

Kieran Sawyer, Sr.
Oak Creek

This time I have to put my two cents worth in about those "terrible" squirrels. I feed them because I like to watch them chase each other and run up and down the yew tree in front of my window. One time a thirsty squirrel jumped up to the bird-bath, missed the edge and slipped into the water.

I have my bird feeders on poles with open baffles. One time one of those acrobats figured out how to overcome the baffle and jumped to the feeder, but the feeder swung around and that poor squirrel slipped off.

There are quite a few remedies to keep the seeds in the feeders for the birds, as you pointed out.

Elizabeth Sameitat
Randolph

Mix cayenne pepper in with the birdseed. The pepper doesn't seem to bother the birds, but I haven't had a squirrel or raccoon at my feeders since I started using it. I had a red squirrel, the curmudgeon of all squirrels, who was a regular at the feeders. He became so upset at my use of pepper that he finally blew a gasket, started jumping up and down on the feeders and deck railings, tried the seed anyway and ran up the flagpole to wipe his burning mouth on the flag. Now that's entertainment!

Leila Nessen
Turtle Lake

One of our naturalists asked if you had observed whether the pepper seemed to irritate the birds' eyes? He didn't know if this treatment was generally accepted and recommends against treating seed, given other options.

We have two squirrel-proof feeders that really work. The barrier stays open for birds but shuts when too much weight is put on it. I bought a new cylindrical feeder with an open base that was emptied of black sunflower seeds in a day. It sat empty for a while then I read a hint to try safflower seeds, as the squirrels don't like them. We now have cardinals, rose-breasted grosbeaks, purple finches, chickadees and nuthatches at the feeders as well as mourning doves and blue jays under the feeder. The squirrels stay away!

Karen S. Jacobi
Wautoma

Stand up and be counted

Come early winter, more than 50,000 people across North America, the Caribbean, Central and South America and the Pacific Islands will spend a full 24-hour day walking around a big circle with their eyes raised to the skies. Is this: a) a re-enactment of an ancient Druid ritual; b) the latest exercise craze, or; c) The National Audubon Society Christmas Bird Count?



Did we mention these folks carry a clipboard in one hand and a pair of binoculars in the other?

The oldest and largest wildlife survey in the world, the **105th Christmas Bird Count (CBC)** runs from December 14, 2004 to January 5, 2005 — and you are welcome to join in the action. The count monitors the status and distribution of bird populations across the Western Hemisphere. Combined with the North American Breeding Bird Survey and other census data, the CBC offers a picture of how the continent's bird populations have changed in time and space over the past hundred years.

Here's how it works: CBC participants are organized into field parties by the local "complier." Each field party covers a specific area of a 15-mile diameter circle on a specific route, and counts every individual bird and bird species they see or hear over one calendar day (from midnight to midnight). At the end of the day representa-

tives from each counting group meet to compile the master list.

Birding novices are encouraged to participate; inexperienced observers are always sent out with seasoned CBC veterans. Birds at feeders within each circle are also counted; if you live within a CBC circle, you can sit in the comfort of your kitchen and count while the coffee perks. Just contact your local complier so you can report your results on the count day.

Curiously, the bird count aimed at conservation has its origins in taking aim for consumption. Prior to 1900, many people engaged in a holiday tradition known as the "Christmas Side Hunt." They would choose sides and go afield with their guns; whoever brought in the biggest pile of feathered (and furred) quarry won. On Christmas Day 1900, ornithologist Frank Chapman proposed a new tradition — a "Christmas Bird Census" to count birds rather than hunt them over the holidays.

With more than 1,500 circles

to be counted, there's always room for another pair of eyes. If you love birds, relish the excitement of friendly competition, and want to make a contribution to science and bird conservation, visit the **Wisconsin Society for Ornithology** website at www.uwgb.edu/birds/wso/cbc.htm for circle locations and contact information for the count compliers.

Want to do something different to ring in 2005? Leave the cheap champagne at home and head over to Prairie du Chien for the state's wackiest New Year's countdown, better known to the locals as **The Droppin' of the Carp**. At the entrance to St. Feri-ole Island the devotees dance around a bonfire to the scaly tunes of Larry and the Carpettes, consume hot chocolate and popcorn, take the Carp Plunge, and as midnight approaches, witness the ceremonial lowering of the *Cyprinus carpio* into the waters of the Mississippi. Festivities to propitiate the angling gods begin at 9

As they lowered Lucky the Carp to usher in 2004, Carp King Thomas Rowell and Queen Burnita Gokey surveyed their happy subjects. Join the revelry!

p.m. on December 31. See www.prairieduchien.org or call (608) 326-8602.

Whoever said honesty is the best policy missed the turn off Highway 11 into Burlington. The Racine County city — home of the real whopper — harbors the world-renowned Burlington Liars' Club. This stalwart gang of incorrigible fibbers stages an annual competition for the year's **Championship Lie**. In an election year there were certainly plenty of good candidates, but the BLC is looking for original work. Fabricate a falsehood, slip it in an envelope with a dollar (a real dollar, please; no counterfeits!) and mail it before December 31 to the BLC, 179 Beth Court, Burlington WI 53105. The winning liar receives fawning media attention and the dubious honor of having a nose longer than Pinocchio's. ❧



DAVID LARSON



COURTESY OF DAVE COLLINS, MIDWEST NEWS

Flambeau River State Forest

Winter recreation on the Flambeau, the second largest state forest, is a great way to experience this remote land. Snowshoeing, cross-country skiing and snowmobiling are all popular here as is ice fishing for walleyes and crappies.

During winter, the forest is also abuzz with timber sales. Due to the moist soils in the area, harvests are conducted when the ground is frozen to minimize soil disturbance and road ruts.

Plan a visit from the forest's headquarters about 13 miles east of Winter on County Highway W.

To find more activities on the state forests, check our website at: <http://dnr.wi.gov/org/land/forestry/StateForest>



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