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WISCONSIN NATURAL RESOURCES

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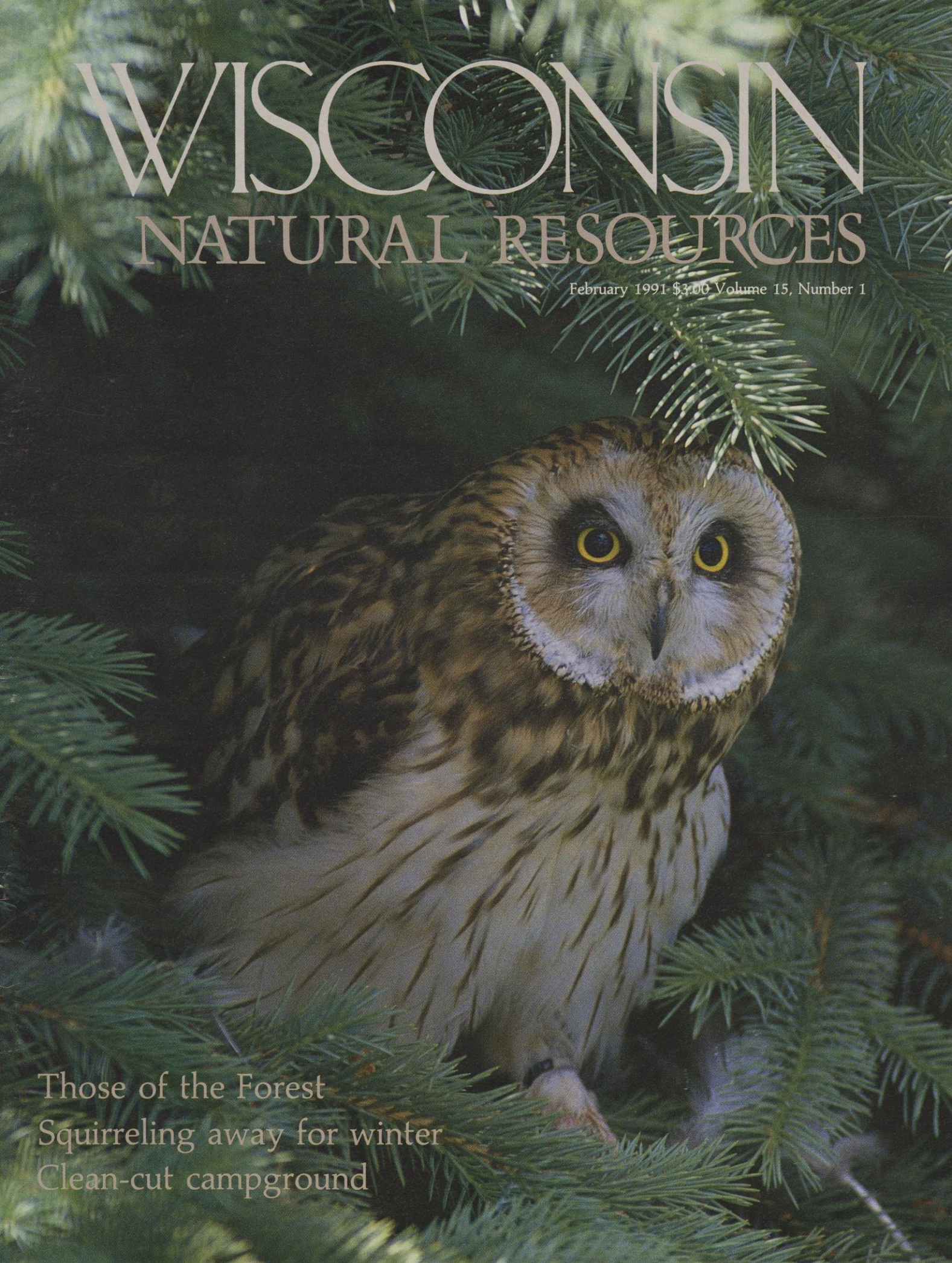
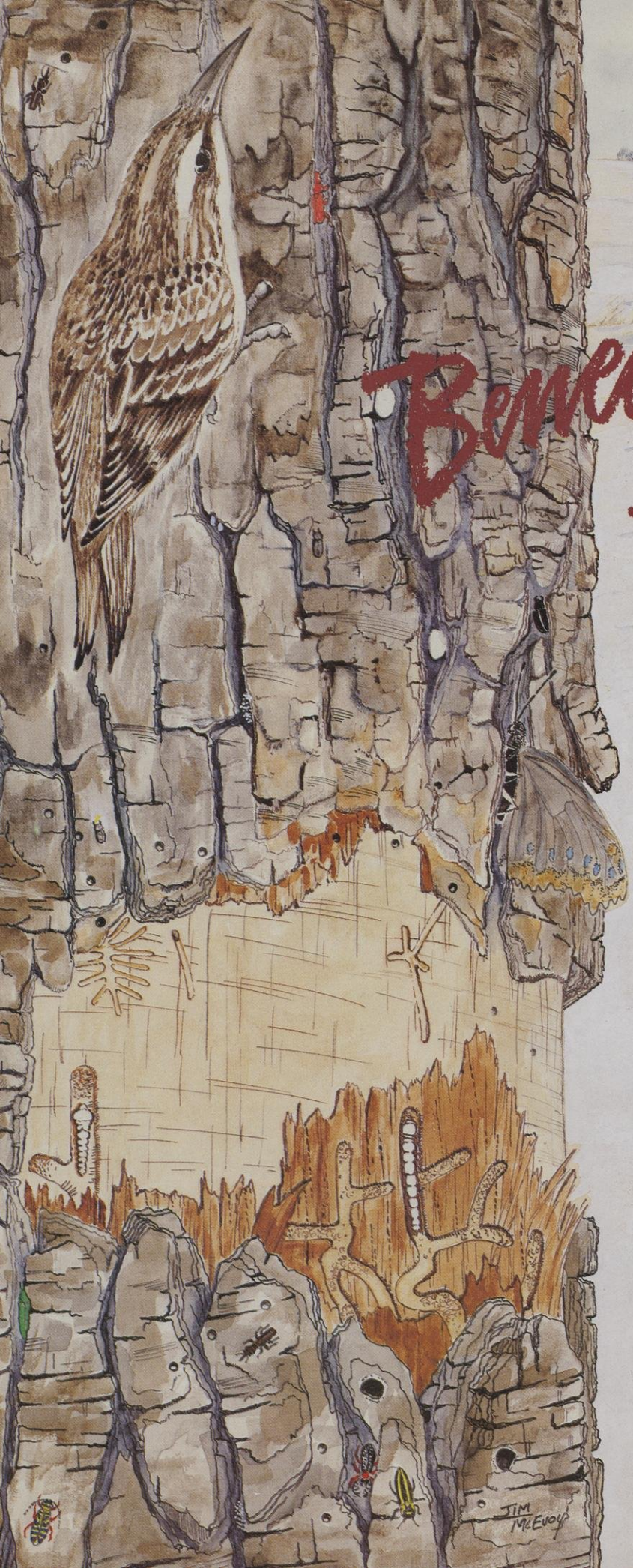


Those of the Forest
Squirreling away for winter
Clean-cut campground



Beneath the Bark

Anita Carpenter

Stripped of their leaves, drifted in snow and creaking in gusty winds, trees are vulnerable. You might think they are weak in winter. In fact, trees are pretty tough, and that toughness provides refuge for a world of organisms. To a tree, bark provides an insulating layer and a tough hide that prevents desiccation, disease and injury. To many beetles, bark is a doorway, a portal to their home tunnels. To a fall webworm caterpillar, fissured bark provides a protective crevice to weather out the winter. To a brown creeper, bark is a textured place mat whose crannies provide supper. To curious people, tree bark is a textbook just waiting to be pored over on a winter walk.

Each tree species has its own characteristic, textured bark — American beech is steel gray and smooth, black cherry is scaly, shagbark hickory peels in shaggy plates and white oak is deeply furrowed. Bark varies in thickness from paper-thin white birch to corky-thick bur oaks.

At the surface, tree bark in winter looks lifeless, but hidden in and under the bark are insects and eggs that temporarily use the bark as home and nursery. Many beetles, including the bark, metallic wood-boring and long-horned families spend their formative stages in or under bark. Even when you don't see them, you can identify beetles' presence by the unique tunnel patterns they leave behind. On dead trees without bark, a nature detective can generally tell what insects and birds have been eating even though the diners have long since departed.

Small, inconspicuous adult bark beetles (Scolytidae family) burrow through the bark and excavate a brood gallery in the inner bark or along the wood's surface. Eggs are laid in little notches at intervals along the sides of the gallery. After the eggs hatch, the larvae feed on the tender cambium layer between the wood and the bark. Each larva mines a tunnel as it moves away from the brood gallery. Larvae will pupate at the ends of tunnels and emerge as adults from round holes they chew through bark. The centipede-like tunnel patterns seen on dead trees are characteristic for each bark beetle species.

The metallic wood-boring beetles (Buprestidae family)

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ILLUSTRATION BY JIM MCEVOY

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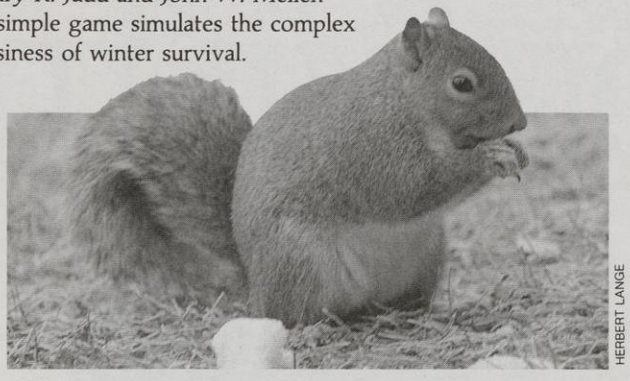

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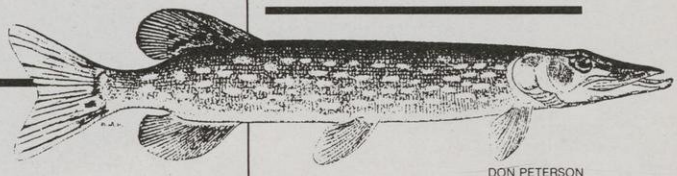

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OLAUS J. MURIE

FRONT COVER:
Short-eared owl.
© STEPHEN J. LANG, MADISON, WIS.

BACK COVER:
Winter arboretum.
© ROBERT E. QUEEN, MADISON, WIS.

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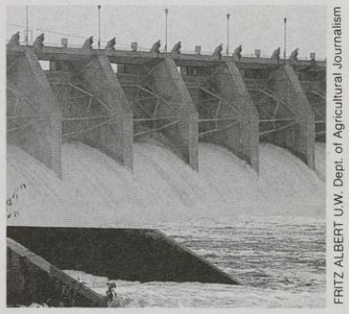

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DAVE DANIELS

SQUIRRELING AWAY FOR WINTER

An outdoor game simulates the serious business of winter survival where some animals come up empty.

Mary K. Judd and John W. Mellen

This time of year, exposure is no joke, but we can learn about it without experiencing it. The inevitable change to harsh winter weather can kill unprepared animals. The cruelty of winter weather is compounded as the season is also a time of food shortage, disease and death.

We developed a fun way to help youngsters and the young-at-heart appreciate the dead-serious challenges animals face in surviving winter. If you're a teacher, day care worker, scout troop leader or you're just wondering how to entertain a passel of youngsters outside on a mild winter day, here's a way they can learn a bit about nature while they burn off some energy in a winter game that's a cross between a scavenger hunt and tag.

Before you don snowsuits, boots and mittens, let's spend a few toasty minutes inside learning about harsher reality outside the door.

Different animals prepare for winter in different ways. To minimize their hardships, more mobile animals like waterfowl and songbirds migrate to warmer climes that have new sources of food. Animals that cannot escape adapt strategies to contend with the cold grip. Ground squirrels, chipmunks, woodchucks, bats, prairie rattlers, garter snakes and bats retreat to burrows or caves, curl up and hibernate. They drop their heart rate, breathing rate, metabolic rate and temperature so low they often appear lifeless. Bears, raccoons and skunks don't enter true hibernation, but they do sleep away much of the winter in caves, dens and tree cavities protected from drastic temperature fluctuations. The warm-blooded animals that tough it out include deer, foxes, weasels, woodpeckers, blue jays, sparrows, chickadees and squirrels. These active winter inhabitants gamble they can protect themselves from cold, rain,

sleet and snow. They must avoid predators and find enough food to stay warm and healthy.

The search for groceries is especially challenging. Leaves have stopped growing and died. Nuts and berries, abundant in late fall, are scarce — most have been eaten or are hidden beneath a carpet of leaf litter and a blanket of snow. If animals can find them, high-calorie foods like nuts, seeds and protein-rich insects help wintering mammals stave off disease. Hunger and starvation decrease the animals' abilities to protect themselves and recover from infections. To compound their problems, animals are more vulnerable to predation in winter as the protective leaves that hid them have fallen.

One disease, mange, particularly strikes rodents, insect-eaters and carnivores stressed by winter weather. Mange is a skin infection caused by parasitic mites. The disease frequently causes hair loss around the head, neck and shoulders, as well as, red scaly spots and scabs about the eyes, ears and muzzle. Affected skin patches thicken, wrinkle and get a scruffy, leathery look. Fungal infections can take hold under the skin. Severely infected animals lose interest in seeking food, become emaciated and may die. By contrast, healthy animals resist mange and can survive mild infestations.

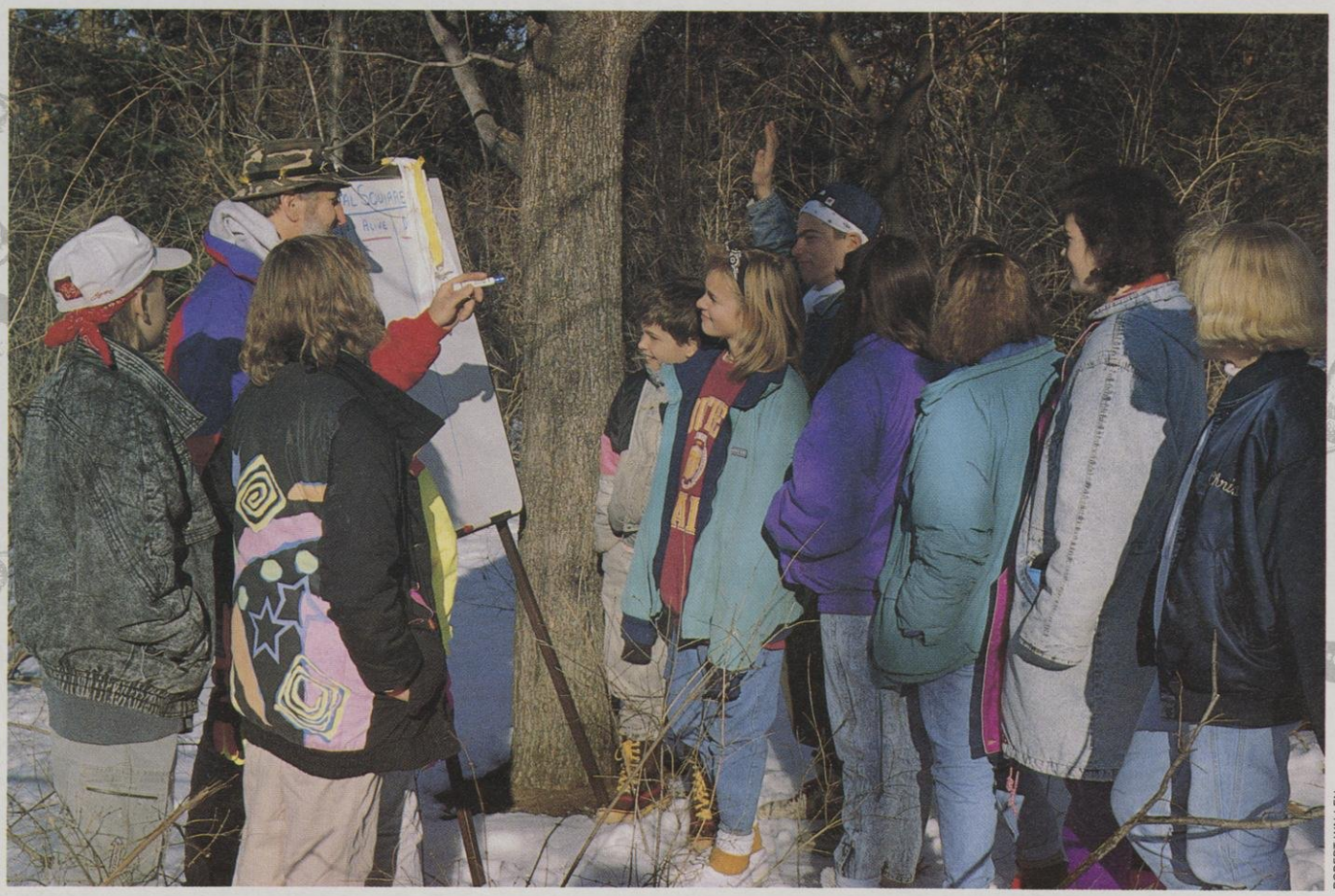
Mange mites are transmitted by direct contact with an infected animal or by brushing against infested nest materials or burrows. Consequently the disease spreads faster when animals are more densely populated.

For purposes of our game, the children are going to pretend to be gray squirrels. This native squirrel's habits were described last year in Wisconsin Natural Resources' October 1990 story, "Bushytails." The game is more enjoyable if the children read a bit about the places squirrels live and the foods they eat in different environments. It's important to remind children that in bad winter weather, squirrels seek shelter in a hollow tree cavity or a leafy nest. In extremely cold weather, squirrels hole up in their dens until the tough weather spell passes.

In our game, as in squirrels' lives, the whole population will not survive the winter. Some squirrels won't find adequate shelter and will succumb to exposure or predators. Others won't find enough food and will starve. Still others will be stressed by diseases like mange. We'll have fun with this simulation, but the ability of animals to meet their needs in winter is no game.

SQUIRRELING AROUND

In this outdoor game, kids assume the roles of gray squirrels in a life-and-death drama of winter survival. Kids will learn to appreciate the complex interplay of food, shelter, weather and disease in a modified game of tag.



ROBERT WALLEN

Students volunteer to play hungry squirrels, winter weather, disease and death. Older students will appreciate wildlife management basics — natural population fluctuations, variable food supplies and the struggle for adequate cover. Younger children will enjoy the fast-paced game.

MATERIALS:

For every 10 participants you will need a whistle; one large sheet of paper and a marking pen; seven strips of cloth dyed or decorated to make arm bands representing *mange* (five colored arm bands), *death* (one dark-colored arm band), and *winter* (one white arm band); 10 plastic sandwich bags, 10 paper lunch bags; one grocery bag; 10 markers or pens; and 300 "food chips."

Make a master sheet of 30 food chips by drawing three columns and 10 rows on a sheet of paper. In 15 of the rectangles, print the word "corn" and underneath it write "5." These food chips will represent corn kernels with a food value of five Calories (kilocalories) each. In 10 of the rectangles, print the word "acorn" and the number "10" because acorns are worth 10 Calories each. In the remaining five rectangles, print the word "walnut", which will be worth 25 Calories each. Photocopy one page for each player and let the children cut apart each sheet into 30 pieces. You could substitute peanuts for the paper food chips and mark the ends with a felt-tipped marker as indicated above.

SETTING:

A large, open wooded area with fallen leaves is the best site. If played on a snowy field, take steps to disguise your tracks after hiding food chips under the snow.

PREPARATION:

Before the children arrive, scatter the food chips on the ground. Hide them under leaves, near trees or in the snow.

Ask the children how the seasons affect them: What do they do in the fall and winter that they don't do in the spring and summer? Ask them to name things that animals only do during certain seasons. Then lead a short discussion of special stresses animals face in winter. Remind the children that animals, like people, need to consume food containing sufficient calories to function normally.

ROBERT WALLEN

All foods are not created equal. Like squirrels, players quickly scavenge high-protein, calorie-rich foods first. Squirrels often settle for larger quantities of less nutritious foods as the winter progresses.

THE SIMULATION:

The game is played in rounds lasting several minutes each depending on the size of the group, play area and how well the food chips are hidden. At least five rounds should be played. Most of the players will be *squirrels,* but a few will play the roles of *winter, mangy squirrels,* and *death* in subsequent rounds. As the group leader, you are designated *nature,* and you have special powers over the game. We recommend playing at least five rounds:

Round 1: autumn. All the kids start as *squirrels.*

Round 2: early winter. Most are *squirrels,* but one child plays the role of *winter.*

Round 3: mid-winter. Most children are *squirrels,* but one plays *winter* and another plays the role of *mangy squirrel.*

Round 4: late winter. Most children are *squirrels* but one plays *death.*

Round 5: late winter. All roles — *squirrels, mangy squirrels, winter* and *death* play.

On the large sheet of paper, tally how many squirrels are alive at the beginning and end of each round. Also note how many squirrels died of each cause at the end of each round.

RULES OF THE GAME:

As *nature,* you decide when winter arrives, when *mangy squirrels* and *death* enter the game and when new *squirrels* immigrate into the area. You begin and end each round by blowing your whistle. Everyone must obey the commands of *nature.*

Begin the game by explaining that players will assume the role of gray squirrels. The season is late autumn. There's plenty of food for squirrels to eat and store. Abundant waste corn can be found in nearby farm fields. The oaks and walnut trees produced a bumper crop of acorns and nuts. Explain that the playing field is strewn with food chips representing corn, acorns and nuts. Explain the food value of each. Describe each player's role with the following:

Squirrels try to survive the winter by finding secure shelter, gathering enough food and avoiding diseases. Each *squirrel* is given a plastic sandwich bag representing its stomach. Gray squirrels need to eat about 150 calories a day in winter and each squirrel tries to fill its stomach with at least 150 calories by the end of each round. Squirrels that don't collect 150 calories worth of food in a

GREGORY K. SCOTT

A hollow den tree and ample food supply are no guarantee of winter survival. Squirrels are preyed upon by raccoons, hawks, owls, fox, coyote and domestic dogs and cats.

round die of starvation and sit out the next round. (As *nature,* you can bring them in as immigrant squirrels in successive rounds. This will keep everyone active, but it will also increase the competition for food and ultimately result in more deaths due to starvation.

Each *squirrel* is also given a lunch bag representing its den. Ask each child to write his/her name on the sack. Each *squirrel* finds a place to set its den at the beginning of the first round and leaves it in the same location throughout the game. On windy days, put a small rock in each lunch bag. Since food chips are in limited supply (plants don't produce food in winter), the *squirrels* may choose to store extra food in their den for future rounds. Other *squirrels,* however, may raid an unguarded den for stored food as long as the den owner is away.

At the end of each round all *squirrels* tally the caloric value of the food in their stomachs. If their sandwich bag doesn't contain 150 calories of food, squirrels may transfer any remaining food chips from their dens into their stomachs. Before the next round begins, all food chips in the stomach bags must be transferred into the large grocery bag you hold as *nature.* These now represent digested food no longer available to the squirrel population.

Squirrels compete with each other for limited food and must also avoid being tagged by *winter* or diseased by *mangy squirrels.* Each den is a safety zone and neither *winter* nor *mangy squirrels* can tag *squirrels* in their dens. A *squirrel* tagged by *winter* must sit out the next round but can be brought back in later rounds as immigrant squirrels or in any other role *nature* selects.

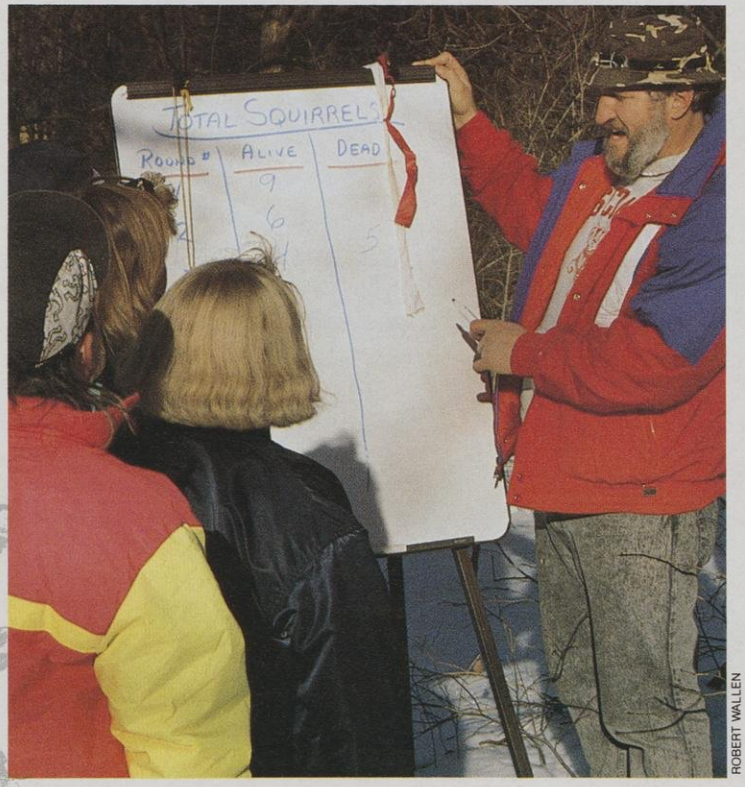
Squirrels tagged by *mangy squirrels* are considered healthy and are released if they have 150 calorie of food chips in their stomach or den. Those with less than 150 calories of food chips are considered unhealthy and become infected with mange. Tie an colored arm band around all squirrels with mange. *Mangy squirrels* try to tag unwary squirrels in successive rounds.

Once a *squirrel* has collected at least 150 calories of food in its stomach, the player may continue collecting food and store it in the den or may choose to sit out the remainder of the round in safety at its den site.

Winter's objective is to keep *squirrels* worried and on their toes. *Winter* should not attempt to freeze every *squirrel* possible. Rather, *winter* aims to make it difficult for *squirrels* to collect the proper amount of food when they stray too far from their den.

ROBERT WALLEN

A *squirrel* is tagged by *mange.* Squirrels are susceptible to a wide variety of parasites and diseases that can weaken them. Infestations of fleas, lice, squirrel pox, rabies and tularemia, in addition to mange, can stress dense squirrel populations.



ROBERT WALLEN

Recap results in the field then warm up in the classroom as students probe and analyze the woodsy dynamics of bushytail life.

STEPHEN J. LANG

Many squirrels beat the odds. Enough survive and thrive to form a stable population of about eight million bushytails in Wisconsin.

Mangy squirrels try to catch *squirrels* with fewer than 150 calories. Unlike healthy squirrels, *mangy squirrels* don't have to gather food for purposes of the game. If tagged by *death, mangy squirrels* die and sit out the next round. They may be brought back into the game later by *nature's* decree.

A *death* player may be introduced into the game after the population of *mangy squirrels* has increased significantly. Only *mangy squirrels* perish when tagged by *death.*

WRAP-UP

To make the game more meaningful, schedule a few minutes inside after the game is over to cool the children down and discuss what happened. Gather the players and discuss their reactions to life as a squirrel in winter. In what way did players believe the game reflected true life for squirrels? How was it different from real life situations? Why were some food chips worth more than others? How did competition change with each round?

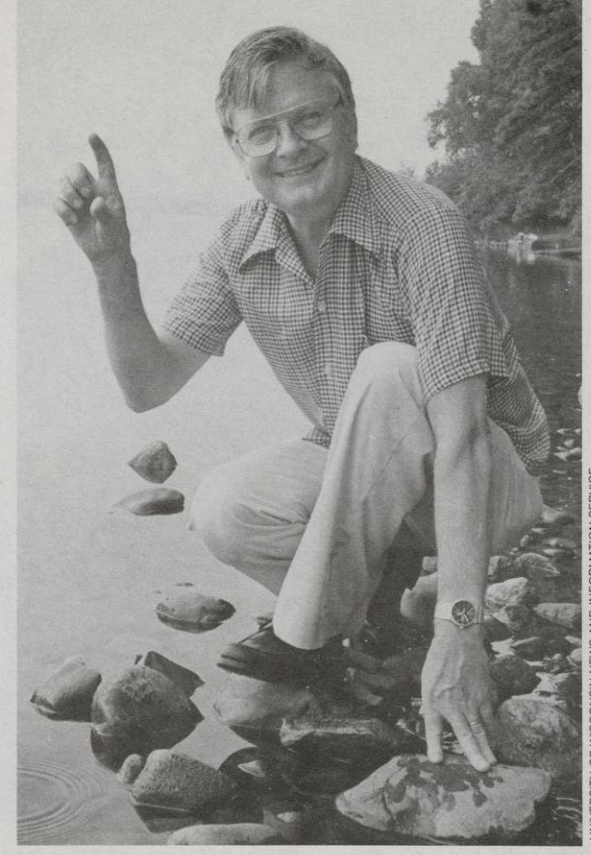
If you played the game as part of a classroom activity, go to the chalkboard and graph the number of *squirrels* at the beginning of each round including the number of live *squirrels* at the end of the game. The population of squirrels should have declined as the season progressed. How many squirrels died from starvation, mange and exposure to severe weather? Ask the players to predict what would have happened to the population as the game progressed. Remind players that spring is a time of rejuvenation and renewal. Surviving squirrels reproduce in late winter and reestablish the population as food sources are renewed and the weather gets more mild.

Discuss the importance of disease in controlling animal populations. People tend to view disease in strictly negative terms. We seek medical attention for ourselves and veterinary attention for our pets and livestock. Ecologists see disease as neither good nor bad, but as an important consideration in each ecosystem. Disease plays an important role in a community that includes producers, consumers and decomposers. Ask the children how disease affects the other components of the natural community. Does disease reduce competition? (It reduces competition and, therefore, could increase the likelihood that remaining animals would find more to eat.) Does disease help predators? (It could. Sickened prey are weaker and easier to catch.) If a squirrel dies from disease is that "bad?" (It's certainly unfortunate for the individual animal, but from an ecosystem perspective its nutrients are recycled by decomposing organisms.)

Finally, if your classroom or backyard has windows facing some large trees, you may want to try coaxing real squirrels closer to the children by scattering some sunflower seeds and cracked corn. They taste better than food chips and the nearby antics of winter squirrels may remind the children of their close encounter with winter survival.

Mary K. Judd is DNR's wildlife education specialist stationed in Madison. John W. Mellen is an assistant professor of biology at Carroll College in Waukesha.

Something fishy in the air



UNIVERSITY OF WISCONSIN NEWS AND INFORMATION SERVICE

John J. Magnuson.

You can't always trust your nose. Lake odors and fishy tastes that offend us don't necessarily harm us, but it's still worth clearing the air.

Natasha Kassulke

In 1990 I spent my first summer as a student in Madison away from home — IT STUNK! At my apartment on Langdon Street, I was bombarded with a septic smell from Lake Mendota. While vacationing, I turned up my nose at fish tainted with an off-flavor from a stretch of the Wisconsin River. Fishy odors from the lake didn't help my love life either. Instead of holding hands, my boyfriend and I held our noses.

These are funny memories as I enjoy an odorless snowfall, but looking ahead to the spring search for summer housing, I'm leery. I don't want another stinky summer by the lake. It's easy to joke about off-taste and odor problems in fish, lakes and rivers, but it's not a laughing matter.

Certain odors help us avoid perils and impending dangers, but what does the smell of rotting algae or the flavor of unpalatable fish really tell us? DNR water quality staff, lake and food experts from the University of Wisconsin-Madison have joined forces to answer those questions. The group aims to show why "an ounce of prevention is worth a pound of cure" when controlling taste and odor in fish and water.

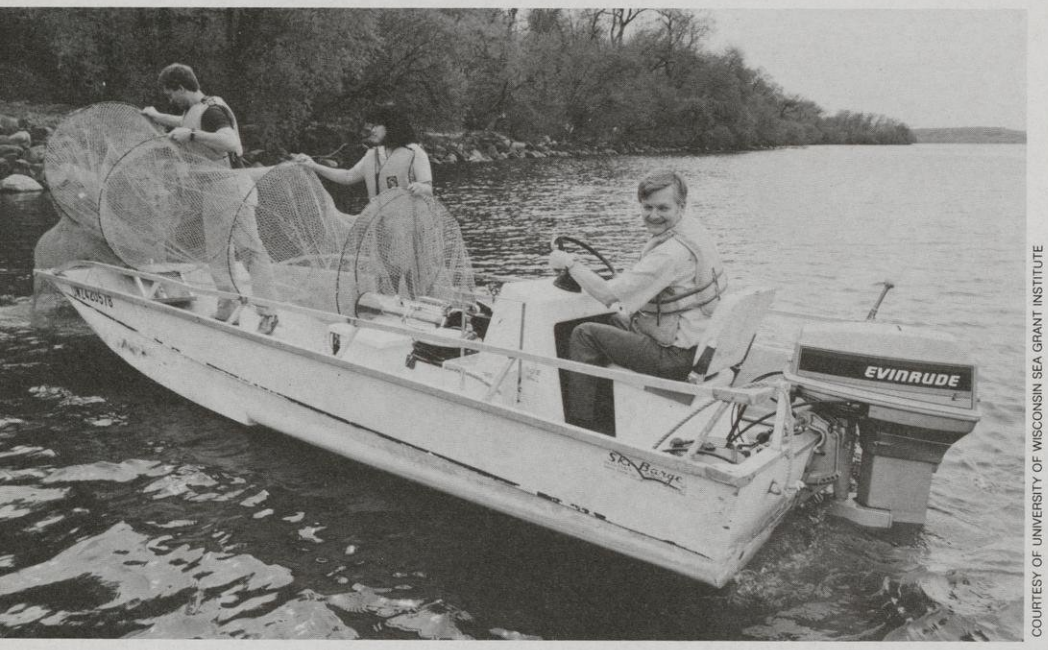
One of those with an eye and a nose for tracking changing lake conditions is John Magnuson, UW-Madison limnologist who has studied Dane County's Lake Mendota for 22 years. He says the lake odors that filled my apartment were caused by dying fish. The fish die-offs were caused by a complicated interaction among fish, water, temperature and algae.

"Everyone gets old and dies," Magnuson says, smiling and pointing out the window of his second-floor office overlooking the lake. "Cisco are a major food source for other fish in the Madison lakes. Once the cisco grow bigger than minnow size, they don't face any other predators. They only die of old age, being caught by anglers or during lake die-offs. In my opinion, die-offs happen when there is a very high density of fish."

He explained how these forage fish react to pressures from nearby cities and farms. Urban lakes receive lots of nutrients that encourage excessive algae and weed growth. As algae decay, bacteria deplete oxygen in cool, bottom waters. Bottom-dwelling fish like cisco are forced to move toward the surface where they die in warm waters. The dead, oily fish roll into shore and putrefy.

"We don't have massive fish mortality every year, just as we don't have massive blue-green algal blooms every summer," Magnuson continued. At moderate levels, aquatic plants are natural parts of the ecosystem, providing food, shelter, oxygen, spawning medium and nesting sites for fish and other aquatic organisms. Algae are typically viewed as nuisances rather than health threats.

However, some strains of blue-



COURTESY OF UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE

A playground and a living laboratory. Scientists have been studying the links among changing water chemistry, lake conditions, fisheries and the environment in Lake Mendota for more than 100 years. Professor Magnuson and University of Wisconsin Center for Limnology graduate students set fyke nets to periodically sample fish.

green algae produce toxins so they won't be eaten. These algae don't look or smell that different from harmless algae, but they act differently. When blue-green algae like *Microcystis, Nodularia, Coelosphaerium, Gloeotrichia, Aabaena,* and *Aphanizomenon* grow excessively, they excrete toxins that can kill animals, but only seem to cause rashes, eye irritations and stomach problems when people swallow them or swim through them.

There's nothing new about these cycles of algae blooms or die-offs on Lake Mendota. Trelease's 1889 paper, "The 'Working' of Madison Lakes" notes: "Every season a greenish-yellow scum occurs in greater or less quantity on Third and Fourth Lakes [Mendota and Monona], during the hot weather of summer after the water has been calm for a number of days in succession." Likening the lake to a vat of fermenting wine, some regarded this scum as evidence that the lake was "working." Using Trelease's definition, many Wisconsin waters are still working hard.

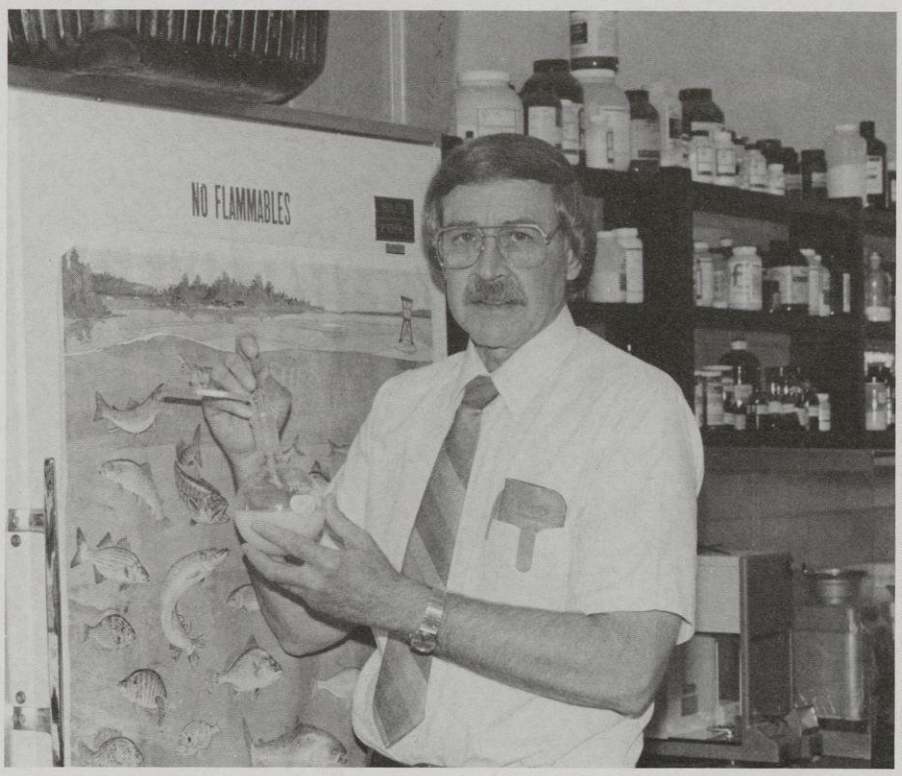
At times Mendota develops the unpleasant odors because it's a large lake (9,730 acres) surrounded by development and agricultural counties. The damage starts in winter when runoff from 240 square miles of frozen terrain, roads, city streets, lawns and gardens drains into the lake. Nutrients also are released from lake sediments deposited during the days when household sewage was discharged into the water.

When the ice breaks up in early spring, sunshine, neutral pH waters and silicon get mixed in the water. Under optimal weather conditions, the mix forms big blooms of colonial algae called diatoms. The diatoms are ravenously grazed by water fleas and the bloom ceases rapidly. The water stays clear briefly in May, but looks are deceiving.

By late June a summer bloom of the blue-green algae, *Aphanizomenon flosaquae,* gives the water its characteristic green color. Other plants are shaded out and the algae predominates. In addition to eutrophying the lake, excess weeds and algae snag fish lines, interfere with commercial fish nets, and cause many of the odor problems and objection-

continued on page 33

(right) Natural cycles on Mendota are as clear as the water after ice melt. Daphnia feeding on diatoms flourish in early spring and produce unclouded waters. Summer blooms of blue-green algae are nourished by winter runoff from streets, fields and sediments.



COURTESY OF UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE

Flavor chemist Robert Lindsay examines how natural changes and human influences in lakes and rivers affect the taste and odors of fish caught from Wisconsin waters.

ROBERT QUEEN

THOSE OF THE FOREST

Hunch down for a rabbit's-eye view of winter woods in the reissue of this classic Wisconsin nature story.

Wallace Byron Grange

Editor's note: Among the remarkable men and women who shaped Wisconsin's conservation heritage, few left as lasting a legacy as Wallace Byron Grange. Naturalist, ecologist, journalist and tireless worker, Grange was hired as Wisconsin's first superintendent of game in 1928 at the tender age of 22. His two-year tenure was memorable for starting the game farm system that led to a state program of stocking animals, rebuilding wildlife populations and restoring wildlife habitat that had been devastated from the lumbering heyday (1870-1890s) and subsistence farming in the early 1900s.

Grange was ahead of his time. He understood that wild animals needed diverse habitats — a mixture of swamps, forests, plains, fields — food and water. Moreover, he practiced what he preached. Grange and his wife Hazel raised game birds and animals in Door County for five years. During the Depression, the Granges pooled their limited savings and bought thousands of tax-delinquent acres in central Wisconsin. As recounted by writer Don L. Johnson, "The Granges moved to their new property in 1937, and during the next 25 years they triumphed over diverse obstacles, environmental barriers as well as bureaucratic entanglements, to restore that land to its natural state. Eventually, Hazel and Wallace were able to convert more than 9,000 acres of derelict land into a conservation showplace." How that property was reworked and subsequently donated to the people of Wisconsin as the Sandhill Wildlife Demonstration Area is a story we will share later this summer.

For now, let us admire Grange as ecologist and author. Those of the Forest *was written as a twenty-fifth wedding anniversary present for Hazel. It's a nature story equally appealing to young readers and adults. It tracks the life of a snowshoe rabbit (or varying hare) named Snowshoe, and his offspring through the course of two years. A latter section of the book takes readers on a journey through forest evolution from the Ice Age through modern times.*

Three selections from the book's wintery beginnings follow. In the opening, Snowshoe faces some rough weather.

Snowshoe hare. COURTESY OF DNR BUREAU OF WILDLIFE MANAGEMENT

The snow-world grays into dusk; then blackness. Color vanished with the dim sun.

Life, too, it seems, journeyed over the hills to sleep below the horizon for the night.

There remains in the world the bleakness of more snow, sifting, sifting, sifting, interminably downward; steadily, rapidly, inexorably — tiny, hard, sharp, broken flakes jostling in their wind-tossed descent.

The wind is here with the snow.

It races across the miles, down from the sky, over the lake, through the hills, upon marsh and prairie and forest. It turns aside, seemingly, for no barrier, asks leave of nothing, living or dead; stays its force for no obstacle.

Tonight, the wind and snow are

the law. They are the elemental authority of all nature. This night, other forces do their bidding. The wind and the snow exert all their power. They drive, ride, march, swirl — and possess the earth.

Yet the wind and snow are serfs of cold.

It is cold that squeezes the moisture of the sky into crystal-white flakes. It is cold that signals the north wind on to lower and warmer latitudes. It is cold that follows wind and snow, taking control of the great battered white world, freezing knife-carved drifts, hardening the crystal robe which at first lies loosely upon the earth.

The wind, the snow, and the cold give way only to the sun. To it, eventually, they give obedience; unwilling, perhaps, but disciplined. If their elemental forces are rebellious tonight it matters not, for in good time the sun will control them; if not this day then the next, or the day after; if not in January then in May, but in the end, always.

Tonight, the sun seems no longer to exist. It is gone behind the hills. It will not be back until earth turns again; until the forest meets dawn.

Unimpeded, the wind, the snow, and the cold race on; three icy elemental forces which howl, sting, and numb.

It is no night for a timid rabbit.

Even in the spreading shelter of the spruces in the lee of the ridge along this swampy pocket, only one of the three elemental forces is to any perceptible degree frustrated.

The wind, it is true, has spent some of its fury upon the supple cedars, upon the swaying figures of the spruces and the bare tamaracks. The wind intrudes less strongly into this little cavern beneath the lower branches of the swamp trees.

But the chilly snow sifts down, much of it scarcely delayed a moment by the mad brushings of boughs.

The cold is here, down to the very surface of the snow. Even below the snow, it seeks the subterranean root and the vast soil which snow, in a manner, protects.

It is to this sheltered cavern beneath the evergreens — to a relative quiet — that the rabbit has come. Experience has brought him to his one sure sanctuary from storm.

He is not alone. The deer is here, bedded down on the other side of the swamp: The deer and his herd, for this is their habitual winter home.

The wolf is here, nose under tail in a patch of willows at the cove, where interlaced branches and snow have all but built him a roof.

The owl is here, in the jungle of the densest trees, huddled close to the trunk of a black spruce, feathers fluffed to insulate its body from the fury.

All those of the forest are here; those of the winter forest.

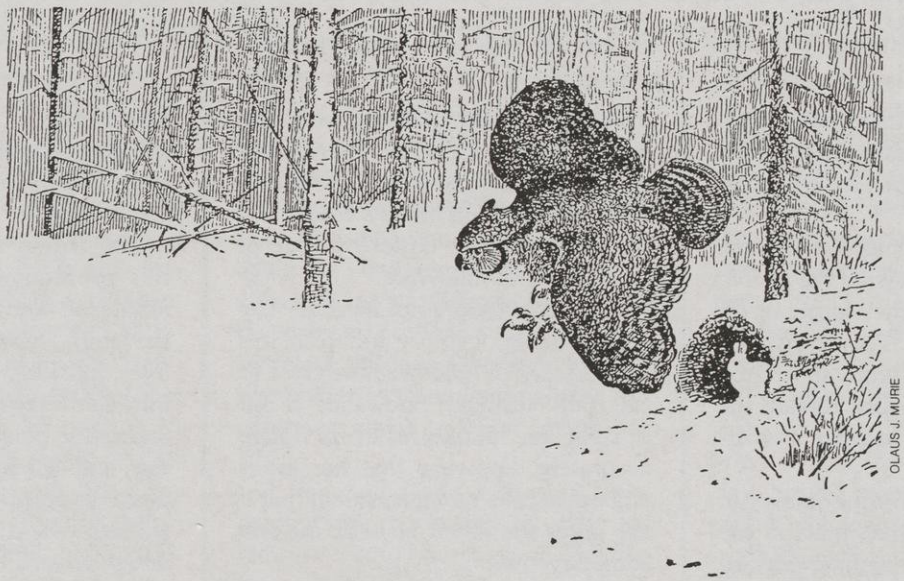
The rabbit does not see or hear them all, each in its own niche, crevice, cavity, nest, den, or bed. He does not see the downy woodpecker and the chickadee which the vicissitudes of the blizzard have brought roosting for the night in the same hollow aspen tree on the tiny swamp island; nor the red squirrel sleeping in a full bushel of moss, leaves, and soft bark of which it has made a treetop nest in a cedar; nor the black bear living on its own fat in its den not far below a huge white pine stump; nor the woodchuck several feet down in the ground, unmindful, in its hibernating torpor, of the storm raging through the night above. The rabbit does not see, among the logs, in the careless brushheaps of fallen trees, in the sedges and the grasses, in the buried litter of the forest floor, or in their snow tunnels, the deer mice, the meadow mice, the red-backed mice, and the shrews; or the weasel which will later follow them.

But, seen or unseen, sleeping or awake, they are here, each in its own manner protected from the wind, from the snow, and from the cold; each pitted against the winter elements — and surviving.

Not all those of the forest have come, as has the rabbit, to the swamp. In the channeled bole of a maple on the nearby ridge, a colony of carpenter ants are as motionless as death this winter night, and will not awaken until spring. The beaver in its lodge in the pond near the swamp gnaws the green bark of an aspen twig, away from the wind, the snow, and the cold, for these are shut out from its world tonight by the ice of the pond. A chrysalid on a dogwood rocks roughly in the wind. In a slow eddy downstream from a rock, below the open riffles of the brook, a cluster of hibernating frogs wash gently to and fro in the water.

Seeds, and roots, and buds are sleeping. Insects, larvae, and eggs lie dormant in wood, humus, and soil. Algae and bacteria, now wholly quiescent, nevertheless survive.

By how many thousands of circumstances and stratagems the things of the forest turn aside, or circumvent, or tolerate, the wind and the snow and the cold that own the world tonight!



In this second selection, Grange describes how natural food webs transfer nutrition and energy as a rabbit is preyed upon by an owl.

Then from the direction of the shrub-covered swamp cove there is a quick series of bleating screams; startled, plaintive, terror-stricken bleats of a single undulating syllable vehemently repeated five times. The sound ends suddenly; unfinished.

Snowshoe scurries under the sweetferns, into one of his former beds.

He sits quietly, unable to see about him, unseen by any others of the forest nearby.

Although the forest is silent except for the rustle of ferns and grasses, the terror in the dying rabbit's shrill crescendo cry remains with Snowshoe in the sweetferns.

The great horned owl eats but a mouthful of the rabbit, then casts the body aside, dropping it to the snow. The owl swoops low along the edge of the swamp toward the hemlock, at the far end of the ridge, in which it will roost during the day. The owl and its mate are already satiated, for hunting has been good. What matters the life of one rabbit?

It is mid-morning. Snowshoe is still hidden in his sweetfern bed.

The air is pierced by the coarsely hollow croak of a raven. Snowshoe listens to the sound: "Craack, craack." It comes from above the swamp, toward the cove. Then it moves lower toward the treetops. Two other ravens answer: "Cr-r-ruck, pr-uck" and "Pr-ruck, cr-r-ruck."

The three ravens cease their circling just over the trees near the shrub-covered cove and drop down to the feast.

So has occurred the alchemy of existence by which a rabbit ceases to be rabbit and becomes owl, or raven, or wolf, instead: the hunted becoming the hunter, flesh of its flesh, bone of its bone. Yesterday, the rabbit's physical substance was cellulose and wood sugar in the bark of a pine — until pine became rabbit. Last night the rabbit hopped upon four feet and listened to the haunting voice of the owl. This night it flies across the swamp on wings, listens and looks for unwary rabbits, and becomes the voice of the owl. The chemicals of rocks, the crystals of snow, the atoms in water, the unseen microscopic fungi and bacteria and protozoa of the soil, the rays of the sun and the light of stars, the wind, the intangibles of time and space, are all changed and interchanged, given and received, taken back, passed on and returned, in one form of energy after another — ceaselessly and imperishably, for nothing is lost. Between the exchanges, assisting them, depending upon them, are the multitudinous forms of life — the plant and animal kingdoms, so different, so alike. And perhaps nothing in life is lost, any more than is physical energy. New forms, new combinations, new arrangements — transformations — but which of the basic building blocks of the universe since the dawn of Creation has had anything added to it or taken from it?

. . . Only beyond the bleating, terrified cry of the dying rabbit is the answer.

. . . As a rabbit, Snowshoe lives his rabbit life. Life is his freedom. Freedom is his life. He cannot preserve one and let go of the other. However much or little he may try, or not try, to understand life, he strives in every moment of his existence to live.

Like good westerns, good nature stories need chase scenes, and this book has several. In this final selection, Snowshoe faces coyotes.

Snowshoe is almost ready to leave the thicket and return to the swamp, but has stopped for a last few bits of bark.

He hears the tinkling of the crust. He sits up, turning toward the sound, moves his ears until they locate its direction accurately. It is some distance away, but approaching. Snowshoe waits no longer. He starts toward the swamp evergreens, leaping at half-speed.

Then, almost before he knows it, he sees the coyote that waits in the opening, and she is rushing toward him. It is too late to return to the jackpines. Snowshoe makes a mad dash, leaping with every modicum of speed his legs contain. But the coyote is quick, and just behind him.

OLAUS J. MURIE

Now the coyote breaks into full voice, uttering a series of yips, yelps and howls, which tumble from her mouth so clamorously that the medley is of almost indistinguishable elements, rising and falling in a weirdly terrifying cadence. Snowshoe feels panic. Unsuspected new power comes into his legs, every cell in his body marshals latent physical strength within him, pouring adrenalin into his veins, stimulating his reserves of power, giving him the supreme drive and coordination of which he is capable.

For an instant, Snowshoe is almost in the grasp of the racing coyote, but the fallen maple top — the one in which the grouse sunned themselves — looms up. Snowshoe plunges within it, through it, under it, turns around and is back through it again while the coyote's momentum carries her a few feet beyond. In her slight delay, Snowshoe gains distance, and races for the alders. The coyote turns in pursuit, but has lost several yards.

Snowshoe reaches the spruces beyond the alders, dodges from the main runway to a lateral, then to another, without slowing his speed, then flees for the swamp's center. For the moment, the coyote is out of sight, but still following.

The coyote does not hesitate. The scent of rabbit is heavy and fresh. It is unnecessary to hold her nose close to the trail. Although Snowshoe is out of sight, she follows his every dodge accurately, knowing that her lungs will outlast the rabbit's; certain that if she gives the rabbit no rest, she will soon have him.

Snowshoe seeks all the dense places he knows, where the spaces between the trees are wide enough for him but too narrow for the coyote; under logs where runways branch, momentarily confusing his pursuer. He is skillful with his own experience and with that inherited from his forbears.

But the coyote is skillful, too. She cuts corners as she sniffs out directly the scent ahead where Snowshoe ran circuitously. Wherever possible she half-circles small thickets instead of plunging through them, but jumps into and through those she cannot avoid. Yet, for some time the coyote follows the trail silently, without gaining the ground necessary to the kill. The panic within Snowshoe increases. He races toward the tangle of windfallen tamaracks, which cover nearly an acre, where the fallen trees crisscross one another, and where, between them, young tamarack saplings grow densely.

But within moments of reaching this protective shelter the coyote reaches it, too, and threshes about in the tangle, scrambling under, jumping over, pushing through, wriggling, into Snowshoe's hiding places. But Snowshoe now has the advantage of size, and can move quickly from one place to another, and back again, without being driven from his best refuge covert.

Nevertheless, no matter where, or how often, he moves within his tangled shelter, the relentless coyote works toward him, her panting loud in the cold air. Snowshoe has time to catch his own breath as the coyote scrambles about. In the pattern of shadows and white patches beneath the windfalls, the odds seem greatly to favor the rabbit. Snowshoe might, if necessary, move about within this tangle all night without being captured.

Then, suddenly, he realizes that there are two coyotes threshing about, on one side of the covert. The danger that they will work him into a corner, from which he will either have to dash between them, or be closely pursued out through the open woods, increases by the minute. If he remains, he may run from the jaws of one into the jaws of the other.

Snowshoe hops quickly across the widest section of the windfallen shelter, then darts from it — unseen — and out through the spruces toward the alders. It is a considerable distance. He covers it rapidly. He is nearly exhausted. Arriving at the border of the swamp, he sits motionless for a moment.

Then, certainly, surely, inescap-

Coyote. HERBERT LANGE

MARK WERNER

ably, it seems, he hears a coyote panting toward him, threading in and out of the shadows and moonlight. Snowshoe bursts away, into the alders, following from long habit the runways he knows best although, on the strong crust, he might jump anywhere with equal speed. He is more familiar with the coverts than is the coyote, but the coyote is faster. Snowshoe tries to redouble his speed. The coyote, close at his heels as they approach the willow cove, once more sets up the pandemonium of its excited cries; a great concordance of yelps and howls tumbled together. The sound increases the terror within Snowshoe. His breath comes rapidly, his nostrils dilate and contract, his heart pounds, his legs work frantically; but no longer has he any feeling of exhaustion; only one thing in all the world matters — he must escape, he must live!

But where can he hide? Where can the coyote not follow? The coyote is too cunning, too relentless, too tireless, and as Snowshoe races for his life the wild panic within him knows no caution; he throws everything but speed to the winds, possessed solely by his desperation. The coyote is some distance behind, but space and time now seem to hang motionless in the moonlight, every second an eon long, every leap a distance as the length of the swamp.

Then Snowshoe hears, from diagonally ahead, the quick bark of the second coyote. It has cut across the angle of their course, and is now following the noise of the chase attentively, about to choose carefully at what point it can best rush in for the kill.

Snowshoe reaches the shrub-flat. Immediately ahead are two rabbits crouched beside a bog birch. Snowshoe jumps headlong between them. For an instant, all three are tumbled together, then each is rushing for its life. Snowshoe turns, makes an enormous leap at right angles to his previous course, makes several more jumps with his utmost strength, then changes his course — back — toward the spruces, along a runway he knows from one end to the other. Beneath the first spruce, he pauses; waiting, listening, trying to breathe, for he feels suffocated.

He hears the puffing of the coyote, the squeaking of its heavy foot pads on the crust; hears the coyote sniff momentarily at the bog birch, then rush onward in the direction the two other rabbits fled. He hears nothing of the second coyote; its location and its scheme are unknown.

Snowshoe listens to the commotion of the brush-wolf as the predator hunts on. It does not know that Snowshoe has successfully handed the chase to his neighbor rabbits. As the sound fades into the distance, Snowshoe turns his head upward and casually nips off a twig of black spruce.

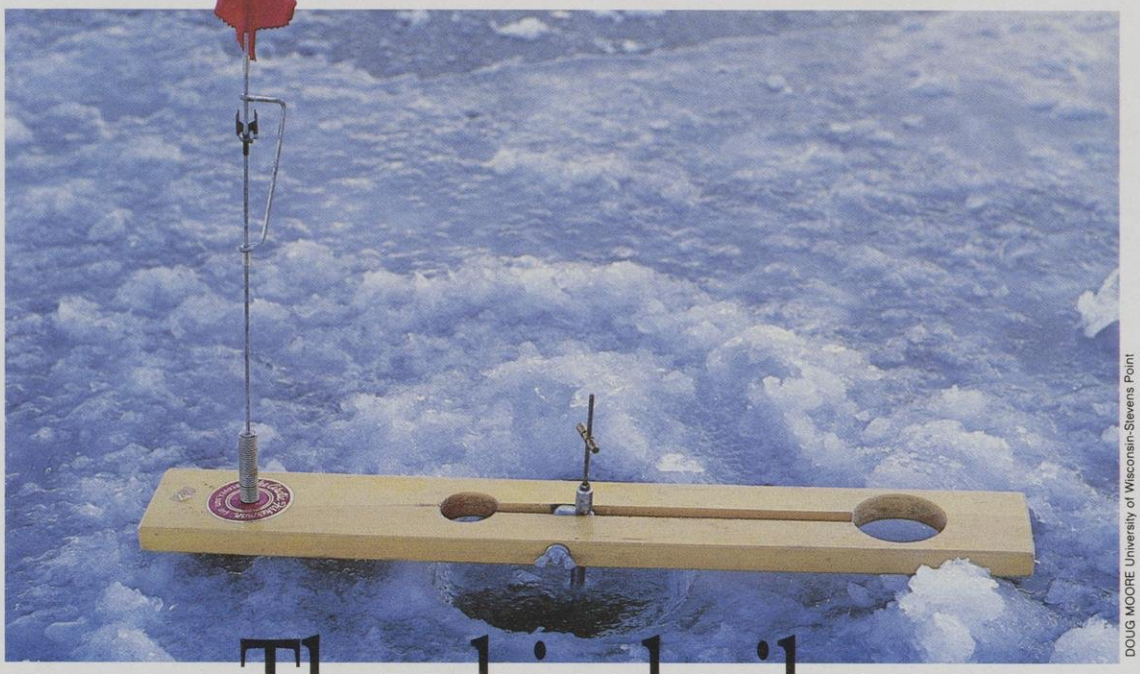
The moonlight is soft above him, and a little of it filters down beside him through the canopy of the swamp, making images of twigs and branches upon the snow; a pattern, a design, which includes elements of earth and moon, spruce and snow, and the round shadow of a rabbit.

From the direction of the far side of the cove, two coyotes blend their voices in a wavering song. In its cadence is the wild, fierce intensity of life's struggle in the forest, and all the soft shadows of earth in the moonlit night.

Snowshoe listens. But not for one moment does he stop chewing his morsel of spruce. ■

Those of the Forest was originally published in 1953. It was reissued last year by Willow Creek Press, now a part of NorthWord Press, Inc. of Minocqua, Wis. Excerpts and illustrations used with permission of the publisher.

THE FLAGS FLY WHEN LUNKER NORTHERNS CRUISE THE WISCONSIN RIVER SHALLOWS.



DOUG MOORE University of Wisconsin-Stevens Point

The chisel pike of Secret Slough

Lowell L. Klessig

I avoided a blindfold but was sworn to secrecy when Steve Hemshrot picked me up at the bank on Custer Hill east of Stevens Point. I piled my gear in his orange diesel car and in a minute we were back on Hwy. 10 heading west toward the Wisconsin River and an unknown destination.

Steve checked that I had purchased the special Swedish hardware and heavy line for the big haul. I had four of the oddly-bent Swedish hooks and 73-pound test line. Steve wasn't impressed: He was using 200-pound test line.

As we bounced along, Steve lectured me on the winter habits of big northerns in shallow water and on the proper use of the Swedish hardware. Trophy pike fishing is a buddy-system sport, he said. In that crucial second when the fish emerges from the hole, you need help because a lunker on land suddenly weighs several times more than it does in the water. When a tip-up flag went up, I was expected to rush to the ice hole, sit on my knees directly across the hole from Steve and hold my head back in case the hook worked loose and shot up out of the hole like a missile. As soon as the fish's head cleared the ice, I was instructed to get my hands under and around its belly and lift the fish out.

Dawn was still cloaked in flowing black when we arrived at the river. City lights and city thoughts were behind us.

We listened to the stillness and occasional ice noises. Steve asked if I heard the "bullfrogs" croaking under the ice. The river burped again, let out a little more water and snickered. I was familiar with the ways and sounds of ice, and I passed Steve's gullibility test with only a slight hesitation.

I'd learned the hard way to be wary of river ice. As we stepped out onto the moaning ice, I relived falling through shell ice on my dad's tractor back in 1961. The Manitowoc River had flooded, then frozen across the marsh all the way into the woods. The water subsided, but the ice stayed high, perched around tree trunks. Without support from water, ice has little tensile strength. When one tractor wheel broke through, the other wheel spun helplessly. As I walked home to get my dad, I

DOUG MOORE

Our intrepid anglers regularly test the river ice with a chisel. Springs, currents and eddys can keep river ice thin in spots even when the weather has been cold enough to form more than a foot of ice elsewhere.

strained for excuses. I had no justification for taking the tractor skating in the woods.

Years later our family learned the same lesson when our deaf cousin, Norbert Bladern, drowned after falling through hollow ice. Gates on the Fox River had been opened overnight. Unsupported ice of Little Lake Butte des Morts no longer held the fisherman.

I reminded Steve of the tragedy as he led me across the sloughs. The center of the sloughs felt solid, but a wet foot seemed likely as we entered and left the braids of high land that knit the sloughs together. The shore ice crunched under our pack boots. As we entered or left each slough, Steve first tested the ice with his chisel. We were in a hurry but we slowed down and shuffled as we neared shore.

It was already 6 a.m.

We crossed from one slough to another and I wondered whether we were taking the shortest route. Perhaps Steve was trying to confuse anyone who might follow our bootprints. Perhaps he was trying to confuse me! On the other hand, maybe the hot spot really was a long way from the road.

Finally, we arrived at a short but broad slough that displayed chopped chunks of ice from a past expedition. The snow showed no evidence of human "intruders" since Steve's last visit. A lone coyote patrolled the slough all night, but, from our observation, had failed to spot even a rabbit.

Steve suggested placing one tip-up right off the point of our slough where it met the other sloughs we had crossed before they joined the river. "As the fish move from slough to slough or to the river, they'll cut corners across the points," Steve rationalized.

DOUG MOORE

When baiting up a Swedish hook, thread the fish from the vent to the head so the bait will hang naturally in the water.

I chopped a hole about 20 feet from shore and tested the depth. We wanted at least 18 inches, preferably three feet of water, under the ice. The water was about 30 inches deep. I used my old underwater tip-up freshly rigged for fishing northerns. For years, it had been retired in favor of more sensitive, homemade, above-water tip-ups — a family tradition of recycling old umbrellas to catch Lake Winnebago walleye.

Steve patiently showed me how to bait the huge Swedish hook that looks like a partly sprung clevis. I held the hook above the 12-inch smelt, inserted it near the tail and pushed it along the backbone. Just behind the head, I eased the hook through the skin. Properly rigged, the smelt would ride upright in the water. Having trained myself to use smaller and smaller hooks, and lighter and lighter line for walleye, I couldn't believe any northern would bit on this contraption. Yet I was the novice. I dutifully marked the depth with a little knot and set the bait a short foot above the bottom.

By 7 a.m., six tip-ups inhabited the slough. I was prepared for a long wait. You can't expect to get many bites or many fish when trophy fishing. Other fishermen would talk about numbers; we would talk about pounds, if we were lucky.

I watch my tip-ups deployed to the southeast down toward the river channel. Steve gazed at his spread out up the slough to the northwest.

Before the first cup of tea was gone, I thought I saw something move on the far shore beyond my far tip-up. I commented to Steve. As he turned to look, the flag yelled at us. We raced toward the tip-up. The fish was still running out the 73-pound line. Steve coached me as I broke the

surface ice in the hole and prepared to set the hook.

As instructed, I pulled several feet of extra slack off the spool after the fish's first run, grabbed the line with both hands, waited until the line started moving again and then pulled hard and fast with all my strength.

The crazy curved hook was set and the line reversed direction slowly. Steve coached harder: "Keep pulling! Don't leave any slack!" He was kneeling on the other side of the hole, ready to tackle the thing if it broke loose as it left the water. As the large head cleared the water, Steve instinctively grabbed the fish and delivered it into the terrestrial world. The hook was still in place in a little corner of its lip.

Steve was excited, shook my hand to congratulate me, and began expounding on how large the fish was: "Over 10, maybe 12 pounds, maybe more!" he guessed. He paced off the length with his pack boots and pronounced it a three-footer. (It later measured 37 inches and weighed 13 pounds.)

I was stunned. It had happened too fast. It had seemed too easy. I didn't really believe the fish was that big. In a strange reversal of boasting psychology, I belittled the lunker slapping at our feet while Steve attempted to bring me back to reality.

Minutes later we were running in the other direction to his far tip-up, but the fish was gone. Steve assured me that the fish would be back in 10 minutes. He was wrong. It was back in about five minutes. Awkwardly, I huddled across from Steve in case I could assist. He didn't need my help. He set the hook through the roof of the northern's mouth. It was a little one, only 35 inches. The super sportsman might have thrown it back if it had not been hooked so severely.

We returned to base, marvelling at the spectacular day it was and would be. The sun had not yet risen in the clear sky.

Before we had fully rested our lungs and legs, my far flag went up again. We raced to it. I prepared to set the hook and pulled on the limp line. There was no resistance and the smelt popped out of the hole. Steve assured me that the fish would return.

It did, in a few minutes. We raced back to the hot hole. The line was limp like the time before, and the fish had hardly taken any line. I was sure that the fish had only tripped the flag again. As I had done with walleye for almost 30 years, I prepared to tease the fish into hitting again. When I twitched the line, I realized the fish was on! I tried to set the hook, but my effort was much too little, much too late.

I had failed and I knew it. My coach knew it too. But the time for remorse would have to wait. The fish was still on the line, but it would not move up to the hole. It moved back and forth like a big steam engine piston right below me; I could not lift it. Steve watched helplessly as I pulled with both hands on the heavy line until the wide line cut the crease in my index finger.

Under tension, the line sung as it sliced the water in short, powerful strokes. The 13-pounder was still slapping only a few feet away, but now it seemed half the size of whatever was on the line.

Two questions raced through my mind several times per second: Why didn't I set the hook better? Could I still catch it? I strained on the line for the eternity of five seconds and then my second question was answered first.

The first question would never be answered.

I reset the tip-up.

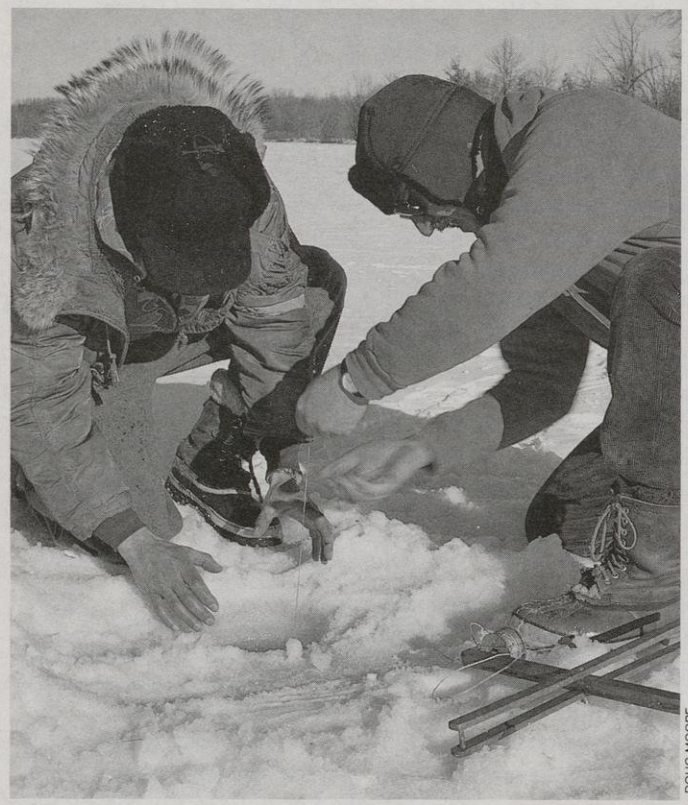
Steve offered solace saying he always misses the biggest bite of the day. Steven even suggested the fish might bite again.

With each step back to our base I nagged myself for failing to set the hook. From the base, we looked back to the flag. Nothing. In fact I faithfully watched that tip-up all day. (It was silent for eight solid hours.)

The sun was peering over the treetops. The day was just beginning. We marvelled at how much had already happened. By trophy fishing standards, the day was already a success even if we didn't get another bite and

Hours of idle conversation interrupted by instants of sheer action. Steve Hemshrot and author Klessig enjoy a cold wait for the next lunker northern.

DOUG MOORE



DOUG MOORE

Ice fishing for large northerns is a team sport. Partners must be quick to grab the slippery heavyweights once their gills clear the ice hole. Many anglers find it equally rewarding to catch-and-release fish in winter. Work quickly to maintain the fish's protective slimy coating and minimize exposure to cold air.

even though the big one got away.

Some time later as I went to check my tip-ups, Steve got another bite on his far line. Still recovering from my loss, I failed to charge to his aid. I should have. He hooked a big one and fought it up into the hole where it broke loose. I should have been ready to tackle it. This experience was getting pretty humiliating for me. After 20 years of ice angling for walleye I was acting like a real novice ice fishing for northern. My mistakes haunted me, but the day was still glorious.

When Steven got an urgent signal from his tip-up toward the north shore, I was hot on his heels. From the grin on his face and the tension on the line, it was clear that this fish would need tackling. But Steven gave me no opportunity to redeem myself; he laid the 16-pound, 39-incher on the ice without any significant assistance. His grin broadened until his whole body was shaking with glee.

The pace slowed after that catch. Steven caught another 35-incher like his first. Without hesitation, he turned it back. We each caught several more smaller ones, which were ordered back and told to grow up before eating smelt again. In total, we had 19 bites and caught eight fish.

By afternoon, the feeding had stopped. We took turns napping on the grassy south slope of the north shore. A bald eagle searched the open river for fish. A hunter stalked squirrels and rabbits. We were lazy like the fish we failed to catch. We basked in the sun and in the morning's success.

One challenge remained: How to get three big fish back to the car without anybody seeing them.

I suggested dragging them from our belts. Steve decided to mount them on the ice chisel so we could maneuver the woods and sloughs and quickly stash them if we saw other fishermen near the landing.

We wished we had a camera to record the primitive scene: The spear-like metal bar with three large, frozen fish hung through the gills and mouth — pikes on a pike, at a 45° to ice-cold chisel. It reminded me of eagle feathers mounted to the spear carried by Indian chiefs.

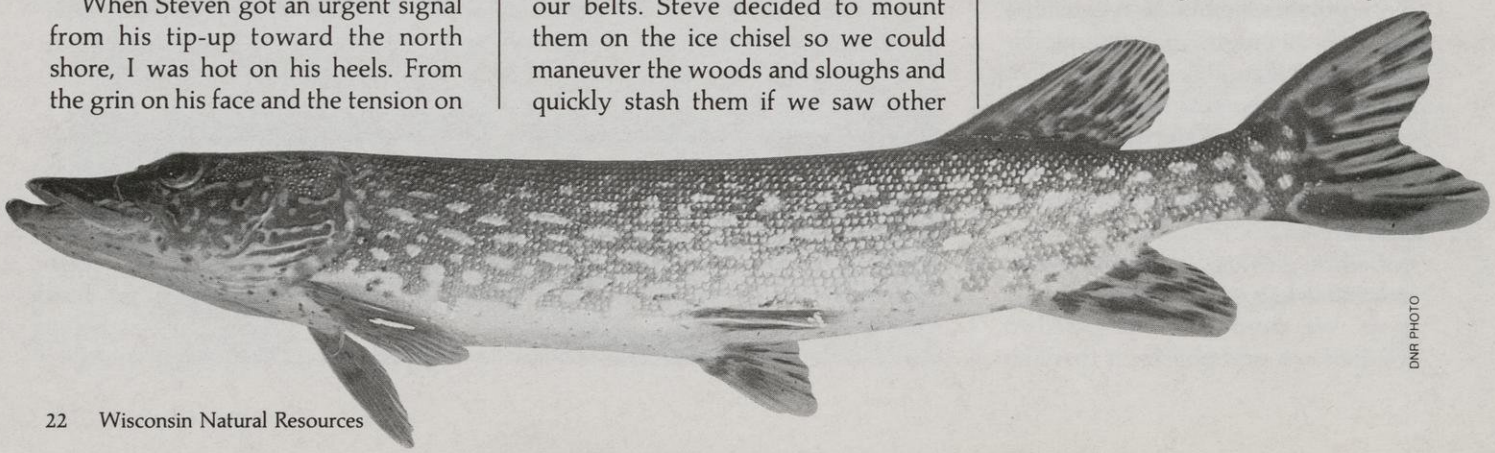
We headed toward the car. Steve carried the chisel most of the way. When he spotted some anglers clad in fluorescent suits coming out of another slough, he passed me the chisel and scouted the woods. I dutifully followed, entering a new slough all the way to the bottom! I stepped over a log near shore and the ice cracked off at the log. With 39 pounds of fish on my back, I could crawl out of the hole, but couldn't rise off my knees. Steve rescued the fish!

We bobbed along, peering around points, looking and listening for fishermen. About a hundred yards from the landing, we waited in some brush near the shore as three parties of panfish anglers headed for home. We were acting like deer waiting for the hunters to quit for the day before bouncing out of cover to eat and play.

The last car left the landing as we arrived. Then the river was quiet, save for the ice; and the sky was dark, save for the stars.

We marched triumphantly to the car, hoisted the chisel high and freed the trophies from their mount — chisel pike no more. ■

Lowell L. Klessig is a professor of resource management and Extension specialist at the College of Natural Resources, UW-Stevens Point. His hobbies include ice fishing and essay writing.



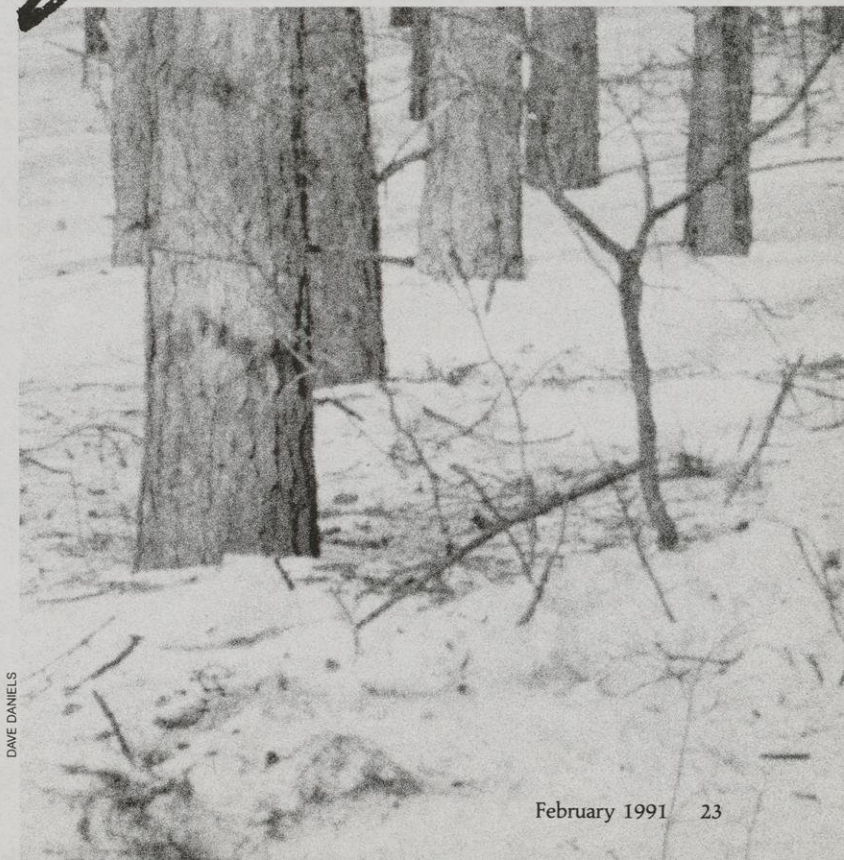
DNR PHOTO

Only the best equipment in skilled hands was good enough for a timber sale at this popular Northwoods retreat.

CLEAN-CUT *Campground*

Dave Daniels

On the Northern Highland-American Legion State Forest, hard work is the forest's middle name. On any given day of the week, in any month, passersby on forest roads may hear the growl of logging equipment, the buzz of snowmobilers skimming by on groomed trails or the laughing voices of campers relaxing in the shade from the noonday sun. The four seasons blend together here as those who earn their living from bountiful forest products share the "big woods" with those who come to play on 220,000 acres of lakes, streams, forests and campgrounds.



DAVE DANIELS

Work and play seem like mutually exclusive terms, but here, they fit together hand-in-glove. Take the Firefly Lake Campground, for instance.

This secluded campground tucked away on a little lake is a popular destination for summer vacationers weary of hot cities and longing for cool trees and refreshing lake water. The regulars at Firefly know to arrive early. The campground's 70 sites fill to capacity on busy summer weekends.

The summer crowd will have to be pretty observant to note other activities that took place right where they're pitching their tents. Last winter a high-tech logging team moved through the Firefly Campground felling carefully selected trees.

"Few people realize that the campground at Firefly was actually chiseled out of an existing pine plantation," says DNR Forester Ralph Hewett. "That plantation is maturing now. To insure the vigor of the forest, selected trees have been marked for harvest," he said.

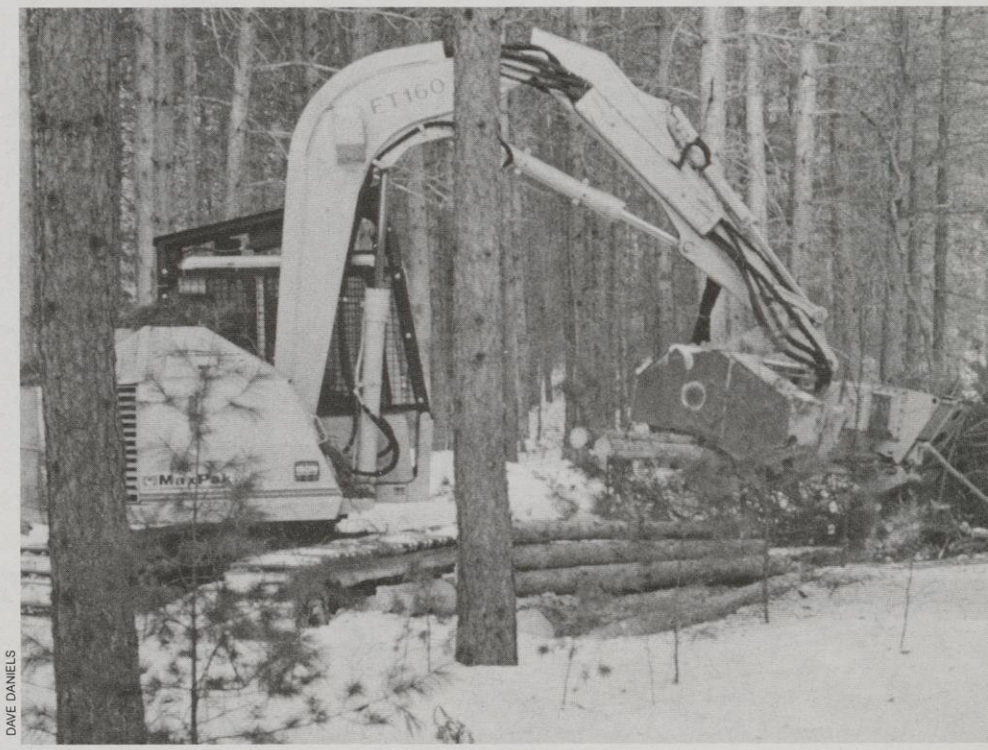
Timber sales are a major revenue source for managing these forests each year and into the future. The timber sale at Firefly was tricky because of the area's dual role as a highly-valued campground.

"We specified stricter performance standards for the logger in this timber sale contract," said Dennis Leith, forest superintendent. "We wanted to be sure that logging activity would be conducted to disrupt the area as little as possible."

The contract sets conditions on how and where the contractor can harvest timber, how slash should be utilized, when logging should be done in particular parcels and which trees should be harvested. Two concluding points in the logging agreement between the department and the contractor at Firefly Campground indicate the level of concern: 1) Excessive damage to the residual stand will not be tolerated; this tract is located in a sensitive recreational and aesthetic area. 2) A high-quality performance operation will be expected throughout the contract period. The timber sale was monitored closely by DNR forestry staff.

It seems fitting that a sensitive timber sale calls for sensitive, state-of-the-art logging equipment. Ken Adamovich of Eagle River skillfully maneuvered his $150,000 wood processor into the forest. Adamovich proved that the behemoth wood processor could be precisely manipulated. A flip of a switch here, a pull on a lever there, and the wood processor became an extension of Adamovich's nimble hands. From a heated cab, the logger moved to a selected tree and sawed it off at ground level. The wood processor's mechanical hands gently lifted and rotated the entire tree away from the stump. Branches on nearby trees were unscathed. Next, the mechanical fingers tipped the tree parallel to the ground, measured out 100-inch lengths of wood and removed limbs at the same time. In an instant, another mechanical arm flashed out and a saw cut 100-inch sticks, dropping them in neat piles nearby. On and on, the process was carefully repeated each time.

Soon another device called a forwarder arrived. It had a mechanical hand attached to a boom that loaded piles of wood in the forest and moved them to a nearby campground road. There, logs were sorted according to species and final product use. In this way, two loggers operating with the best equipment available harvested 2,220 cords of pulpwood from pine, mixed hardwood and aspen stands. Put another way, they cut and processed the equivalent of 17 million rolls of toilet paper! Additionally, Adamovich produced the equivalent of 140,000 board feet of saw logs from red and white pines — enough boards to frame 14 two-bedroom homes.



DAVE DANIELS

With surgical precision, loggers carefully maneuver through the forest campground to harvest selected trees. In skillful hands, the mechanical wood processor holds an upright tree, saws it off at ground level, lifts and rotates the tree from the stump, trims limbs, measures the trunk in hundred-foot lengths, cuts and stacks sawn logs.

As this is a business arrangement, profits will flow in two ways. Adamovich will sell harvested trees on the open market to pay his bills. Since the trees he harvests are publicly owned, state taxpayers also benefit. Before a single tree is cut, the contractor paid stumpage fees of $27,665 for this sale to the state forestry fund. That money is used to

ROBERT QUEEN

It's hard to see the working forest through the trees. Few summer visitors realize that Firefly Lake Campground is sculpted in a pine plantation.

DAVE DANIELS

Using a "forwarder" loggers sort, grade and stack wood by species. Harvested trees could become paper products, lumber or fine furniture. The state's share of logging profits are reinvested in forestry and recreation improvements on public lands.

manage multiple uses of the Northern Highland-American Legion State Forest.

Those vacationing at the campground this year will likely notice little change from past years. Debris left on the forest floor is quickly scavenged by eager campers for campfires. All traces of the tracks from the wood processor and the forwarder will disappear with the melting snow. The hum of machinery will give way to the banter of families and laughter of children around the picnic tables.

One aspect visitors may not notice is how these selective cuts give the remaining trees a new lease on life. Foresters term this "releasing" the trees. Basically, remaining trees get more elbow room, more light, less competition for moisture and nutrients. Consequently, they grow bigger and faster. The process gives the forest a chance to mature from its plantation beginnings to a tract that resembles what virgin forests must have looked like 150 years ago.

Plants of the forest floor also thrive in the additional sunlight. Soon, an understory of young trees will grow to provide more privacy between campsites and seed the soil with trees for the next generation. That's forest aesthetics, and it takes active forest management to achieve them.

As Hewett notes, sometimes it's easy for a forester to get lost in the numbers game of boards and cords. Increasingly, in forests like the Northern Highland-American Legion, foresters are appreciating the compatibility of wood production and recreation.

"A public resource like the Northern Highland-American Legion State Forest should be a model where the best forest management can be practiced," Hewett reflected. "We're not just talking about it," he emphasized, "we're doing it here. Come to Firefly this summer and see what we mean."

Dave Daniels is a DNR public information officer stationed in Rhinelander.

Readers Write

SMALL PACKAGES, WELCOME GIFT

What a Christmas present! The "Small Packages" booklet that was inserted in the December issue was terrific. Thanks to artists George Knudsen and Luann Roberts and writer Maureen Mecozzi, we can all more fully enjoy trees in the wintertime. Keep up the good work gang!

George Tabbert
Onalaska, Wis.

Our pleasure. You can still enjoy many of retired State Naturalist George Knudsen's sketches along state nature trails.

THE BOTTOM LINE

On page 10 of your October issue there is a statement, "Toxics, coupled with past and present logging practices have degraded the organisms on the riverbed."

Would you please explain to me how logging degraded the organisms in the Menominee River. I can't figure out how it would be done.

LaMont G. Engle
Hales Corners, Wis.

Benthos or bottom-dwelling organisms are an important component in the food chain. Portions of the Lower Menominee River are covered with wood chips, bark, sawdust and other wood debris from the lumbering era. This material provides poor habitat for benthos and the aquatic life that feeds on the bottom. In addition, some of the higher concentrations of pollution indicators such as Chemical Oxygen Demand, organic carbon and total Kjeldahl nitrogen may, in some cases, be related to these deposits.

PHOTOGENIC FLORA

I wish to unveil the secret identity of the "pretty flower" that Jack Day was sitting next to in the October issue. The photographer for the "Remedial Action Plans" articles should take a bit more care in photograph selection or Jack Day should have selected a different flower to pose with. Purple Loosestrife!

Many magazine photographs contain aesthetic, but cryptic nuisances. I hope that *Wisconsin Natural Resources* is one to acknowledge this.

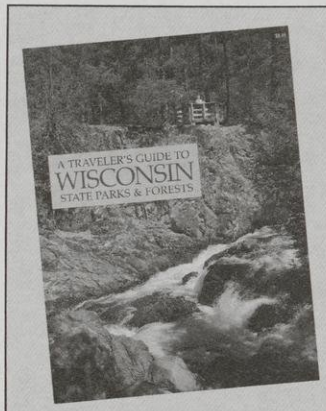
Adam B. Porth
Madison, Wis.

Purple loosestrife (Lythrum salicaria) is a beautiful, invasive plant that crowds out native plants in wetland and shoreland areas. It's no surprise to see loosestrife growing among riprap boulders on Green Bay shores where we photographed Mr. Day.

LAND USE PLANS

I can relate to your article "Designs on the Deutsche landscape." Californians and others can learn a lot about land use planning. Not to mention good beer and bratwurst as well.

Jon Schlegel
Turlock, Calif.



NEARBY GETAWAY

When you've got the time, we've got the place to relax. Whether you have a week or a weekend, visit Wisconsin's state parks to hike, swim, fish or just loaf in a hammock. State park vacations are easy to plan, inexpensive and only a short drive from your home.

We've made it easier than ever to plan from your armchair. *The Traveler's Guide to Wisconsin State Parks and Forests* describes the facilities and unique features of each state park, forest, trail and recreation area. Many of the campgrounds accept mail-in reservations. Can we hold a spot for you for the busy summer season?

For each copy of the guide, mail a check for $10.95 (includes 45¢ tax and $1.55 shipping charge) to DNR Parks and Recreation, P.O. Box 7921, Madison, WI 53707. If you order a parks admission sticker at the same time, the traveler's guide costs only $8.55 including tax and shipping. Or save the postage charges and pick up a copy at DNR offices and parks.

BAD ACTORS ARE BAD NEWS

I enjoyed reading Duncan Pledger's "Open Letter to an Uninvited Guest" in the October issue.

I had been wanting to write such a letter myself but didn't quite know where to send it. Your magazine is the perfect place.

I would like to add a few more reasons why land owners are posting their land. Four years ago some apparently frustrated vandal shot two holes through my aluminum fishing boat which was turned upside down against a log. An accident? NO! The shots were made from inside the boat, which means the shooter had to get down on his knees within a few feet of the boat.

Two years ago my wife and I were in the backyard of our vacation home when two adult hunters with two teenagers came out of the woods. They started yelling that we could not be outside without wearing blaze orange clothes. They were hunting on my property, too close to a residence and had the nerve to tell us we were violating the law! We know better than to go near the woods without wearing blaze orange but to have to put on blaze orange to walk from the house to our car is ridiculous.

The McNaughton Ski Trail is close to our property. Every year "shooters" (they're not hunters) shoot up many of the direction signs the DNR places at intersections along the trail. Some even take the time to change the signs so skiers can get lost.

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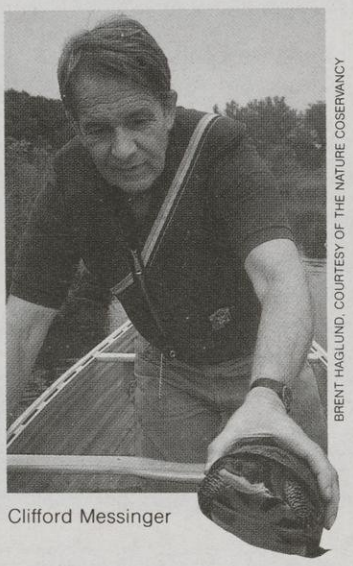
Then there's my neighbor who had two different windows shot out of his house when he was away. Both shots were dead center in the windows. He posted his land a few years ago after repairing his windows and bullet holes. I'm posting my land this year!

Don Niebler
Brookfield, Wis.

CORRECTION

A quotation about the nature of environmentalism in our December issue of Earth Notes (Issue 6) was improperly credited to former Natural Resources Board member Clifford Messinger. The thought was penned by Milwaukee Journal reporter Paul G. Hayes in his January 7, 1990 Wisconsin Magazine profile of Messinger titled "The Conversion." We regret the error and highly recommend the article that captured Messinger's personality and philosophy.

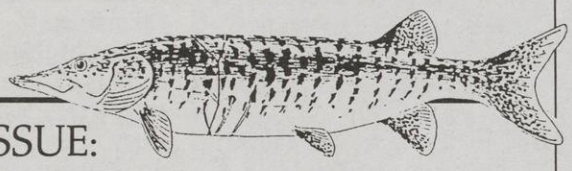
Mr. Messinger passed away last November, but his deeds live on. His career as businessman, manager and environmentalist followed a path that inspires all industrialists, property owners and environmental advocates to seek common ground.



BRENT HAGLUND, COURTESY OF THE NATURE CONSERVANCY

Clifford Messinger

Starting this issue, *Wisconsin Natural Resources* magazine is being printed on recycled paper. Our paper is produced in Wisconsin by a Wisconsin firm. We are committed to building markets for recycled goods. We encourage new opportunities for responsible recycling enterprises. We firmly believe that our readers will support the costs of this environmental investment. Write us with your reactions to our new paper stock.



NEXT ISSUE:

Trophy musky fishing
Out in the woods
Lake sturgeon sketchbook

continued from page 2

JOHN BAKER

Metallic wood-boring beetles lay eggs under bark.

also use bark for a nursery. As with bark beetles, each species invades a specific tree species or group of trees. For example, the twolined chestnut borer uses black, red, white and bur oaks. The female deposits her eggs in small clusters in the cracks and crevices of the chosen oak tree. After the eggs hatch, the larvae bore into the bark, leaving oval-shaped tunnels as they zigzag and feed in the soft woody surface. When the larvae are ready to pupate, they move into the outer bark and construct hibernation chambers where they winter. The adults emerge in spring, boring D-shaped holes.

Whether insects overwinter as eggs, larvae, pupae or adults, tree bark provides countless hiding places. Microscopic aphid eggs are hidden in bark crevices. Fall canker-worm moths lay their eggs in clusters around twigs. The fall webworm caterpillar finds a protected nook for a pupal cocoon. Adult flies, beetles, bugs and spiders crawl into a crack or slip under a bark scale. Adult butterflies, including mourning cloaks and Compton's tortoise shells, may also find a safe wintering spot in tree bark.

Stark trees, alive with inactive insects, provide an immovable feast that attract brown creepers, nuthatches and woodpeckers. By using different feeding styles, the birds share this bountiful food supply. The brown creeper starts at the bottom of a tree and spirals upward. Its long down-curved bill probes into spaces missed by nuthatches which spiral headfirst down the trunk. Woodpeckers hitch their way up the tree but their chisel-like beaks find goodies missed by brown creepers. Woodpeckers also drill into the bark to feast on the larvae other birds can't reach.

Drill marks in bark tell us still more about past struggles to find food. Horizontal rows of holes that grow larger as the tree matures tell of earlier visits by yellow-bellied sapsuckers. Long vertical breaks in the bark's symmetry tell of lightning strikes and freeze cracks. The bark tells tales of past human injustices, too: carved initials of young lovers, bark warped by ever-tightening fence wire, gashes from an errant motor vehicle.

On a trail or along a city street, rest a moment on a winter stroll to examine live and dead trees. Take the time to make skin-deep discoveries on and under the bark. ■

Anita Carpenter uncovers and discovers new aspects of nature from her home in Oshkosh, Wis.

WISCONSIN TRAVELER

FEBRUARY 1991

INSIDE

Fish school

Wisconsin undercover

A Native American feast

New directions

VOLUME 3 NO. 1

NORTHERN LIGHTS

Skylights

It could happen to you.

Perhaps on a clear February night, when the quiet crackles in your ears and the black of dark conceals all that stretches beyond your nose. Suddenly, up in the sky, not a bird, not a plane, not the Man of Steel, but a great dancing curtain of light, now green, now red, now a pale pearly shimmer skipping across the horizon.

And in the blink of an eye it's gone.

It just might happen ... if you're in the right place at the right time. Astronomers say events occurring now on a star 93 million miles from Earth will result in better sightings of the aurora borealis, or northern lights, in Wisconsin this year.

The Fox Indians feared the northern lights, believing them to be the ghosts of their enemies returning for revenge. The Menominee recognized the glow as light from torches used by friendly giants of the North. Among today's young skygazers, a myth persists that the aurora borealis is nothing more than sunbeams bouncing off Santa's front yard.

Believe what you will, says Robert Elliot, astronomer at the University of Wisconsin-Eau Claire, but turn to science if you want the facts.

"The northern lights are a solar phenomenon," he says. "When we have an increase in sunspots, which are enormous magnetic storms on the sun, we see more vivid auroral displays on Earth. And we're going to see more sunspots this year because we're in the middle of an 11-year sunspot cycle."

Intense explosions on the sun near clusters of sunspots whip gusts of hot gas, known as solar wind, toward the earth. The wind's high-speed electrons

Continued next page

Shimmering ribbons of light illuminate the northern sky. Look for the aurora borealis as you travel through Wisconsin this year.

Astronomy Department, University of Wisconsin-Madison

Haute courture

Gasp while Ricky Pierce sends one soaring for a three-pointer. Step aside as Alvin Robertson goes up for the rebound. And watch young point guard Steve Henson make a name for himself in the NBA. There's no better place to see a game of hoops than at Milwaukee's new Bradley Center, home of the **Milwaukee Bucks**.

Wisconsin's professional basketball team challenges opponents from around the country in the spacious, 18,633-seat arena located downtown on 4th Street and State. If a pre-game supper or post-game snack is part of your game plan, you'll find a number of fine restaurants within walking distance of the center. The Bucks' regular season runs through April 20. Tickets for upper level seats range from $6 to $17; on the lower level, $18 to $28. For schedule information and tickets, call (414) 227-0550.

Continued from previous page

collide with atoms and molecules in the upper atmosphere, resulting in an electrical discharge that emits light of varying colors, depending on the atom or molecule whacked. "Nitrogen gives off a red glow, oxygen causes a whitish green," Elliot says.

The glowing particles gather along earth's ever-changing magnetic fields, forming two basic types of aurora. "You might see a greenish glow in a long band along the northern horizon," notes Elliot. "This one is easy to confuse with city lights. Or you might see vertical shafts of pearly light, folded like a ribbon on edge. The shafts hang for four or five minutes, disappear, then reappear in a different spot."

Neither seasons nor temperature nor time of day have any bearing on auroral activity. "A dark, clear sky anytime of the year is all you need to see the lights," says Elliot. "We tend to notice more displays in winter because there are more hours of night. The northern lights also appear during the daytime, but we can't see them."

Richard Dreiser of the University of Chicago's Yerkes Observatory in Williams Bay, Wis. says you can see the northern lights anywhere in the state, but the farther north you go, the better chance you'll have. "Minocqua would be better than Milwaukee," Dreiser says. "The important thing is to get away from city lights. Pick a clear night and face north." How to distinguish the northern lights from simple clouds? Says Dreiser: "You can see the stars through the aurora borealis."

Carry a compass this year as you wander Wisconsin to ski, hike, sail, or fish. Face the right direction after dark and you might see the northern lights.

Even if you don't see the aurora borealis, you'll never get lost. You'll always know which way is north.

For statewide tourism information, call 1-800-432-TRIP.

Where to see the stars

Yerkes Observatory, Williams Bay, Walworth County. Run by the University of Chicago's Department of Astronomy and Astrophysics, the 96-year-old facility is a masterpiece of flamboyant turn-of-century architecture. Yerkes houses the world's largest lens telescope in its 90-foot dome. Tours are offered on Saturday mornings from October to May and Saturday afternoons from June to September. Special night viewings can be arranged in advance. (414) 245-5555.

Washburn Observatory, University of Wisconsin - Madison, Dane County. The century-old observatory looking out over Lake Mendota is open the first and third Wednesday of each month (every Wednesday from June 20 to August 15) if the sky is 75% clear of clouds. Viewing begins at 7:30 p.m. November to March and 9 p.m. April to October. The Hot Line, (608) 262-9274, includes schedules for astronomy-related activities in the Madison area. Call the Celestial Connection, (608) 262-4636, for a verbal stargazing guide that's updated monthly.

Hobbs Observatory, Fall Creek, Eau Claire County. Located on the 360-acre Beaver Creek Reserve, the observatory is open the third Saturday of the month from November through February, and every Saturday after dusk from March to October for public viewing and astronomy talks. (715) 877-2212.

Cast a hypothesis, float a theory

Proud students display the day's catch after careful study of walleye habits and habitat. Thomas Benedict Sheffy

The University of Wisconsin - Madison School of Natural Resources and the Wisconsin Department of Natural Resources will offer a class this summer for people interested in learning scientific ways to catch fish.

"Scientific Fishing Tactics and Techniques: Walleye and Musky" is an intensive, four-day course held on Lake Tomahawk, just south of Minocqua. Experienced teachers will introduce you to fish behavior and lake ecology, and you'll also learn how to read the weather and use modern fishing equipment.

Two sessions are available — June 13-16 and June 20-23. Each session is limited to 10 boats and 20 anglers, who must provide their own boats, tackle and poles. Preference is given to those who register in pairs, so why not sign up with your spouse, your son or daughter, or a good friend? The fee: $195 per angler, which includes instruction, lodging and all meals.

Write the CALS Conference Office, 250 Babcock Dr., UW Jorns Hall, Madison WI 53706, or call (608) 263-1671.

Native cuisine

Colors and flavors of the Earth spice meals prepared by the Tekakwitha Club. Baked squash and other delicious side dishes complement savory wild game, the highlight of each feast. Jean B. Meyer

Dine on roasted venison and nutty wild rice served by the **Tekakwitha Club** and you'll taste the spirit of the Northwoods.

The club, a Catholic women's organization on the Lac du Flambeau Reservation, has prepared traditional Chippewa feasts for weddings, funerals and other events since 1979. A few years ago, tour groups were added to the list.

"We like introducing people to Indian food," says Maggie Johnson, president of the club. "It's a chance for them to taste something different and learn about Native American culture."

Tekakwitha members cook venison in a number of ways: roasted, barbecued, stewed. Local hunters donate most of the meat. Depending on what's available, the menu may feature beaver, bear or turtle.

Indian fry bread is another club specialty never failing to delight. Flattened balls of yeast dough immersed in hot oil emerge crunchy on the outside, chewy inside. Fry bread is delicious plain; honey butter and maple syrup are on the tables for those who prefer a sweeter treat.

Wild rice, a Chippewa staple harvested from sloughs and wetlands. Commercially grown rice is darker in color. ROBERT QUEEN

Wild rice, baked squash, mashed potatoes with gravy, baked beans, cranberries, a beverage and dessert complete the meal.

The Tekakwitha Club serves groups of 20 or more for $7 a person, family style. Please call several weeks in advance to make arrangements.

Tekakwitha Club, (715) 588-7285; Lac du Flambeau Chamber of Commerce, (715) 588-3346.

Make a Date

March 2 **Combined Specialties Dog Show of Greater Milwaukee**, West Allis, Milwaukee County. Make the rounds with pedigreed hounds. (414) 327-1489.

March 2-3 **Wollersheim Winery Open House**, Prairie du Sac, Sauk County. Tour the cellars, take a horse cart ride through the vineyards and sample a soupcon of the grape. 1-800-VIP-WINE.

March 15-17 **Ice Bowling Tournament**, Sheboygan, Sheboygan County. A striking event that promises to adjust your frame of mind on a spare afternoon. (414) 457-9495.

March 17 **St. Patrick's Day Parade**, Town of Erin. Guaranteed to drive the snakes out of Washington County. Begins at 11 a.m. at the intersection of Highways 83 and 167. Begorra! (414) 628-0397.

March 24

Dean Tvedt

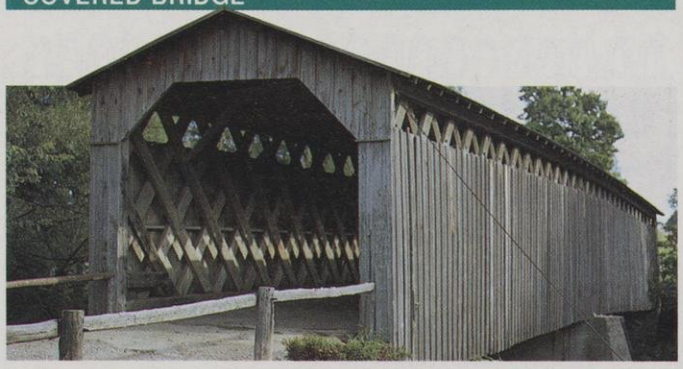
Flapjack Day, Maywood Environmental Park, Sheboygan County. Enjoy a short stack while you witness the spring sap run and watch maple syrup being made. (414) 459-3906.

Write for the Calendar of Events, Wisconsin Division of Tourism Development, P.O. Box 7606, Madison WI 53707, or call 1-800-432-TRIP.

Need more information?

Travel questions: 1-800-372-2737
Travel publications: 1-800-432-TRIP
Road conditions: 1-800-ROADWIS
Outdoor recreation: (608) 266-2277
Historical Society sites: (608) 262-9606

COVERED BRIDGE



The 115-year-old Cedar Creek Bridge spans a century of Wisconsin history. Staber Reese

A roof over your head

Born in 1876, semi-retired in 1962 and now well-weathered to a silvery gray, the **Cedar Creek Bridge** is the last covered bridge in the state.

The 120-foot structure pales when compared to larger sheathed bridges like the 630-foot Portage Bridge, the 650-foot Bridgeport Bridge and the 655-foot Boscobel Bridge that once spanned the Wisconsin River. But what it lacks in size, the Cedar Creek Bridge makes up for in charm. Its interior framing timbers, cut from white pine grown in the Baraboo bluffs, are arranged in a lattice pattern. The roof and a board-and-batten exterior were "wood preservatives" constructed to protect timbers and road planks from the elements.

The bridge crossed Cedar Creek on a town road three miles north of Cedarburg in Ozaukee County. As time passed and more people moved into the area, the rumble of the automobile replaced the click-clack of horse hooves and hobnailed boots on the bridge.

In 1962, Covered Bridge Road was built parallel to the venerable structure and cars now pass alongside, rather than through the bridge. Today the only traffic Cedar Creek Bridge will bear is the two-footed (or four-footed) kind.

To find the bridge, go to the intersection of highways 143 and 60 north of Cedarburg. Take Highway 60 one mile north to Covered Bridge County Park. Then park your car and walk across a piece of Wisconsin history.

Wisconsin Department of Transportation, (608) 266-0369; Cedarburg Chamber of Commerce, (414) 377-9620.

Ever wonder why an uncovered bridge is icy when the rest of the road surface is dry? Frigid air swooshing beneath a bridge or overpass keeps the structure cold, so the ice can't melt. Remember these tips from the **Wisconsin Office for Highway Safety**: If you hit an ice patch on a bridge, ease up on the gas, hold the wheel steady and roll through. Drive carefully when the sun is out and the temperature is rising during February and March. Ice can be wet at 30°F and twice as slippery as ice at 0°F.

HIGHWAY MAP

Road riddle

Q: What has cities but no people? Roads but no cars? Rivers but no water?

A: The **1991 State Highway Map**, prepared by the Wisconsin Department of Transportation.

The latest edition of this compact, easy-to-read map will help you locate state and county parks, national forests, airports, railroads, Wisconsin Information Centers, waysides, trails, historic sites and roads, of course — county trunks, highways (but no *toll*ways) and interstates. Complete with a detailed city index, mileage chart and insets of major cities. How to hold the Badger State in your hands? It's no riddle. Pick up your free copy of the 1991 State Highway Map at Wisconsin Information Centers, local chambers of commerce, or write DOT Document & Map Sales, 3617 Pierstorff Rd., Madison, WI 53707.

Historical facts

● In 1875, the Wisconsin Legislature offered a $10,000 prize for the invention of a machine that would be a cheap and practical substitute for the horse.

● February and March are the best months of the year to bring a group of kids to the **State Historical Museum**, 30 North Carroll St., Madison. Curator of Education Howard Kanetzke says the late winter months are less busy, allowing staff to spend more time taking the youngsters back in time.

Let 'em work off that excess energy at the State Historical Museum! Staber Reese

Call ahead to make reservations for groups of 15 or more. (608) 262-7700.

● **Old World Wisconsin**, 35 miles southwest of Milwaukee in Eagle, is open for cross-country skiing on Fridays, Saturdays and Sundays from 9 a.m. to 4 p.m., weather permitting, through early March. Six miles of groomed trails lead skiers past nine ethnic farmsteads and a reconstructed farm village. $3 adults; $2 ages 13-17; $1.50 ages 5-12; half-price for all on Fridays. (414) 594-2116.

Wisconsin Traveler is produced by Wisconsin Natural Resources magazine in cooperation with Wisconsin's Division of Tourism Development, Department of Transportation, and State Historical Society.

continued from page 10

able off-flavors in fish and other food.

Robert Lindsay, a UW-Madison food scientist and flavor chemist, has been studying off-flavors and taints in fish for more than 15 years.

"Little was known about off-flavors when we started looking at them," he remembers. "Industries [accused of causing odor problems] used to collect a bunch of fish. They'd host fish frys and say there was nothing wrong with the fish. Meanwhile, anglers were complaining about off-flavors in fish and the DNR started conducting taste tests."

To assess off-flavors more scientifically, Lindsay helped the DNR systematically collect fish, serve them to taste panels of 30 people and ask diners to describe the flavors.

> "As lake water quality improves, the fish will have fresher flavors."
> — Dave Stuiber

"By using panels, we got an average picture of the tastes of fish in certain waters," Lindsay recounted. "We plainly and conclusively described the fish flavors typically encountered in Wisconsin." By consensus, the taste panel documented off-flavors in fish from the Wisconsin River. Then Lindsay started investigating what caused these sporadic flavor problems.

Three distinct flavor taints were identified. The first, a kerosene-like or medicinal flavor, was caused by alkyl phenols, which entered the river from natural vegetation and industrial sources including wood fiber. In low concentrations, alkyl phenols didn't noticeably taint fish flesh, but in higher concentrations the compounds caused very offensive odors and flavors.

The second flavor, which was somewhat sulfurous, was caused by the thiophenol and thiocresol contained in paper mill effluents. Unlike alkyl phenols, these compounds can cause off-flavors in low concentrations.

COURTESY OF UNIVERSITY OF WISCONSIN SEA GRANT INSTITUTE

It's tricky business determining when fish have an off-flavor or odor. Perceptions vary. Food scientist David Stuiber has verified that people who regularly eat fish tainted with certain chemicals lose the ability to sense those odors and flavors.

The third flavor, a foul-smelling earthy-must, was caused by the compounds geosmin and methyl isoborneol, which are produced by blue-green algae and other algae that colonize decaying vegetation. Lindsay describes the odor as a cattail odor: "The best way to simulate it is to leave your muddy clothes in a room and disappear for a while. When you return to the room, that is the smell of cattails."

The worst of all flavors, Lindsay notes, is a combination of all three off-flavors.

"Some people believe off-flavors are the natural flavors in fish," says David Stuiber, UW-Madison food scientist for 20 years.

His research verifies that people exposed to odors over time lose their sense of taste and smell.

"People who rely on their catches for most of the protein in their diet consider every fish an edible game fish," Stuiber stated. "They've grown so used to the off-flavors that they don't recognize any difference."

"When you first bring fresh fish out of the water, it should smell like that seaweed odor you get standing at the end of a dock on a cool, damp day where the wind is blowing in from the lake," Stuiber says. "That's the normal flavor you should expect in high-quality fish."

Stuiber and Lindsay have been spending more time in recent years isolating the compounds that give fish good aroma. Research shows these fresh fish odors are similar to those found in melons and cucumbers. By isolating and highlighting these positive aromas, the scientists aim to improve the taste and shelf life of commercially-marketed fish.

The food scientists work with environmental specialists to improve water quality and fish habitat. Stuiber confidently predicts that as lake water quality improves, the fish sport an-

glers catch will have fresher flavors.

Tasty fish and fresh-smelling waters are part of DNR's vision for improved water quality. Aesthetic improvements naturally complement other actions to limit pollution discharges, slow lake eutrophication, stem toxics and monitor ecosystem health.

DNR and its research partners use a mix of biological, mechanical, chemical and regulatory tools to improve water quality. Parallel programs work on permanent solutions to keep agricultural wastes, city stormwater, lawn pesticides, garden fertilizers, soil and sediment from construction projects out of waterways.

"We intend to keep working with businesses and communities, on land and in the waterways," says Bruce Baker, director of DNR's Bureau of Water Resources Management. "Limiting sources that cause taste and odor problems complements our efforts to control toxics, organic and inorganic wastes in water."

Nevertheless, objectionable flavors and odors can be caused by such small amounts of compounds that it's unlikely regulations would resolve all complaints.

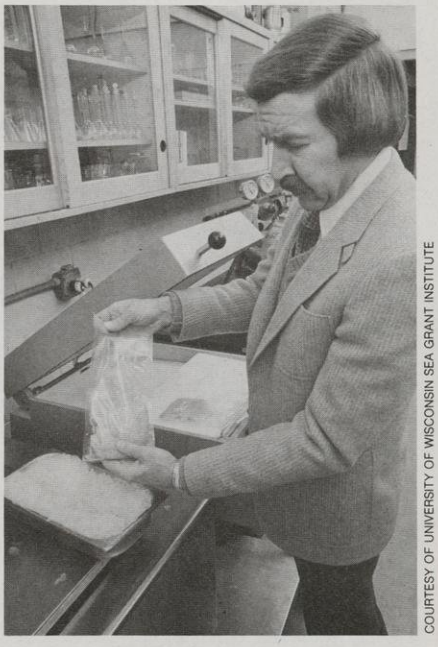
"You can't shut everything down to a zero discharge," Lindsay notes. "Monitoring industries along the rivers and lakes has lessened discharges or at least improved waste treatment prior to discharging. Taste and odor problems will be suppressed in the next few years, but they're certainly not going to go away."

> "Taste and odor problems in fish will be supressed in the next few years, but they are certainly not going to go away."
>
> — Robert Lindsay

Stuiber agrees, and he doesn't bemoan the fact that the days of pristine Wisconsin waters are over. "The first time you walk into an area and put one foot in the water, you've changed it," he says. " 'Pristine' waters exist only in the eyes of the beholder."

Concerns about water pollution, taste and odor problems haven't dampened the DNR/UW team's enthusiasm for catching and cooking fish. In fact, their upbeat predictions have restored my faith in the future quality of both fish and surface waters. I'm looking forward to future springs when love, instead of decaying algae odor, will fill the air and the fish will be more tasty than ever. Now where did I put the address for that apartment by the lake? ■

Natasha Kassulke worked for DNR's Bureau of Water Resources Management while pursuing a journalism degree at Edgewood College in Madison.



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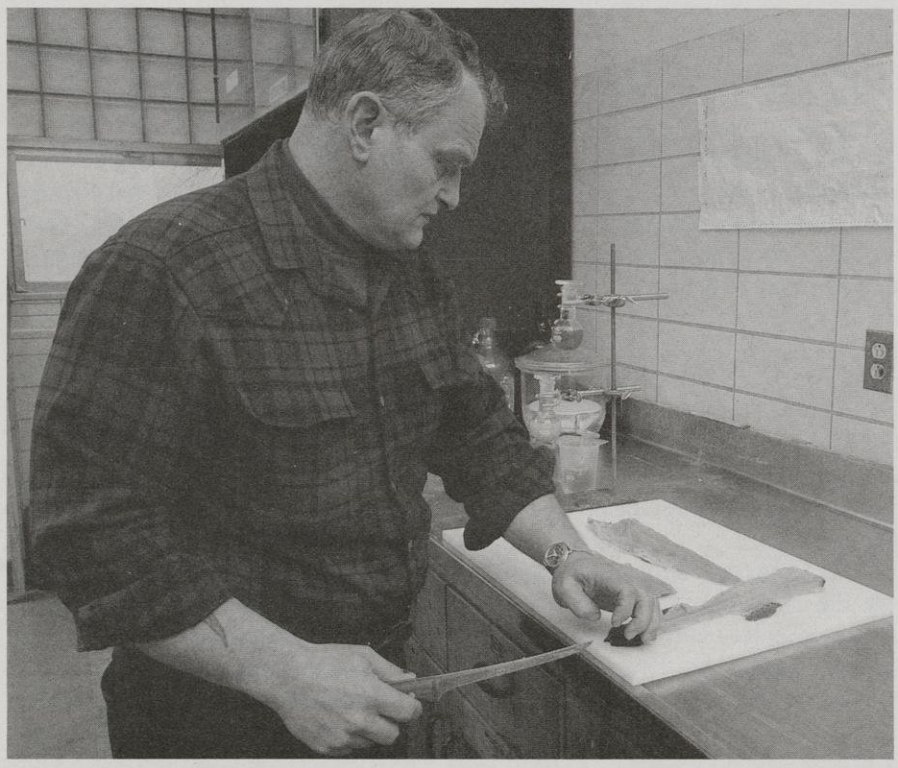
Robert Lindsay



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Fish can absorb off-flavors from the waters where they live. Other odors taint fish during processing and merchandising. Food scientist Dave Stuiber works with commercial fishermen and processors to maintain and enhance fresh-caught flavors in fish.

(right) A blue-green algae bloom "working" on Lake Mendota.

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