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WISCONSIN NATURAL RESOURCES

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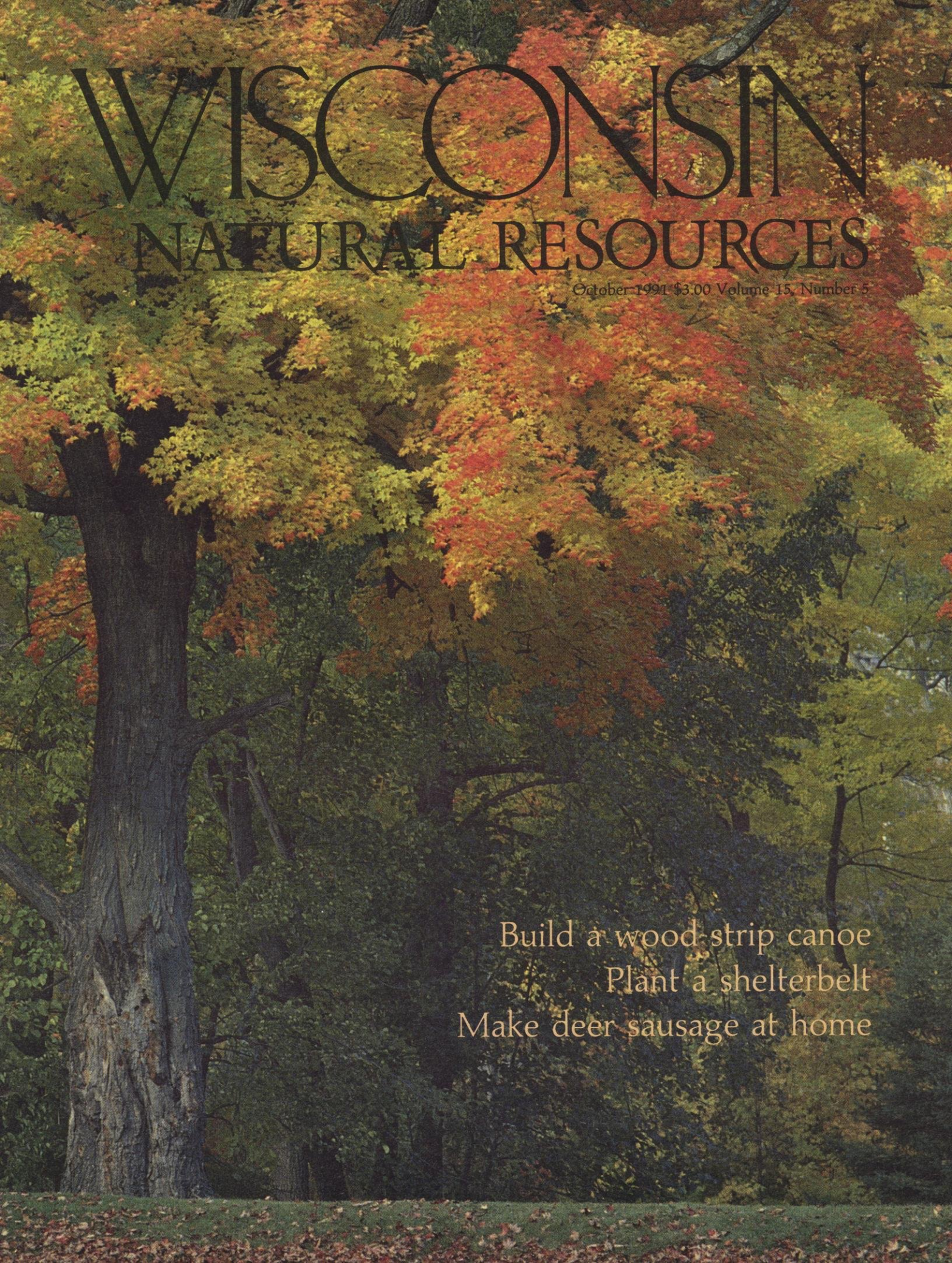

Build a wood-strip canoe
Plant a shelterbelt
Make deer sausage at home

The smell of humus

Al Cornell

It's a mixed hardwood forest. The leaves from sugar maples lie light tan on the forest floor. Mixed in are white ash, basswood and American elm leaves. Hickory and red oak leaves add a darker hue.

These new, dry leaves amplify forest movements. Squirrels playing here a month ago made far less noise than the frenzied actions of a pair of shrews. I remember as a child that squirrels on dried leaves sounded like fierce beasts of the forest. Although deer move more quietly than squirrels, the leaves amplify their steps even though they are long out of sight.

Two things exposed some of this rich, black forest soil: a hundred years of cultivating the ridgetop up the valley, and a large deer population whose numerous trails and scrapes rutted up the ground.

This biologically active layer of decomposing organic matter gives off a smell of humus, a history of earthy heritage. These hills and valleys formed slowly on a natural timetable. Change was nearly imperceptible, years seemed endless. Ten thousand repetitions of icy winter splendor, flower-spangled animation, summer nectar, falling leaves and frosty brilliance built the humus, but left the smell unchanged.

A surveyor, a record in the county clerk's plat book and four unending strands of barbed wire changed that smell for a while. Pioneers unearthed the smell and sought its treasure. Settlers still test the woodland to see what it offers civilization.

Would its mast crop fatten hogs? No.

Did it offer cows enough nutrition to fill a milk pail? No.

Could its lumber and forest be harvested? Somewhat.

This plot survived fire, the caterpillar and the chainsaw. A fence was built and 70 years of grazing the forest came to an end. The smell of humus again permeated the air. Barkless twigs at the top of a red elm remind us that things change. The passenger pigeon is gone, but other basics are alive. The turkey is back. And the smell of humus will endure. □

Al Cornell is a DNR wildlife technician stationed at Tower Hill Park in Spring Green, Wis.

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BARBARA MULVANEY

WISCONSIN NATURAL RESOURCES

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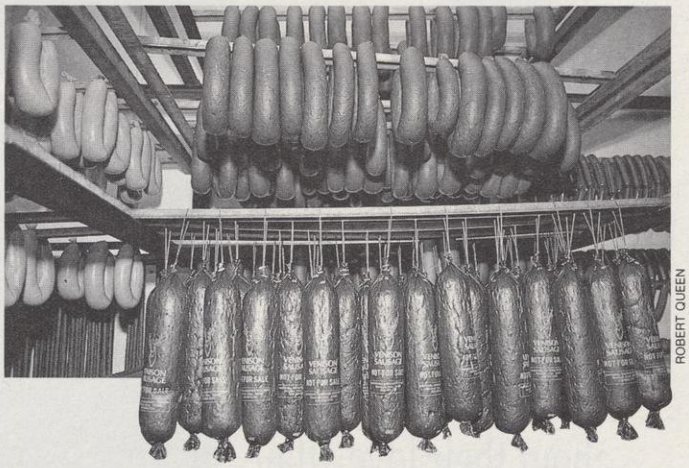
JIM MCEVOY

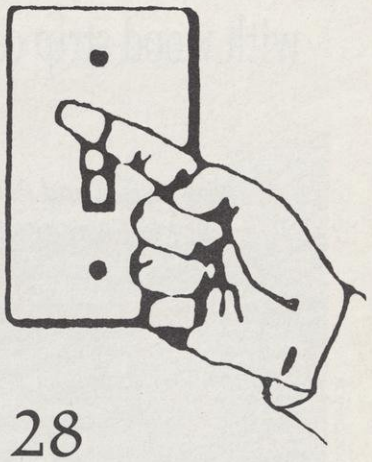
VISION 2000 WISCONSIN'S PERSPECTIVE



ROBERT QUEEN

SUZANNE WADE

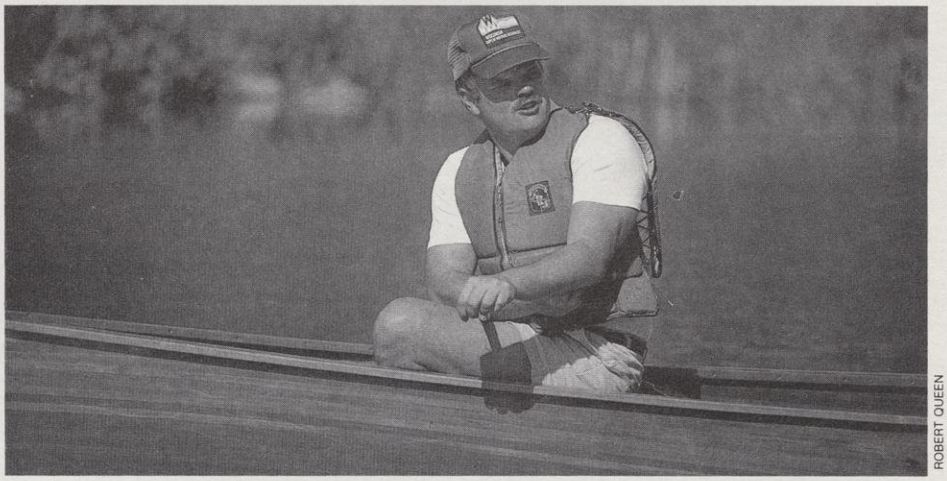
Mark Montaba's students from Ozaukee High, Fredonia, collect water samples from upper reaches of the Milwaukee River at Waubeka Dam.



COVER:
Fall colors sparkle at Devil's Lake State Park
MICHAEL WEIMER, St. Charles, Ill.

STRIPPERS

ROBERT QUEEN



ROBERT QUEEN

Two novice boatbuilders tell the naked truth about their love affair with wood strip canoes.

(top) Paul Stone.
(below) Joe Brusca.

Joe Brusca and Paul Stone
Photos by Rich Hayes

Join us, if you will, on a blustery day in the summer of 1986. En route to Canada's Quetico Provincial Park through Cache Bay, we crossed Saganagons Lake, 20,000 big acres of boundary waters straddling the U.S./Canadian border. As 2½-foot swells crashed across the bows of our aluminum "water bruiser" canoe, we struggled to keep pace with one of the canoes in our party. It slid through the choppy waves like a hot knife through butter.

After checking into the ranger station, we paddled on to the Silver Falls portage, passing canoeists on their way out of the park. Each gave the other boat in our party an admiring glance and commented "Hey, nice canoe!" or "What's it made of?" or "How much does it weigh?" or "Did you make it?"

The object of all this attention was an 18½-foot wood strip and fiber glass canoe built by fellow canoe enthusiast Ken Koscik of Monona, Wis. This was our first trip with Ken and his stripper; it would not be our last. By journey's end we felt a kinship with Ken and ownership in that strip-

per. We vowed someday to build our own.

Several years later, Ken's son took up with a stripper in the family workshop. After helping Ken Jr. complete his canoe, we decided it was time to set our own dreams afloat.

We enlisted Rich Hayes, a friend and Madison-area craftsman. Like the Three Musketeers, we agreed the canoe-building project would be all-for-one and one-for-all. We would build one canoe at a time and swore to work on each other's canoes to the death. Little did we know the fatal blow would fall upon our nights and weekends.

What did it matter? It was December; the long-range forecast predicted a cold, nasty winter. Passing up Wisconsin's ice fishing and cross-country skiing seasons didn't seem like an overwhelming sacrifice considering that by summer, we could be the proud owners of seaworthy wood strip canoes, the envy of fellow canoeists. We drew straws on who would claim the first canoe: Paul first, Rich second and Joe, third.

The perfect canoe

Before the first strip was cut, we had to decide on the canoe design. Because our experience with Ken's canoe was so positive, the choice was easy: We wanted ours to be just like his.

Ken styled his stripper after the United States Canoe Association's Tuttle Cruiser, adding a few modifications of his own. Eighteen feet four inches long, the canoe has a maximum gunwale width of 34 inches. The asymmetrical design (the widest point of the boat is approximately one foot back of center) and a sleek, sharp bow allow the canoe to cut cleanly through the water with minimal resistance, reducing paddling effort. With no keel and very little rocker (see design primer), the canoe tracks straight and glides easily.

This is a king-size canoe: There's plenty of room to carry too much equipment and a couple of oversized paddlers, a necessity in our case. While Ken's cruiser doesn't have the turn-on-a-dime maneuverability of a shorter canoe with more rocker, its long, streamlined lines and tremendous capacity make it a perfect craft for extended lake trips.

Next, we had to find a place to build our dream boats. We needed a heated building with at least 20 feet of open space. Ken, a great humanitarian, graciously offered us the workshop under his garage. Heated by a wood-burning stove, the shop overlooks Lake Monona, which provided some gorgeous sunsets to ease our toil. [*Authors' note:* The lack of an ideal workshop shouldn't stop you from building a canoe. We once helped a fellow lay the fiber glass on a canoe in his spare bedroom. If you have the will, there is a way.]

Having selected a canoe design, secured a workshop and informed loved ones of our impending missing-persons status, we were ready to begin construction.

Rich Hayes scribes red cedar strips that will be cut to contour the canoe bottom. The wooden mold on which the wood strips are laid out is called a strongback. Its shape and design determine the canoe's speed, stability, length and balance. Once the strips are glued and coated with fiber glass, the canoe is removed from the strongback. Note that staples hold the wood strips in place until the glue hardens.

One strip at a time

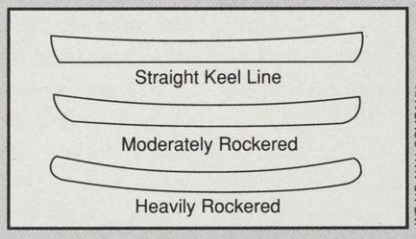
A canoe is born on a strongback. (It's also carried on one, but that part comes after the boat is built.) This skeleton — a series of shaped plywood pieces each representing a widthwise cross section of a canoe — establishes the form and dimensions of the craft. By adjusting the shape and the spacing of the pieces, a builder can increase the length of a canoe, make it narrower or wider, create a flat bottom or round bottom, and so on.

Although it never becomes part of the finished canoe, the strongback is

A design primer

Canoe builders consider a number of design elements before they construct a strongback, the building form giving a canoe its final shape. Design is an exercise in compromise: Add a few inches in length, and a canoe is easier to paddle straight but harder to turn. Increase the depth and the canoe can carry more weight, but will be more difficult to paddle. The trick is knowing the canoe's ultimate purpose. Will it be a flatwater racer or a whitewater racer? A solo boat? A tripper to carry the loads for extended camping expeditions? These are a few of the properties designers ponder:

Rocker: The amount of curve from bow to stern. Viewed sideways, a canoe with moderate rocker resembles a grin, while a heavily rockered craft is shaped like a big smile. Rocker makes a canoe easy to turn because the bow and stern are curved up out of the water, but difficult to paddle in a straight line.



Entry line: The point at which a canoe first pushes aside water. A narrow, sharp bow cuts through water easily, keeping resistance to a minimum, reducing paddling effort and allowing the canoe to glide straight.

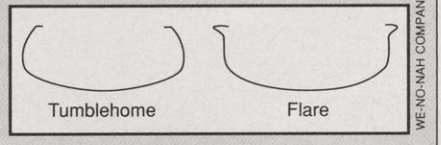
Exit line: The point at which the water displaced by a canoe returns to its previous state. Canoes with narrow, sharp sterns allow the water to flow back with little resistance, which helps paddlers maintain speed.

The three dimensions: *Length* — Longer canoes track straighter, move faster and glide farther, because the elongated profile puts up less water resistance. Shorter canoes turn sharper, but offer more resistance because they tend to be wider. *Width* — Wide hulls are easier to balance, but they push water farther apart, requiring more muscle to move the canoe. *Depth* — The deeper the canoe, the more gear it can hold. But too much depth causes excess wind resistance, making the craft tough to paddle.

Fullness: A measure of how quickly the hull widens out from the bow. A narrow hull that widens gradually will be faster than a canoe that widens sooner and stays wide longer. On the other hand, more fullness offers greater stability and capacity.

Cross section: The crosswise hull contour. A flat-bottomed canoe has "initial stability" — it feels solid and stable when level, but if a paddler leans over beyond a certain point of balance, the canoe quickly capsizes. A round-bottomed canoe has "final stability" — it won't capsize easily, but feels tippy when level. The best design solution is a combination of the two, called a shallow arch hull.

Flare: A quality a canoe has if the hull above the waterline is shaped outward. Flare deflects waves and offers extra resistance to capsizing, but paddlers have to reach farther out to avoid hitting the sides of the boat.



Tumblehome: If the hull above the waterline is shaped inward, the canoe has tumblehome. Paddlers don't have to reach over as far to paddle canoes with tumblehome. Flare and tumblehome can be combined into the same hull.

the most important element in construction. It's the spirit of the boat — the unseen force conferring speed, stability, balance and a host of other qualities desired by the builder.

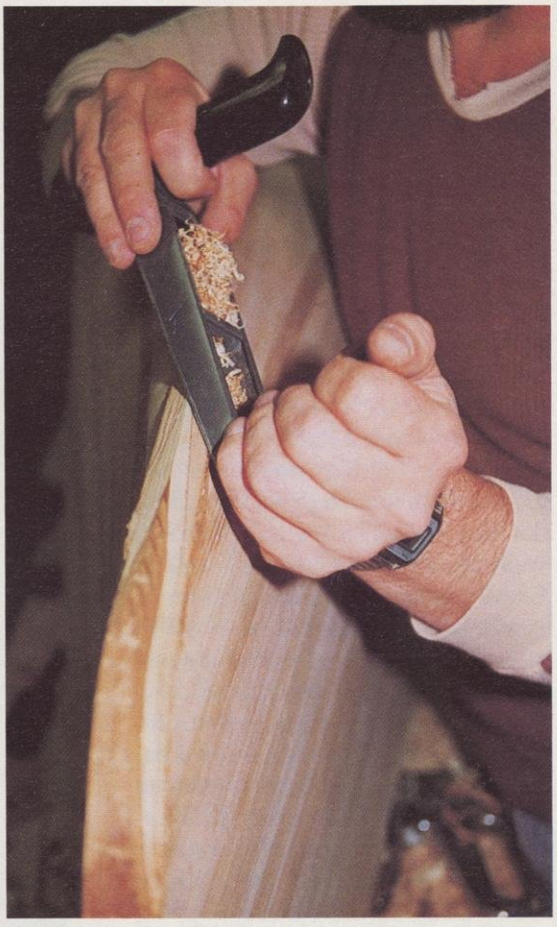
Unlike some designers who break their strongbacks so others can't paddle the same path to glory, Ken conveniently kept his excellent strongback and let us use it.

The thin wood strips laid lengthwise across the strongback become the hull of the canoe. The wood should be lightweight, easy to work, and beautiful — redwood, red cedar and Wisconsin's native white cedar are the best. Other woods can be used in combination with the three top choices, but remember: After a long portage with an oak strip canoe, you may decide to use it for firewood rather than carry it another inch.

We chose red cedar, mostly because the wood came in the lengths we needed and the price was right. To build each canoe, we needed 80 strips of wood 3/4-inch wide and 1/4 - 3/16 of an inch thick. Approximately four, 20-foot long, 1 x 8-inch boards provide enough strips for one canoe, depending on the saw kerf (the width of the groove made by the saw blade). We cut our boards on a table saw with a very thin blade to maintain a small kerf.

Attaching the strips to the strongback was the best part of building the boat, because the work went fast and we could see the canoe take shape almost overnight. Starting at the top (which becomes the bottom of the hull), each strip was glued to the edge of the adjoining strip and stapled to the strongback. We didn't drive the staples all the way through, since they served only to hold the strips down until the glue dried. Then the staples would be removed. A shim in the stapler helped us drive the staples to the correct depth.

We even got a little arty, carefully mixing and matching the natural coloring of the strips to achieve the most attractive pattern. About 15-20 hours later, we sat back admiring a fully stripped hull — only to be reminded by Ken that our canoe was only 10



(top left) Stapling and gluing the boards is only 10 percent of the work in a handmade canoe. Hours and hours are spent smoothing the craft with electric sanders and by hand sanding.

(top right) In the hands of craftsmen, a surformer takes the rough edges off the boards, rounds out curves and slowly shapes the hull for sanding.

(below) Resins are gently smoothed and scraped over the fiber glass cloth to form an even layer. The canoe will receive three coats of resin on the outside, one coat on the inside to provide tough, durable protection for the wooden shell.

percent done.

After pulling the staples, we groomed the hull with a surformer, a rasp-like tool used to shave off slivers of wood. It takes off a little less than a plane, but more than sandpaper. By changing the blades in the surformer, we were able to follow curves and get at tight spots.

Sanding the surformed outer hull took about eight hours with orbital sanders and hand-sanding. We started with a 40-grit sandpaper working down to an 80-grit paper, aiming for a nice, smooth surface without dimples or dips. Such imperfections would leave pockets of resin or air when we tackled the most delicate task of all — "glassing" the canoe.

A sheer coat of strength

Fiber glass seals and strengthens the hull. The white, shiny fiber glass fabric comes in a variety of weights — four ounce, six ounce, eight ounce,

etc. Heavier fabric absorbs more resin, adding weight to the finished canoe, but the additional stiffness improves the boat's resistance to damage. We used a double layer of four-ounce cloth on Paul's canoe. Joe doubled-up six-ounce fabric on his boat and Rich used a single layer of eight-ounce cloth.

We were somewhat skeptical of the outcome as we cloaked our beautiful strippers with the opaque cloth, but Ken assured us that the fiber glass bedsheet wouldn't hide the wood for long. Wear full-face respirators and gloves when working with fiber glass. For that matter, it's a good idea to wear a respirator when sanding. Good ventilation is important, too.

We mixed a polyester resin with a catalyst and liberally brushed the mix on, saturating the fabric. Magically, the cloth turned transparent, revealing the rich color of the red cedar strips. We were extremely pleased with the effect. We scraped off the excess resin to prevent air pockets — too much resin causes the cloth to "float" away from the wood, trapping air in between.

Our joy was short-lived. The next day, when we checked the cure of the resin, we discovered that a polyurethane sealer used on the strips prior to glassing was incompatible with the polyester resin. The canoe was molting. It took two minutes for us to peel off hours of work, and hours more to sand off the offending polyurethane.

Live and learn! Back to glassing. Starting with new cloth, we applied the first coat of resin and let it dry until the surface was tacky to the touch. A second coat followed. Once dry, we sanded down the hull, then brushed on the third and final coat. Whew!

Canoe glassers have a choice of two resins: Polyester or epoxy. We used polyester on Paul's canoe. It's volatile, flammable and smells to high heaven, but polyester resin is half the price of epoxy and more durable, though it tends to blister. Epoxy penetrates better and holds a stronger bond to the wood but is less resistant to cuts from rocks. Rich and Joe used epoxy. Despite the initial disaster on Paul's canoe, all three of us were pleased with the results of the two resins.

After popping the canoe off the strongback, we had to surform, sand and glass the inside of the hull. Inside, we applied only one coat of resin to the cloth, allowing the weave of the fabric to stand out for a rough, no-slip surface.

One down, two to go. Once Paul's canoe was off the strongback and glassed, we began building Rich's boat. We learned from our past mistakes: It took us about 300 hours to build the first canoe, but only 150 hours to complete the third.

For the finishing touches, we fitted the edge with gunwales of Sitka spruce and screwed them into the hull. White ash and cherry were used for the thwarts, bow and stern covers.

Paul Stone in the stern, Joe Brusca in the bow test their sleek, stable craft. The cedar canoe is fitted with Sitka spruce gunwales, white ash and cherry thwarts, bow and stern plates. This 18'4"-wood strip canoe weighs about 60 pounds. It's lighter and more responsive than a comparable aluminum canoe.

COURTESY OF WISCONSIN DELLS EVENT

(left to right) The Koscik, Hayes, Stone and Brusca launching party paddles Mirror Lake with a touch of class.

Build it yourself

Inspired to construct your own wood strip canoe? Be prepared to spend $400-600 in supplies and several hundred hours constructing the craft. You'll find that supplies purchased in bulk will be cheaper, so find a building partner or two if you can. With a building buddy, construction will be easier on the mind, body and wallet.

Here are a few sources and books to help you along: The Wooden Canoe Heritage Association, Ltd., P.O. Box 226, Blue Mountain Lake, NY 12812 is an excellent source of information on building and restoring canoes.

The *Stripper's Guide to Canoebuilding* by David Hazen, available through Tamal Vista Publications, 222 Madrone Ave., Larkspur, CA 94939, details the planning and construction of wood strip canoes.

Canoecraft: A Harrowsmith Illustrated Guide To Fine Wood Strip Construction by Ted Moores and Merilyn Mohr, printed by Camden House Publishing Ltd., 7 Queen Victoria Road, Camden East, Ontario, Canada, K0K1J0 is a good technical book to guide your canoebuilding endeavor.

McCormick Lumber, 3156 Milwaukee St., Madison WI, is one of the few sources in the state for clear red cedar boards and 20-foot lengths of Sitka spruce. If you're interested in obtaining white cedar or other woods, write Terry Mace, Forest Products Utilization and Marketing Specialist, DNR, 3911 Fish Hatchery Rd., Madison WI 53711 and ask for publication number FR-025-90, "Wisconsin Primary Wood-Using Industry Directory."

Gougeon Brothers, Inc., P.O. Box X908, Bay City MI 48707, or call (517) 684-7286, has epoxy resin, catalyst and fiber glass cloth. McCormick Lumber in Madison also carries resins. Check with boat builders or marinas in your area for other sources of wood, resins and cloth.

If you don't want to start from scratch, try a kit. Nature's Gallery, 314 N. Main, Rice Lake, WI 54868, sells wood strip canoe kits featuring routed white cedar strips and cane seats.

Front and back thwarts were placed equidistant from the bow and stern seats. The center thwart, which has a yoke, was placed just back of center for easier carrying. Air locks — small sealed air chambers in the bow and stern — provided buoyancy. We lined a mold shaped like a comfortable tractor seat with thick sheets of fiber glass cloth and saturated it with resin. Once dry, the each seat was screwed to wood slats attached to the gunwales. Rich opted for traditional cane seats.

The christening

Six months had passed since we left the lumber yard with those 20-foot lengths of red cedar. We had transformed the boards into three wood strip canoes weighing 58 to 60 pounds apiece. But would they float? And how would we christen these extraordinary craft?

We decided only a gala coming-out party would do justice to our new canoes, so we invited our understanding mates and our mentor Ken Koscik and his wife to join in the inaugural cruise.

A warm, sunny afternoon provided the perfect setting for our first launch at Mirror Lake State Park. Appropriately dressed in suits and ties, we guided our significant others (appropriately clad in dresses) across the placid waters in our handsome boats to Ishnala, a restaurant on the lake. Photographers from Wisconsin Dells Events came to record the event for posterity.

The first passing boater looked us over and commented on the beauty of our canoes. How we loved to hear those words! □

Semi-professional canoewrights Joe Brusca and Paul Stone claim to hold down real jobs in DNR's Southern District as solid and hazardous waste program supervisor and real estate program supervisor, respectively. Rich Hayes is a carpentry contractor in Dane County.

Shelter your shelter

Natural windbreaks, sun screens and air conditioners are yours for the planning and planting.

Maureen Mecozzi

Should you plant a shelterbelt?

The answer, my friend, is blowin' in the wind.

When the gales of November howl through the storm windows, when January's snowdrifts block the garage door, when the gusts of August feel like breath from a blast furnace, you'll know the right response is an emphatic YES.

Just about any home on a lot larger than a postage stamp will benefit from a shelterbelt. Several staggered rows of trees and shrubs on the perimeter can redirect cold winds or deflect hot sun away from your home, making it easier and cheaper to heat and cool. Shelterbelt trees provide food and a safe haven for wildlife, cleanse the air, cut down on noise, provide privacy, enrich the landscape and the soul — why, it's enough to make a person want to grab a shovel and start planting immediately.

Whoa! Put that spade away for a couple of months (you can't plant trees now, anyway) and take up a pencil instead, because planning a shelterbelt is just as important as planting one.

A look at the lot

Planning begins with a sketchpad and a walk around the estate. Make a rough scale outline of the lot, marking property lines, streets, driveways, underground power lines and septic fields. Sketch in the house, garage and other buildings, indicating the direction each faces and how far the structures are from the lot lines. Note where the soil is well-drained or wet. Use circles to show the relative size and position of existing trees.

Now find a convenient stump, sit down and rest your chin on your hand. Think. Ask yourself: "What do I want to accomplish with this shelter-

belt?" The answer will dictate the location of the belt and the kinds of trees you use to create it.

If your aim is to channel cold winds away from your home, you'll want to plan a windbreak of conifers, or evergreens, parallel to the north and west sides of your house and perpendicular to harsh prevailing winds.

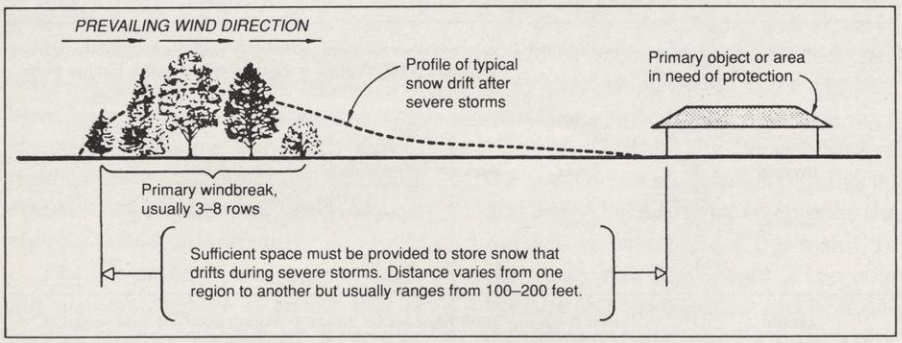
A shelterbelt provides maximum wind protection at a distance of two to three times the height of the mature trees. Generally, a shelterbelt reduces wind to a distance 10 times its mature height and reduces wind speed 70 to 80 percent inside the barrier. If the tallest trees top out at 30 feet or so, the shelterbelt should be 60 to 100 feet from the house. On a smaller lot, plan to plant shrubs or low-growing trees like eastern white cedar that can be sheared, kept at 10-15 feet in height and planted closer to the house

To be effective, shelterbelts should consist of at least two rows of trees and shrubs for wind protection and a minimum of three rows to combat blowing and drifting snow. Shrubs, short trees and slower growing trees belong in the outermost and innermost rows, where they'll receive adequate light and have room to develop.

Spacing between rows and between individual plants will depend on the species you choose and how much room they need to grow. Allow about eight to 15 feet between rows. At maturity, the outer row should form a fairly solid barrier, with just a few gaps between individual plants. Trees in inner rows can have a little breathing room, but the rows should be staggered to keep wind and snow from funneling through. Like a slatted snow fence, a windbreak with air spaces breaks up gusting winds, prevents drifting and keeps strong eddies from forming in protected areas.

Summer shelterbelts on the south and east sides shade your home from the sun, lowering interior temperatures and, we suspect, tempers. Shading varies at different times of the day and season, depending on the angle of sun. Tall deciduous trees offer plenty of shade in summer no matter where the sun is, yet allow warming rays through after shedding their leaves in fall and winter. A row of deciduous trees with high branches form a "ceiling." Wind picks up speed as it flows beneath the canopy, and the breeze is cooled by transpiration. On a hot, windy day, the leaves of a single tree may release up to 100 gallons of water. The moisture helps cool the air.

By planting a row of maples, oaks or other deciduous trees perpendicular to the south and east, you can direct cool air right through your windows. (You may decide to sell that air conditioner and buy a nice hammock to sling between those oaks!) Again, mature tree size will indicate how far away you should plant the row from the house: Close enough to shade, not so close that branches will someday rest on the roof or pose a fire hazard.



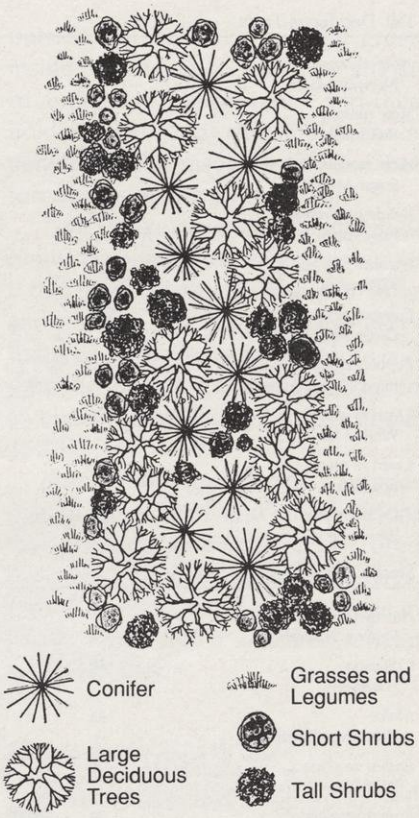
USDA SOIL CONSERVATION SERVICE

Trees form a living windbreak and snow fence on this farmstead shelterbelt. Note that smaller trees are planted on the inside and outside rows, taller trees in the center.

North, south, east and west: We've covered the four cardinals, but there are two more vital points to consider before you pencil in rows of little circles on your lot plan.

The first is that you needn't hold yourself hostage to the tyranny of symmetry. Shelterbelt trees don't have to be planted in arrow-straight rows. You'll achieve a more attractive, natural feel by gently curving the rows and planting some trees and shrubs closer together in clumps. Just make sure you haven't left any big gaps that cut all the way through the belt. Curving the rows increases "edge" — the area between two different kinds of vegetation. Wildlife favor edge for its diversity of food and shelter.

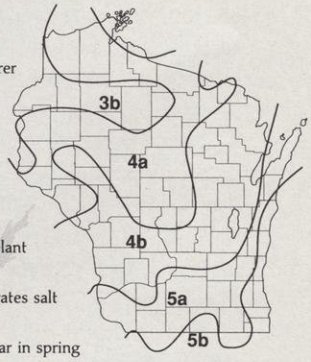
The second item is an interactive exercise. Go stand on the site of your future shelterbelt. Gaze up and stare down. Are there any power, gas or telephone lines overhead or under foot? You may have to shift the belt a few feet to one side, or plant shrubs and smaller trees underneath wires so your shelterbelt won't grow into a safety hazard. Trees entwined in power lines need to be trimmed often — a dangerous and costly endeavor that, despite the best effort of the



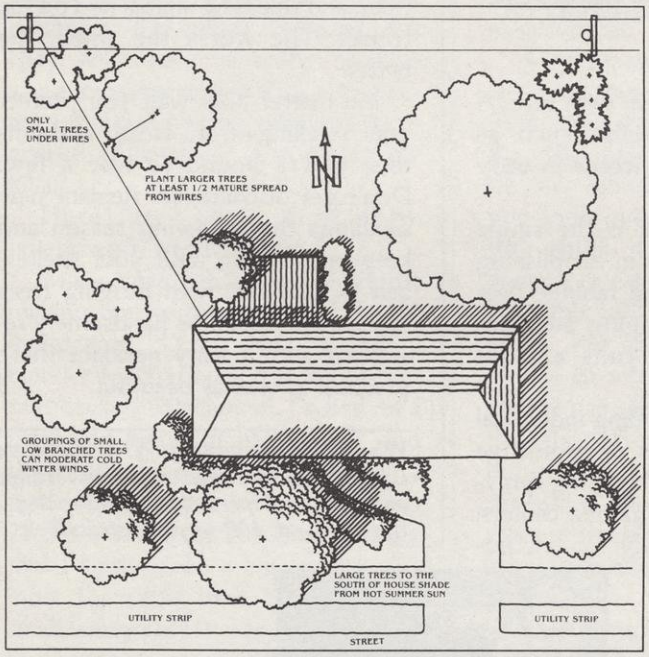
MINNESOTA DEPARTMENT OF NATURAL RESOURCES

Naturalized plantings provide woody cover for wildlife as well as wind, snow and sun protection.

NAME	HARDINESS ZONE	GROWTH RATE (slow, moderate, fast)	FORM	HEIGHT	VALUE TO WILDLIFE	REMARKS
Tall Deciduous Trees						
Acer platanoides Norway Maple	4a	m	round	60′	cover	forms dense canopy
Acer rubrum Red Maple	3b	f	round	60-90′	cover	tolerates poor drainage
Acer saccharum Sugar Maple	3b	s	round	60′	cover	salt-sensitive; fine fall color
Betula papyrifera Paper Birch	3b	m	oval	60-80′	food	attractive peeling bark; susceptible to bronze birch borer
Fraxinus americana White Ash	3b	m	round	70-80′	food	tolerates poor drainage
Fraxinus pennsylvanica Green Ash	3a	m	round	50′	food & cover	resists drought
Populus canadensis eugenei Imperial Carolina poplar	3b	f	columal	40-60′	cover	hardiest of the hybrid poplars
Quercus alba White Oak	4a	s	round	60-80′	food & cover	tolerates salt; difficult to transplant
Quercus rubra Red Oak	3b	m	round	75-90′	food & cover	plant in well-drained soil; tolerates salt
Tilia americana Basswood	3b	m	round	120′	food & cover	salt-sensitive; bees collect nectar in spring
Small Deciduous Trees						
Amerlanchier arborea Downy Serviceberry	3b	f	upright	20′	food	white flowers; edible fruits; yellow to red fall color
Crataegus Hawthorns	3b	f	spreading	15-30′	food & cover	avoid planting in moist or wet sites
Malus Flowering Crabapples	4a	f	round	15-30′	food & cover	produces abundant white to pink blossoms in May; fruits mature in September
Prunus americana Wild Plum	3	f	spreading	10-30′	food & cover	forms dense thickets valuable for bird nesting; produces dense clusters of white flowers in May
Prunus virginiana Common Chokecherry	3a	m	upright	20′	food & cover	drought-resistant; forms dense thickets. Hard to find in large quantities.
Sorbus americana Mountain Ash	3a	m	oval	20-30′	food	produces small flowers and orange fruits. Very susceptible to fire blight in warm, wet years.
Tall Conifers						
Picea abies Norway Spruce	3b	f	pyramid	60′	food & cover	dark green foliage; dense crown; resists drying winter winds; seeds eaten by red and gray squirrels
Picea glauca White Spruce	3a	m	pyramid	80′	cover	provides excellent cover for birds and mammals; prefers cool, moist sites
Picea pungens glauca Colorado Blue Spruce	3a	f	pyramid	60′	food & cover	bluish needles
Pinus resinosa Red Pine	3b	f	pyramid	80′	cover	resistant to drought
Pinus strobus White Pine	3a	m	pyramid	100	cover	tolerates salt; resists drought; susceptible to white pine blister rust
Medium Conifers						
Juniperus virginiana Eastern Red Cedar	3b	s	pyramid	20-50′	food & cover	grows in dry soils; turns brownish in winter; susceptible to cedar-apple rust, so don't plant near apples or crabapples. Hard to find in quantities for windbreaks.
Picea glauca densata Black Hills Spruce	3a	s	pyramid	40′	cover	resists drought; narrow, dense habit
Thuja occidentalis Northern White Cedar	3a	s	pyramid	40′	cover	likes wet soils and shade
Thuja occidentalis fastigiata American Arborvitae	3a	m	columnar	20′	cover	
Shrubs						
Cornus racemosa Gray Dogwood	3b	f	upright	7′	nectar & cover	small white berries mature in August; good cover for songbirds
Cornus sericea Red osier Dogwood	3a	f	spreading	10-12′	food	distinctive red stems; prefers wet to well-drained soils
Cornus amomum Silky Dogwood	3b	f	upright	12-15′	food & cover	
Physocarpus opulifolius Eastern Ninebark	3b	f	vase	10′	food & cover	arching branches of ninebark make good wildlife cover; birds eat the small seeds
Viburnum trilobum American Highbush Cranberry	3a	f	upright	10-13′	nectar & food	edible red fruits are valuable emergency food source for wildlife in harsh winters
Corylus americana American Hazelnut	3a	f	clumps	8′	food & cover	plant on well-drained sites; forms dense cover; nuts readily eaten by wildlife



trimmer, may result in a misshapen tree. Follow this rule of thumb: A tree should be planted at least one-half of its mature spread away from any overhead wires. A red maple with an anticipated spread of 40 feet at maturity, then, should be planted at least 20 feet away from power lines.



Your planting plan should consider prevailing winds, sunlight and manmade obstacles like power lines, sidewalks, buried cables, water mains and gas lines.

Choosing the right varieties

Choosing the trees and shrubs for your shelterbelt is an exercise in imagination, vision and restraint. You must be able to "see beyond the seedlings" and picture how the belt will look at maturity. To do that, you'll need to collect some data about various tree species.

Start by perusing a good tree field guide to get a feel for the diversity of tree and shrub life. Then, visit a local arboretum or botanical garden, take a walk in a nearby park, or drive by an established shelterbelt around yards or farm yards. Note which tree species are thriving, which lack vigor, what deciduous trees look like after the leaves fall. Pay attention to the shapes and sizes of different species.

Next, take a cue from gardeners who indulge in a seed-catalog frenzy each December. Write for catalogs from nurseries in Wisconsin or in other states with comparable weather. (You don't want to order trees grown in Florida, for instance. They're likely to pull up roots and head back to Orlando when the thermometer drops to 45 degrees.)

As you leaf through the catalogs and find species that are intriguing, check for the following six qualities:

1. Is the tree or shrub hardy for your temperature zone? Most catalogs have plant hardiness zone maps. If you're uncertain, inquire at a local garden center or contact your county extension agent.

2. What is the tree or shrub's height and spread at maturity?

3. How rapidly will the tree grow?

4. Is the species susceptible to diseases and insects?

5. Is the species used by wildlife? Birds, butterflies, bees, squirrels and other wildlife favor the nectar, fruits, seeds and nuts produced by shrubs like hazelnut and silky dogwood, or trees like thornapple and wild plum. Spruces and pines provide excellent cover. Maximize the natural value of your shelterbelt by choosing species that benefit wildlife.

6. Is the species easy to maintain? Does it have a reputation for brittle, easily broken branches or for producing an overabundance of seed pods or fruit that must be raked each season?

Now, a word about restraint. If you saw a tree in a catalog that really captured your fancy, stop and check the six points before you do anything rash. A redbud tree might offer a stunning spring display of flowers, but won't be able to withstand winter in Stevens Point. Boxelder attract boxelder bugs, have brittle branches, and spread like weeds. Wildlife love honeysuckle, but it's notoriously invasive. You'll be living with your shelterbelt species for a long time, so choose carefully.

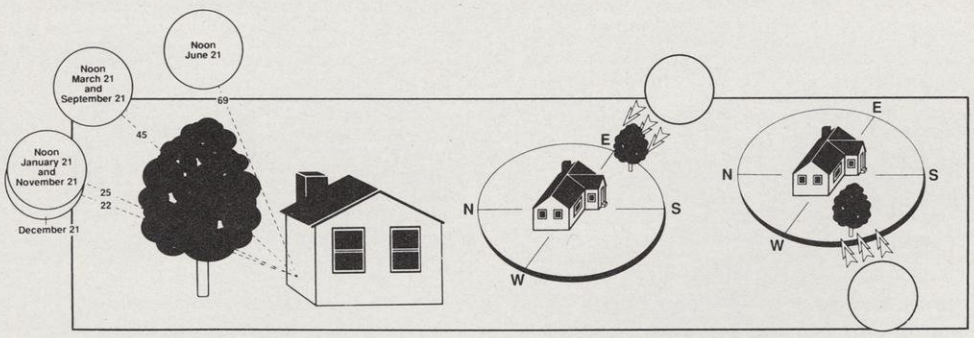
Armed with this information, you can determine how many trees to order for your shelterbelt. The Department of Natural Resources also offers packages of shelterbelt seedlings at reasonable prices. For details, write the DNR Bureau of Forestry, Box 7921, Madison WI 53707. DNR foresters and wildlife managers will be happy to answer your questions about tree species and shelterbelt designs.

Ordering and planting

Unless your last name is Rockefeller, you'll be buying seedlings rather than full-size specimens to establish your shelterbelt. Some seedlings have been seedlings longer than others, however. Nurseries designate a seedling's age with a double hyphenated number: 2-1, for instance. The first numeral indicates the number of years grown in the original seedbed; the second, the number of years the seedling has been in a transplant bed. A 2-1 white spruce is actually three years old: grown two years in its original seedbed, then transplanted into a new bed for an additional year.

Since they've been pruned and given additional growing space, transplants are larger and have better developed root systems than seedlings. They're also more expensive. If you have an abundance of patience, you can buy conifer seedlings, plant them in a garden setting, tend them for a few years until they're at least 18-24 inches tall, then transplant them to the shelterbelt. Your home transplants will compete better with weeds.

Whether it's your average red fescue/Kentucky bluegrass lawn mix or just common cow parsnip, any plant that competes with your young trees for moisture, nutrients, light and space is officially a weed. Weeds grow faster and often taller than young seedlings, killing them or



Keep your cool naturally. Deciduous trees provide shade in summer; warming sunlight in fall and winter. Trees on the east and southeast shade your house in the morning. Trees planted southwest of the house provide afternoon shade.

keeping them from growing quickly and vigorously. You must decide now how you will control weed growth, well before the first seedling arrives.

Fall is a fine time to begin site preparation. Remove or kill all vegetation in strips or circles two- to four-feet wide where you intend to plant by applying a post-emergent herbicide such as glyphosate, using a rototiller, or scalping turf right down to the soil with a hoe. Organic gardeners who eschew herbicides should roto-till or scalp the turf and rely on mulching and frequent cultivation to control weeds.

The ground should be absolutely bare when the seedlings are planted. After planting, you must continue to cultivate, mow, mulch or use herbicides to control weed growth for at least three to five years, until the trees are big enough to begin shading out the competition. Plan now for the method you intend to use.

If you choose to cultivate, expect a minimum of four or five sessions with the hoe each summer. Mowing controls competition for light and space, but weed roots still compete with tree roots for moisture and nutrients. Plus, you'll need to allow adequate space between trees and shrubs for the mower. A six- to eight-inch layer of mulch — grass clippings, wood chips, bark, sawdust or leaves — controls weeds and reduces moisture loss, but you may find it difficult to obtain enough mulch for several dozen or perhaps hundreds of trees. No weeds should be present when the mulch is set down.

Chemical controls work well when applied in the proper amount at the proper time, but always follow label directions and use them with care. A pre-emergent herbicide such as simazine will control weeds in early spring.

Controlling weeds is the single most important factor in establishing a shelterbelt. Stopping rabbits, deer and mice from chomping and nibbling on seedlings runs a close second.

Aside from surrounding individual trees with wire cages or protective plastic tubes, you can try using spray-on repellents sold at garden centers; hanging bars of stinky ... er, fragrant soap from the branches; hanging human hair stuffed in a piece of nylon stocking from the branches (check with your local barber or salon for a steady supply); sprinkling blood meal around the roots; dusting the seedling with powdered phosphate rock; rubbing liver or meat on the trees; and smearing animal lard on the trunks. The worse the smell, the better!

No matter how well you protect your seedlings from weeds and critters, you're bound to lose a few. Don't get discouraged. Replant new seedlings the following season and keep on planting until your shelterbelt is filled out with thriving trees and shrubs. You'll be handsomely rewarded with a leafy necklace that's practical as well as beautiful. □

When she's not writing, WNR Associate Editor Maureen Mecozzi is out weeding, mulching and periodically replanting a two-year-old, 300-seedling shelterbelt.

Confessions of a tree planter

A personal testimonial from the author, who, having oft been humbled in her efforts by the superior wits of weeds and rabbits, offers this tree-planting advice gleaned from the College of Outdoor Knowledge:

1. Don't.

2. If you insist, get plenty of mulch. Then get more. And more. Perhaps you have some nice neighbors who will be happy to unload their grass clippings and leaves, or know a carpenter with wood shavings galore. Cultivate these friendships. You will need them.

3. Develop a taste for *hasenpfeffer* (German rabbit stew). If it's not to your liking, plan to spend the winter making cages for your seedlings from poultry netting — wire or plastic — and wooden lath or stakes. Cages are well worth the investment of time. If it's money you have to invest, buy plastic tubes. Brands like Tubex consist of a thin plastic tube with narrow open chambers running the length of the tube that collect condensation and direct moisture to the roots. You slide the tube over the seedling and attach it to a stake. Gnawing beasts are utterly foiled.

4. See #1.

5. Ignore #4. After planting a couple hundred trees and tending them for half a decade, you may not survive to see your hard work come to fruition BUT someday, somebody will be around to appreciate it. You'll have done a great service to birds, wildlife and your neighbors.

DENNIS YOCKERS

Testing the waters

Students drawn past the water's edge discover common concerns with their neighbors.

Suzanne Wade

It's easy to say that Wisconsin's rivers and streams deserve protection; that pristine waters should stay that way; that waters used by industries and cities are burdened with pollution. Nobody would disagree with those statements, but intentions alone do not clean waters or restore them. Rivers and streams need supporters. Even more, they need advocates who understand how natural systems work and how human activities affect waterways.

A nucleus of 600 high school students is wading into these water quality issues. They take the vital signs of waterways: recording the seasonal and annual changes of rivers near their homes. That's not so unusual. School projects have gauged water clarity, performed chemical tests and hunted for aquatic bugs since the early 1970s. What's unusual is these students carry the idea a step further. They judge how their local waterway measures up to other waters nationwide and worldwide.

The program, "Testing the Waters: Linking Students and the Water through Technology" (TTW), combines the tools of scientific investigation and the power of communications technology to focus on a practical problem in the students' home communities.

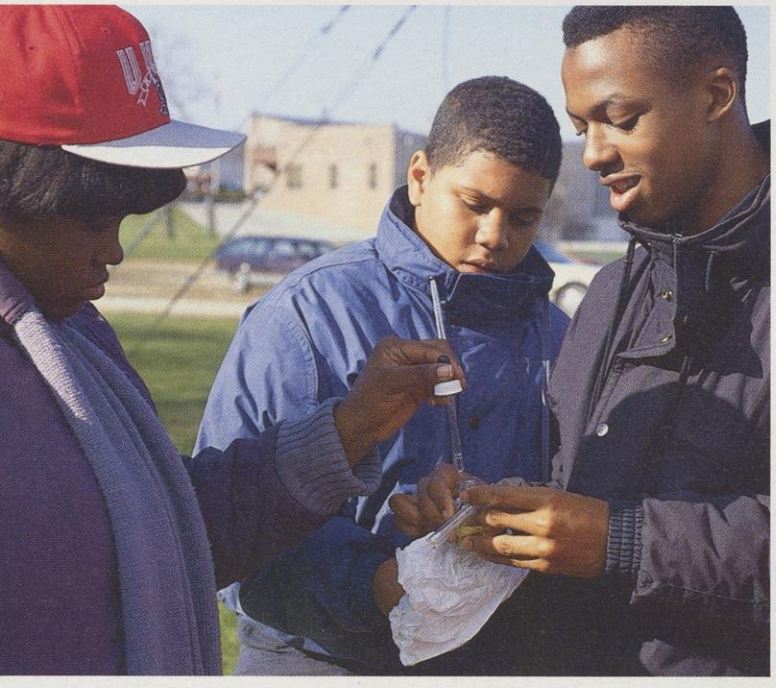
TTW takes a practical approach. Students get out of the classroom to collect water samples, insects, fish, clams, crustaceans, worms and other aquatic organisms that indicate water quality. Compiled information is available via computer to a nationwide network of schools using the same methods to monitor water quality in their communities. By tracking water quality changes and comparing results with students from other schools along the same river, the students appreciate that the waterway does not begin or end at their town lines. Solving water quality problems requires cooperative work among many communities in the same watershed.

Educators believe the TTW program, originally developed to study the Rouge River that winds through industrial Detroit, provides a model for schools in riverside communities in Wisconsin.

The TTW program was tested last year in 16 Milwaukee area high schools in five counties. Another 16 schools have joined the program this fall. The project started last October when students and teachers met in a two-day workshop at Riveredge Nature Center. Participants learned how runoff from city streets, farmyards and building sites has worsened water quality on the Milwaukee area's three major rivers: the Milwaukee, Menomonee and Kinnickinnic. Schools selected for the pilot project are located near rural, urban and suburban river stretches of these metropolitan rivers.

SUZANNE WADE

(left to right) Linda Weinkaetz, Kaying Chang, Sherry Puckett and Tammy Neuy of West Bend West High School sampled upstream portions of the Milwaukee River.



DENNIS YOCKERS

The same biological and chemical tests were performed by students downstream in Milwaukee. By comparing results, students learn how water quality changes as rivers pass through communities on the journey from the headwaters to Lake Michigan.

Land use in each community affects water quality. In the rural stretches, farming practices add large amounts of soil, fertilizers and pesticides into the water. Adjacent golf courses and lawns that are right down to the riverbank also add fertilizers and pesticides. In the suburbs, eroding soil at construction sites and failing septic systems carry sediments, nitrates, phosphates and bacteria into the water. Large flocks of city geese and ducks add their own interesting assortment of pollutants to the water. In the city, every rain washes a smorgasbord of chemicals, leaves, litter and debris into the river through storm drains.

Guided by environmental professionals, the 90 students learned how to take ten different chemical, physical and biological tests. The experts explained how these tests correlate to water quality. The students also learned procedures for recording sampling results and sharing data via computer modems with other schools. Students who attended the workshop trained the rest of their class when they returned to school. Trained naturalists from area nature centers accompanied each class as students tested the waters.

It paid to hit the waters early. The first tests occurred during balmy, crisp Indian Summer days in early November. Later, others would win the "Zero Award" for testing when the wind chill dropped below zero. Even with grey skies and snow-slicked leaves, the students gathered up test samples, lowered measuring devices from bridges and donned hipboots to gather insect samples.

Only a few students tripped and took an unwelcome dip. Joel Mandelmann, a student from Nicolet High School, squeezed water from winter clothes and said "This is really interesting. If we can find ways to clean up the river, maybe we could use it for recreation."

Students testing in the contaminated Menomonee River Valley wondered how the water had gotten "so

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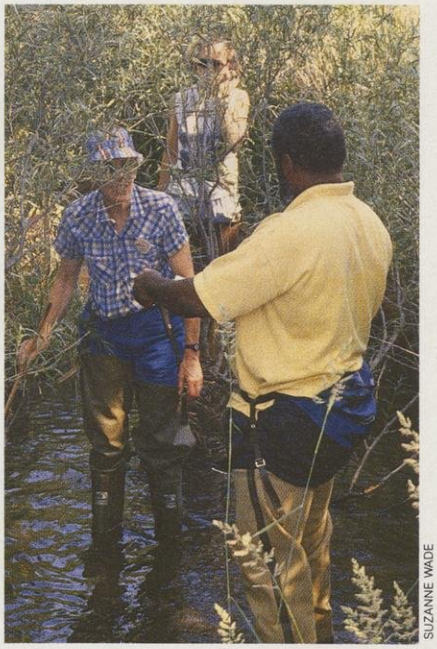
Teachers wade the waters to learn the testing skills they will pass on to students.



SUZANNE WADE

THE MISSING LINKS

Enjoy your hunting season even longer by making sausages and jerky at home. Here's how.

David L. Sperling
Photos by Robert Queen

Hunters enjoy their sport so much that they are famous for finding ways to extend the season. They schedule planning meetings with their hunting buddies. They build tree stands and blinds or spend weekends sprucing up the hunting shack. They go on scouting trips. They work on their equipment, go hunting and take their deer to the meat locker. A month or so later, the freezer is filled with roasts, ring bologna and summer sausage that will be savored at parties and get-togethers to relive the hunt.

There's is another way to put your personal touch on your hunt: try making your own sausages and jerky at home. Just as many anglers have discovered the pleasures of smoking and pickling fish, you can make home blends of garlic and herb sausage, smoked luncheon meats and venison jerky.

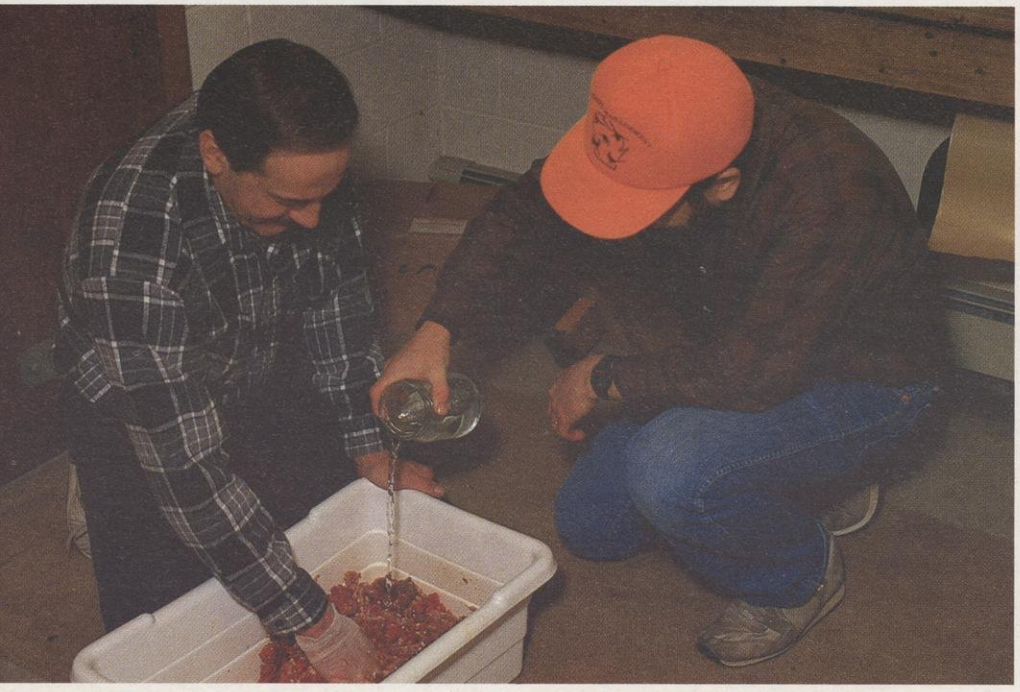
A tasty assortment of meaty treats are yours for the making. **1.** pepper loaf, **2.** brining needle, **3.** pastrami, **4.** kielbasa, **5.** oven and meat thermometers, **6.** summer sausage, **7.** Italian sausage, **8.** country sausage, **9.** jerky

How wurst meisters get started

Roy Javenkowski and Larry Maltbey, of Rhinelander, Wis. took the time to show *Wisconsin Natural Resources* magazine just how much fun it can be. Javenkowski runs a certified auto repair business in

(above) Keep it clean and pay attention to details. Roy Javenkowski dons latex gloves to grind and mix game meat with pork for homemade sausage. He carefully trims and weighs each batch keeping a close eye that the meat is the right texture for each type of sausage.

(below) Follow a recipe and keep notes. Javenkowski and Larry Maltbey add water to the mixture of meats, cures and spices. All ingredients are carefully measured and mixed in a set order. Home sausagemakers should keep a record of each batch to take the guesswork out of quality wursts and loafs.



town. "I hunt and fish in my spare time," he said. "I built a smoker and started smoking fish to add some variety to eating fried fish. Then I thought, jeez, I'd like to try something else. I wanted to make sausage from the venison and other game I hunted, but in those days, I couldn't get any good information on it. Everything was geared to commercial sausagemakers who were working with large quantities of beef and pork."

"I got interested in smoking meats after about 30 years of smoking fish," explained Maltbey, who leads the water resources biologists for DNR's North Central District. "In fact, that's how I met Roy. About six to seven years ago we were both trying to learn about sausagemaking."

" When I first started making sausages, I didn't know much about curing sausages," Javenkowski related. "I made a lot more dog meat than edible sausage, and I don't have a dog now," he smiled, "so I have to be more careful."

How the pros do it

The homemade process is not that different from the steps followed by professionals.

Commercial sausagemakers first clean and weigh the game. "The product has to be of the highest quality," says Mike Woelffer of Marshall Sausage Kitchens in Marshall, Wis. "All fat, gristle, hairs, skin and off-color meat must be removed to make good sausage. You can make sausage from tougher cuts of meat, but basically, if the meat doesn't look good enough for the table, it isn't good enough for sausage either."

Game meat is mixed with curing salts and stored under refrigeration for several days or longer. Game is mixed with other meats (usually pork or beef trimmings), ground and prepared for stuffing. Different products get different spicing and different grinds. The mix is then fed into a stuffer and into casings where it's twisted into rings, links or sticks. Meat hangs in the smokehouse and is cold smoked (160-180°F) for about

18-20 hours. The final product is steam-cooked, wrapped and refrigerated.

Some homemade sausages are not cooked. They are fatty sausages that are dry-cured and hung for several weeks until the outside shrivels into a dry rind. Genoa and other Italian sausages are typical of these delicious, dry-cured, sausages, but they are tricky to make. Novice sausagemakers should stick with varieties that are smoked and cooked to ensure all bacteria and molds are killed.

Here are some tips from Javenkowski and Maltbey:

Make small batches — "I started making bratwurst at home about 15 years ago," Larry said. "I used a blender/food grinder that had a sausage-stuffing attachment. I relied on a premixed blend of brat spices, and they turned out pretty well, but I made some mistakes. I used to make 25 pounds of brats at a time, figuring that I could make a big batch in almost the same time I could make small batches. That was a big mistake. By the time we got around to eating those last 15 pounds of brats, they were freezer burned.

"Now we know. We keep our game meat frozen and we only defrost three to five pounds at a time. We also like to mix lean pork trimmings into our sausages and loaves. Anytime you make sausages with pork, we've found it's better to make small batches that we can eat up in a month or so."

Keep the meat clean — "You can't use junk meat and expect to make good sausages," says Larry. "Keep the meat clean, trim out the fat, gristle, any blood, hairs and the like. If you look over a piece of meat and you think it doesn't look good enough to eat as a roast, then it isn't fit to mix into 10 pounds of sausage either. We also wear latex hospital gloves to mix the meat and spices, and we use a lot of cold water to rinse the fats out of equipment and keep things very clean. You have to be concerned about cleanliness because you are working with foods that will grow bacteria and molds if you're not careful."

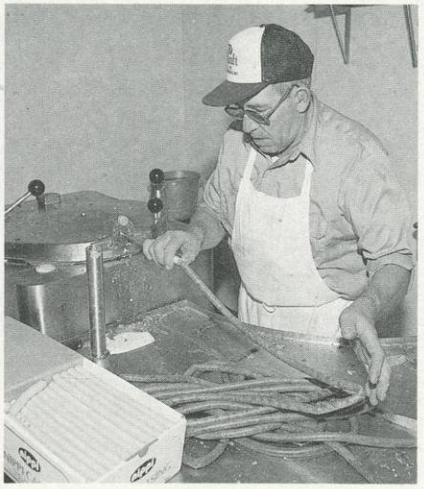
Keep the meat cold — "You learn a lot by trial and error," Roy said. "I knew that it was important to keep everything very clean, but it took a while to learn that it's equally important to keep everything very cold. We cut up the meat into chunks or strips, mix in the spices, add the cures, grind the meat, stuff the casings, cool the sausages, let them sit and then dry them. We keep the meat cool the whole time. The surface of the sausage also needs to be dry before you smoke it."

Use thermometers — "My smokehouse is a little fancier than most," Roy says. "I heat it with gas and I can control the temperature and vents pretty precisely. The point is, I have more control than the person using a small electric smoker or a grill, but I still rely on thermometers when I'm cooking. I watch the oven thermometer and I stick a meat thermometer in the center of a large sausage to gauge how fast the sausage is cooking and when it's done. Never guess about the internal temperature of meats by looking at the outside."

"It's no different when you are using your oven to cook jerky, pastrami or a loaf," Larry added. "Home ovens typically are not calibrated for the low temperatures and long cooking

(left) Take your time stuffing sausages. Italian sausages are slowly forced from the stuffer into casings. Each sausage link is pinched and twisted in one direction. The next link will be twisted in the opposite direction to prevent unraveling in the smoker.

(right) Commercial sausagemakers follow the same steps on a larger scale. Here "hot sticks" are formed in an electric stuffer controlled with a foot pedal.



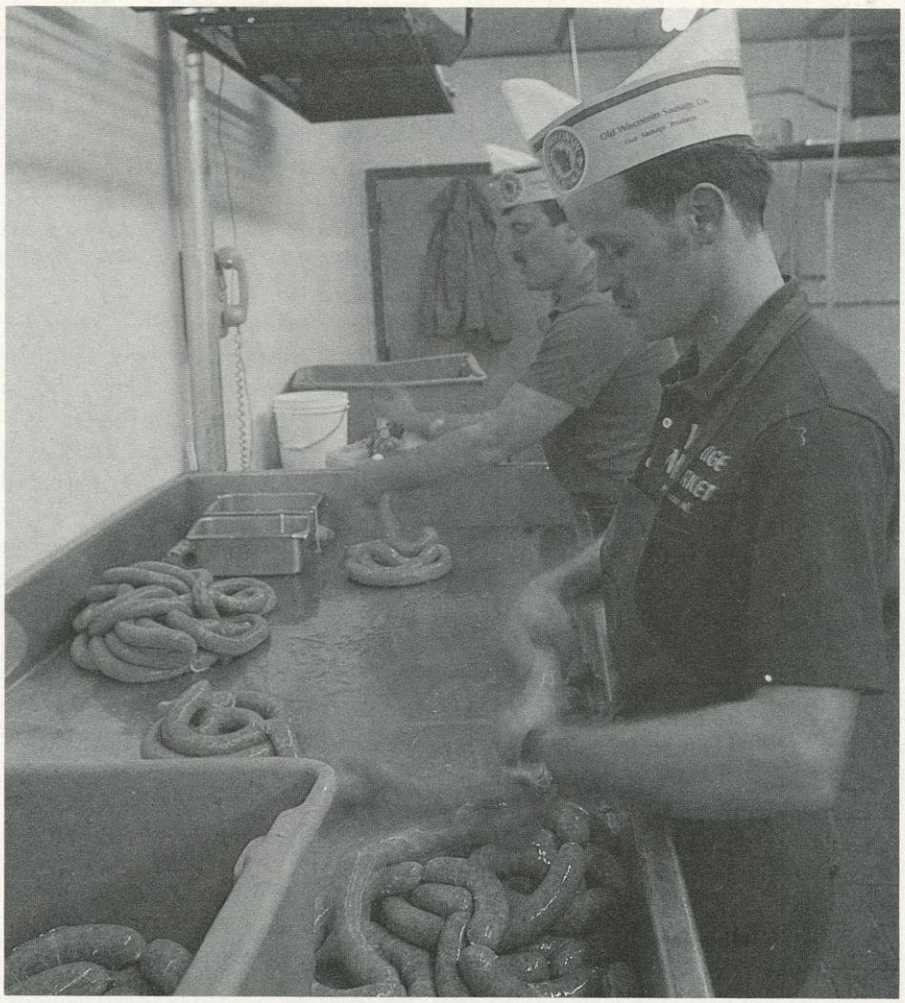
times called for when making sausages or dehydrating jerky. In fact, most oven dials don't even show temperatures below 200°F. Yesterday, I wanted to cook a sausage at 170°F and I guessed where that was on the temperature dial. Well, that oven light didn't stop heating until 200°F and it took me several minutes of fooling around with it to get the oven to hold at 170° where I wanted it."

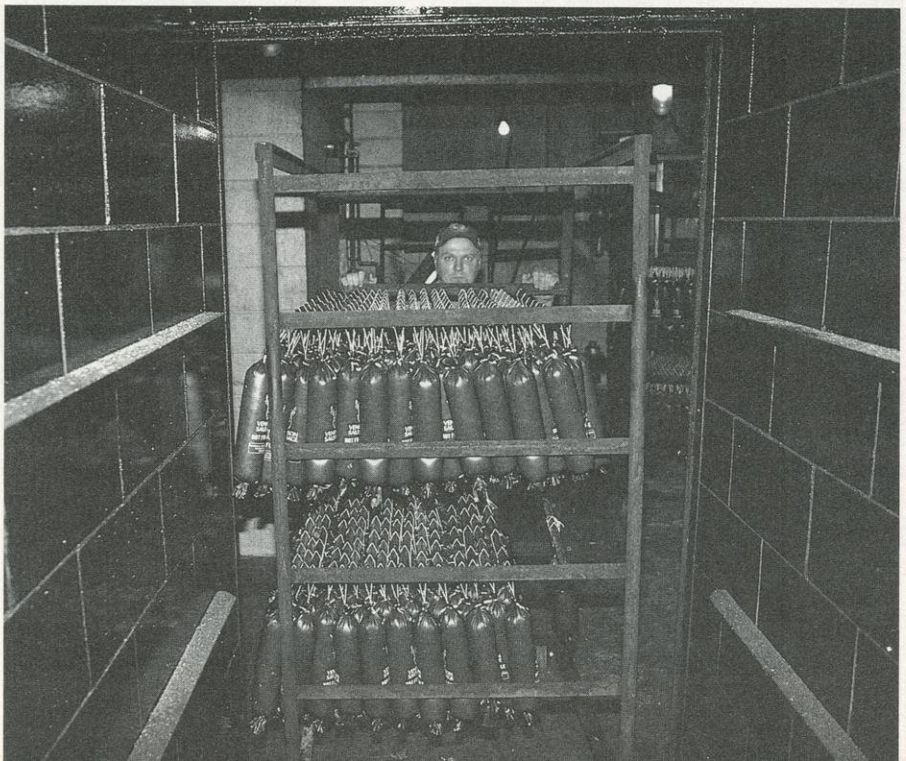
Look for local supplies — It's probably easier to get some of these supplies in smaller towns than in larger cities. Small towns may still have local meat markets that will sell a person casings and equipment. We buy our casings, clean them and freeze according to directions. Some are frozen solid, other are frozen in a salty water solution. These days, most sausagemakers use synthetic casings for larger sausages, but may still use lamb casings for small sausages like wieners. We use beef casings for kielbasa, bologna and country sausage; pork casings for brats, Italian sausage and hot dogs; lamb casings for hot sticks and slim jim type sausages.

We also found a meat supply house that sold us durable plastic tubs. They are great for making small batches of sausage and they clean up quickly.

We bought our meat grinder second-hand and rigged it up with pulleys to a small motor. The sausage stuffer and spices were purchased mail-order.

Buy small quantities of spices — We've found several places that will sell fresh spices in bulk and also sell some of the special supplies called for in sausage-making. Several recipes call for corn syrup solids, curing compounds, dextrose and the like. These aren't things you can typically find on a grocery shelf, but you'd be surprised how many places sell these items through the mail. We've purchased spices from Butcher Packers Supply in Ohio, Mandeville Company in Minneapolis, Minn.; F.W. Witt & Company in Yorkville, Ill.; and Rytek Kutas in New York. Food





Fine sausagemaking is an art and a tradition practiced to perfection at many small businesses throughout Wisconsin. (above) Seasoned hands hand-twist bratwurst at lightening speed at the Village Market in Waunakee. (below) Mike Woelffer wheels racks of venison summer sausage into the smokehouse at Marshall Sausage Kitchens. The sausages will be smoked for 18-20 hours then steam cooked to a uniform internal temperature.

Javenkowski adds wood chips and sawdust that will flavor country sausages. The temperature in his gas-fired smokehouse can be carefully controlled, but he uses both an oven thermometer and meat thermometers to keep close track as the sausages slowly cook.

co-ops sell bulk spices or you may also convince a local sausage house to sell you some of their spice mixes. We suggest ordering small quantities, because spices are better fresh and you will want to try several blends until you find one you really like.

Keep records — Meat, spices, cures, grinding method, storage, casings and smoking times can all change the taste and texture of homemade sausages. Since sausagemaking can be so variable, it's important to keep records of each batch. That way you can make adjustments if a batch is too salty or crumbly, or repeat your recipe if you got it just right. Note how ingredients were prepared and ground, how long the batch cured, mixing time, casing type, smoking times, temperatures and wood choices in the smokehouse.

Practice stuffing sausages — Stuffing a good sausage is an art that is learned more than taught. Keep the casing wet. Slowly fill the sausages. Watch for air bubbles. Twist the link in one direction, then twist the next link in the opposite direction to prevent unraveling. Restuff any sausages where the casing bursts or has holes. Handle sausages with care.

Know your smoker — Each smoker is designed to put a certain quantity of product a set distance from the heat source. Follow manufacturer's directions, keep the smoker clean and monitor the temperature to keep meat within the 150 - 180°F temperatures needed to kill microorganisms. Some commercial smokehouses smoke at colder temperatures, then cook or process the product before it's eaten.

Mike Woelffer offers these additional hints about smoking sausage in a tiny electric smoker or in a larger commercial operation. "You want to start the smoking process and then keep everything going in the right direction — slow steady heat," he says. "You don't want the temperature of the venison sausage to keep going up and down because that overcooks the outside or undercooks the inside of the meat. You don't want it too cold because the smokehouse can heat unevenly and won't give the meat a nice smoky taste.

"Many smokehouses, even commercial ones, don't pay enough attention to the smoke: They get uneven heat, the smoke doesn't penetrate all the way and the sausage centers aren't done. A stick of meat that's underdone may look o.k. from the outside, but it will rot and get green inside. You want to build the smoke to a nice, even temperature and then hold it there until the smoky flavor penetrates the meat — hot but not too hot to overcook the meat."

"We smoke our meats for about 20 hours at about 160-180°F, then move it to a steam cooker for about an hour and a half at 170°F. That heats everything up to the same temperature and gets the entire stick of sausage up to an even internal temperature of about 152°F."

Storing sausages — All sausages should be cooled and dried before storage. Most sausages can be stored in a refrigerator for seven to 10 days. Before freezing, wrap each sausage in plastic wrap, seal it and then rewrap in freezer paper.

Start smokin'!

Javenkowski and Maltbey agreed to share several of their favorite recipes, but many others are available at public libraries and bookstores. They recommend *Great Sausage Recipes and Meat Curing* by Rytek Kutas, (MacMillan Publishing Company, New York, currently out of print). A new book, *The Quick and Easy Art of Smoking Foods*, by Chris Dubbs & Dave Heberle (New WIN Publishing Company, Clinton, NJ) is a how-to guide with a few recipes for fish, game, commercial meats, cheese and vegetables. We especially liked the Appendix — Troubleshooting Your Smoking Problems. The University of Wisconsin-Extension office offers dandy publications on butchering game, game cookery (soups, stews, and venison recipes) and home canning of meats. The UW Sea Grant Institute offers publications on home smoker designs, fish pickling and fish smoking.

Here are a handful of recipes well worth trying. *Note: Prague powder #1 is a brand name of nitrate sausage cure. When using another brand, start with this amount and experiment a bit until results are satisfactory. Fermento is a brand name of a flavoring powder that adds a slight sour taste.*

COUNTRY SAUSAGES

makes about 11 pounds

5 pounds trimmed pork butt
5 pounds lean venison
1 pint water
6 tablespoons salt
2 tablespoons black pepper, cracked
1 tablespoon cayenne pepper
1 tablespoon garlic powder
1 teaspoon mace
3 tablespoons powdered dry mustard
4 teaspoons onion powder
½ teaspoon nutmeg
2 teaspoons Prague powder #1
1 ounce corn syrup solids
1 cup dry nonfat dry milk
1 teaspoon mustard seed

1. Grind meat through a ¼" grinder plate. Mix in salt, peppers, garlic, mace, mustard, onion powder, nutmeg, curing powder.

2. Mix in water slowly. Add corn syrup solids, dry milk and mustard seed.

3. Load into sausage stuffer, fill 1½ to 2" casings and twist 10-12" links. Dry the sausages.

4. Smoke 3-4 hours until internal temperature reaches 170°F.

5. Cool in a snowbank, cold water bath or refrigerator.

KIELBASA

makes about eight 2-pound rings or links

15 pounds of pork butt or pork/game mix
1½ pints ice water
3 cups dry milk
7½ tablespoons salt
1½ tablespoons sugar
1 tablespoon Prague powder #1
1½ tablespoons black pepper
3 cloves garlic, pressed
1½ teaspoons marjoram

1. Grind meat through ¼" plate.

2. Mix in other ingredients in order. Mix well after each ingredient is added.

3. Stuff into bratwurst-sized casings but form into longer links or bologna-sized rings.

4. Smoke until kielbasa reaches internal temperature of 160°F

SLIM JIMS

a thin, hot snack meat

5 pounds pork or pork/beef/game mix
1 tablespoon Prague powder #1
2 tablespoons paprika
3 tablespoons ground mustard
1 teaspoon ground black pepper
½ teaspoon ground white pepper
½ teaspoon ground celery salt
½ teaspoons mace
½ teaspoon garlic powder
2¼ ounces salt
¾ ounce powdered dextrose
3 ounces Fermento
2 teaspoons cayenne pepper

1. Grind meats twice through fine grinder plate (3/16" or finer).

2. Add other ingredients. Mix after each addition.

3. Stuff narrow, ½" but long (10-12") sausages in lamb casings.

4. Smoke several hours until sausages reach an internal temperature of 170°F.

ROY'S SUMMER SAUSAGE

makes 50 pounds, about 16 sticks

25 pounds pork
25 pounds venison
1 pint water
1 pound Heller's Complete Cure with sugar
25 tablespoons coarsely ground black pepper
25 teaspoons mustard seed
25 teaspoons garlic salt
10 teaspoons hickory smoked salt
3 teaspoons crushed whole peppercorns
5 teaspoons cayenne pepper
5 teaspoons garlic powder
12 ounces Fermento
2 ounces powdered dextrose

1. Grind meat through a ¾-inch plate. Mix well and grind again.

2. Add one pint cold water.

3. Add other ingredients, mixing after each addition.

4. Stuff into large, synthetic casings (about 3 inches and 14-15 inches long).

5. Smoke three days at temperatures not exceeding 100°F.

6. Preheat oven to 150°F. Cook until internal temperature of sausages reaches 142°F.

7. Cool in a cold water bath until completely cooled, then hang in a cool, dry place for 1-2 days to dry.

VENISON PASTRAMI

4-5 pound venison roast

The brine:
2 tablespoons garlic powder
6 tablespoons curing salt
¼ cup white sugar
1 teaspoon ground black pepper
2¼ cups water

The baking cure:
2 tablespoons coarsely ground pepper
1 tablespoon ground coriander

1. Select a solid rump roast or any large muscle meat from the hind quarter. Trim all fat from roast.

2. In a saucepan, combine all brining ingredients and bring to a boil. Cool brine completely.

3. Inject brine with a brining needle throughout the roast. If the roast contains the large, femoral artery, pumping brine through this artery will feed the solution throughout the roast.

4. Store the meat covered in a plastic, glass or enamel pan in the refrigerator. Never brine meat in a metal pan. Turn the meat and pump brine into the roast once a day for five days.

5. After five days, rinse the roast, then soak it in water for five-10 minutes. Repeat rinsing and soaking, then pat the roast dry. Rub the roast on all sides with the baking cure.

6. Place coated roast in a broiler pan on the middle rack of the oven preheated to 150°F. Cook one hour. Insert a meat thermometer in the roast. Raise temperature to 200°F and cook for 5-9 hours until roast reaches an internal temperature of 170°F. Remove pastrami. Wrap it loosely in a dry towel and let it cool overnight. Pastrami can be stored or sliced the next morning.

OLD FASHIONED PEPPER LOAF

makes 10 pounds or four loaves of tasty sandwich meat

7 pounds pork butt
3 pounds beef chuck, venison or other game
6 tablespoons salt
8 tablespoons corn syrup solids
1 tablespoon coriander
4 tablespoons onion powder
3 teaspoons ground celery seed
1 tablespoon ground white pepper
2 teaspoons Prague powder #1
1 quart ice water
3 cups nonfat dry milk

1. Grind pork through 3/16" grinder plate. Add ¾ of all remaining ingredients except the ice water and the dried milk. Mix well.

2. Grind the beef or game through the same 3/16" plate. Add to other meat mixture and add remaining spices, ice water and dried milk. Mix very well and set aside.

3. Spray four bread pans with non-stick cooking spray. Sprinkle the sides and bottom heavily with crushed black pepper.

4. Press the meat mixture into the pans working it in with your fingers to assure all air pockets are eliminated. Smooth the surface with wet fingers until each loaf is shaped like a mounded loaf of cooked bread. Press crushed pepper into the top of each loaf.

5. Bake in the smokehouse for eight hours at 170°F or until internal temperatures of each loaf reach 152°F.

6. Remove and cool overnight.

Making jerky

Dried or "jerked" meat has been a standard method of preserving meat for centuries. In arid areas, meat was often smoked or peppered to keep off flies and air dried. In our more humid climate, the meat must be dried in a dehydrator or slowly dried in an oven.

VENISON JERKY

3 pounds lean venison from the hindquarter

The marinade:
1 tablespoon salt
1 teaspoon Prague powder #1
1 teaspoon onion powder
1 teaspoon garlic powder
1 teaspoon ground black pepper
¼ cup light soy sauce
⅓ cup Worcestershire sauce
1 teaspoon cayenne pepper

1. Cut meat into strips ¼ to ½" thick and ¼ to ¾" wide.

2. Mix marinade in a large glass bowl. Marinate meat 24 hours. Stir and turn the meat twice during that period.

3. Drain and dry the strips.

4. Place in a dehydrator at 145°F or place on the oven racks. If you own a gas oven with a pilot light, the heat from the pilot light will dry the jerky in 3-4 days. Otherwise, preheat oven to 150°F. Place racks back in oven and leave the door cracked open. Jerky will dry in 6-8 hours.

5. Cool and store in airtight cans or plastic bags.

RESTRUCTURED VENISON JERKY

a way to make jerky from venison scraps

For each pound of venison, measure:
1 tablespoon curing salt
1 teaspoon sugar
½ teaspoon black pepper
½ teaspoon garlic powder

Mix together with a spoon.

1. Select lean meat. Trim all visible fat and the connective tissue (fascia) butchers call "silver skin." It has a shiny, smooth surface that stays rubbery tough if cooked.

2. Grind strips of meat through a medium-fine plate of a meat grinder or blend them in a food processor until the meat is the consistency of coarse hamburger. Mix meat with measured seasonings.

3. Place ground, spiced meat between two large sheets of waxed paper or plastic film. Roll with a rolling pin to a uniform ¼-½" thickness. Cut into strips ¾" wide by several inches long.

4. Carefully transfer strips to the drying rack of a dehydrator or place directly on an oven rack. If oven-drying, dry at 150°F for 10-11 hours until meat is chewy and leathery.

5. When jerky is dry, blot up any oily drops from the surface with a paper towel. Cool completely in open air until meat is room temperature. Store in an airtight container (a clean dry coffee can is fine) or freeze in airtight freezer bags.

Keeps up to a year. Says Roy: "Properly prepared, it'll keep indefinitely, or longer!"

Hot sticks headed for the smoker at Marshall Sausage Kitchens.

continued from p. 16

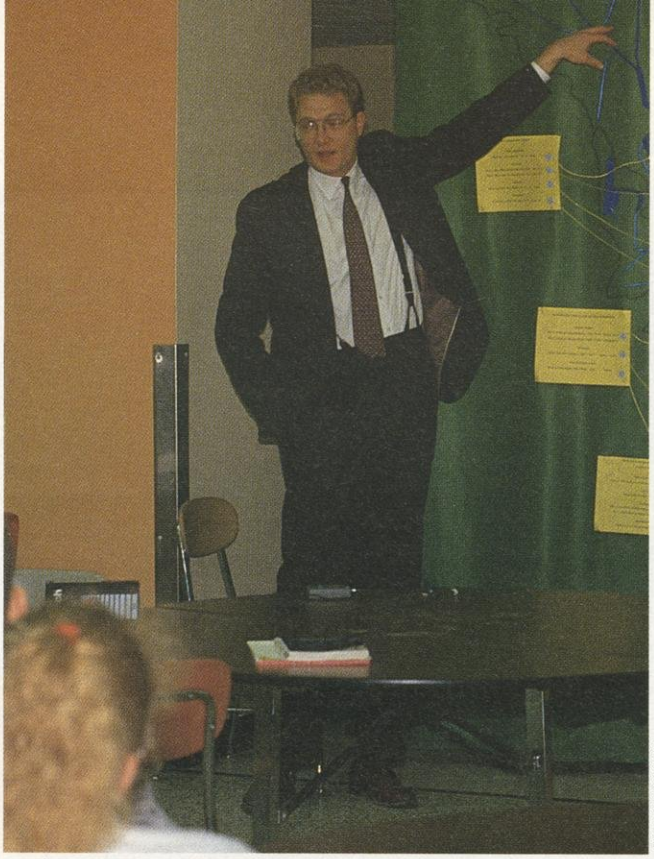
bad" and what could be done to clean it up. Here, rubber gloves protected the students from contaminants and bacteria. These students want to see their results used to enlighten others to the dangers of water pollution.

Collected data was tabulated, charted and rated using a water quality index similar to test scores the kids see at school: scores of 90 - 100 were classified as "excellent water quality"; 70-90 range was "good"; 50-70 was "medium"; 25-50 was "bad"; below 25 was "very bad." Since weather and season affect water quality, each site was tested at least twice during the school year; once in late fall and once in early spring.

The lowest score was recorded in spring behind the Waubeka Dam. A Menomonee River site in the industrial flats of Milwaukee was close behind. Not surprisingly, the best water quality was recorded in smaller upstream tributaries.

More than beakers and biology

The project didn't end with fall and spring monitoring. In April, 100 students held a Testing the Waters Student Congress at Riverside University High School. Armed with charts, slides and videotapes, students from schools in similar areas of the watershed analyzed their results and developed recommendations for improving water quality in their communities. Milwaukee's Mayor John Norquist listened to the presentations and gave an encouraging keynote address that was sensitive to students' concerns.



DENNIS YOCKERS

Milwaukee Mayor John Norquist describes challenges of working with many communities to protect the watersheds and rivers that drain through the metropolitan area. Watershed boundaries are shown in red, rivers in blue and testing stations are marked with yellow dots.

Afternoon workshops showed how student commitment to clean water could be turned into action in home communities. Topics included Writing to Get Attention, Communicating with Government Officials and Creative Expression with a Message through Music. At day's end each student and teacher pledged to do one thing to improve water quality. The pledges were personal, serious declarations that took seed.

Spillover to riverside communities, study habits and values

Two students from Juneau High School won environmental essay contests using nonpoint pollution as their subject. Students from other schools conducted semester research projects on water pollution. Other students will conduct similar studies on Lake Michigan through the Schlitz Audubon Center. Riverside University High School and the local Rotary are considering "adopting the Milwaukee River" as a theme for a school/business community partnership.

The program attracted an impressive array of sponsors. Private/public funding has come from in-kind donations from Riveredge Nature Center, Havenwoods Environmental Awareness Center, Schlitz Audubon Center, Wehr Nature Center/Extension Services, University of Wisconsin Extension, Milwaukee Priority Watershed Program, Wisconsin Department of Natural Resources, Milwaukee

You could get a close look at aquatic organisms, review test results with colleagues and share a good time at the Testing the Waters Student Congress.

DENNIS YOCKERS

DENNIS YOCKERS

Students are encouraged to find different ways to express environmental concerns. Creola Frye and Ananda Morningstar (left to right) from Rufus King High School designed a tee shirt for the Testing the Waters conference.

County Extension, and the Milwaukee Metropolitan Sewerage District. Grants came from the Milwaukee Foundation, The Wisconsin Energy Corporation Foundation, the Wisconsin Coastal Management Program, the Wisconsin Department of Natural Resources, the Wisconsin Environmental Education Board and interested individuals.

The water testing program attracted interest from local journalists. A number of newspaper articles tracked the students' progress and a segment of a TV outdoors show focused on the project. One teacher credits the publicity with revitalizing his school's ecology club. The club plans to work with elementary students on river cleanups next year.

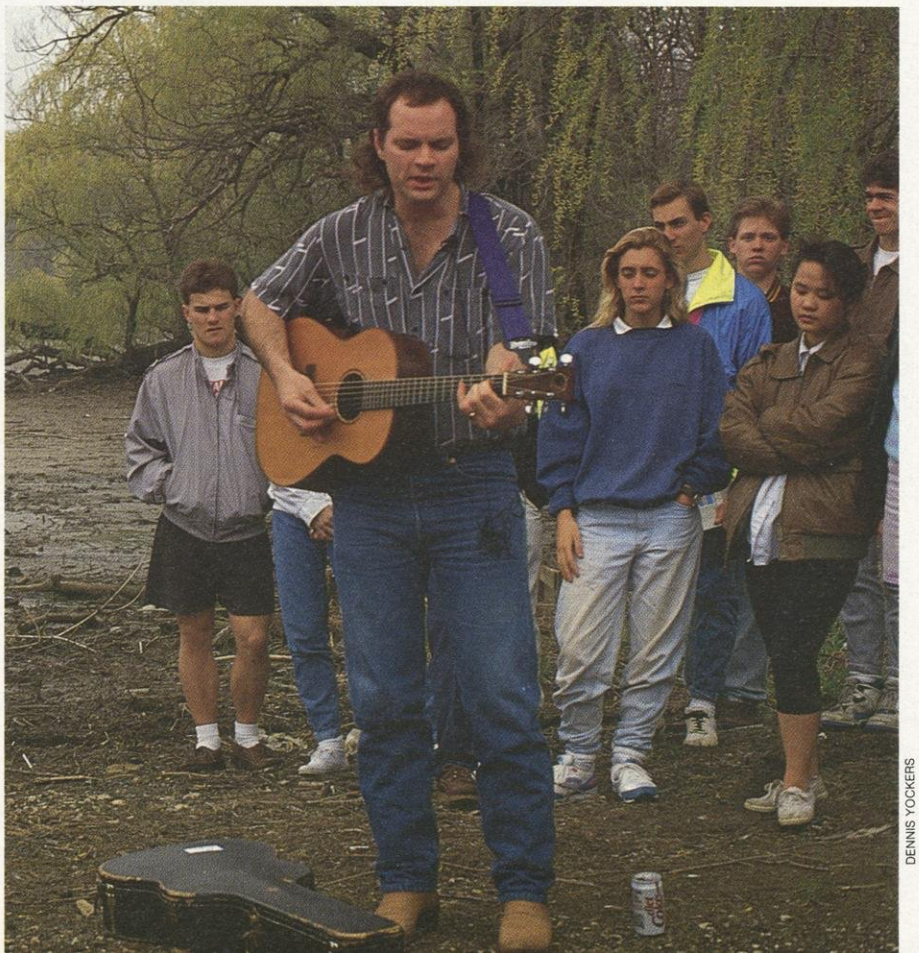
One of the biggest undertakings followed a canoe trip on the upper Menomonee River. Chuck Ritzenthaler's students from Germantown High approached the school board for permission to send letters to local homeowners describing simple things individuals can do to improve water quality. The letters were sent out this past spring. Several teachers report the project has strongly influenced students' career plans. One teacher deemed the program the "strongest career influence" in his 13 years of teaching.

The program also reinforces good study habits and problem-solving skills. Students use the same procedures professionals use when collecting samples and transmitting data. Chemistry classes identify and quantify chemical reactions; biology classes classify fish, plants and insects using a variety of lab skills. In fact, schools have infused programs like Testing the Waters into humanities, history, math, and geography courses as well as agriculture, biology, ecology and environmental science classes.

As Paul DeChant, teacher at West Bend East, stated: "It's a different way to teach chemistry. We're finding that water quality is improving in Riverside Park since the dam was removed." The class documented increases in dissolved oxygen, cooler, faster water and a greater diversity of insects and invertebrates. DeChant said that one of his major goals is to help make the average person more aware of their impact on their environment.

This awareness and the students' desire to do more multiplied when

Environmental balladeer Ken Lonnquist showed the powerful message music carries along the shores of the Milwaukee River.



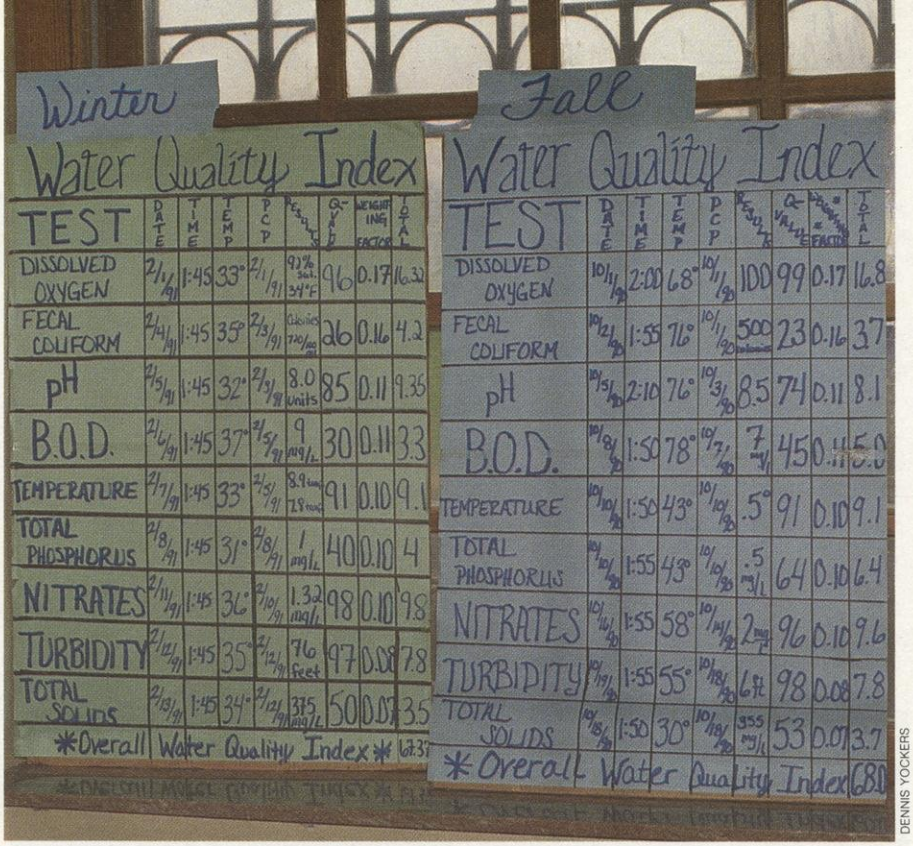
DENNIS YOCKERS

they started viewing the river's watershed as a system covering more than 830 square miles. A Grafton teacher, Stu Hannam, appreciated the chance to blend science with real life experiences. Hannam's students use their science skills to evaluate what they've found, but more importantly, they feel they are participating in a meaningful study.

Drew Hettich, a student at Rufus King High School, echoes that message. "I think it's a good learning experience for people our age," he said. "If you let people learn this stuff while they're young, they'll practice some of the principles later on, and take care of what they've got." Mark Anders, Nicolet High School sophomore, put it this way: "To me, this project showed the closeness of environmental problems. These problems do not just exist in other parts of the world. The problem is here and now, and if we don't learn about it now, then there will be nothing left to preserve and restore later on."

Sharing results next door and around the world

Water flows without regard to political boundaries. It links nations and cultures and is an excellent focus for comparing our home environment to other watersheds. Testing the Waters forges electronic bridges to show students that water quality concerns are international. All students who participate in the program also become members of The Global Rivers Environmental Education Network. GREEN provides global links to exchange data and ideas among students who are studying local water quality through hands-on monitoring projects. Students can join with other students along the Milwaukee rivers or around the world who use computers, modems and newsletters to set up "sister watershed" relationships. Thousands of students from more than 50 nations in Africa, Asia, Europe, Latin America, North America and Australia are members of GREEN. Through their common concern for water quality, students share their cultures and learn to apply science to their daily lives. By contacting colleagues living along the Rhine, Ganges, Rio Grande, Nile, Mississippi and Danube rivers, and by participating in an annual Student Congress, Testing the Waters provides a forum for Wisconsin students to think globally . . . act locally. □



DENNIS YOCKERS

(above) Test results noted very little winter and fall variation on this river stretch. Students learn to conduct many of the same tests professionals use when monitoring water quality.

(below) Computers link students who are testing water quality along the same river, across the state or across the world.


JUDY KLIPPEL

Suzanne Wade, environmental education specialist at the Riveredge Nature Center in Newburg, directs the Testing the Waters program. Riveredge Nature Center also manages finances and provides fundraising and office support for Testing the Waters.

Readers Write

SPRING WATER

Compliments to Barbara Gear and Howard Kanetzke on their well-written and informative article on Wisconsin spring water ("Springing back," June 1991).

I teach a course on the geography of Wisconsin at the University of Wisconsin Milwaukee campus and appreciate the great value of *Wisconsin Natural Resources*. It seems every issue is filled with stimulating articles, ideas and useful facts that I can incorporate into my lectures.

The article on Wisconsin's springs does an especially fine job of emphasizing the tremendous value of our state's groundwater resources. Our state's spring water was and is sold widely in bottled and canned form, but it might be worth noting that it was once sent to Chicago by pipeline. At the time of the 1893 Chicago's World's Fair, the Hygeia Mineral Springs Co. of Waukesha was granted the concession for providing pure Wisconsin spring water to fairgoers. A specially built pipeline more than 100 miles long carried the water from Waukesha to a cooling plant at the fairgrounds, where it was distributed to 167 booths for sale at one penny per glass. There were also 372 taps for private delivery to various organizations running the fair.

Thanks for a superb issue. Keep up the good work!

Howard Deller
Dept. of Geography
UW-Milwaukee

As a member of the International Bottled Water Association, I found your article "Springing back" very informative and accurate. Of particular note was the reference to the use of "voluntary guidelines" in regards to labeling (or mislabeling) of bottled water. As Wisconsin's "buried treasure" continues to create jobs and revenue, and at a time when the bottled water industry has been criticized for lack of regulation, it is my opinion that the Department of Agriculture, Trade and Consumer Protection should focus not only on product quality but on the integrity of this great resource.

David Holdener
Nicolet Forest Bottling Co.
Mountain, Wis.

FISH JERKY

One of the fish markets mentioned in the "Dockside delicacies" article from the June 1991 issue ships fish jerky throughout the United States. Where can I get a recipe for fish jerky and can bluegills be used to make it?

Gary J. Jankowski
Cudahy, Wis.

Contact your county University of Wisconsin-Extension office and ask to speak with the family resources specialist. The number is listed in the phone book under "County Government." Both Extension and the UW Sea Grant Communications Office (1800 University Ave., Madison WI 53705) publish booklets about drying and smoking fish. Bluegills are such a dry, delicate fish that they may not make good jerky. Oily, solid fish like salmon, herring, cisco, alewife, carp and buffalo are more suitable for smoking and drying.

PUBLIC TRUST

Your last three issues, which featured articles on public water use, prompted my writing.

Our family has owned property on Big Lake Gilmore in Washburn County since 1949. For many years the lake supported an excellent fishery; a meal of freshly-caught walleye was nearly always available.

A few months ago we received a letter from the Gilmore Lake Association informing us that tribal spearfishing would be taking place on Big Lake Gilmore. What's interesting to note is that we haven't caught 12 walleye in 12 years on this lake. The fish just don't seem to be there.

From my layman's view, the problem on Big Gilmore has to do with the increasing use of huge, high-powered boats and motors, which erode shoreline and destroy fish spawning areas. There is no logical reason for a boat powered by a 100-horsepower engine to be on this small of a lake. My experience tells me that there's a direct correlation between the increase in "big motor" use and the decline in fishing success. In the last 10 years, the wave wash and erosion has added 22 feet to our shoreline. Obviously, someone else has lost shoreline. I think legislation is needed to prohibit the use of these behemoths on small bodies of water.

Thanks for raising some of the issues about water rights and boating safety. It is unfortunate that we are finding the best time of year to spend "at the lake" is January and February.

Glenn Schwanberg
St. Cloud, Minn.

We're sorry to learn that development, changes in the fish population and more crowded conditions on the water make Big Gilmore less of the quiet place it was when you first visited in 1949. The potential effect of large outboard motors in small lakes is worth noting. Many natural forces, including wind and currents, also move sand and muck — especially in shallower water.

We appreciate your concern about the walleye population in the lake. The number of walleye that can be speared in a given body of water without harming the overall population is based on research by DNR fish biologists. As you might suspect, the allowable catch on Big Gilmore was relatively small: 29 walleye were taken by spearers in 1991.

NAME THAT PLANT

I'm interested in wild things! There's a wildflower growing way out in a nearby marsh that's tall, with a blue-purple flower that resembles an iris. I call it "snake flower." Do you have any ideas?

Dorothy Ruth O'Krowley
Madison, Wis.

We'll make a wild guess: Most likely it's blue flag (Iris versicolor).

THE GREEN MACHINE

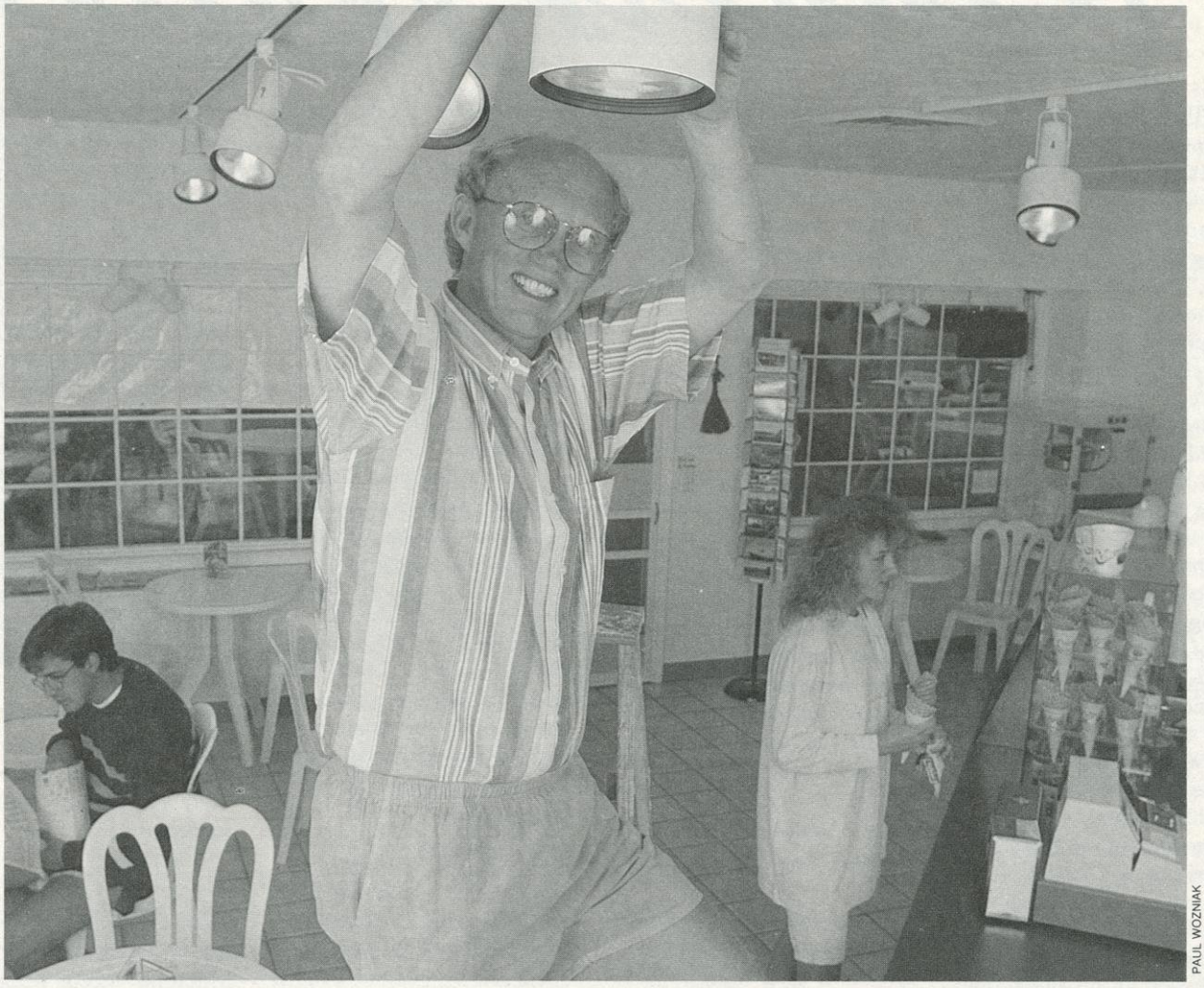
The message in "The Green Machine" needs to be spread far and wide! Your magazine is excellent and a terrific bargain!

J.H. Foegen
Winona State University
Winona, Minn.

"The Green Machine" (August 1991), your supplement on environmental car care, is excellent! Plaudits to artist Rich Malone, author Maureen Mecozzi and all those who supplied technical information. Where can I get extra copies?

Edward H. Riggs
Green Lake, Wis.

Write Publications, DNR Bureau of Information and Education, IE/4, Box 7921, Madison WI 53707. Include the publication number, IE-053.



PAUL WOZNIAK

Ed Krisch saves watts without sacrificing light at his Fish Creek frozen yogurt shop. An estimated 35-45 percent of the nation's $93 billion electric bill pays for lighting.

TAKING CHARGE
OF ENERGY CHOICES

Meeting energy demand for the next 20 years implies choices for our environment and our lifestyles.

David Iliff and Paul Wozniak

Last May, Ed and Judy Krisch made a business investment that was as important for their Fish Creek frozen yogurt shop as it was for Wisconsin's energy future. The Krisch's removed eighteen 150-watt floodlights and replaced them with screw-in fluorescent lights.

The fluorescent fixtures cost more, but they shed an equal amount of light while using only 10 percent as much electricity as incandescent lights. The energy-efficient appliances cut the shop's power use, increased Fish Creek's supply of electricity and delayed the need for new power plants. Over time, the new fixtures will save the Krisch's money, too.

Recent projections from the state's electric utilities provide concrete examples of how such day-to-day consumer choices affect the environment. Every two years the state's 11 major electric utilities file an Advance Plan with the Public Service Commission, the state agency that regulates municipal and private utilities to ensure the public is provided with telecommunications, natural gas and electricity at reasonable rates. The Advance Plans

estimate how many power plants and other fuel sources will be needed to meet future energy demand. The latest forecast estimates utilities will need eight more coal-fired plants and 31 additional combustion turbines to meet our energy needs during the next 20 years. Utilities currently operate 25 coal-fired plants and 26 combustion turbines to produce electricity.

Coal-fired plants are large and expensive to build and operate. They also contribute to global warming, acid rain and other forms of air pollution. Combustion turbines — large gas-fired generators that lay idle most of the year — pollute less, but they take up valuable land and can be noisy or unsightly depending on design and location. Both types of plants require vast transmission lines to transport electricity long distances. Building fewer power plants would be preferable environmentally and economically.

To avoid building more power plants, electric utilities must use existing energy supplies more efficiently and lower energy demand.

Environmental and economic conservation measures, termed "demand side management," could take many forms. Energy planners have focused on three strategies to reduce energy demand: Energy *conservation* encourages using energy-efficient appliances, construction techniques, and better insulation to reduce energy use. *Load management strategies* aim to spread energy demand more evenly throughout the day and the year. This avoids the need for combustion turbines and peaking plants that are only fired up occasionally. *Fuel switching* substitutes more efficient fuels in place of electricity — for instance, replacing electric ranges and clothes dryers with natural gas appliances.

Analyses in the Advance Plan show that many options for reducing energy demand are less costly than building fossil fuel plants, and all are less harmful to the environment. Moreover, these conservation measures may create more Wisconsin

DEMAND SIDE MEASURES: Those options which change electricity use.

CONSERVATION

Reduces overall energy use through using less and/or using it better. Demand for electricity at any one time is also lowered. The following are six types of conservation measures.

Building Shell Measures. Insulating and weatherizing residential and commercial buildings. Saves energy used for space heating and air conditioning. Increases customer comfort.

Lighting. Replacing incandescent lighting with higher-efficiency fluorescents or other lighting technologies. Taking advantage of natural lighting. Reducing unnecessary lighting levels and increasing use of reflectors and occupancy sensors. Produces less heat, thereby reducing air conditioning load.

Motors. Replacing motors used in commercial and industrial applications with newer, more efficient motors. Using motors with adjustable speed drives. Sizing motors properly to the task.

Heating and Cooling Efficiency. Replacing furnaces, water heaters and refrigeration units with new, high efficiency appliances. Clock Thermostats. Promoting the purchase of air conditioners that are more efficient than would otherwise have been bought. Using whole house fans instead of air conditioning.

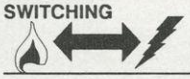
Process. Changing the way things are done, usually in the industrial sector, so as to use less energy in the process. For example, optimizing the efficiency of a production line by eliminating bottlenecks.

Customer Renewables. Using small-scale, customer-sited renewable technologies to replace loads otherwise served by electricity. For example, solar space or water heating and wood-burning stoves.

LOAD MANAGEMENT

Reduces the amount of electricity which is demanded at any one time. Usually, peak load is shifted to a time when there is less demand and when energy costs are lower. Examples of major forms of load management are: air conditioner control or cycling, interruptible industrial service and cool storage systems.

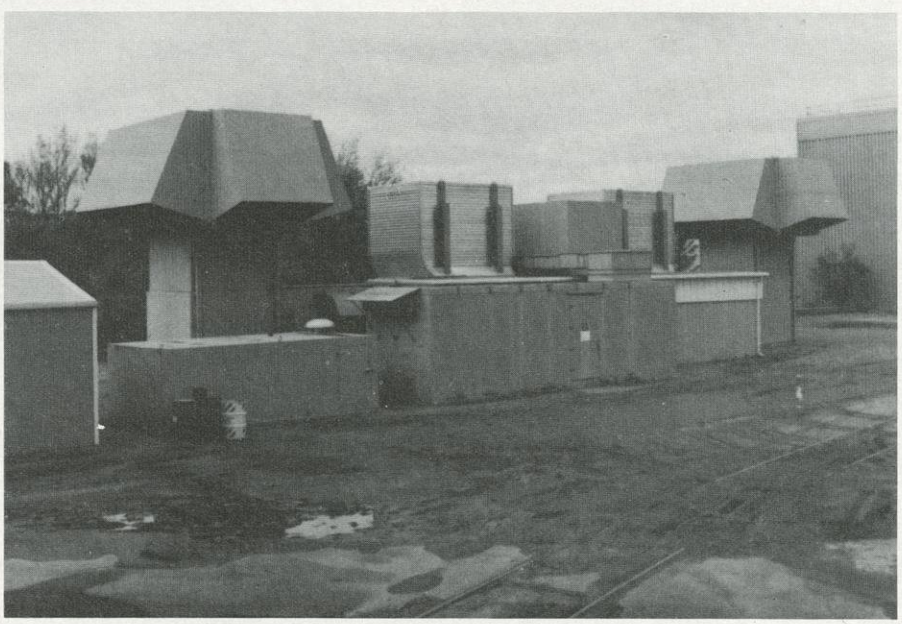
FUEL SWITCHING



Reduces both use of electricity and demand for electricity at any one time by replacing electric loads with energy produced from less expensive or more efficient fuels. This is most commonly achieved by substituting natural gas appliances or processes for electrical ones.

WISCONSIN PUBLIC SERVICE CORPORATION

Combustion turbines are only fired up to meet peak electrical demand. Energy conservation and other incentives to customers can significantly cut the number of power plants electric utilities need to build. The choices consumers make have both economic and environmental consequences.



WISCONSIN PUBLIC SERVICE CORPORATION

jobs per dollar spent than building new power plants. However, the 20-year plans submitted by utilities decidedly favor building new plants.

To meet an expected 45-50 percent increase in energy demand, utilities propose spending $7 billion on new power plants (not including fuel costs), while investing nearly half a billion dollars in programs to reduce energy demand. Some regulators and public interest groups think utilities should invest more in demand side measures.

Part of the challenge in changing our energy habits lies in changing the traditional mindset of some of those who provide power. Selling less electricity is a foreign idea to some utility managers. Their business offices, their bosses and their shareholders are accustomed to measuring growth in increased sales. They fear that decreases in electric usage will reflect poorly on the sales staff and the utility management team.

However, growth isn't necessarily in the best interest of the customer or the shareholder. Growth can increase costs and risks without increasing profits or efficiency. Education and other economic incentives are tools that could change this perception. One of the most important groups to reach with this message could be stock brokers and securities analysts whose views strongly influence utility investment decisions.

Energy development comes at a price beyond dollars and cents. Utilities estimate the cost of new power plants by analyzing construction costs, operating costs, maintenance costs and fuel costs, but they don't fully factor environmental costs to society into the price of providing power. Some of the hidden environmental costs in producing electricity with conventional technology include:

- the costs of global warming (the greenhouse effect) as fossil fuel burning produces carbon dioxide;
- the costs of air pollution damage to health, crops and materials;
- environmental costs from exploring for coal and gas;
- fuel transportation accidents and waste fuel disposal;
- lake, forest and structural damage from acid rain;
- costs to future generations of depleting non-renewable resources.

The Public Service Commission only recently required utilities to factor these external costs into their analyses. It's not an exact science, but it is critical for provoking public discussion that ultimately will influence consumer and corporate behavior. Much as the social, health and other costs of smoking have changed attitudes about cigarettes, paying the health costs of air pollution could lead to burning less fossil fuel.

Changing environmental laws are also forcing such comparisons. Clean Air Act revisions require utilities to include the costs for reducing acid rain in their projections. Legislative proposals to limit carbon dioxide emissions from power plants could lead to long-range shifts away from coal plants towards natural gas, conservation and renewable energy sources.

Attitudes are changing. Utilities traditionally limited spending on energy conservation measures because they sensed customers would rather pay higher bills than invest time and higher up-front costs in insulation, caulking and energy-efficient appli-

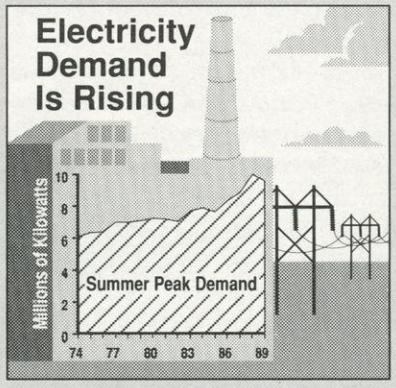
Air conditioners profoundly change home energy demand

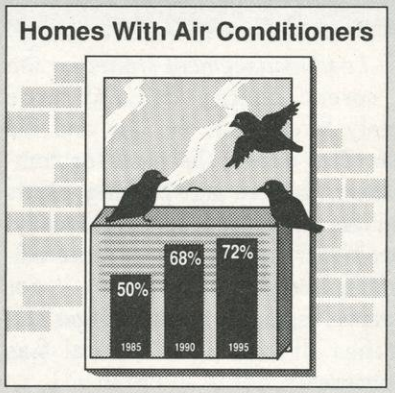
One reason for the dramatic rise in Wisconsin electric demand is increased use of the air conditioner.

Like the European starling, the air conditioner is not native to Wisconsin. The first air conditioner was invented in Brooklyn, New York about 1902, not too long after starlings were imported to America. Shortly thereafter one of the first air conditioners was installed in a Milwaukee chocolate candy factory. Like the starlings, air conditioners quickly took hold and are now commonly found in every Wisconsin community.

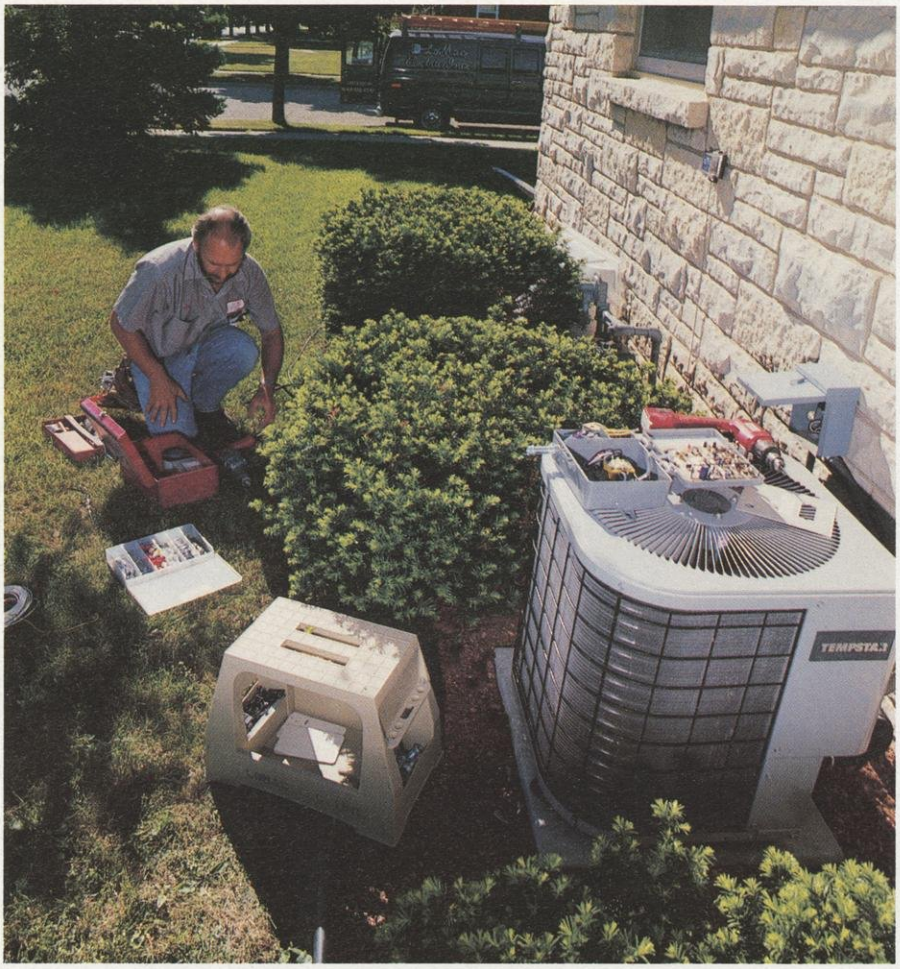
In 1985 about 50 percent of Wisconsin homes had central air or window units; by 1990, 65-70 percent of homes were so equipped; and 1995 projections estimate 70-75 percent of Wisconsin homes will have air conditioners.

For new homes, central air conditioning, like good insulation, is hardly viewed as an option. "It's now a customary amenity," according to Scott Fergus, Wisconsin Realtors Association. "Over the last four to five years, we've seen central air become a standard feature."





During the hottest hours of 1990, home air conditioning accounted for half of the peak demand from businesses and homes.



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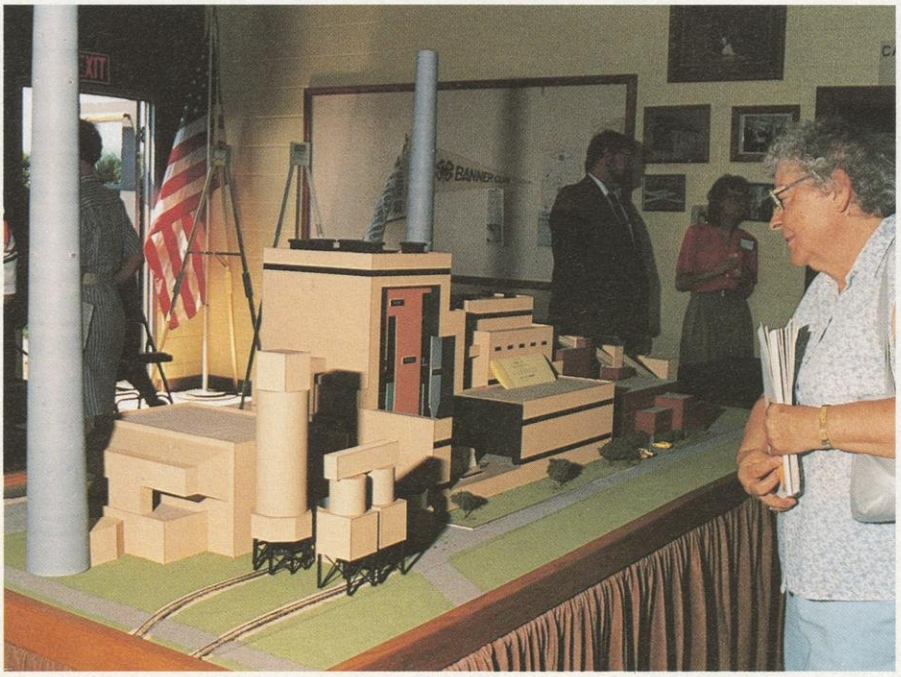
(above) Incentives can give homeowners more choices to save energy. Electric utilities can install a remote control on air conditioning condensers. Letting utilities cut power to air conditioners for only a few hours a year during peak demand can forestall the need for some power plants.

(below) Participants view a model of a proposed power plant at a public hearing. Utilities and regulators increasingly consider the hidden costs of energy — subsidies, tax credits, environmental degradation, health care costs and employment shifts — in energy decisions.



PAUL WOZNIAK

ances. Recent programs to cut peak power demand in homes and businesses show that consumers will change their habits and cut energy use if they can save money over time. Utilities made headway by conducting home energy audits and offering time-of-day discounts. They are only scratching the surface of potential customer interest in innovative measures like installing efficient lighting and offering direct control over air conditioners.

Public hearings on the Advance Plan will give regulators a sense of other energy-saving options that are acceptable to consumers: Should power companies and regulators provide strong incentives to customers who conserve energy? Can energy conservation in homes and businesses reduce collective energy use enough to halt the need for more power plants? Should the environmental costs of the energy production be reflected in electric bills? Or will we pay the consequences in higher bills from doctors, painters, lost tourism dollars and higher taxes for environmental restoration? □

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Summaries of energy issues raised in Wisconsin electric utility 20-year plans are available from the Advance Plan Manager, Public Service Commission of Wisconsin, P.O. Box 7854, Madison, WI 53707-7854 or call (608) 267-3599.


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