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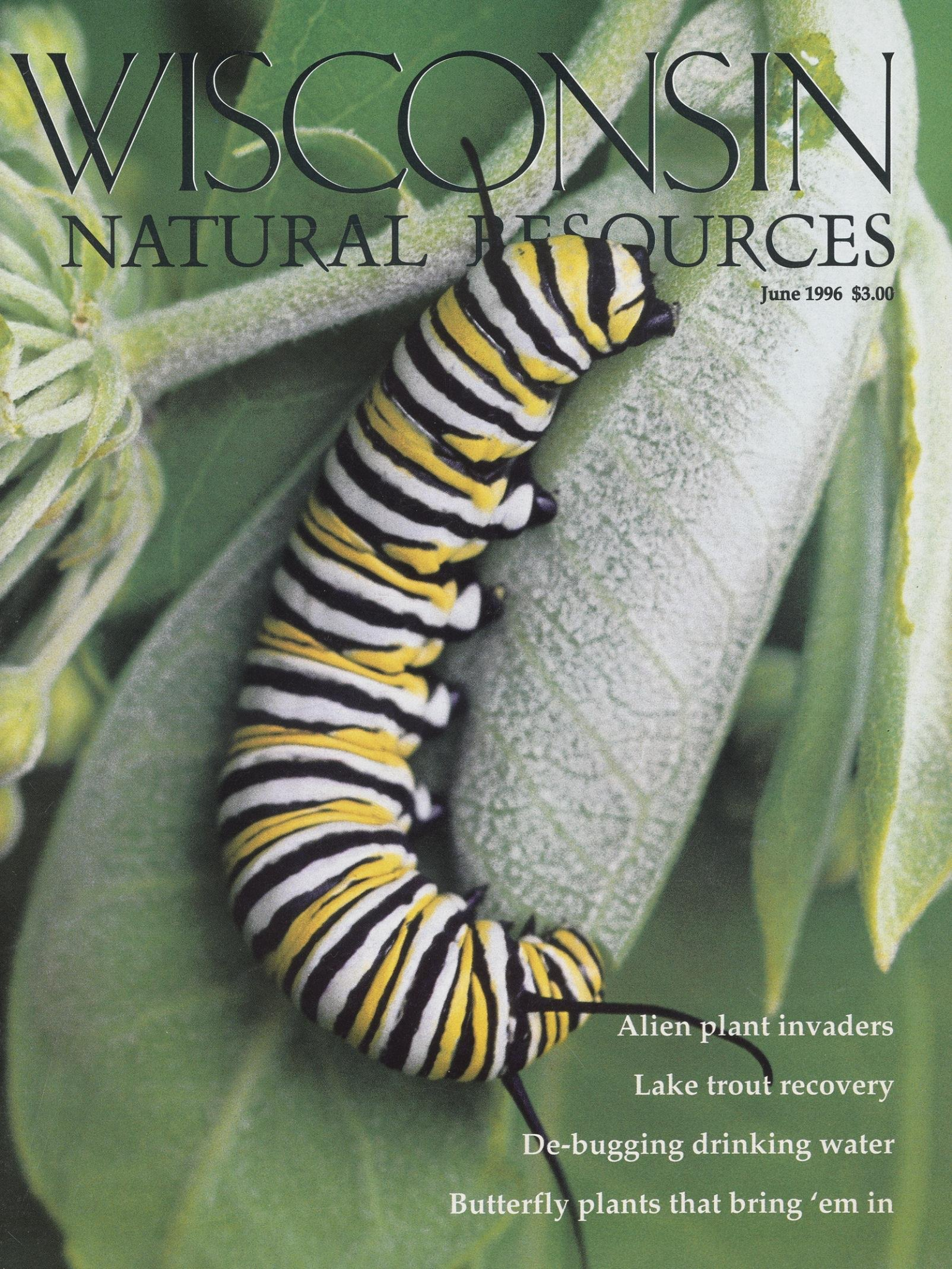
WISCONSIN NATURAL RESOURCES

June 1996 $3.00



Alien plant invaders

Lake trout recovery

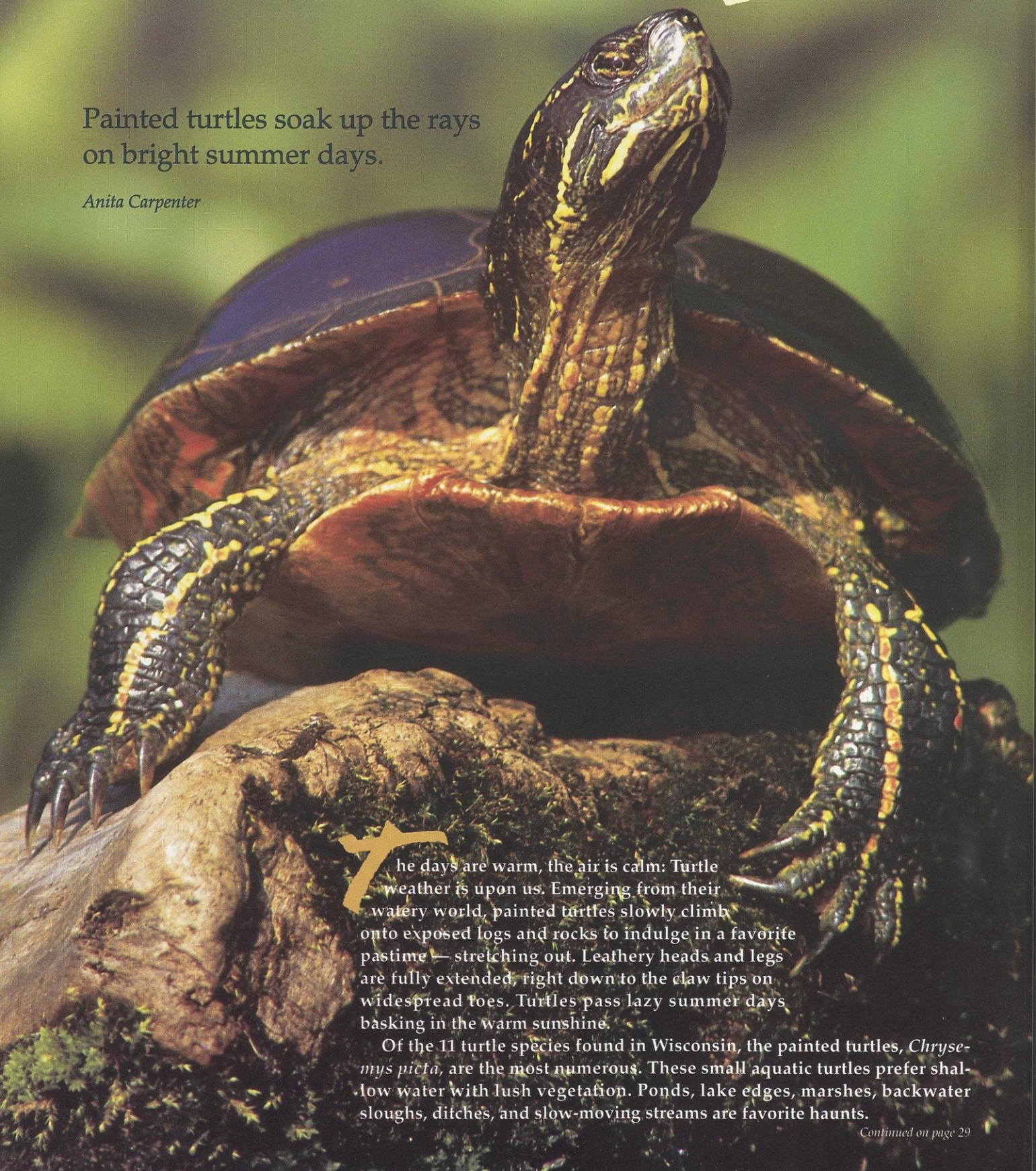
De-bugging drinking water

Butterfly plants that bring 'em in

Sun seekers

Painted turtles soak up the rays on bright summer days.

Anita Carpenter



The days are warm, the air is calm: Turtle weather is upon us. Emerging from their watery world, painted turtles slowly climb onto exposed logs and rocks to indulge in a favorite pastime — stretching out. Leathery heads and legs are fully extended, right down to the claw tips on widespread toes. Turtles pass lazy summer days basking in the warm sunshine.

Of the 11 turtle species found in Wisconsin, the painted turtles, *Chrysemys picta*, are the most numerous. These small aquatic turtles prefer shallow water with lush vegetation. Ponds, lake edges, marshes, backwater sloughs, ditches, and slow-moving streams are favorite haunts.

Continued on page 29

Printed in U.S.A.
PUBL-IE-012
ISSN-0736-2277

WISCONSIN DEPT. OF NATURAL RESOURCES

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Wisconsin Natural Resources magazine (USPS #34625000) is published bimonthly in February, April, June, August, October and December by the Wisconsin Department of Natural Resources, 101 S. Webster St., Madison, WI 53702. The magazine is sustained through paid subscriptions. No tax money or license fees are used. **Subscription rates** are: $8.97 for one year, $15.97 for two years, $21.97 for three years. Second class postage paid at Madison, WI. POSTMASTER and readers: **subscription questions** and **address changes** should be sent to *Wisconsin Natural Resources* magazine, P.O. Box 7191, Madison, WI 53707. Toll-free subscription inquiries will be answered at 1-800-678-9472.

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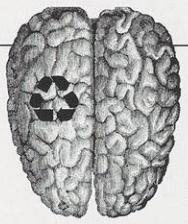
WISCONSIN NATURAL RESOURCES

June 1996 Volume 20, Number 3



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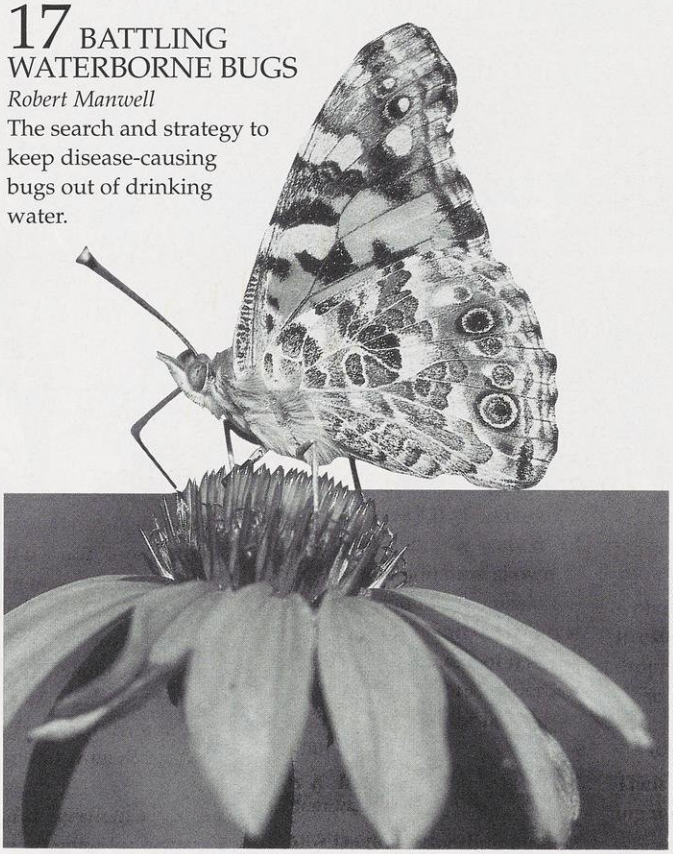

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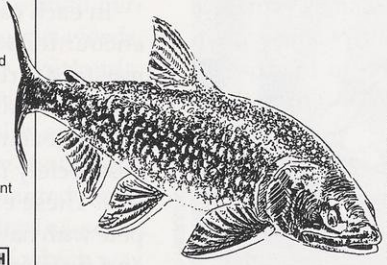


RUTH MASLOSKI KING

FRONT COVER: Monarch butterfly larva *(Danaus plexippus)*. You can plant the plants that draw them in.
SCOTT NIELSEN, Superior, Wis.

BACK COVER: Dame's rocket *(Hesperis matronalis)* is one of the deceptively beautiful invasive plants that crowds out native species. Read about them in our lead story.
AL POWERS, Green Bay, Wis.

IS NO GROUND SAFE??!

GREEN

BUREAU OF ENDANGERED RESOURCES

Invasive plants like purple loosestrife are great competitors. They grow faster, spread more quickly and adapt to a wider range of conditions than native species.

For once, the tabloids are right. Our native species and landscapes are under assault from plants that just don't belong here.

S. Kelly Kearns

In search of blooming trilliums and spring beauties on an early May hike, you're dismayed to find instead a dense stand of plants blocking the sun from the forest floor. Perhaps you're canoeing a marsh, hoping to see nesting cranes or wrens, but you encounter a stand of broad-leaved grass smothering other plants; only the occasional red-winged blackbird claims territory here. Later in the summer, while fishing on a favorite lake, each cast brings up a clump of slimy weeds. The plant tangled in your line is pictured on signs at the boat landing reminding you to remove the weed from your boat hull before moving to another lake or river.

In each case you've had a real-life encounter with green aliens. Garlic mustard, reed canary grass and Eurasian water-milfoil are only three of the dozens of invading plants that cost society millions of dollars to control. These exotic, hardy plants compete with native species for space, light and nutrients, and the natives often come up short. The result: Our plant

ALIEN HORDES INVADE
forests, prairies, wetlands!

ecosystems become simpler, with fewer and fewer different species.

When exotics displace native plants, they also eliminate specific habitats for animals, birds and insects. As habitat disappears, so do the species that depend on them. We lose the variety of life, and see the depth and breadth of all living things diminished.

Tough competitors on the field and in the forest

How do non-native plants compete so successfully with native plants that have adapted over centuries to growing conditions in Wisconsin? Some have no natural predators here — the insects, fungi or mammals that would control their spread. Most of these plants spread rapidly because they are ecological pioneers and colonizers. They are adapted to move in quickly once the soil is disturbed. They grow fast, flower early, are pollinated easily, and set seed in a short time. Their seeds and shoots can tolerate a wide range of growing conditions.

Hundreds of plant species have been brought into the United States, or transplanted from region to region, for landscaping, agriculture, erosion control and wildlife habitat. A small percentage of these become super-weeds, invading our woodlands, wetlands, native and restored prairies, lakes and streams, agricultural fields and gardens. Among the more notorious examples: crown vetch, planted along roadsides to stabilize sloping soils; teasel, the fruiting head of which was used years ago to comb horsehair and card wool; and multiflora rose, distributed to build hedgerows for wildlife habitat and windbreaks.

Other species were brought here as food crops or for medicinal purposes: Dandelion provided a source of vitamin C before citrus fruits gained widespread popularity; garlic mustard was used as a fresh green and a medicine; chicory root was dried and ground to make a coffee-like beverage; burdock root was used for food. Weed seeds travel in grain, in the hair of imported animals, and in the ballast waters of ships.

NOEL CUTRIGHT

How do we stop these troublemakers before they take over? By vigilant monitoring and early control of specific "pest" species. Parks personnel, road crews, public property managers and private landowners can learn to identify the invasive species, note where patches are growing, and take action before the patches get too big.

Control becomes difficult after an invasive plant develops a strong root system and spreads its seeds. Trees, shrubs and herbaceous perennials may resprout after being pulled, and the seed may remain viable in the soil for many years. While it's possible to limit the spread of an exotic plant, fully eradicating the invader is nearly impossible.

In severe cases, invasions of non-native species can so drastically alter an ecosystem that there are not enough remnant native plants to naturally restore the site after the invasive plants are removed. In these cases, intensive planting, seeding and maintenance can slowly restore native plant communities.

The first step in control is learning to recognize and identify the troublesome plants that threaten both natural and agricultural areas. Get to know these biological opportunists and be ready to take action when they mount an offensive near you.

Woodland invaders

For decades now, several European species of buckthorn *(Rhamnus cathartica and R. frangula)* and honeysuckle *(Lonicera x bella, L. tatarica)* have been penetrating the understory of woodlands, particularly in the southern and eastern parts of the state near urban areas. (See our story "Growing native," Oct.'95.) Brought in as landscape plants, these prolific invaders are aided in their advance by birds that feed on the fruits and deposit the seed as they fly or perch.

Researchers at the University of Wisconsin-Madison and elsewhere have developed techniques for con-

FREDRICK SEARS

Garlic mustard grows profusely forming a dense green blanket in woodlands.

trolling the shrubs. These plants green-up before native species and retain their leaves after most shrubs. The stems are cut and the open stumps are painted or carefully sprayed with an herbicide, usually a glyphosate, that will seep into the root system. (Cutting the stems without using herbicides merely stimulates the shrub to resprout.) Even so, these are tough plants: to sufficiently weaken or kill them, they must be cut several times a year, three or four years in a row. In areas where the soil can be disturbed without affecting other desirable plantings, a specialized tool called a Weed Wrench can pry the plants from the ground. Smaller plants may be hand-pulled.

A relatively new invader to Wisconsin woodlands is a distinctive herbaceous biennial named garlic mustard *(Alliaria petiolata)*. Triangular leaves emit a distinctive garlic odor when crushed. In the plant's second year, a single flower stalk emerges with smaller triangular leaves and small four-petaled white flowers. Garlic mustard can quickly carpet a forest floor because it is able to stay green and photosynthesize throughout the winter if there is no snow cover. Many areas of the state have not been infiltrated by this plant, so the best control method is to carefully monitor sites and hand-pull any plants before they can produce seed. (Adventuresome cooks may want to try boiling the leaves in two changes of water and eating them with butter and salt!) For stands too large to pull by hand, cut down the garlic mustard with a string trimmer just before the plant flowers, then repeat the treatment each time the plant tries to flower in successive years. Prescribed fires may also aid in control. The tiny seeds are very long-lived and may continue to emerge for many years, so mark each spot and monitor the area periodically during the growing season.

Prairie pests

There are dozens of non-native plants that can be troublesome in prairies, pastures or other open areas; some are even sold in North American "wildflower" seed mixes for gardens. Dame's rocket, chicory, Queen Anne's lace, and favorite non-natives such as daisies can become very weedy. When planting a remnant or restored prairie, use plants native to the area so that no one species dominates the planting.

Cool-season Eurasian grasses such as smooth brome *(Bromus inermis)*, quack grass *(Elytrigia repens)* and two bluegrasses *(Poa pretensis and Poa compressa)* have and will continue to compete with native species in remnant and restored prairies. In prairies, these grasses are best controlled by regular burning, timed to knock back the early-growing exotics before the natives emerge.

Although prescribed burning generally keeps most exotic plants from dominating prairies, a few species require more effort. A relatively recent troublemaker in prairies, barrens, dunes, roadsides and pastures is spotted knapweed *(Centaurea maculosa)*. This problem perennial displaces both native and planted forage grasses on western rangelands, and now it's moving eastward. The flowers are similar to the garden bachelor's button, a close relative. Small populations can be pulled or dug, but any plants with flowers or seeds should be bagged up and removed to prevent reseeding. Intensive burns can reduce the population of spotted knapweed.

Research is being conducted on two species of flies that feed on the seed head and are fairly successful at reducing knapweed seed production. Herbicide control using 2,4-D has had mixed results.

An interesting plant that can be both an ecological pest and a health hazard is wild parsnip *(Pastinaca sativa)*. If the plant juices touch your skin in the presence of sunlight, you can develop a blistering rash that can be worse than poison ivy. Wild parsnip is found in old fields, roadsides, disturbed or restored prairies. It looks like Queen Anne's lace, but is much stouter, reaching up to five feet. The plant dies after producing yellow flowers and large flat seeds in its second or third year. To control the plant, remove the first year's rosettes by cutting the root just below the soil surface. Wear gloves, a long-sleeved shirt and long pants when working with this species.

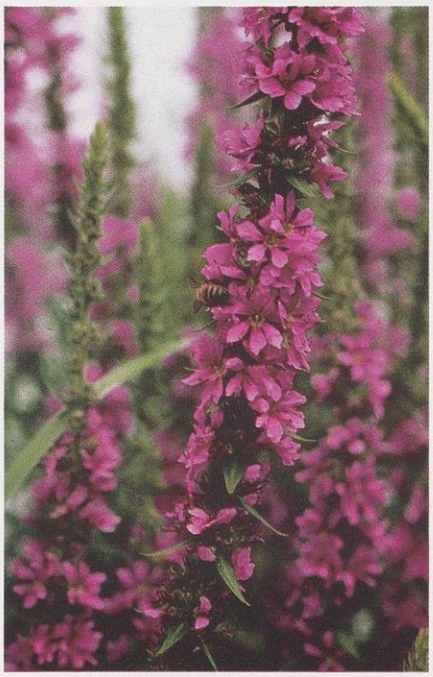
Wetland tormentors

Perhaps the showiest and best-known of Wisconsin's exotic invaders appears in our wetlands. Purple loosestrife *(Lythrum salicaria)*, a large magenta-flowered perennial, was introduced to North America by beekeepers as a good pollen plant. Because of loosestrife's ability to withstand wet soils, many shorefront gardeners planted it near the edges of rivers, streams and lakes. The tiny seeds are easily transported by currents and moving water. Once it takes root, purple loosestrife displaces other emergent vegetation.

Loosestrife plants should be pulled or dug out as soon as they are identified. If the plants are in flower, pull them, wrap them in plastic bags and discard them. Cut stems should all be removed so they don't root again. Larger infestations are best controlled with judicious applications of herbicides in mid-summer.

The Wisconsin Department of Natural Resources has joined an interna-

S. KELLY KEARNS



BUREAU OF ENDANGERED RESOURCES

Sometimes the enemy is us. *(clockwise from top)* Reed canary grass was introduced as a forage crop. Purple loosestrife is valued as a pollen source. Chicory's root is used in folk medicines and coffee blends.

DARRYL R. BEERS

tional effort to use natural predators to control this weed. Several insects that feed on loosestrife in its native European habitat have been released at a few state wildlife areas. It's unlikely that the insects will eradicate the plants, but they may help control the population and slow its spread. Since 1987 it has been illegal to cultivate, sell or distribute purple loosestrife, now labeled as a nuisance weed. The ban, and an extensive public awareness campaign, remind residents to remain watchful for "the purple peril."

A less showy but more insidious invader of marshes, wet meadows and wetter prairies is reed canary grass *(Phalaris arundinacea)*. One variety is native to North America, but a European cultivar considered "improved" was distributed to farmers in the 1930s. Early soil conservationists thought it would be a "miracle plant," allowing farmers to grow a forage crop in so-called waste lands. Decades later, it is now difficult to find a lake or wetland in Wisconsin that does not have large areas dominated by this dense, clone-forming grass. Effective control requires mowing or burning and spraying in midsummer, just before flower-

Plants viewed as "weedy" when found in Wisconsin

Woodlands

bishop's goatweed *Aegopodium podegraria*
black locust *Robinia pseudoacacia*
burdock *Aretium minus*
common buckthorn *Rhamnus cathartica*
dame's rocket *Hesperis matronalis*
European honeysuckle species *Lonicera x bella*
garlic mustard *Alliaria petiolata*
glossy buckthorn *Rhamnus frangula*
multiflora rose *Rosa multiflora*
Tartarian honeysuckle *Lonicera tatarica*

Prairies and Open Areas

autumn olive *Elaeagnus umbellata*
birdfoot trefoil *Lotus corniculatus*
Canada bluegrass *Poa compressa*
Canada thistle *Cirsium arvense*
common teasel *Dipsacus sylvestris*
crown vetch *Coronilla varia*
cut-leaved teasel *Dipsacus laciniatus*
Kentucky bluegrass *Poa pretensis*
leafy spurge *Euphorbia esula*
musk thistle *Carduus nutans*
orange hawkweed *Hieracium aurantiacum*
plumeless thistle *Carduus acanthoides*
quack grass *Elytrigia repens*
Russian olive *Elaeagnus angustifolia*
Siberian elm *Ulmus pumila*
smooth brome *Bromus inermis*
spotted knapweed *Centaurea maculosa*
white sweet clover *Meliotus alba*
wild parsnip *Pastinaca sativa*
yellow hawkweed *Hieracium caespitosum*
yellow sweet clover *Meliotus officinalis*

Wetlands and Aquatics

curly-leaf pondweed *Potamogeton crispus*
Eurasian water-milfoil *Myriophyllum spicatum (M. exalbescens)*
purple loosestrife *Lythrum salicaria*
reed canary grass *Phalaris arundinacea*

Lawns and Gardens

bindweed *Convolvulus arvensis*
burdock *Arctium minus*
dandelion *Taraxacum officinale*
deadly nightshade *Solanum dulcamara*
ground ivy/creeping Charlie *Glechoma hederacea*
quickweed *Galinsoga ciliata*

IN THE NEXT ISSUE OF

WISCONSIN NATURAL RESOURCES

NEW COURSES BLAZE NEW TRAILS OF OPPORTUNITY
Women continue to enjoy a wide range of outdoor activities overcoming traditional barriers.

TRAIL SIGNS
The nature trails in state parks have new stories to tell.

BACKYARD CAMPING REMINISCENCE
Tickle your funny bone with summer memories of sleeping outdoors.

CAN YOU HAVE ART AND EAT IT TOO?
If you thought fish were only for eating, don't miss this ancient art form — Gyotaku.

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ing. As the soil is full of reed canary seed, it will take follow-up burns or mowing for several years to give native plants an advantage.

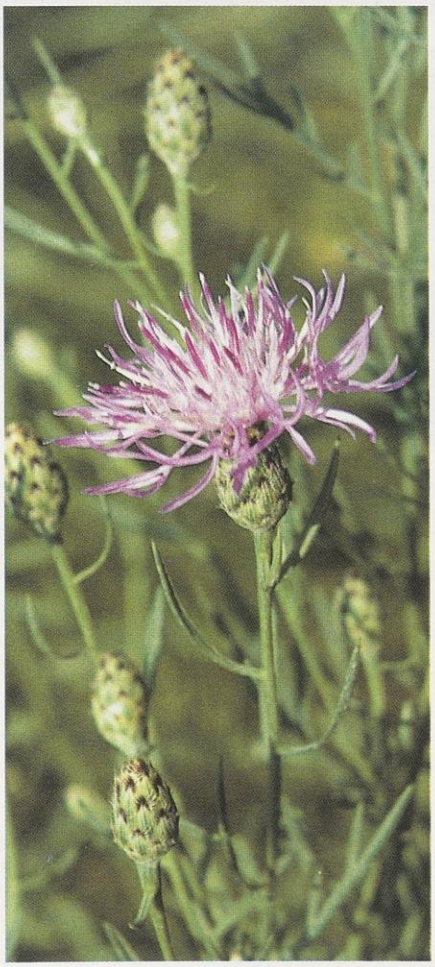
The struggle below the surface

Nutrient-rich lakes are ideal habitat for the invasive aquatic plant Eurasian water-milfoil *(Myriophyllum spicatum)*. The plant reproduces from stem and root fragments; it can be spread when boats are launched with pieces of the plant sticking to the boat, motor or trailer. Signs at boat landings on infested lakes now urge boaters to clean the aquatic plants from their boats before moving on to another lake or river. Each year hundreds of lake associations and municipalities clear invasive aquatic plants from landings and beaches. Herbicides are not recommended as they also kill the native plants. Milfoil may be kept under control by maintaining healthy stands of native aquatics. You can help by preventing runoff of nutrients like lawn and agricultural fertilizers and manure, and pollutants including pesticides and road salts.

On the home front

Weedy exotic plants thrive not only in natural areas, but also in our gardens and lawns. The most pernicious weed in many yards is ground ivy, also called Creeping Charlie or gill-over-the-ground *(Glechoma hederacea)*. This low-growing member of the mint family rapidly colonizes disturbed soil in vegetable and flower beds, and can smother grass, especially in shaded areas. The plant's habit of sending out rootlets where the stem touches the ground prevents even the most vigilant gardeners from controlling it by hand pulling. Glyphosate may be used on ground ivy, but it will also kill any other green plants. A less toxic option is to apply a solution of laundry borax (seven tablespoons/gallon of warm water). Applications at this rate should not damage adjacent lawn grasses but test a small area before widespread applications.

BUREAU OF ENDANGERED RESOURCES



DICK BAUER

Two plants that quickly colonize disturbed prairies pastures and roadsides: *(above)* wild parsnip and *(right)* spotted knapweed.

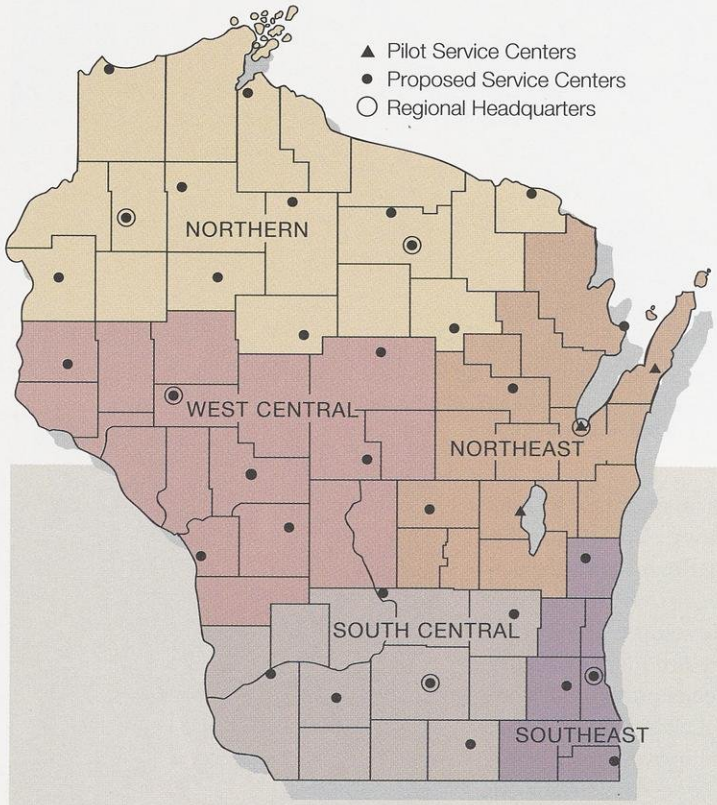
The best defense: maintain a thick, dense, healthy lawn. Pull or dig out weeds before they flower and disperse seed. Dandelion, sow thistle and quickweed can develop viable seed if pulled while they are just flowering. Keep the flowerheads out of your compost pile, or you'll be aiding and abetting seed dispersal in your yard.

Whether your concern is preserving native plants in natural habitats or cultivating a weed-free vegetable garden, it's wise to learn all you can about these troublesome exotic plants. Armed with that knowledge, you can plan to control the invaders in the most ecologically benign way. □

S. Kelly Kearns is a native plant biologist with DNR's Bureau of Endangered Resources in Madison, Wis.

Trying to keep the customer satisfied

How DNR is reorganizing to provide better service to its human and more natural customers.



The pace of change is picking up. Wisconsin's conservation programs, well over a century old, evolved in eras of overfishing, heavy logging and uncontrolled hunting. State environmental programs started as public health programs to stem waterborne diseases. It has taken decades to develop an environmental ethic to now reclaim rivers and tame billowing smokestacks.

Environmental laws in the last 25 years cast out a regulatory net to control the largest sources of pollution. We set standards and worked with big business to change the way they do business. Though at times the regulatory programs were confrontational, we've been largely successful

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WISCONSIN DEPT. OF NATURAL RESOURCES

MOONLIT INK

in protecting the public from pollution sources and restoring fisheries, forests and wildlife from historic sources of harm. Over time, both business and regulator learned that it is much more costly to clean up than to prevent air pollution, fouled water, hazardous spills and chemical dumping.

To further restore the environment, we no longer just point a finger at big business. We are re-examining our community decisions, municipal services and our individual habits.

Where and how communities expand determines what else can live on the land. Where we place roads determines where we will build homes and how fragmented the landscape will become. Development shapes the habitat we leave for animals. Our activities can sustain or tear apart the fabric of nature's safety nets in soil, wetlands, landscapes and watersheds.

We are just beginning to appreciate the collective costs of seemingly benign individual decisions. The combined effects of fertilizing suburban lawns may be as polluting as some industrial discharges. The consequences of 20-minute commutes between communities may be as serious as smokestack emissions. What we discard in household trash poses some of the same concerns as the by-products of business.

Preserving our environmental gains will require new approaches. Individual action on private and public property can threaten the land in ways that are difficult to quantify: small amounts of pollution from one region drift downwind and flow downstream. Technology gives us tools to detect low levels of contaminants, but toxic effects may not be apparent for decades.

As we examined what we needed to do to sustain Wisconsin's natural resources and environmental quality, DNR managers clearly saw that we needed better connections: better links between our management programs, better approaches to show people the consequences of their actions, new ideas to foster better lifestyle choices. We also knew these changes would have to come in an era of less government spending and more limited public resources.

To better mesh DNR programs, we took a fresh view of our work. Should we manage fish, game and forest species separately or should we organize to manage habitats? The challenge is, we need both. A second challenge in leaner times is involving people more in our work while making business easier for our customers. To do more with fewer funds requires tremendous cooperation among government, private business and other public services. We'll maintain traditional regulations and enforcement, because they are still needed, but we will also seek more partnerships to prevent problems and encourage innovative solutions that protect resources.

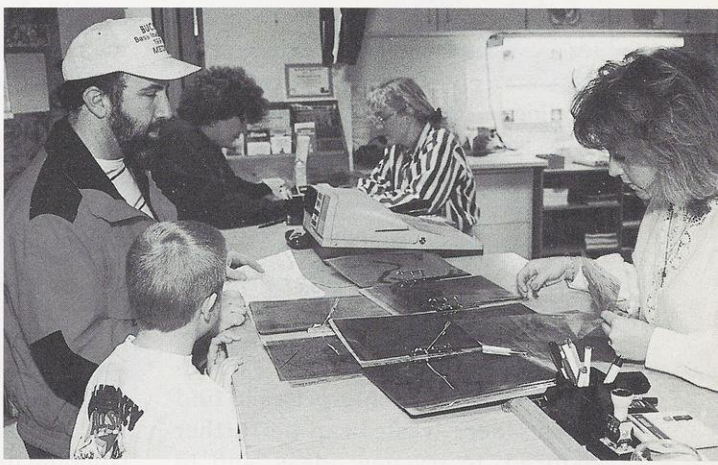
A new view of customer services

To offer customers better service and to give them ways to help themselves, DNR offices will be revamped and staff responsibilities will change a bit. The plan calls to open 35 service centers during the next three years. Most of these will be retrofits of existing offices. The aim is to locate offices within a 30-minute drive of most state residents and to remain open for business at hours that are more convenient. What we mean by "open evenings and weekends" will depend on how comfortable customers become with technology, and what services customers truly need outside of normal business hours. It's possible that recreational licenses and permits might be easily managed through automated kiosks at convenient locations, just as automated tellers allow simple banking transactions.

The front desk at service centers will change, too. We plan to equip stations with computers that give better statewide access to data now stored in files or in our headquarter offices. We aim to handle 80 percent of customers' questions right at the service center. If your questions can't be answered quickly, the person providing customer services will guide you to the proper quarters and will stay with you until you get the information you need.

Offices will gear up to swiftly handle the transactions that currently bring you to our doorstep like buying fishing licenses, reserving campground sites, submitting hunting applications and registering recreational vehicles. Then we'll start taking on your home improvement projects that require an environmental permit — putting in a dock, riprapping a shore or reviewing applications to develop near a wetland. We'll adapt to provide the right on-site expertise, so if you need to consult with an environmental engineer, a well specialist or a community forester, you will know when those specialists will be available near you.

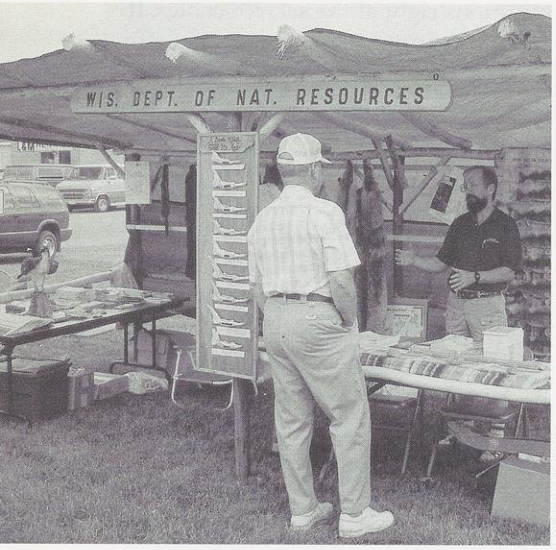
Service centers will also be home to some of the technical staff our business customers need — a metals plater planning a wastewater system, a printer who anticipates air emissions, a body shop that wants to establish in a small town — could all find out how to meet environmental requirements at a service center.



ROBERT QUEEN

A key goal in reorganization is equipping DNR service centers to handle more of our customers' requests for permits, licenses and answers over the counter.

We will further streamline services to communities and individuals whose environmental and natural resource projects qualify for financial assistance. Our partners in building sewage treatment plants, building recreational



DNR FILE PHOTO

Community outreach and community partnerships will help businesses and individuals manage resources on their property.

trails, reducing runoff, restoring dams and cleaning up tire piles will find that most grant and loan programs are consolidated in the new Bureau of Community Financial Assistance. Staff will suggest ways to package loans, apply for grants and suggest other incentives to stretch environmental protection funding.

Wisconsin's major businesses are important partners in maintaining environmental progress. As such, DNR environmental specialists will be trained to better understand the unique processes of major businesses. These "sector specialists" will concentrate on papermaking, foundries, engine manufacture and other enterprises to find areas where wastes can be further reduced, to try new ideas, and to understand industrial processes well enough to coordinate applications for environmental permits. Environmental practices which prove to be cost savers for one business might be applicable elsewhere. The sector specialists will promote sharing such tricks of the trade that are not deemed trade secrets.

Pollution prevention/waste reduction tasks at DNR will be consolidated in a new Bureau of Cooperative Assistance. One of its tasks is monitoring environmental practices nationally and overseas that might help Wisconsin firms operate cleaner, more economical manufacturing lines.

Moreover, we are mindful that our recreational customers — anglers, hunters, campers, bicyclists and others — still expect we will maintain quality resources and strong enforcement, where necessary.

Get yer programs here!

The new structure has fewer staff and supervisory layers. Our headquarter operations are still designed to form policies and support field offices. As with any new team, it helps to have a scorecard to sort out the players. Here goes:

The Division of Lands combines most of the resource management programs including forestry, wildlife management, endangered resources, facilities and lands, parks and recreation. Field employees in forestry, wildlife management and parks will maintain field posts. Some field staff will relocate to the new service centers in nearby communities. Staff who formerly managed one property will become members of teams that will manage all of DNR properties within a natural boundary like a watershed or a forest.

The Water Division consolidates programs that were formerly housed in environmental quality, enforcement and resource programs. A Bureau of Watershed Management will oversee runoff management, discharge permits, floodplain/shoreland management, Great Lakes issues, water quality standards and modeling. A Fisheries and Habitat Protection Bureau will combine the talents of fisheries managers with those who monitor water quality in lakes, wetlands and rivers. Programs to maintain the quality of drinking water and groundwater will be combined in one bureau.

An Air and Waste Division houses the air quality and waste management programs. The air program will organize to manage air emissions from four different kinds of sources —combustion processes, painting and coating, small businesses and general manufacturing. Duties in the waste management programs had expanded so significantly in recent years that it made sense to split the group into smaller work units. A Bureau of Waste Management will inspect and license solid and hazardous waste facilities, develop strategies for reducing wastes and continue recycling programs. A new Bureau of Remediation and Redevelopment will oversee cleaning up and returning contaminated lands to fruitful uses. Their work will include developing environmental incentives to recover polluted lands, removing contaminated sediments and overseeing remedial work at old dump sites.

A Division of Enforcement and Science coordinates work of the warden force with recreational safety programs, environmental reviews, research and technical laboratory services.

A Division of Administration and Technology combines many of the department's internal support services (personnel, human resources, budgeting, mail, aeronautics, safety and finance) with DNR expertise in computer services, data storage and electronic mapping.

A Customer Assistance and External Relations Division combines the communications, financial assistance, waste reduction, licensing and customer service programs previously discussed.

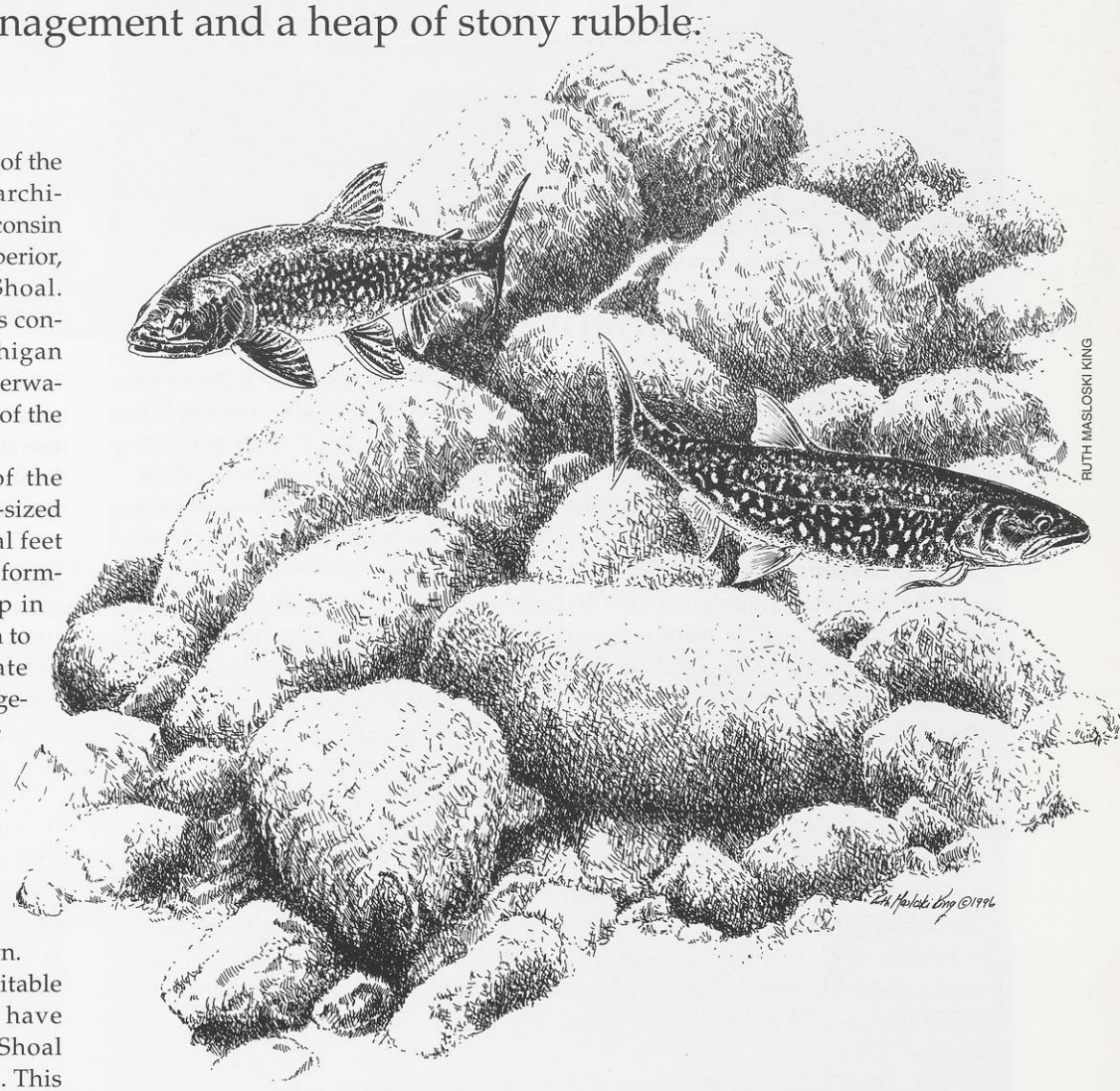
DNR field offices will have new names and will realign boundaries to follow natural ecological features. The former six "districts" will be realigned into five "regions." The Northern Region, for instance, covers northern Wisconsin's forest and lake belt. The Fox-Wolf river basin will be located in the new Northeast Region. All counties will still have regional contacts, and the large Northern Region will maintain offices in Spooner and Rhinelander.

How long will it take to make all these changes? The first customer service centers are being tested now in northeastern Wisconsin. Another 15 or so centers will open by the end of the calendar year and remaining centers would open by the end of 1999. □

Trout on the rocks

The Apostle Island lake trout population flounders no more, thanks to management and a heap of stony rubble.

Betsy Bartelt



On the eastern edge of the Apostle Islands archipelago, in the Wisconsin waters of Lake Superior, lies Gull Island Shoal. Covering 7,700 acres, the shoal is connected to the north end of Michigan Island and Gull Island by an underwater reef, essentially an extension of the islands' red sandstone.

Underwater photography of the shoal reveals pebbles, basketball-sized rocks and large boulders several feet across tumbled together in piles, forming shelves and steps that drop in eight- to 10-foot increments down to about 40 or 50 feet. It's a desolate scene, a gray seascape void of vegetation. Only in summer does the shoal take on color, when algae carpets the rocks. The soft green barely lasts the season; violent waves spawned by autumn gales wipe the algae away, cleaning the spawning reef even on boulders 40 feet down.

The shoal may appear inhospitable to human eyes, but lake trout have been spawning on Gull Island Shoal for as long as has been recorded. This was one of few locations where naturally-reproducing lake trout found refuge when the rest of Superior's lake trout population was devastated by the parasitic sea lamprey in the 1950s. Today the shoal is the center of activity for the restoration of the species, and biologists are optimistic about the future of Lake Superior's native predator and favored target for anglers.

Protected just in time

Back in the 1950s, when cars were sprouting fins on land, lake trout were faltering in the water. Once the dominant predator in Lake Superior, the lake trout was in serious trouble. Over-fishing and parasitism by the sea lamprey, a non-native eel-like species with a raspy sucker mouth, caused Superior's lake trout population to collapse. Although a small number of fish survived and continued to reproduce at Gull Island Shoal, annual population surveys conducted there showed a steady decline in spawning activity. In 1961, no females were captured during spawning assessments.

State and federal agencies working on Lake Superior started combining their resources to restore lake trout. A Sea Lamprey Control Program set up electrical barriers in tributary streams to capture and destroy sea lamprey before they could spawn. The U.S. Fish and Wildlife Service and DNR fisheries crews stocked lake trout and surveyed native populations. Beginning in 1962, and until 1970, commercial fishing was prohibited in Wisconsin waters of Lake Superior. Conservative fishing regulations were set, sea lamprey control and a massive lake trout stocking program were undertaken. The population of lake trout at Gull Island Shoal respond-

STEVE SCHRAM

The 50-year-old *Hack Noyes* is a floating lab where biologists survey lake trout.

The essential fisheries management tool

Aboard the research vessel *Hack Noyes*, Steve Schram, DNR Lake Superior fisheries biologist, and his crew had just completed a difficult morning lifting gill nets at Gull Island Shoal. Braving rough seas, the *Hack* was chugging back to Bayfield. As some of the crew washed down the interior of the vessel, removing fish slime, scales and eggs that were splattered over every surface, Schram was busy cutting otoliths, tiny ear bones, out of lake trout that did not survive the netting.

Schram worked quickly and with precision, removing the gills, cracking the spine open and locating two otoliths. Carefully removing the flecks of white with his tweezers, he transferred them to another crew member who placed them into a small envelope onto which was recorded corresponding fish data. The otoliths would be used later to age the fish.

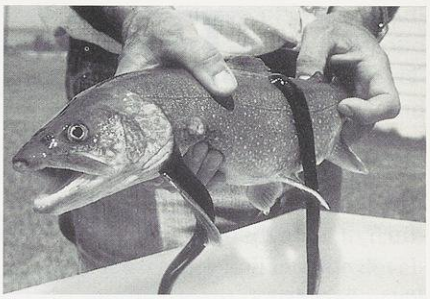
"The *Hack Noyes* is the backbone of the Lake Superior fisheries program," said Schram of the good old boat. Once a commercial fishing tug on Lake Michigan, the *Hack* will be 50 years old this year. The ship has seen a variety of duties, including ice breaking and rescue operations.

The 55-footer was built in 1946 by Burger Boat of Manitowoc, Wis. The state bought the boat in 1951 from a commercial fisherman for $17,000. It was moved to Bayfield in the mid 1950s, and went to work enforcing commercial fishing regulations, mainly assisting in locating illegal nets. There were many to be found during that era, with one bust of 25,000 feet of net worth $2,000.

The *Hack Noyes* became part of the Lake Superior fisheries program in 1970. New equipment was added and today the boat contains a bow thruster for fine maneuvering, a spacious working area, fish tanks, a desk for data recording and specialized navigation equipment.

Renowned for being highly seaworthy, the *Hack* is also known for "rocking and rolling" in rough water. The crew has plenty of stories about days when the *Hack* handled ten-foot waves or better. "Trying to work under these conditions takes some getting used to," said Schram, who has been on board when 18-footers crashed across the bow. Regardless of the weather, the crew must work every day during the assessment period, because leaving gill nets unattended means dead fish.

Named for Haskell P. Noyes, a former head of the Wisconsin Conservation Commission, the *Hack Noyes* will continue its service to the department. Biologists collecting Lake Superior's fish population statistics will continue to depend on this reliable vessel, maybe for another 50 years.



US FISH AND WILDLIFE SERVICE, MARQUETTE, MI

Sea lamprey sucked the lifeblood from the lake trout fishery.

ed immediately. By 1974 the population increased, but both sport and commercial fishing pressure increased, too.

A year later over-fishing had again weakened the lake trout population. It was clear: Without protection, lake trout would be in jeopardy again. To give the lake trout a chance to recover, the state established the Gull Island Refuge, prohibiting sport and commercial fishing year 'round.

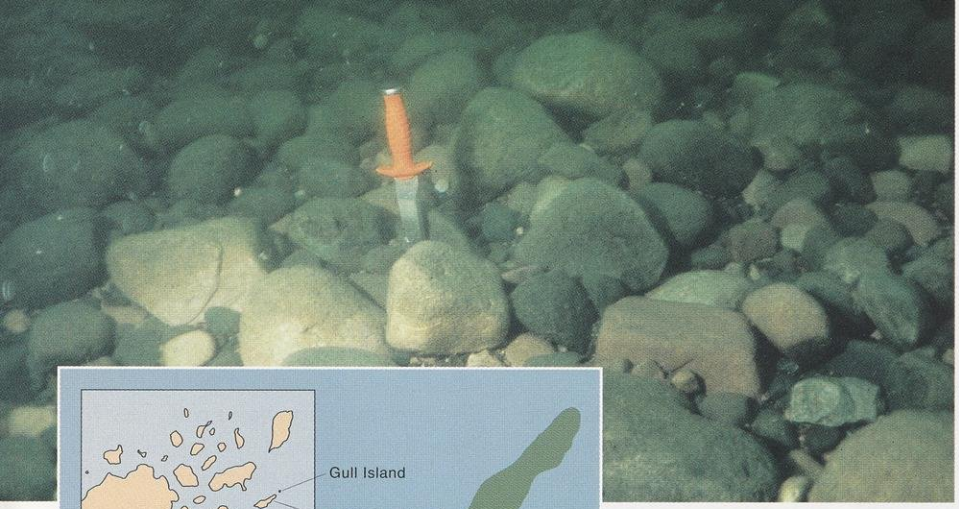
Though lake trout had been stocked from the fifties until recently, biologists concluded these stocked fish did little to rebuild fish populations. Stocked fish lack a natural homing instinct and do not return to the shoal to spawn. Stocked fish also don't survive as well as their wild counterparts.

The 7,700-acre rocky shoal has just the right conditions for lake trout. The trout spawn where the rocks are approximately one to three feet in diameter, packed and piled, with the largest rocks on top and smaller ones underneath.

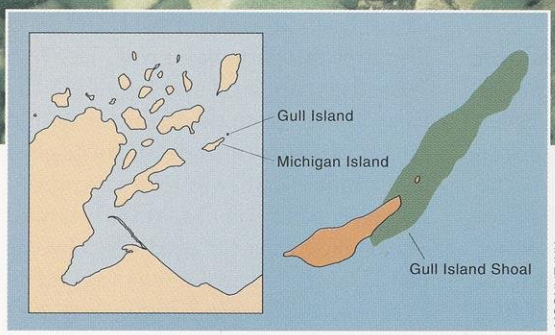
Lake trout eggs filter down in the cracks of the rock pile, out of reach from predators, and can safely develop from October through early June when they hatch. At that time, the tiny fingerlings have the protection of the rock pile and can swim to safety in the cracks when danger is present. Once they reach adulthood, these same trout will heed their homing instinct and return to spawn in safety at Gull Island Shoal.

A haven for lake trout and fisheries biologists

"Our studies at Gull Island Shoal provide the best lake trout data in Lake Superior and probably in the Great



UNIVERSITY OF WISCONSIN SEA GRANT PROGRAM



MOONLIT INK

Lakes," says Stephen Schram, DNR Lake Superior fisheries biologist in Bayfield. Lakers disappeared from lakes farther south. The other Lake Superior populations in more remote locations were not studied as intensively, Schram said. The U.S. Fish and Wildlife Service started keeping records here of lake trout reproductive success in the early 1950s. The State of Wisconsin took over trout-tracking duties in 1969.

During the spawning season, approximately 2,000 trout are captured and tagged at Gull Island Shoal each year by DNR staff. Gill nets are set and checked daily for two weeks. Every lake trout caught is measured and marked. A tiny plastic tag is attached near its dorsal fin. Each tag has a unique number that corresponds to data collected on that fish. More than 50,000 lake trout have been tagged during the past 25 years.

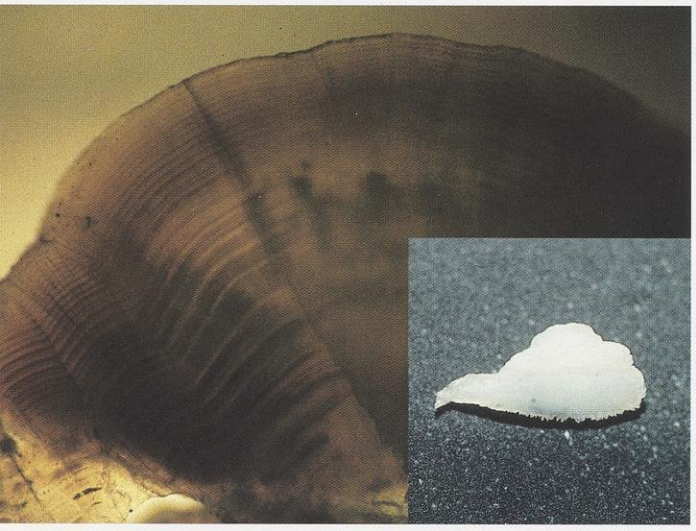
Netting fish that were tagged from previous assessments is not unusual. Recaptures and tag returns from anglers have helped biologists piece together movement patterns to determine the home range of the refuge's lake trout. "Many fish stay within the refuge or within the Apostle Islands after spawning," says Schram. "Some move eastward along the Keweenaw Peninsula and a few even migrate around the peninsula into Keweenaw Bay."

The odd jumble of shallow boulders at Gull Island Shoal protected breeding lake trout from predators. The shoal lies offshore of the Apostle Islands National Lakeshore jutting into Lake Superior in northernmost Wisconsin.
(below) Fisheries crews hustle in rough seas to assess the lake trout population and its health.

STEVE SCHRAM

Tagging also helped solve a puzzle concerning the age of some lake trout. Biologists had a clue that some recaptured fish were older than they appeared. The span of years the fish had actually been "at liberty" did not jibe with the age indicated by the traditional method of aging — counting rows of annual growth on fish scales.

A microscopic closeup of a otolith cross section shows the tree-like annual growth rings
(right) The tiny, whole otolith.

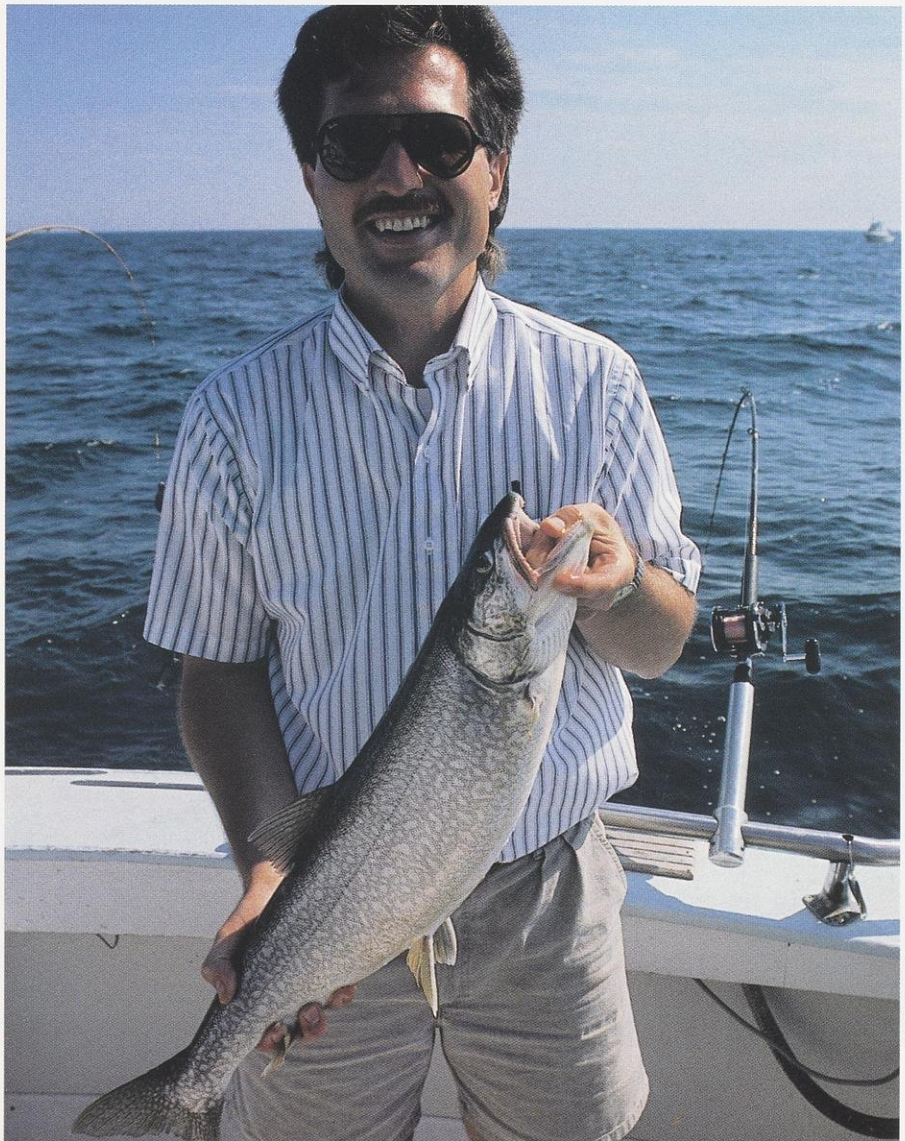


(BOTH PHOTOS) STEVE SCHRAM

Biologists began using a different procedure for aging in the mid 1980s using cross-sections of ear bones, called otoliths. The otolith is a calcified structure located in a fish's inner ear which shows annual growth zones much like tree-rings. Otoliths are removed from dead fish and examined under a microscope. Age data gathered with this method did jibe with recapture dates of lake trout. The tags on the fish had helped validate this more accurate method of aging.

Several years ago, two lake trout provided biologists with an example of just how old some of the Gull Island Shoal population can grow. The fish were first captured and tagged in the early 1970s. From the tag information and otolith examination, biologists determined that both fish were about 26 years old. The oldest Gull Island Shoal lake trout ever aged was 32 years old. The native male was tagged in 1974 while spawning at the shoal and recaptured in 1995.

Sport anglers who catch tagged lake trout can help biologists learn more about these sleek, native predators.



ROBERT QUEEN

Sport anglers have helped researchers learn more about lake trout populations by relaying tag information when they catch a lake trout. Location of catch, date, length of fish, tag number and color are sent to the DNR office in Bayfield, providing additional data to supplement what's collected during annual assessments. In return, the angler receives a letter from the biologists with the information gathered on the fish to date.

Anglers can help us by releasing large lake trout, Schram added, because the big fish are so valuable as spawners. Their genes can rebuild long-lived sturdy stock. "Catch it, take a picture of it and release it," he asks.

"You have to take the long view when you work to restore lake trout," Schram said. "These fish are slow-growing, late-maturing and they may be caught once they leave the refuge." There's plenty of reason to be hopeful now. More than 450 wild, female lake trout were tagged last year. Back in 1961, no females were recorded at the shoal. "We haven't reached a maximum amount of fish this shoal can produce, Schram said, but the lake trout population has rebounded nicely from dangerously low levels just a few decades ago." □

Betsy Bartelt writes about fisheries issues from the DNR office in Bayfield, Wis. She also works as a park ranger and is president of a local Audubon chapter.

Need a little re charge?

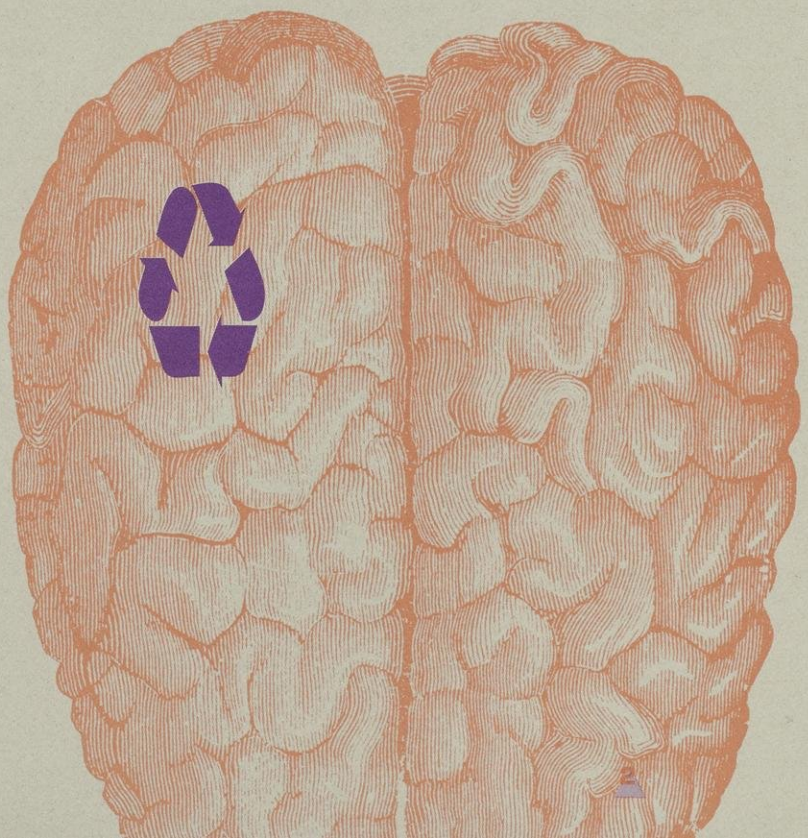
Test Your re-Flex

The quiz that challenges you to re new your commitment to a cleaner environment.

A brief review

For more than a decade you've been at it, day in, day out. Crushing cans and bundling newspapers, collecting motor oil and composting leaves. This reduce-reuse-recycling stuff is second nature to you now. In fact, it may be hard for you to recall the time when refuse stubbornly refused to be controlled. When trash multiplied without restraint.

How about reflecting for a moment on all you've learned over the years about the creation and the handling of waste? How about testing your RE-flexes? You might be surprised at how knowledgeable you've become about reducing waste, and reusing and recycling everything from plastic soda bottles to children's clothing. Why, you might even remember things you forgot.



Test Your RE-Flex is a 50-question, five-part quiz with sections on recycling history, terminology, habits, facts & figures, and methods of action. As you work through the quiz, don't dwell on any one question — remember, this is a test of your recycling reflex, so you should answer quickly!

Each correct answer is worth one (1) point unless otherwise noted. Some questions may have more than one correct answer.

You can reuse this quiz and share it with others by listing your answers on a separate sheet of paper — how about the back of an old envelope, just to keep in the spirit of things?

Take the quiz

Re-history

1. Which Wisconsin communities have had long-running recycling programs?
   a. Brown Deer, Fox Lake, Madison
   b. New Berlin, New Rome, New Paris, New Diggings
   c. Old Lebanon, Old Indian Point, Old Badger Mills

2. When did Wisconsin's Recycling Law (1989 Wisconsin Act 335) take effect?
   a. 1972
   b. 1990
   c. 1989

3. Where and when did curbside recycling first begin?
   a. Bloomer, Wis., 1934
   b. Baltimore, Md., 1874
   c. Anchorage, Ak., 1969

4a. Who could be considered the "father of American composting" for reintroducing the country to the benefits of compost at the turn of the century?
   a. Sir Uriah Heep
   b. George Washington Carver
   c. J.I. Rodale

4b. Who is the "mother of composting?"
   a. Mother Teresa
   b. "Moms" Mabley
   c. Mother Nature

5. Napoleon's son had a rattle made of
   a. sapphire-encrusted silver
   b. gold with ivory inlay
   c. recyclable aluminum

6. What was the first compacting garbage truck called?
   a. the "Lambeau"
   b. the "Packer"
   c. the "Lombardi"

7. True or False: If the Pilgrims had six-packs, we'd still have the plastic rings from them today.
   a. True
   b. False
   c. If the Pilgrims had six packs, they never would have left England.

Terminology

8. Seven types of plastic used to package consumer products are referred to by name, abbreviation and number. Give yourself one (1) point for matching each number with the correct name and abbreviation:

1 — **PVC** POLYVINYL CHLORIDE

2 — **PS** POLYSTYRENE

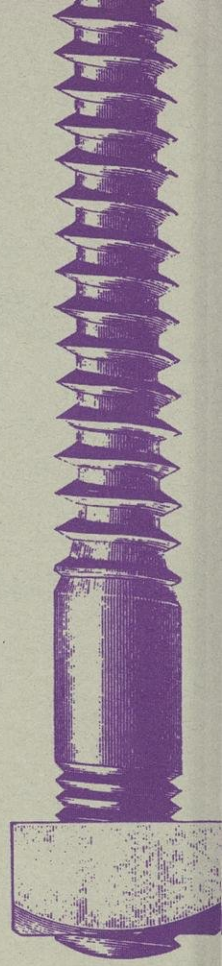
3 — **LDPE** LOW DENSITY POLYETHYLENE

4 — **PET** POLYETHYLENE TEREPHTHALATE

5 — **HDPE** HIGH DENSITY POLYETHYLENE

6 — OTHER

7 — **PP** POLYPROPYLENE



9. What does the term MSW stand for?

a. more standard wrapping
b. mixed solid waste
c. municipal solid waste

10. OK, smarty, what is MSW?

a. everything but the kitchen sink
b. everything including the kitchen sink
c. recyclable materials plus wastes collected from homes, businesses and institutions.

11. What is vermicomposting?

a. composting with vermin
b. composting with worms
c. composting without oxygen

12. Composting is

a. a natural process that converts plant materials to humus.
b. a good way to deal with yard waste.
c. a & b

13. Name the three R's of waste management:

a. reduce, reuse, recycle
b. return, recycle, repair
c. recycle, retread, renew

14. What is leachate?

a. liquid left in the bottom of soup cans and milk bottles.
b. liquid formed in landfills from water seepage and decomposing garbage.
c. spent grain from the distilling process.

15. A drop-off center is

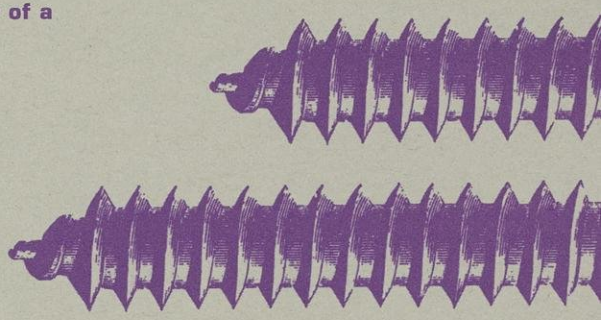
a. a place where you drop off recyclables.
b. an area unsafe for swimming.
c. a basketball pass.

16. Which example illustrates the practice of *precycling*?

a. You can buy milk and bottled water in many containers. You choose to purchase them in refillable or returnable jugs.

b. You need three lag bolts. You're in a hardware store where bolts are sold in plastic blister packages, three to a pack, and also loose in open bins. You choose three bolts from the open bin, pay for them, decline the offer of a bag and slip the bolts into your shirt pocket.

c. Both a & b are good examples of precycling.



17. Humus is

a. the long bone in the upper part of the arm.

b. taking excessive pride in one's garden.

c. decayed organic matter.

d. a delicious mix of chick peas, tahini, lemon and garlic.

Habits

Score yourself accordingly: three (3) points for "Of course!"; two (2) points for "Sometimes"; one (1) point for "Nah!"

Do you	OF COURSE!	SOMETIMES	NAH!
18. ...consider what happens to a product or package when you are finished with it?	3	2	1
19. ...repair an item, even if you could get a new one for nearly the same price?	3	2	1
20. ...ask yourself if you REALLY need something before you buy it?	3	2	1
21. ...write product manufacturers about packaging concerns or packaging improvements?	3	2	1
22. ...look for longer-lasting alternatives to disposable products?	3	2	1
23. ...buy in bulk whenever possible and practical to avoid excess packaging?	3	2	1
24. ...purchase products made from recycled materials?	3	2	1
25. ...use durable mugs or cups at the office instead of disposables, and pack your lunch in a reusable container?	3	2	1
26. ...read labels and choose nontoxic products to clean the house?	3	2	1
27. ...use a cloth bag when shopping, or reuse paper and plastic bags?	3	2	1
28. ...leave grass clippings on the lawn instead of bagging them?	3	2	1

1 23

By the numbers

29. How many recycled plastic milk jugs does it take to make one six-foot park bench?

a. 1,050
b. about 500
c. 825

30. Paper can be recycled...

a. as many times as necessary.
b. up to seven times, depending on the length of the fibers.
c. only three times.

31. An American family of four generates about _____ of waste per week.

a. 15 pounds
b. 70 pounds
c. 126 pounds

32. How much of that waste could be reduced, reused or recycled?

a. 15%
b. more than 50%
c. nearly all of it

33. How many recycled soda bottles does it take to make one polyester suit?

a. five for the jacket, three for the pants
b. too many — I prefer natural fibers.
c. 26 PET bottles

34. A typical householder needs _____ to handle recycling chores.

a. two hours every Saturday morning
b. 73 minutes per month
c. two days per month

35. True or False: One out of every six U.S. trucks is a garbage truck.

a. True
b. False
c. Sorry, I can't decide. I'm flipping a three-sided coin.

36. If properly made, the center of a compost heap will reach temperatures of _____ within four to five days.

a. 60–80° F
b. 140–160° F
c. hot enough to roast marshmallows

37. Over a lifetime, an American will throw away _____ times his or her adult weight in garbage.

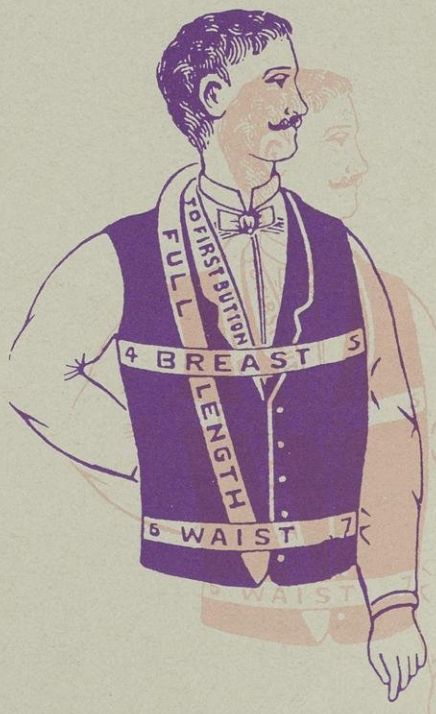
a. 20
b. I'm dieting, so it won't be that much.
c. more than 600

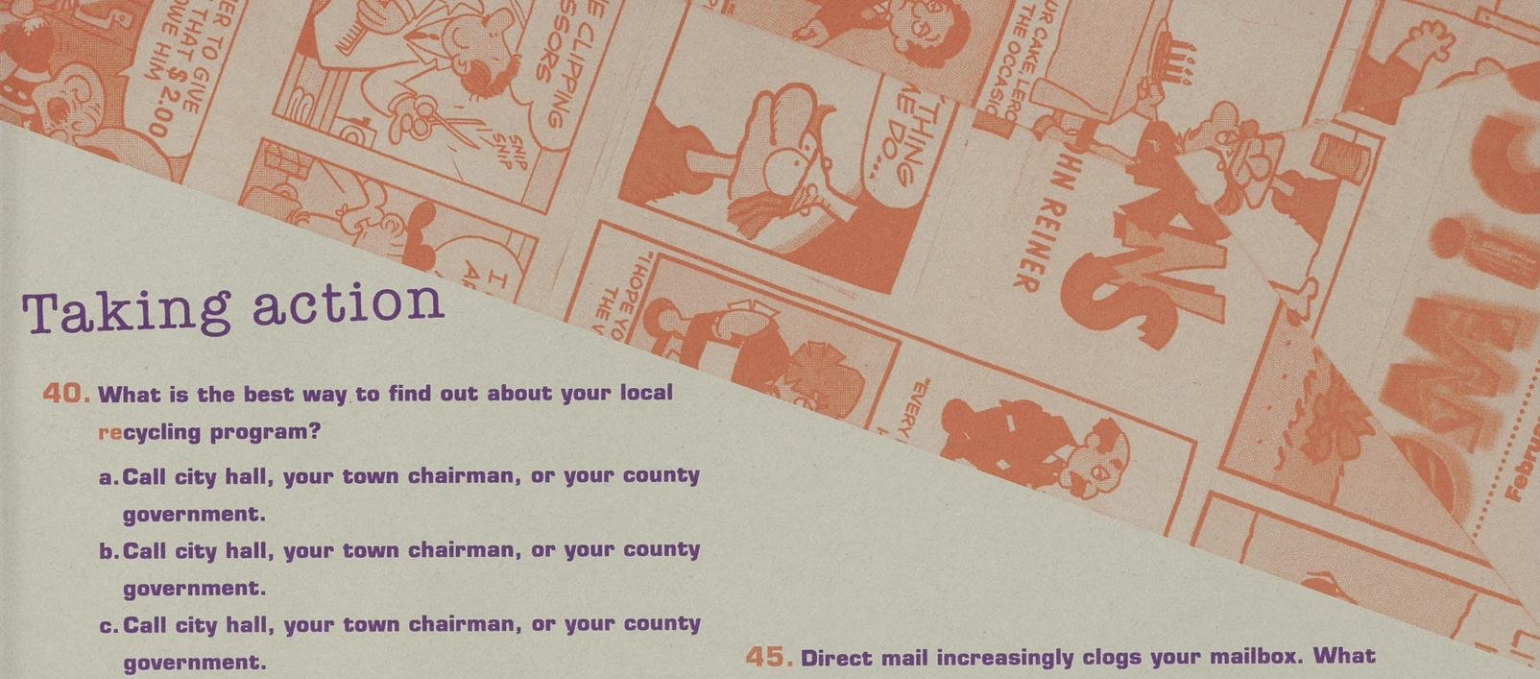
38. In 1995, what percentage of Wisconsin households participated in some form of recycling?

a. 76%
b. 68%
c. 97%

39. How many Wisconsin households are served by curbside recycling programs?

a. about three-fourths
b. exactly half
c. more than you might suspect





Taking action

40. What is the best way to find out about your local recycling program?

a. Call city hall, your town chairman, or your county government.

b. Call city hall, your town chairman, or your county government.

c. Call city hall, your town chairman, or your county government.

41. How can you make car tires last longer?

a. Slow down and stay off rough roads.

b. Keep them properly inflated and rotate them every 5,000 miles.

c. a & b

42. Can this magazine be reused after you have read it?

a. Sure. It makes a great fly swatter.

b. Yes! I give my back issues to schools, hospitals and day-care centers.

c. Not yet. I'm saving all my back issues so I can leave a complete set to my local public library. Please don't tell my spouse.

43. When your refrigerator has chilled its last quart of milk, you:

a. contact your local recycling coordinator to find out who can safely recycle the appliance.

b. stick a screwdriver into the compressor to release the CFCs (chlorofluorocarbons) into the atmosphere.

c. leave it to rust on the back porch as a commentary on our postmodern throwaway society.

44. What do you do when the grass in your small front yard needs to be cut?

a. Call Rent-A-Sheep.

b. Hop on your double-overhead cam eight-cylinder turbo-charged twin engine power mower with leather bucket seats, give the lawn a crew-cut and bag up every single blasted clipping in sight.

c. Burn a few calories by using a push mower, then leave the clippings on the lawn to enrich the soil and keep yard waste out of the landfill.

45. Direct mail increasingly clogs your mailbox. What should you do?

a. Write Mail Preference Service, Direct Marketing, P.O. Box 9008, Farmingdale, NY 11735 and ask to have your name removed from as many direct mail listings as possible.

b. Tell your mail carrier to cut out the monkey business.

c. Refuse to answer to "Occupant."

46. When your 12-year-old son has outgrown last year's parka, you:

a. hand it down to your disgruntled but cold 11-year-old son.

b. use the cloth to make a quilt.

c. wash it, then donate it to the Salvation Army or other charitable organization.

47. During the winter holidays, you cut back on waste by

a. reusing gift boxes, and by wrapping gifts in the Sunday comics or in wrapping paper you've saved from other holidays.

b. using one cinnamon stick in the mulled wine instead of three.

c. eating the popcorn-and-cranberry tree garland.

48. You're cleaning out the garage and find a stack of suspicious-looking old cans whose labels are marked with the skull-and-crossbones. What should you do?

a. Flush the contents down the toilet.

b. Pour the contents down a storm sewer.

c. Put the cans in a cool, dry place, then contact your local government and find out when the next "Clean Sweep" hazardous waste collection day is going to be held so the contents can be disposed of or managed properly.

Double bonus!

Give yourself 10 additional points if you answer both questions correctly; five points if you can answer only one of the two.

In the film *Casablanca*, several of the characters want to "recycle" the letters of transit.

49. Where did Rick (Humphrey Bogart) hide the letters?

50. Which character or characters eventually "reused" the letters to get out of Morocco?

The answers

1. a
2. b (The law gave communities until 1991, 1993 and 1995 to ban landfill disposal of specified materials.)
3. b
4a. c
4b. c (Bonus question. You don't really expect a point for that, do you?)
5. c
6. b
7. a — In the last few months the plastics industry has developed a ring that will degrade in sunlight, but if you know that much, you should be writing this quiz, not taking it.
8. No. 1 (PET);
   No. 2 (HDPE);
   No. 3 (PVC);
   No. 4 (LDPE);
   No. 5 (PP);
   No. 6 (PS);
   No. 7 (Other)
9. c
10. c
11. b
12. c
13. a
14. b
15. a
16. c *Precycling is* considering the waste consequences of goods and services — disposal, recycling and packaging — before making a purchase.
17. c

(For questions 18–28, fill in the points from your answers.)

18.
19.
20.
21.
22.
23.
24.
25.
26.
27.
28.
29. a
30. b
31. c (The average is 4.5 pounds per person per day.)
32. b
33. c
34. b
35. a
36. b
37. c
38. c
39. a
40. a, b or c
41. c
42. a, b or c
43. a (NEVER release CFCs from a compressor. Trained people can recover CFCs and prevent their escape to the atmosphere.)
44. c
45. a
46. a, b or c
47. a
48. c
49. In Sam's piano.
50. Victor and Ilsa Lazlo.

The moment of truth

So, how did you do? Add up your points to see how quick your RE-flexes are.

SCORE

86–76 Renaissance Man, Woman or Child! If everyone had RE-flexes like yours, what a wonderful world this would be.

75–60 Good grip on reality. Your RE-flexes are sharp.

59–40 Receptive to new ideas, but reluctant to reverse old habits. C'mon, you know you can do better.

39–21 Please re-fresh your memory...soon. Start by re-reading back issues of *Wisconsin Natural Resources* for recycling information.

20–0 In dire need of resuscitation! Contact your local recycling program for help immediately!

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PUBL IE 216 96

Written by Maureen Mecozzi

Design by Moonlit Ink

BILL MEYER ©MILWAUKEE JOURNAL SENTINEL

(above) Milwaukee residents line up at the Pryor Street artesian well to get their fill of water when tap water supplies were contaminated with cryptosporidium.
(below) What lab tests look for: cryptosporidium fluoresces as a bright green dot; giardia as an oval-shaped rod.

Battling waterborne bugs

Protect watersheds, and the armies of bacteria and other microscopic creatures will have a harder time advancing on our drinking water supplies.

Robert Manwell

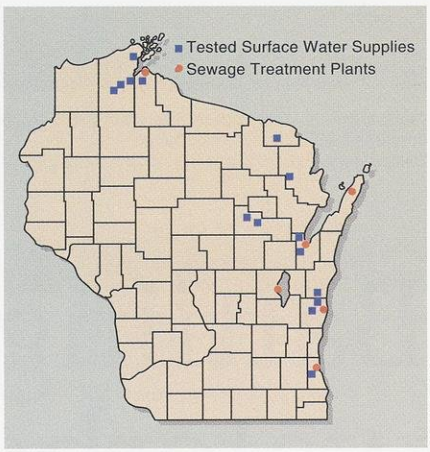
Providing abundant fresh water is one of the most basic services we expect from our municipal governments. More than half of Wisconsin's five million-plus citizens rely on local governments to collect, process, test and distribute potable water to their homes. An even greater percentage of the public drinks water that has been treated and distributed by a municipal treatment plant at some time during the day at the workplace, in a restaurant, at school or in other public buildings.

While chemical contaminants in water pose a risk over time, biological contaminants present the most urgent hazard faced by water utilities. Bacteria, viruses and parasites are increasingly hard to trap and treat, and they are the cause of nasty flu-like symptoms like diarrhea, nausea, cramps and fever associated with "bad water."

The job of assuring the safety of municipal water supplies is becoming more difficult and expensive. It was the tiny yet potent protozoan *Cryptosporidium parvum* that sickened 403,000 Milwaukeeans in the spring of 1993. Only four to eight microns in size, so small that 2,500 to 5,000 of them could line up head-to-tail in the space of an inch, the "crypto" bug infested the city's water supply with devastating results. One hundred people eventually died during the crypto epidemic, prompting a full review of how water treatment facilities operate and where cryptosporidium is likely to be found.

Cryptosporidium is not a recent discovery, yet no federal or state standard exists for crypto in drinking water at this time. The same is true for another pesky protozoan with the jaw-breaking name of *Giardia lamblia* — a similar organism familiar to many outdoors enthusiasts. Both crypto and

(BOTH PHOTOS) STATE LABORATORY OF HYGIENE



MOONLIT INK

Cryptosporidium and giardia counts in water supplies are difficult to quantify and analyze. Even if cysts are found, lab analysis can't determine if specimens are alive and could cause infections or are dead. Many public water supplies and sewage treatment plants were sampled to determine how widespread crypto and giardia might be in the environment.

giardia are common in Wisconsin, the United States and throughout the world.

They're there, but where?

Following the Milwaukee outbreak of cryptosporidosis, the illness caused by cryptosporidium, the Wisconsin Legislature allocated $280,000 to fund a two-year study of crypto. The project was a joint effort between the Department of Natural Resources and the State Laboratory of Hygiene (SLOH). Over 500 water samples were collected from streams, lakes, wells and drinking water treatment plants in the southeast, northeast and northwest regions of Wisconsin. It was and is the largest study of its kind ever done.

Good news and bad news surfaced from the research. On the bad side, every type of drinking water source tested had either cryptosporidium, giardia, or both, present in at least some of the samples collected. Also, crypto was found in about four percent of the finished tap water samples tested. The good news is that compared to studies from other states, both parasites were found less frequently and in smaller numbers.

Private wells were tested, too. Although generally considered safe because soil and rock above the aquifer filters water, wells that come into contact with rivers or flood water can be contaminated. In the Wisconsin study, crypto was found in one of the six wells tested in Door County, where the aquifer supplying area wells flows in the cracked-and-creviced dolomite. This bedrock covered with thin soils easily channels surface water contamination into groundwater.

The findings didn't surprise researchers. "These organisms have always existed in the environment and will continue to do so," says Joe Ball, a DNR water resource specialist and one of the report's authors. "Our study data suggests that no more than normal concentrations exist in Wisconsin's surface waters under average conditions."

Capturing these diminutive pests is not an easy task. Large amounts of water (more than 100 liters) must be pumped through an extremely fine filter. The filter is then scraped and the resulting material examined under a microscope. Because the giardia and crypto organisms are so small and are diluted in so much water, even the best labs isolate and identify giardia or crypto about 40 percent of the time. To further complicate matters, the test can't tell if the specimens are alive and could cause an infection, or are dead and of no concern.

Nature has provided both of these protozoans with the ability to survive in two very different environments. The infectious form of both crypto and giardia is encased in a hard-shelled capsule called a cyst in the case of giardia, and an oocyst for crypto. These capsules survive in the outdoor environment for up to a year. Some of the highest stream concentrations are found during winter under ice.

Once ingested into the warm, dark gut of a new host, stomach acid dissolves the shell, releasing the organisms which attach to the lining of the small intestine and interfere with the body's ability to absorb nutrients and water. The life cycle is completed when the crypto and giardia reproduce in the gut and form new cysts or oocysts which are passed from the body in feces.

All creatures great and small carry crypto and giardia

Humans aren't the only creatures favored by this pair of prodigious parasites. Scientists are able to identify several species of cryptosporidium and giardia, and each one seems to prefer a different host. Wildlife is a common source of the giardia found in surface waters, according to Dr. Rebecca Cole, wildlife parasitologist for the National Wildlife Health Center.

"Birds and reptiles generally do not share their form of giardia with humans, but mammals have been found to carry a form that can infect humans," Cole says.

Crypto is common in dairy herds. Common manure spreading practices can wash crypto into streams and lakes.

"It's a difficult problem," says Dr. Sheila McGuirk, professor of veterinary medicine at UW-Madison. "There isn't any effective antibiotic for treating dairy herds, and adults can carry the parasite without exhibiting any symptoms. Calves pick up the infection from their mothers and show symptoms for a while, especially diarrhea, but eventually their symptoms disappear too." McGuirk says an animal vaccine shows some promise in providing immunity to the herds; if successful, it would reduce the number of oocysts shed by calves.

Although the joint DNR-State Laboratory of Hygiene study was unable to pinpoint a source of the crypto that sickened Milwaukee, unusually high spring runoff conditions in agricultural lands that are a part of the watershed are thought to be at least one possible source of the 1993 outbreak.

Fighting what we can't see

Given the abundance and range of crypto and giardia, it's unlikely they will ever be eradicated from the environment. The DNR/SLOH report concludes that the best way to control the spread of these disease-causing organisms is a combination of watershed management and efficient operation of municipal utilities that draw drinking water from the Great Lakes.

Since 1978, the state's Priority Watershed Program has offered grants to adopt "best management practices" (BMPs) on private lands. BMPs can be as economical as planting grassy strips to slow runoff, as simple as changing the timing of fertilizer applications or as involved as building engineered structures like water diversions and sediment basins.

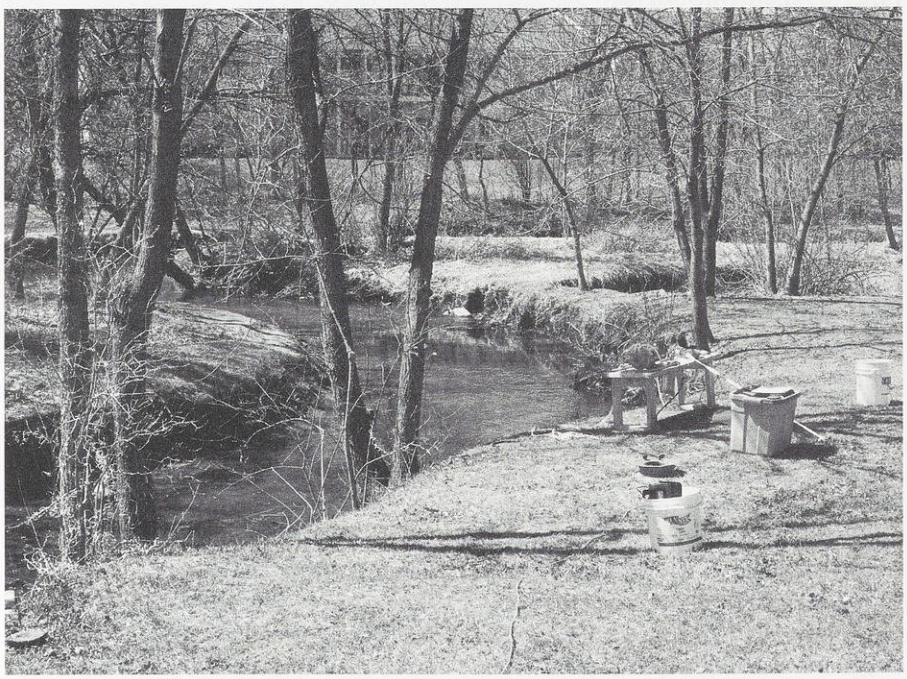
Following the 1993 Milwaukee crypto incident the Department of Natural Resources issued new operating guidelines to the public utilities and companies who treat and provide drinking water. By October 1996, municipalities must have a certified operator on duty at all times. Some communities need to install state-of-the-art monitoring instruments and upgrade aging treatment equipment.

Efficient water treatment is especially critical during the spring, when melting snow and spring rain is unable to soak into frozen fields, greatly increasing the volume of runoff. Recent studies show that turbid waters carry much higher concentrations of organisms that can tax the treatment plant's abilities to remove enough of the microscopic disease-causing bugs.

Guidelines designed to eliminate giardia from tap water are not effective against crypto. Scientists are uncertain which combination of practices will remove cryptosporidium or render it harmless in drinking water. As a start toward developing cost-effective treatments for cryptosporidium, the Environmental Protection Agency will require drinking water treatment plants to begin sampling and reporting incidences of crypto in their systems. This information will aid EPA in prescribing the most economical treatment for crypto at a future date.

Treatment plant improvements, state-of-the-art treatment technology and watershed managements come with a price, however. Milwaukee is planning a switch from chlorination to ozone treatment — a newer and more effective treatment technology — at a

Runoff reaching streams and rivers in the country and near cities was tested as the search for crypto and giardia sources continued.



DNR PHOTO

cost of $54.7 million. Additional measures, including more frequent sampling, replacing filters at each of Milwaukee's treatment plants and extending the Howard Avenue treatment plant intake pipe another 4,000 feet out into Lake Michigan, will bring the total price tag to $87 million.

Actions to maintain quality drinking water supplies haven't been limited to improvements in land management and treatment operations. Researchers aim to set public health standards for cryptosporidium and giardia. The challenges include the fact that it is difficult to collect and quantify these microbes in water, and researchers have not quantified what doses will cause disease.

Wisconsin Senator Herb Kohl successfully amended the Safe Drinking Water reauthorization bill to address the problem. It would fund research to investigate new treatment technologies and develop practical methods for detecting microbial contaminants including giardia, cryptosporidium and viruses, for finding "reliable and efficient methods to determine when cryptosporidium may cause disease.

The disease outbreak in Milwaukee has spurred tremendous interest and business opportunities to develop new methods of detecting crypto quickly and stemming its harmful effects. The National Farm Medicine Center in Marshfield is refining a method of centrifuging water to concentrate disease-causing parasites. Early results show the technique captures 82 to nearly 100 percent of organisms in water samples, compared to three–40 percent recovery by other techniques. The tests only take hours compared to current filtering techniques that require two days.

(BOTH PHOTOS) ROBERT QUEEN

(top) Campers can boil water, use chemical disinfectants or use mechanical filters to treat drinking water for biological contaminants. Public drinking water supplies at parks, restaurants and institutions also need to be tested.

Outdoors, don't drink the water

Giardiasis — the illness caused by the giardia organism — is often called "backpacker's disease" or "beaver fever" because campers, paddlers, hunters and anglers are infected after drinking water directly from pristine-looking lakes and streams. All 18 streams tested during the two-year study tested positive at least once for giardia — even several of Wisconsin's Outstanding Resource Waters, considered our least polluted streams and lakes. With crypto and giardia so widespread, how can you dodge the infectious cysts while swimming, water skiing or fishing?

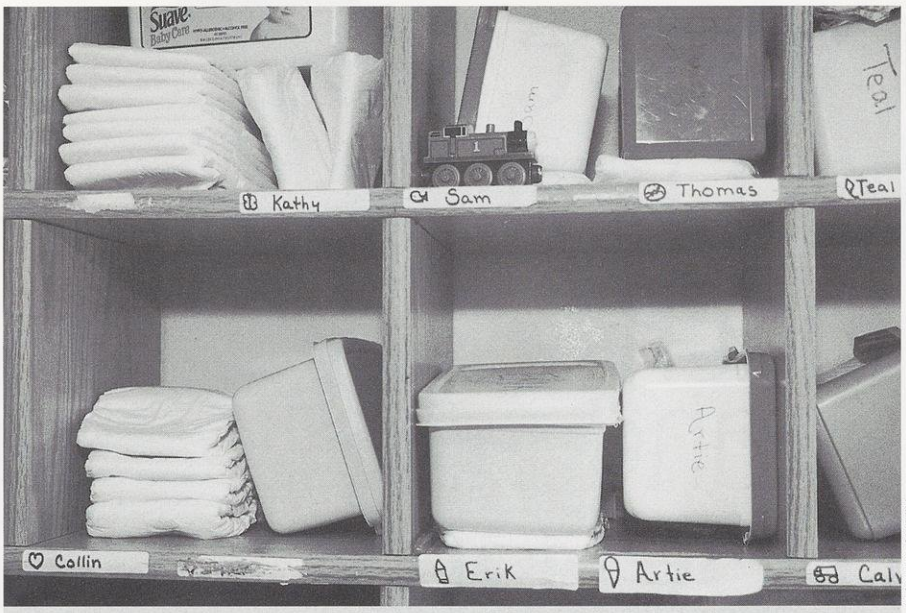
It's wise to consider all surface water contaminated no matter how clean and clear it looks, and to resist the temptation to drink without taking adequate precautions first. Take extra care to avoid ingesting the water around beaches, lakes and streams, especially during periods of heavy precipitation or runoff, when cysts or oocysts are most likely to be present.

State and national parks and forests provide safe drinking water at specified locations in campgrounds, and at many recreational sites and buildings. In the interests of health, these water supplies are subject to the same testing requirements as other public water supplies. But backcountry travel is another matter. Preparedness and caution offer the only line of defense against waterborne disease.

There are three basic strategies for treating water in the outdoors.

Boiling is tried and true but takes time and fuel, and leaves the water tasting flat. Also, while boiling water for one minute is recommended at sea level, boiling times increase to three-four minutes at high altitudes.

Chemicals (iodine tablets or crystals are most common) take from 20 minutes to an hour to work properly, depending on water temperature, clarity and acidity. It's difficult to judge these factors, so the safe route is to



ROBERT QUEEN

Not only in water

Drinking water supplies represent the greatest potential for large-scale outbreaks of crypto and giardia, but there are other ways these parasites can be passed. Giardiasis is a common ailment of children in day-care centers. Statistics from the Department of Health show that children under the age of five are three times more likely to contract giardiasis than older children or adults. With a large concentration of diaper-age children present, child care providers must maintain strict hygiene regimens to break the oral-fecal infection cycle. Although scientists are not sure how many giardia cysts it takes to infect a human, it is known that a soiled diaper can contain millions.

wait the maximum recommended time, every time. Iodine leaves a distinctly medicinal taste and can be harmful to fetuses and people with thyroid problems.

Small water filters, ranging in price from $40 to $250 are convenient, fast and reliable. Most can process about a quart of water per minute and can filter 100 to 5,000 gallons of safe drinking water before the filter must be replaced. Some have prefilters to strain out the algae and larger suspended particles before the water reaches the really fine-pore filter. Most have replaceable filters and some permit cleaning of the filter.

No "cure" for crypto

Cryptosporidium is not a new organism, but it is newly understood as a health threat. In otherwise healthy individuals cryptosporidiosis is a self-limiting illness, meaning that the body's immune system will eventually defeat the infection. While there is no effective medical treatment available for crypto, there is evidence that healthy people develop an immunity to crypto after an initial exposure. McGuirk notes that people from farming backgrounds seem to be less susceptible to repeat infections compared to urban dwellers.

For those with weakened immune systems, a cryptosporidium infection can be deadly. Organ transplant recipients, people with AIDS, and people undergoing chemotherapy are especially vulnerable to cryptosporidosis. Others facing increased risks of infection are child care workers and anyone who comes in contact with feces at home, on the job or on the farm.

The situation is somewhat brighter for giardia. From 1990–1994, Wisconsin averaged 1,614 giardia cases per year, but giardiasis is treatable with several easily available drugs once an accurate diagnosis is made. Making that diagnosis usually involves several trips to the doctor's office with stool samples since the telltale cysts are not always present in every stool.

Protecting our water by protecting our watersheds

The Natural Resources Defense Council attributed at least 116 outbreaks of disease in the United States to drinking water between 1986 and 1994. The group also reports that more than 25,000 water systems serving 92 million Americans did not meet Safe Drinking Water standards in 1993–94.

Statistics like these should be a call to action. Although a water utility's jurisdiction generally ends at municipal borders, it can help protect the water supply by maintaining contact with regional planning commissions, the Department of Natural Resources and upstream industries and municipalities. Under DNR's new structure, basin management teams — DNR resource managers and representatives from agriculture, industry and municipalities within a water basin — will plan and allocate resources for watershed management.

Protecting watersheds as much as possible from human and animal wastes provides an important barrier between humans and cryptosporidium and giardia. At the same time, we must realize that both organisms are prevalent in the environment and may also be found in high-quality filtered water. For municipalities, installing more effective treatment alternatives, such as ozone treatment, and operating treatment systems at peak efficiency at all times, can backstop watershed management practices. □

Robert Manwell writes about environmental issues for DNR's Bureau of Information and Education in Madison, Wis.

Where painted ladies lunch and emperors dine

Plant hosts offer sustenance to Wisconsin's hungry caterpillars and can make the difference between the survival or decline of many butterfly species.

Anita Carpenter

Walk in a summer meadow ablaze with flowers and monarch butterflies will float all around you. Stroll along a sun-dappled woodland trail and mourning cloaks will flit about your face. Slosh through a wet meadow and silver-bordered fritillaries will defend their territories from your intrusion. High-step in a bog and bog coppers will scatter from your approach. Tend your garden and cabbage whites will watch you work.

Butterflies are everywhere. Some, like the monarch, are common. You'll see them flying lazily above meadows, drifting through towns, sailing over highways. Other butterflies, like the swamp metalmark, are restricted to very specific habitats. It's unlikely you would get a glimpse of one unless you made a special effort to seek out their haunts.

What determines where butterflies are likely to be found? To find the answer, look at another stage in the butterfly's life cycle. Butterflies progress through four stages: from egg, to larva or caterpillar, to pupa and finally to free-flying adult. The female adult butterfly is choosy. She only deposits eggs on or near plants upon which the larvae will feed. These plants, called larval host plants, are specific for each butterfly species. If the plant is common, like milkweed, a host plant for the monarch, the butterfly species is likely to be common. If the host plant is uncommon, rare or restricted to a specific habitat, so is the butterfly.

Planting the host plant doesn't guarantee the butterfly will come, but without host plants, there can be no butterflies. That's why, when a butterfly is listed as a threatened or endangered species, its larval host plant is also protected.

The hosts with the most

Which host plants satisfy the needs of the 130 butterfly species regularly drifting, darting, fluttering and floating over Wisconsin each year? You might be surprised at the diversity butterflies choose to use. The menu includes deciduous and evergreen trees, shrubs, flowers and "weeds."

Most Wisconsin tree species and many shrubs host butterflies. Black and pin cherry leaves are the favorite food of

A painted lady feeds on a coneflower. DONNA KRISCHAN

the larvae of the easily-recognized eastern tiger swallowtail *(Papilio glaucus)*, a five-inch large yellow butterfly with black stripes. Its elusive two-inch green caterpillar with two orange eye spots and a yellow band feeds primarily at night, high in the tree tops. It hides during the day in rolled-up leaf shelters. Larvae of the red-spotted purple *(Limenitis arthemis astyanax)*, a four-inch black butterfly with iridescent blue scaling on the upper hind wings and red spots on its underwings, prefers cherry, as does the coral hairstreak *(Satyrium titus)*, a quarter-sized butterfly. The larvae of the striped hairstreak *(Satyrium liparops)* dine on cherry and wild plum leaves.

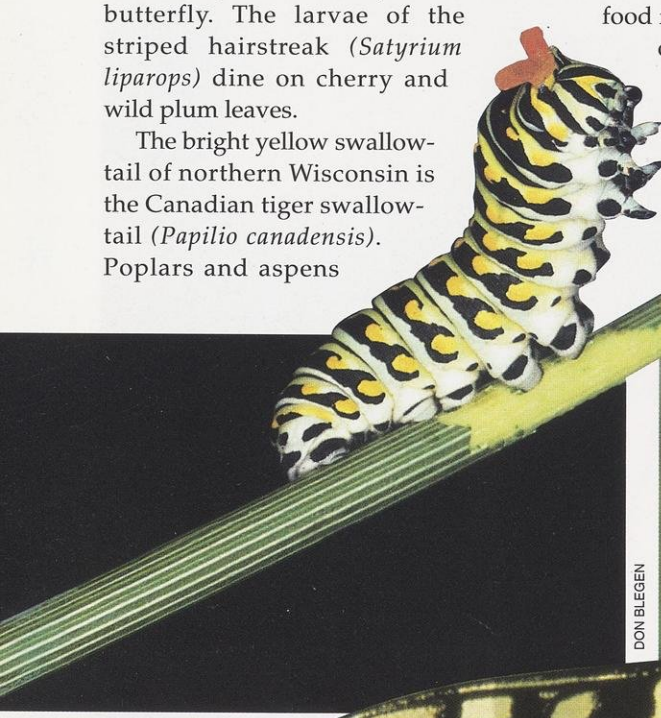
The bright yellow swallowtail of northern Wisconsin is the Canadian tiger swallowtail *(Papilio canadensis)*. Poplars and aspens lose a few of their leaves to these hungry larvae as well as to caterpillars of red-spotted purples and white admirals *(Limenitis arthemis arthemis)*. Larvae of the dreamy duskywing *(Erynnis icelus)*, an easily overlooked gray-brown butterfly, also eat aspen and poplar leaves.

Oak trees host munching caterpillars of two of our less conspicuous butterflies. The scrubby red oaks of central Wisconsin provide food for the larvae of Edward's *(Satyrium edwardsii)*, and banded *(Satyrium calanus)* hairstreaks. The adults fly mostly in July. Eggs are laid on oak twigs in summer and hatch the following spring.

Several butterfly species prefer willows. The shrubby willows of wet

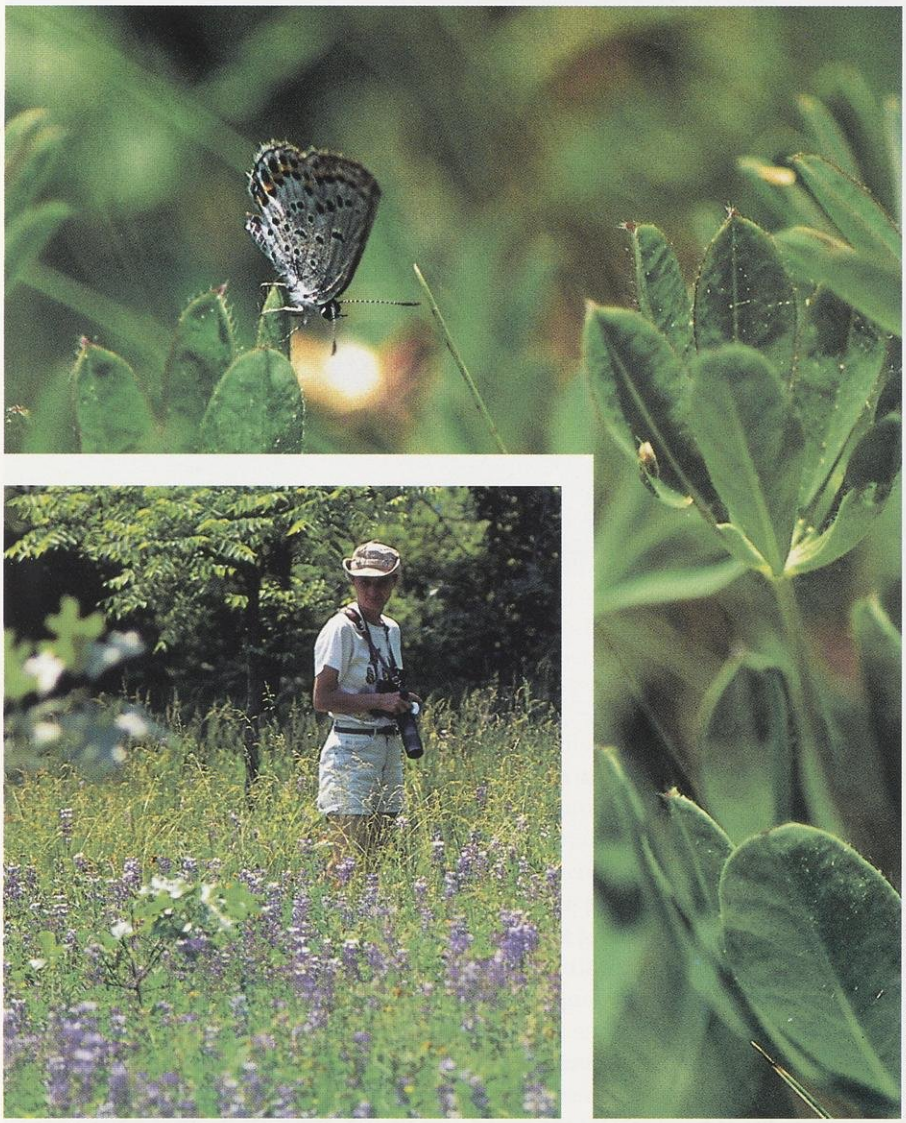
(below) Mourning cloak larvae on willow.
(left) Black swallowtail caterpillar feeding.
(bottom) Swallowtail species each favor distinct leaves and shrubs.

ANITA CARPENTER



DON BLEGEN

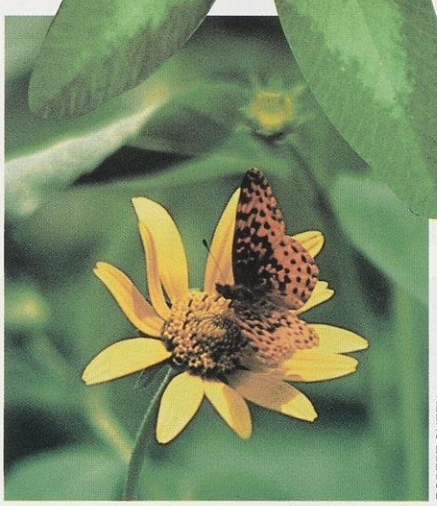
BERNARD LYNCH



(BOTH PHOTOS) ROBERT QUEEN

(top) The endangered Karner blue butterfly needs lupine for food, shelter and nursery.
(bottom) The author searches a field of lupine for the elusive, tiny butterfly.

DON BLEGEN



ROBERT QUEEN

(top) A least skipper feeding on red clover.
(bottom) A fritilary finds its flower.

meadows are chosen by Acadian hairstreaks *(Satyrium acadica)*. The mourning cloak *(Nymphalis antiopa)*, a common four-inch beauty with chocolate brown wings edged with a creamy band, is not as fussy. It prefers willow, but larvae will feed on American elm, paper birch, aspen and hackberry.

The viceroy *(Limenitis archippus)*, the orange mimic of the monarch, lays her eggs on the leaf tips of willows.

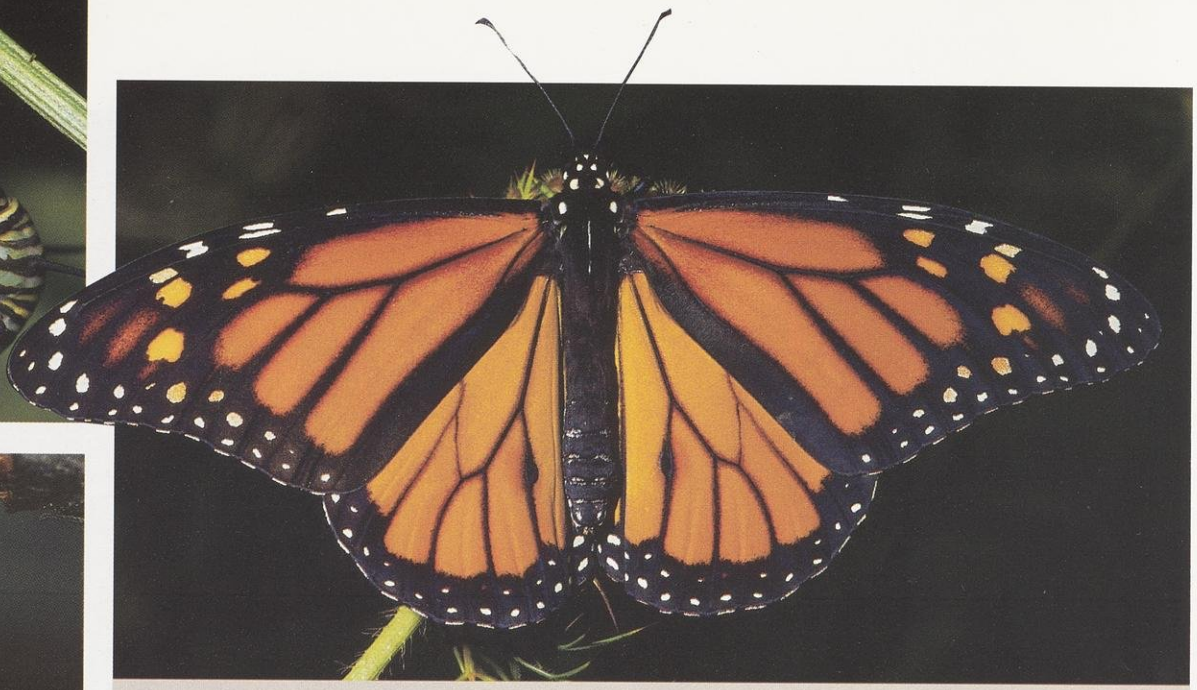
Hackberry is a southern tree whose range extends north into southern Wisconsin and along the Mississippi River valley. Hackberry emperors *(Asterocampa celtis)* dine on — you guessed it — hackberry leaves. Eggs are laid on the underside of leaves. Half-grown larvae overwinter attached to the leaves, which naturally fall to earth. In spring the young caterpillars must climb the tree before munching on the new year's leaf growth. If you'd like to help the hackberry emperors that visit your yard, don't rake up fallen leaves in autumn. The tawny emperor *(Asterocampa clyton)*, and the American snout *(Libytheana carinenta)*, a stray visitor to Wisconsin, also use hackberry as a host plant.

Black locust is the sole host plant for Wisconsin's largest skipper, the silver-spotted skipper *(Epargyreus clarus)*. After the female locates a suitable black locust, she lays each of her eggs on a nearby plant. After hatching, the young, hungry larva feeds on black locust leaves at night and hides in a leaf shelter during the day.

A stand of prickly ash can be a nightmare to walk through but as you struggle, remember that this plant hosts Wisconsin's largest butterfly, the giant swallowtail *(Papilio cresphontes)*. This impressive six-inch butterfly has black wings with a broad horizontal yellow stripe and a row of yellow spots along the trailing edges. The mature 2½-inch brown-and-white larvae resemble bird droppings, to deceive and discourage hungry predators. As with most caterpillars, swallowtail larvae feed at night and are not easily found.

Evergreens also host butterfly larvae. The eastern pine elfin *(Callophrys niphon)*, one of Wisconsin's smallest

SEQUENCE PHOTOS BY GREG VANDELEEST



A monarch prepares to pupate, changes in the chrysalis, starts to emerge and becomes an adult butterfly. *(bottom)* They feed on common milkweed.

Milk-fed monarchs

While the monarch butterfly is best known for its spectacular migration to wintering grounds along the Gulf Coast and Northern Mexico, the summer show in Wisconsin is more intimate. Poke around a common milkweed and you'll likely find a voracious caterpillar munching away on the thick leaves. This food source improves the monarch's chances of survival long after the caterpillar finishes feeding. Milkweed contains toxic substances that are incorporated into the monarch's body over time, making it distasteful to predators.

The caterpillar itself is a virtual eating machine, shedding its skin up to six times as it grows. After several weeks of almost continual feeding, it attaches to a plant stem or leaf in the characteristic "J" shape and begins to pupate, creating the familiar light-green, gold-spotted chrysalis.

Inside the chrysalis, the caterpillar continues its journey to adulthood. Since it hatched, the caterpillar has contained growth centers called "imaginal buds." Hormones secreted by glands close to the caterpillar's head inhibit the buds' growth. Shutting off this hormone causes the caterpillar to enter the pupal phase. Now, the imaginal buds start to grow and develop into adult organs and structures. At the same time, the organs of the caterpillar gradually dissolve into a liquid substance that feeds the developing adult. All of this takes about two weeks, depending on the temperature.

It's easy to tell when the adult monarch is getting ready to emerge from the chrysalis: the case becomes transparent and the butterfly can be seen inside. A short time later, the pupal skin suddenly splits open near the head and the adult butterfly emerges. Its wings are in no way ready for flight, as they are still crumpled and moist from being wrapped inside the chrysalis. The monarch moves to a sheltered spot where it can hang upside down, to dry its wings and swallow air. This pumps fluid into the veins of the wings and causes them to expand fully.

After several hours the wings will harden, and the monarch can fly away. Depending on the time of year, the adult will either feed on nectar for a short time and then lay eggs (if female), or it will begin the arduous journey to the wintering grounds hundreds of miles away.

—Greg Vande Leest

DONNA KRISCHAN

A home for butterflies

Birds and bats have had them for years. Now butterflies can get in on the backyard real estate boom when you mount a butterfly house in your yard, field or garden.

The carpentry skills necessary to build a butterfly house are no more complex than those needed to construct your average bird bungalow. The narrow wooden box, about two feet in length but only three-and-a-half inches wide, has a pitched roof and several long, ⅛-inch slits cut into the front panel. A two-foot copper pipe is driven 10 inches into the ground, and the butterfly box is set on the pipe, raising the bottom of the box about eight inches above ground.

Place your butterfly house near nectar sources and larval host plants. Insert a few long twigs for roosts, and wait for the colorful tenants to arrive. It's likely you'll have a houseful in no time — butterfly habitat is decreasing and butterflies will be looking for shelter.

If your handyguy/gal skills end once you've opened a pickle jar, the Beaver Dam Senior Citizen Center sells all-cedar butterfly houses for $12.40 inside Wisconsin (price includes shipping, handling and state sales tax), $14.00 outside Wisconsin. Write Dan Kopff, Beaver Dam Senior Citizen Center, 114 E. Third Street, Beaver Dam, WI 53916. Or call (414) 887-4639.

butterflies, lays her eggs on developing needle clusters of jack, red and white pines. The larvae feed on young needles. Little is known about the life history of bog elfins *(Callophrys lanoraieensis)*, a tiny inhabitant of black spruce-tamarack-sphagnum bogs of northern Wisconsin, except that black spruce is its host plant. The olive hairstreak *(Callophrys gryneus gryneus)*, Wisconsin's only iridescent green butterfly, feeds exclusively on red cedar or juniper. Although red cedar is common, the little butterfly is not.

Finding favor with flowers

Many butterflies select flowers for host plants. There's a cozy relationship between milkweed and monarch butterflies *(Danaus plexippus)*.

A large green caterpillar with black stripes and yellow spots frequently appears in gardens on dill, parsley and carrot. Have you ever wondered what this caterpillar becomes? Your yard has been blessed with a visit by a wandering black swallowtail *(Papilio polyxenes)*, a four-inch black beauty with a yellow band along its wings. Make room for a few extra plants and let the caterpillar feed and live.

Another garden visitor is the cabbage white *(Pieris rapae)*, an exotic or nonnative species. The slender green caterpillars with the lateral yellow stripe bedevil gardeners by munching on cabbage and broccoli.

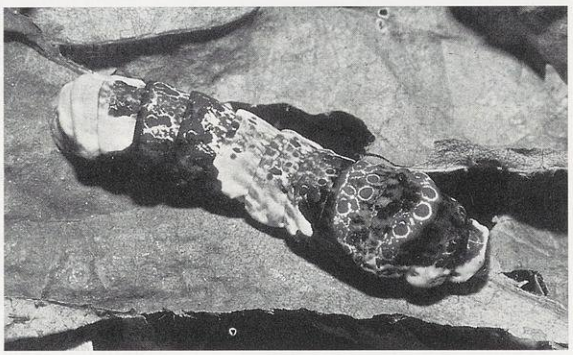
Two native white butterflies found in sandy habitats, the Olympia marble *(Euchloe olympia)*, and mustard white *(Pieris napi)*, nectar on the tiny, white blossoms of rock cress, a diminutive six-inch plant. Later the butterflies lay their yellow eggs singly on rock cress leaves, which the larvae consume.

The silvery blue butterfly *(Glaucopsyche lygdamus)* lays its eggs singly in the developing blossoms of wild pea. After the eggs hatch, the one-half inch, slug-shaped larvae feed on the lavender flowers. Often the larvae are tended by ants that drink the sugary dew the larvae secrete. In return, the ants probably provide some protection for the caterpillars from hungry predators and parasitic wasps.

Wild lupine, with its beautiful spikes of blue flowers, hosts the federally endangered Karner blue butterfly *(Lycaeides melissa samuelis)*. Females lay eggs on lupine leaves and blossoms, which become food for the slug-shaped larvae. Two rarer butterflies, the Persius duskywing *(Erynnis persius)*, and frosted elfin *(Callophrys irus)*, also depend solely on lupine.

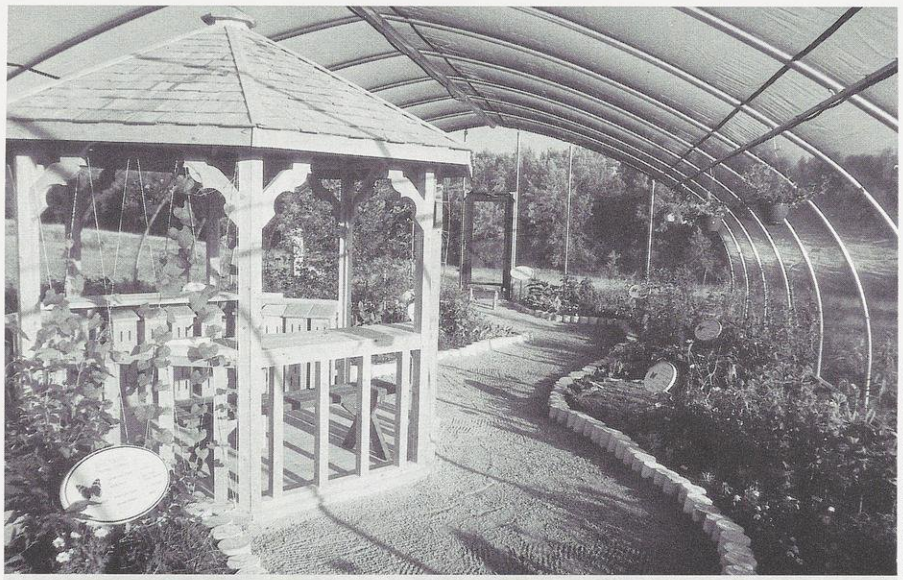
Violets are hosts for many orange-colored fritillaries. Silver-bordered fritillaries *(Bolaria selene)* feed on violets in slightly drier meadows. The very common great-spangled fritillary *(Speyeria cybele)* chomps on violets found in open moist areas, but this butterfly is a wanderer — it may be found in habitats not often populated with violets. The rare Wisconsin-endangered regal fritillary *(Speyeria idalia)*, a prairie butterfly, prefers bird's-foot violet. Characteristically, fritillaries lay their eggs singly on plants near a violet. The young larvae must find their way to the correct plant.

Other flowers that are used as host plants include sunflowers and asters by Gorgone checkerspots, *(Chlosyne gorgone)*; turtlehead by Baltimore checkerspots *(Euphydryas phaeton)*; bearberry by Hoary elfins *(Callophrys polios)*; asters by pearl crescents *(Phyciodes tharos)*; wild indigo by wind indigo duskywings *(Erynnis baptisiae)*; leatherleaf and Labrador tea by brown elfins *(Callophrys augustinus)*; blueberry by Henry's elfins *(Callophrys henrici)*; everlasting and pussy toes by American ladies *(Vanessa virginiensis)*; and native cranberries by bog coppers *(Lycaena epixanthe)*. The northern blue *(Lycaeides idas)*, a Wisconsin endangered species, feeds on dwarf bilberry, a member of the blueberry family and a Wisconsin threatened species.



JOHN BAKER

The giant swallowtail larva looks like bird droppings and fools most would-be predators.



MOSQUITO HILL NATURE CENTER

A garden that's all aflutter

Butterfly enthusiasts who want to see a lot in a little time should plan a summer stop at the Mosquito Hill Nature Center in New London, Wis. (northwest of Appleton). Naturalists there built a 30-by-50 foot screened-in garden to house butterflies and the plants they feed upon. The Butterfly House is open to the public on Wednesdays, Saturdays and Sundays, 11 a.m. to 3 p.m. from July 6th through Labor Day (Sept. 2nd). Group tours can be arranged in advance on Thursdays and Fridays. Signs along the paths clearly mark larval host plants and a guide can help you identify the 50 or so species of butterflies, flitting about. The Center is located at N3880 Rogers Road, New London, WI 54961. Call ahead to (414) 779-6433 to find out about summer butterfly tours and events. "We have hundreds of flights daily," says naturalist Jim Anderson.

Don't pull that thistle!

Some of our most common and widespread butterflies use plants we consider to be weeds. Have you removed stinging nettles from your yard? The eastern comma *(Polygonia comma)* and question mark *(Polygonia interrogationis)*, two orange and dark brown anglewing butterflies, choose nettles. The larvae of the Milbert's tortoiseshell *(Nymphalis milberti)*, a two-inch brown butterfly with a bright orange and yellow band, feed communally on nettles. The unmistakable red admiral *(Vanessa atalanta)*, a two-inch brown butterfly with an orange-red band across its wings, feeds on nettles. All these butterflies are wanderers and may find your nettle patch and reproduce. Their colorful wings brighten any yard.

Thistles are another plant we can't seem to appreciate. Thistles are wonderful, not only as rich nectar sources for butterflies but as host plants. Thistles of all kinds are devoured by larvae of painted ladies *(Vanessa cardui)*, whereas the swamp metalmark *(Calephelis mutica)*, is a thistle connoisseur, feeding only on the equally rare swamp thistle *(Cirsium muticum)*.

Other unassuming plants butterflies use include sheep sorrel by American coppers *(Lycaena phlaeas)*, curly dock by bronze coppers *(Lycaena hyllus)*, and plantain by common buckeyes *(Junonia coenia)*. Grasses are the preferred food of common wood-nymphs *(Cercyonis pegala)*, little wood-satyrs *(Megisto cymela)*, and skippers. Sedges are chosen by eyed browns *(Satyrodes eurydice)* and other skippers.

Protect plants, save butterflies

Butterflies do little damage to host plants. Most species lay single eggs on the chosen host. When the hungry caterpillar finishes eating and wanders off to pupate, the plant recovers.

Butterfly species that can use a variety of host plants have larger populations and better chances for survival. Butterflies dependent on a single host plant face the greatest challenge for survival. Once the host plant is gone, the butterfly is lost.

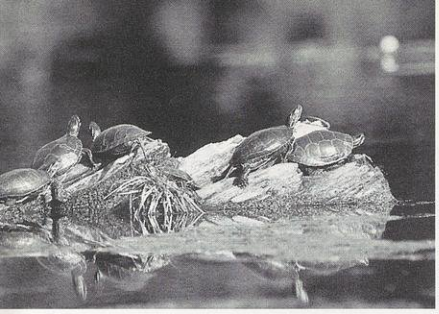
Some butterflies are wanderers and may find new areas to colonize. Others, such as the swamp metalmark, are fairly sedentary, not straying far from their place of "hatch." If their habitat is altered or destroyed and the host plant is lost, there is little, if any, chance for survival.

Everyone makes choices on land and habitat use that affect the lives of butterflies. We mow roadsides when monarch caterpillars are feeding on milkweed. We remove nettles and thistles. We spray our yards for insect control. We drain and fill wetlands.

Butterflies would benefit from a little help from us. Besides planting the colorful flowers that provide nectar for adult butterflies, consider plantings that host caterpillars, too. Be willing to tolerate a few holes in violet leaves and the disappearance of willow leaves. Save yourself the effort of mowing those expansive country yards — let most of the native vegetation remain. If you find a black swallowtail caterpillar in your garden, view it as an opportunity to study the remarkable transformation from caterpillar to butterfly. Share the thrill with children.

Butterflies are Wisconsin's flying jewels. To enjoy their colorful wings in the future, we must look beyond their beauty and recognize that they cannot survive without a variety of plants and habitats. □

Anita Carpenter takes wing with Wisconsin's flying jewels in the fields, forests and gardens near her Oshkosh home.



STEPHEN J. LANG

Painted turtle pileup.

Continued from page 2

Although only one species of painted turtle populates the continental United States, four distinct subspecies occur and two of them live in Wisconsin. The western painted turtle, *Chrysemys picta belli,* inhabits the western half of the state. It grows to seven inches in length. The six-inch midland painted turtle, *C. p. marginata,* lives primarily in southeastern Wisconsin. The southern and eastern subspecies are not found here.

Painted turtles are easy to recognize. Long yellow stripes run the length of the neck, mark the edges of each leg, and pattern the dark green head. The smooth oval carapace, or upper shell, ranges in color from dark green to black. Only painted turtles have red markings highlighting the outer margins of the carapace.

Patterns on the lower shell, or plastron, can help you distinguish the subspecies: The midland painted turtle has a dark gray oblong area in the middle of its yellow plastron; the western painted turtle has an irregular branched pattern covering most of its plastron. To confuse matters, plastral markings vary and blend together where ranges of the two subspecies overlap.

When cold weather returns, painted turtles hibernate in the soft mud of their ponds. After iceout, courtship begins when amorous males slowly swim in pursuit of females. When a female is ready, she allows a suitor to overtake and face her. He uses the back of his foreclaws to stroke her head and neck. She reciprocates by stroking his outstretched forelimbs. If all goes well, she sinks to the pond bottom, he follows, and mating occurs.

A female leaves her pond to lay eggs in late May, traveling up to a quarter-mile to find suitable nest sites in loose soil exposed to the sun. She'll excavate a flask-shaped cavity, then deposit four to 20 eggs, usually eight, in the nest. She covers the nest and returns to her pond. The white leathery eggs harden within a day. Warmth from the sun-heated soil incubates the eggs, but survival is largely left to fate. Hungry skunks, raccoons, badgers and foxes raid many nests.

In those nests where eggs survive, silver-dollar-sized turtles emerge in September and crawl to the ponds. Eggs laid later in the year or in harder soils may not produce young until the following spring. This strategy increases the chance that some of the hatchlings will survive predation on land as well as freezeout in the pond. How the youngsters survive sub-freezing winter temperatures in the nest just a few inches below the surface is still a mystery.

If painted turtles survive their first year, they have a good chance of living a long life. Males mature in five years; the slightly larger females, in six to seven years. With any luck, painted turtles may have 40 summers to stretch out on a favorite log and bask in the summer heat. □

Anita Carpenter keeps her binoculars and field guides within reach of the chaise lounge in Oshkosh, Wis.

Readers Write

GOT THE POINT

Can I order a copy of the October 1995 issue? The article on arrowheads was excellent. My compliments to the author and photographer.

Lanny Roth
Chippewa Falls, Wis.

Back copies of most issues are available for $3.00 plus $1.50 shipping. We appreciated the help of several staff from the State Historical Society of Wisconsin who loaned illustrations and projectile points, and identified the specimens we displayed in that story.

SEEING MERLINS

I recently read your article "Magnificent merlins" (April 1994) as I believe I saw one just before Christmas. About 2:30 p.m. on December 20th I was watching three mourning doves feeding on the ground under our bird feeder. All of a sudden I heard a ruffling of feathers and a bird shot past the window. It startled me! At that moment, the bird nailed one of the doves. That dove never had a chance.

I ran up the stairs to tell my wife so she could witness the experience. We were too late. The falcon disappeared.

I got my binoculars and started scanning the trees and bushes. I noticed a flurry of feathers raining down through the bushes and knew I had found the bird. I never got a good, full frontal view, but I did see the right side of its back and a side view. It had a prominent wide band of white at the end of the tail and two distinct white bands above that. The back and wings were dusty gray to black and the side of the breast was tan to rusty in color. The bird had no leg feathers nor could I see any leg bands.

I watched it eat for a full 20 minutes, got my field guide and determined that the falcon was a merlin.

Russ Winters
Middleton, Wis.

Author Dave Crehore responds: *If you really had a merlin in your back yard in southern Wisconsin, it is a pretty special yard! Merlins have been known to winter over in Wisconsin; one spent the winter at the Manitowoc County fairgrounds a few years ago, but it's a rare sight. If the bird was jay-sized, it might have been a merlin or a sharp-shinned hawk. If the bird was crow-sized, it could have been a peregrine falcon or a Cooper's hawk. Sharpies and Cooper's definitely winter here and are known to nest in suburban areas.*

All four of these birds have more-or-less distinct white tips on their tails, but only the sharpie and Cooper's have distinct white bands farther up the tail. The banding on the merlin and peregrine is grayer. The diagnostic characteristic is the facial coloring. The merlin and peregrine have distinct "moustaches" descending vertically from the eye; the other two birds do not. Also, merlins tend to take sparrow and warbler-sized birds as prey.

GOOD WORK, GREAT VALUE

I'm a former Wisconsin resident, now a snowbird in San Diego and a summer resident in Door County. I've been a regular subscriber to Wisconsin Natural Resources and I've seen the publication evolve from a mimeographed quarterly publication to the excellent magazine produced today. It's worth much more than the subscription price.

Curtis Burr
San Diego, Calif.

SWEET SINGER

Anita Carpenter's December article describing the brown creeper was of great interest to me. We live in northern Oconto County and I have long wondered what bird had such a sweet, melodious song in March while the ground was still snow-covered. After spending some time with our

Readers Write

Audubon bird tapes, I was surprised to discover that the marvelous singer was the seldom-seen brown creeper. Now the creepers are making daily visits to our feeding station for a meal of peanut butter, bacon grease and corn meal. I spread it onto the tree with a spatula.

Ms. Carpenter's article gave us more information about this valued friend.

Margaret Lowery
Townsend, Wis.

You are truly fortunate to attract crooners to your feeders. Two suggestions: You might consider placing your bird meal in a feeder rather than pressing the concoction into the bark. Squirrels and other gnawing animals will also be attracted by the mixture and they could damage the bark in the process of eating up the tasty, nutritious paste. Why not make a feeder out of scrap lumber? Start with a piece of 4x4 about 18 inches long. Bore several ¾-inch diameter holes on each side about one inch deep. Then, drill a small ¼-inch hole under each large hole, and glue in two-inch-long pieces of quarter-inch dowels to form perches. Screw a big eye hook in one end of the lumber, fill the big holes with your feed mixture, and suspend the feeder from a sturdy branch.

Second suggestion: Try substituting shortening for bacon grease in your mix. Some birds are put off by the smoky and salty fats rendered from cured meats.

THE PORKY CHORUS

I sure liked the February article about porcupines. On a bitterly cold fall afternoon back in 1946, a friend and I were trying to feed suckers to muskies on the south fork of the Flambeau River between Fifield and Lugerville. The fish were not much interested.

We kept hearing a flute-like musical note in the middle range of the register in a pitch without detectable rhythm or sequence. We couldn't see any sign of human habitation, but the "voice" sure sounded like a person. My curiosity forced me to check it out. About 200 yards from the place I climbed up the riverbank and found the orchestra: three adult porkies and two juveniles in a floodplain with some broken down willow trees. Whether this was a songfest or a public discussion, I do not know. We listened to the "program" for about an hour and then left. It was just too cold to hang around any longer in a canoe and the fish were not hungry anyway.

I've had no other similar experiences, so I don't know if this is common porcupine behavior or not.

G.J. Bachhuber
Tomahawk, Wis.

MAGIC EYE AT DNR?

Has anyone else seen the "lady" in your August 1995 story on Allenton Creek? If you take the picture of the "pillow section" of the creek rehabilitation shown on page 28 and turn it upside down at arm's length or better, you can see the image of a lady. Also notice the "tears" under her eyes. Is she crying for her old stream bed?

Roy K. Behnke
Coleman, Wis.

Editor David L. Sperling replies: *Roy, as someone who NEVER sees the figure in the Magic Eye drawings, I leave this for other readers. On the other hand, I did see a zucchini once that had the profile of a past President of the United States.*

TEACHING TOOL

My wife and I enjoy your articles and the good pictures. From time to time, I use the magazine as a teaching tool with angler education courses and 4-H programs in Calumet County. We also use your pieces on horticultural subjects with our Master Gardener's program.

I always promote this magazine as an excellent publication about our state and statewide issues. I've been receiving it for more than 30 years and firmly believe the publication only gets better over the years.

Ronald Richter
Brillion, Wis.

NO WOLF FAN

Interest in the wolf's head endangered species license plates shows how far people can be misled, in my opinion. It started when wolves were classified as "endangered species" so money could be spent restoring them. This, in spite of the fact that 50,000–60,000 wolves thrive in Canada, more than 10,000 in Alaska and 1,000 in Minnesota. It bothers me that our deficit-laden government continues to waste money restoring wolves, spreading wolf propaganda and withholding facts.

For instance, how many Wisconsin people know that during 1994 some 172 Minnesota wolves were killed for damaging livestock? Last year the number dropped to 78, nearly equal to Wisconsin's entire wolf population.

Wolves are top predators. Their numbers will keep increasing until food supplies or diseases start to reduce their population. I think it would be best if wolf numbers were controlled by hunting and trapping before this happens.

Although wolves have an important role in prime wilderness ecology, we've shown for over 50 years that the Wisconsin ecology does just fine without wolves. Wolf supporters try to treat every patch of woods as if it were prime wilderness in need of wolves.

I believe that wolves should not be in places where they conflict with human activities. There are vast areas of North American wilderness where thousands of wolves could roam without this conflict.

Lawrence Krak
Gilman, Wis.

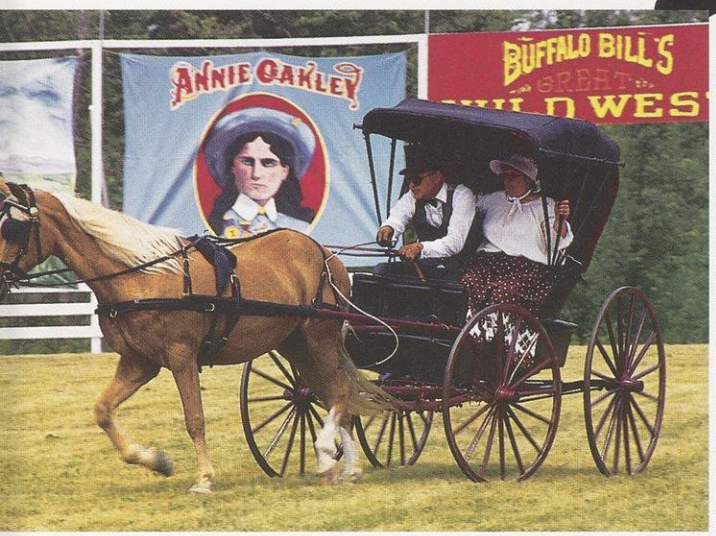
We are thankful that many people feel differently than you do about restoring wolves, extirpated species and endangered resources. Many, many people provide financial support, volunteer time and strongly back the idea of restoring wolves as part of Wisconsin's natural diversity. They reject the notion that endangered species should only thrive in remote locations rarely visited by people; they reject the notion that wild species should only survive in limited areas instead of throughout their natural range.

No one will deny that wolves occasionally prey upon livestock. As a Minnesota DNR predator specialist told the New York Times last December, "People have come to accept the wolf as a critter they can live with." Why? One reason the specialist emphasized was that "wolves preying on livestock and poultry are promptly removed by animal damage control agents...and farmers are fully reimbursed for their losses."

Adrian Wydeven, Wisconsin DNR's wolf ecologist, notes that the packs in the upper Midwest mainly hunt white-tailed deer and beaver, not livestock. "Wolves have a tremendous natural prey base and there is a lot of unoccupied habitat," Wydeven said. It would take another 15 to 20 years before wolves would saturate their habitat in Wisconsin, he added.

The wolf license plates serve as a symbol in our daily travels that the public is more tolerant of wild species, more supportive of natural diversity and more willing to view people as part of a natural ecosystem rather than as rulers of the natural kingdom.

WISCONSIN TRAVELER



PHOTOS COURTESY OF THE STATE HISTORICAL SOCIETY OF WISCONSIN

One wild time

Perhaps, if you are one of TRAVELER'S more venerable readers, you will remember the year 1896. Perhaps, during that year, you happened to be in Sheboygan. At South Side Bluff to be specific. On a Monday — say the 31st — in August.

If that's the case, you need read no further. TRAVELER cannot help you this month. Should you attend the event about to be elaborated upon, it would simply be another case of been there, done that.

Now. If you weren't around in 1896, you are undoubtedly a young whippersnapper (just what *is* a whippersnapper, anyway?). High-strung youth such as yourself are often in need of reminders about the past, lest they forget that they did not invent rip-roaring rollicking good times. Yes, kid, folks were whooping it up way back in 1896 and lucky for you, some of that fun is coming back around 100 years later.

Make your way to Greenbush on the weekend of June 29th and 30th, when **Buffalo Bill's Wild West Show** will ride into the outdoor arena of the **Wade House Stagecoach Inn**, with guns blazing and ladies swooning right and left.

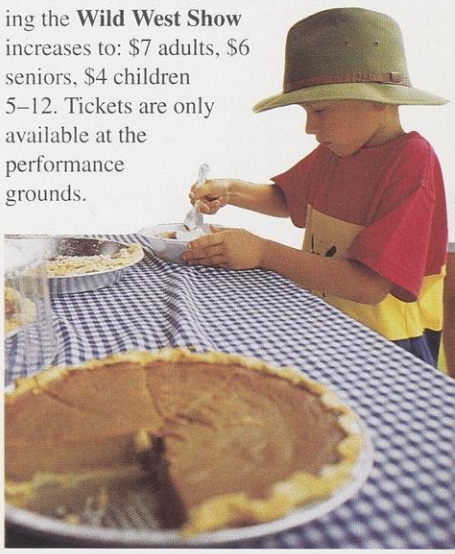
A century ago Bill & Co. wowed the Sheboygan County locals with fabulous displays of trick riding, shooting, and lariat work. His Congress of Rough Riders of the World enacted a stagecoach hold-up and a U.S. cavalry charge, leavening the drama with rustic comedians and the high kicks of can-can dancers. For civilized Wisconsin, it was a taste of the untamed world of cowboys and Indians that lay beyond the wide Missouri. Former frontier scout William Frederick Cody knew that world was fast disappearing in the wake of railroads and settlers. A shrewd entrepreneur, Cody also detected nostalgia collecting around the idea of the Wild West. Thus his famous traveling show was born.

Today the Friends of the Wade House will follow in Bill's hoofprints. Expect to see astounding feats of horsemanship and marksmanship in the 210 x 180-foot Wade House corral decked with larger-than-life banners of Miss Annie Oakley and other notables. (*Traveler's tip:* Don't stand near the spittoon by the gate.) The two-hour show features the lively musical accompaniment of Buffalo Bill's Cowboy Band, know in its more staid moments as the Sheboygan Heritage Band.

You can't have a show without sideshows, and there will be excitement aplenty at the **1896 Country Fair** on the Wade House grounds. Nothing you'd need to shield the youngster's eyes from, you understand — only wholesome thrills allowed. At this writing the friends are working up a recipe for cowboy stew, which they hope to serve as an authentic taste of the West. (There may not, however, be enough beans in the county to guarantee a steady supply.)

1996 is the 150th anniversary of the State Historical Society of Wisconsin and Buffalo Bill's birthday. Celebrate both at the Wade House Wild West Show!

The Wade House was built in 1850 by Sylvanus and Betsey Wade to provide food and shelter for travelers on the busy Sheboygan and Fond du Lac Plank Road. Today, the State Historical Society owns and operates the handsome Greek Revival-style inn, which is outfitted with authentic furnishings. Costumed guides conduct tours of the inn and the smokehouse, blacksmith shop and other buildings on the grounds. The site includes the Wesley W. Jung Carriage Museum, housing over 100 horse-drawn vehicles. The Wade House State Historic Site is located six miles west of Plymouth just off State Highway 23 in Greenbush, Sheboygan County. Open daily from 9 am to 5 pm from May 1 through October 31. Admission: $5 adults, $4.50 seniors, $2 children 5–12. Admission during the **Wild West Show** increases to: $7 adults, $6 seniors, $4 children 5–12. Tickets are only available at the performance grounds.



They'll reenact Buffalo Bill's famous Wild West Show the last weekend of June. Traveler guarantees that the pie is the genuine article. A la mode anyone?