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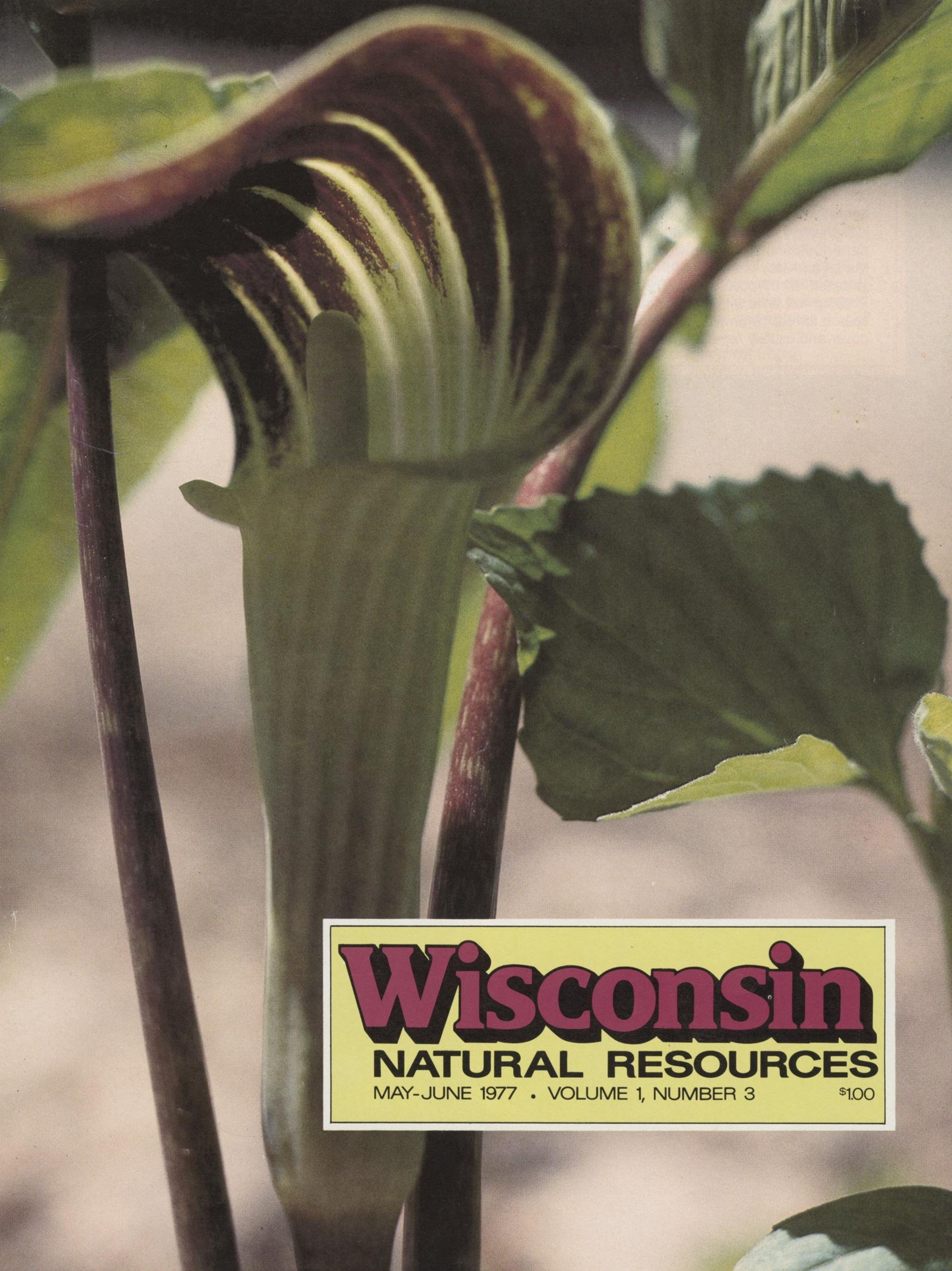
Wisconsin
NATURAL RESOURCES
MAY-JUNE 1977 • VOLUME 1, NUMBER 3
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Mr. Camouflage

GEORGE J. KNUDSEN, Chief Naturalist, DNR

The *WOODCOCK,* also called "Timberdoodle", is a chunky, robin-sized bird, with a "dead-leaf" pattern. Found statewide, woodcock arrive in late March and stay until mid-fall. They nest on the ground in dense, shrub-covered wetlands, or in nearby woods. Probing wet soils with long, flexible-tipped bills, they search for earthworms. Both sexes match the ground cover and usually remain unseen until disturbed.

In March and early April, just after sunset, the males resting on the ground, utter single, loud, "peeent" or "beezp" calls separated by pauses. After peeenting awhile, they fly skyward in spiralling, twittering flights, level off, increase their twittering, change to a chirping song and continue this as they plunge steeply back to earth. Shortly, they begin to peeent again, starting their next show for nearby female "doodles"!

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May–June 1977 Volume 1 Number 3

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Front Cover

Photo by Dr. John C. Weaver, UW President

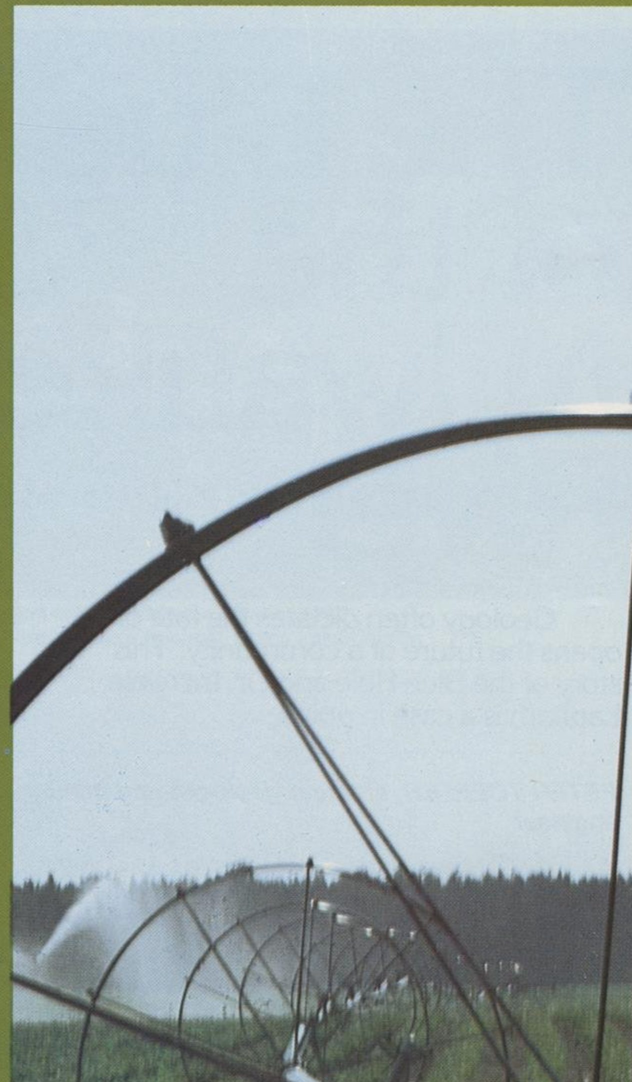
This Jack-in-the-Pulpit *(Arisaema atrorubens)* is a sample of Dr. Weaver's photography. See page 25 for more of his spring photos—and page 28 for a story on endangered plants.

Jack-in-the-Pulpit comes up in mid-May and is found in damp Wisconsin woods. In late summer, bright red berries appear. It was once used as a food source by Native Americans, who boiled it first to get rid of the oxalic acid. Hence, its other common name—"Indian Turnip". Don't pick Jack-in-the-Pulpits, though. They're not plentiful, so let everyone enjoy.

Back Cover

Photo by Dean Tvedt

Walleyes run on the Wolf River at Fremont right after iceout, but for most of the state, fishing season starts May 7. No matter where or when though, make sure you're ready to go. Pick up copies of Wisconsin Boating and Fishing Regulations now. Learn the rules, make sure you have proper licenses and enough Personal Flotation Devices (PFD's) aboard to insure a safe outing. Be courteous and don't litter. It'll mean more fun in 1977.



WISCONSIN DEPT. OF NATURAL RESOURCES

The Blue Hole of the Milwaukee River

Old Cement Kilns: 1927

Geology often dictates the fate or opens the future of a community. This story of the Blue Hole and Dr. Increase Lapham is a case in point.

PETER TOEPFER, amateur geologist and mining engineer

Many Milwaukee residents have heard of the Blue Hole. But very few know the interesting history of this small falls on the Milwaukee River, in Estabrook Park, a half-mile north of the Capitol Drive bridge.

The Blue Hole could be considered a monument to Dr. Increase A. Lapham, a very prominent citizen of early Milwaukee and Wisconsin. A self-taught scientist of active and inquiring mind, he was in the forefront of developments which led to the greatness of the new state. His books extolling opportunities to be found in Wisconsin led to rapid settlement.

Lapham, as a young man, had been persuaded to come to Milwaukee by Byron Kilbourn, one of Milwaukee's founders. Kilbourn had earlier been an engineer on the canal connecting Lake Erie to the Ohio River in northwestern Pennsylvania. Moving west to the future Milwaukee, he carried with him his enthusiasm for canals. Kilbourn's great objective was to build a canal connecting Milwaukee with the Rock River. Lapham arrived in 1837 to carry out those plans. Canal transportation was considered important in those days before the railroads when the few roads were mud wallows.

Lapham's surveys envisioned a canal up the lower part of the Milwaukee River, crossing to Pewaukee Lake, and reaching a summit at Lake LaBelle after 316 feet of lift by lockages. From Lake LaBelle, 80 feet of lockage would lower the canal boats to the Rock River near Jefferson. Shallow-draft steamboats were expected to reach this point from the Mississippi.

Lapham and Kilbourn even planned a canal up the Milwaukee River to Lake Winnebago. Campbellsport, in the hills south of Fond du Lac, was to be where the canal crossed the sub-continental divide, accounting for the unlikely "port" in Campbellsport's name.

Author Peter Toepfer.*

By 1848 enthusiasm for canal building had withered away. However, Lapham's surveys of the Milwaukee River paid unexpected dividends. Niagara Limestone of eastern Wisconsin is exposed at many places in this riverbed, but just above Milwaukee, Lapham's seemingly-foolish interest in fossils led him to discover that the impure limestone there was of Devonian age. This was an entirely separate formation from the prevalent Silurian Niagara Limestone.

Lapham called attention to this rock having composition similar to Devonian limestones elsewhere which were being used to manufacture natural cement. Natural cement is limestone containing clay minerals. Natural cement was made by firing such rock in kilns, and finely grinding the clinker. It is unlike lime mortar, and much stronger.

Tests in 1874 indicated the Milwaukee rock could make a natural cement with strength superior to that being made in northern New York State and a Louisville, KY. Production began and the local cement became very important to the youthful Wisconsin, which no longer had to rely on out-of-state cement that was costly to transport.

To get at the limestone, the Milwaukee River was diverted along its west bank, and deep quarrying was done on the exposed river bottom for a half a mile. Later, the river was allowed to drop in a waterfall (the present Blue Hole Falls) into this quarry, and quarrying shifted to the river's west side. A narrow rock wall, a half-mile long, separated the two quarry sites.

However, introduction of Portland cement began in the late 1870's, and this gradually displaced the natural cements. Portland, made with controlled blending of calcareous limestone and clay shale, produces the best possible composition and has consistently superior strength.

The abandoned quarries were known as the Blue Hole.

The waterfall into the east quarry remains today, its height greatly reduced by rock fill which has dammed the river below. Until the 1930's there was a second waterfall where the river waters poured across the solid rock wall into the west side quarry. One could paddle a canoe into the cavern left by underground quarrying. Three arched kilns built of stone remained on the east bank.

The wall between the quarries then was an island and had become a well-populated hobo jungle. Hobos scratched a living from the city dump there, gathering scrap iron, brass and paper. Their shacks, many large and elaborate, were made from old boards, and the furnishings were discards from the dump. Some even had porches from which the proud owners fished. It was a Huckleberry Finn existence we no longer see today.

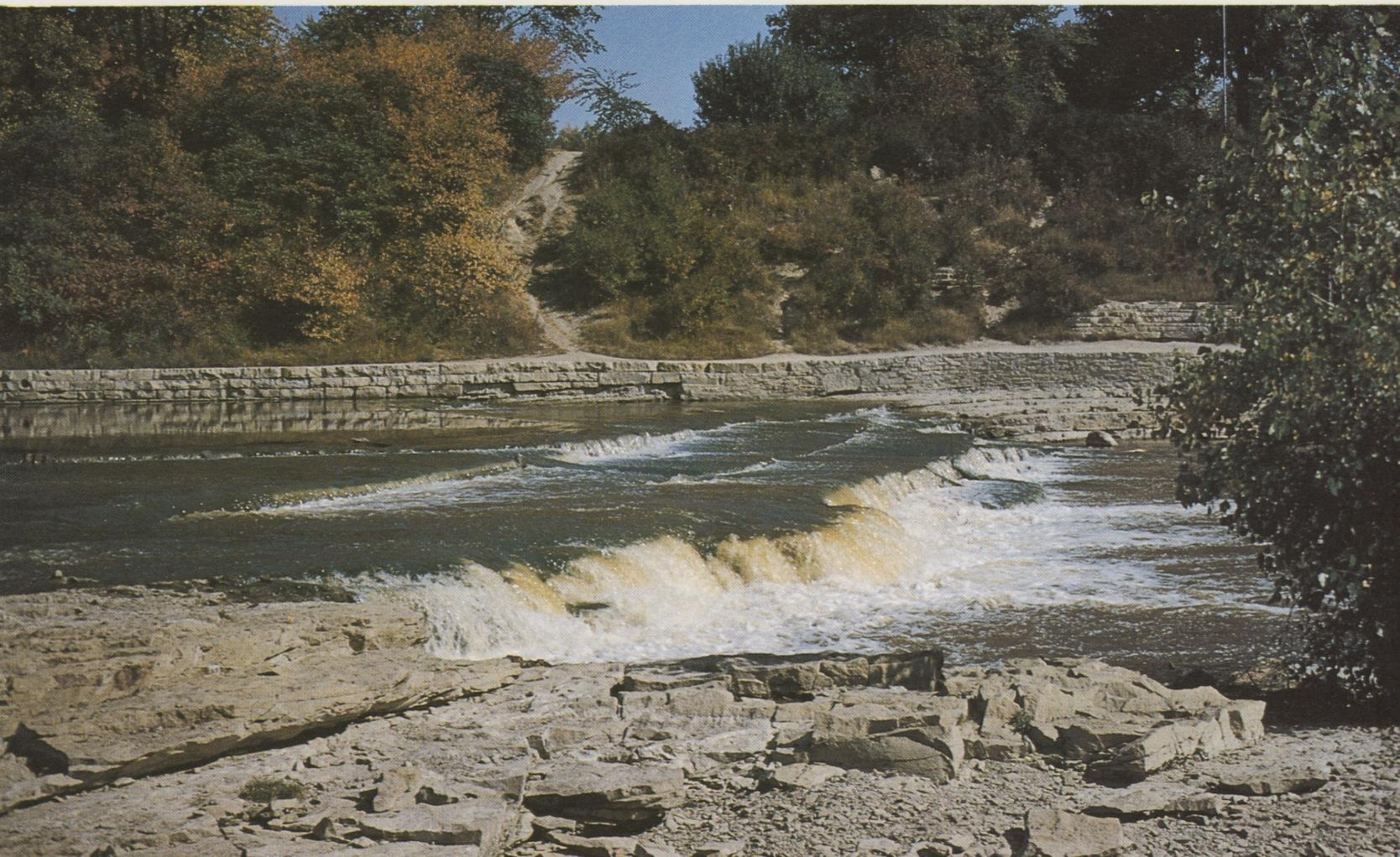
The hobos left in the 1930's when WPA came to establish Estabrook Park. Gone, too, are the old kilns which are now covered by a steep grass lawn. The west side quarry has been completely filled, eradicating the long rock island, the cavern, and the lower waterfall. Only the upper falls remains. It is now a typically neat, orderly park, and nearly all evidence of the Blue Hole's past is gone.

Someways I liked the old look best but while changing the Blue Hole is to be regretted, it was a very dangerous place where many children drowned. The deep waters with overhanging quarry ledges were death traps which every year claimed lives. The quarries had to be filled.

Today, deep quarry waters still extend below the remaining falls. It is dangerous, though not as dangerous as the old place. But, if the loose rock fill forming the rapids below were removed, the full, impressive height of the Blue Hole Falls would again be revealed, making the present deep water shallow and safe.

Milwaukee should develop this scenic waterfall. Since its rich past has been buried, the Blue Hole deserves at least an historical marker for a headstone.

**Mr. Toepfer, who lives in Milwaukee is a retired mining engineer. His specialty is minerals and his hobby is writing about Wisconsin geology as it relates to history. This story of the Blue Hole is taken from an 18 volume unpublished manuscript.*



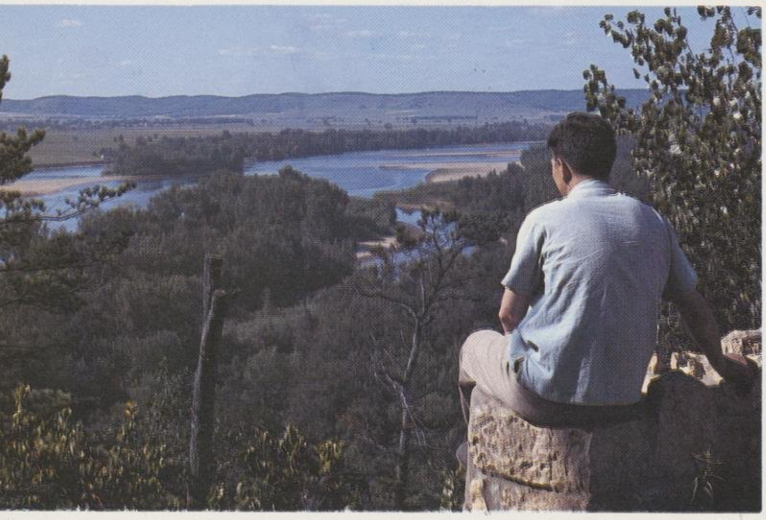
Blue Hole Falls Today

Photos by Peter Toepfer.

Your other state parks

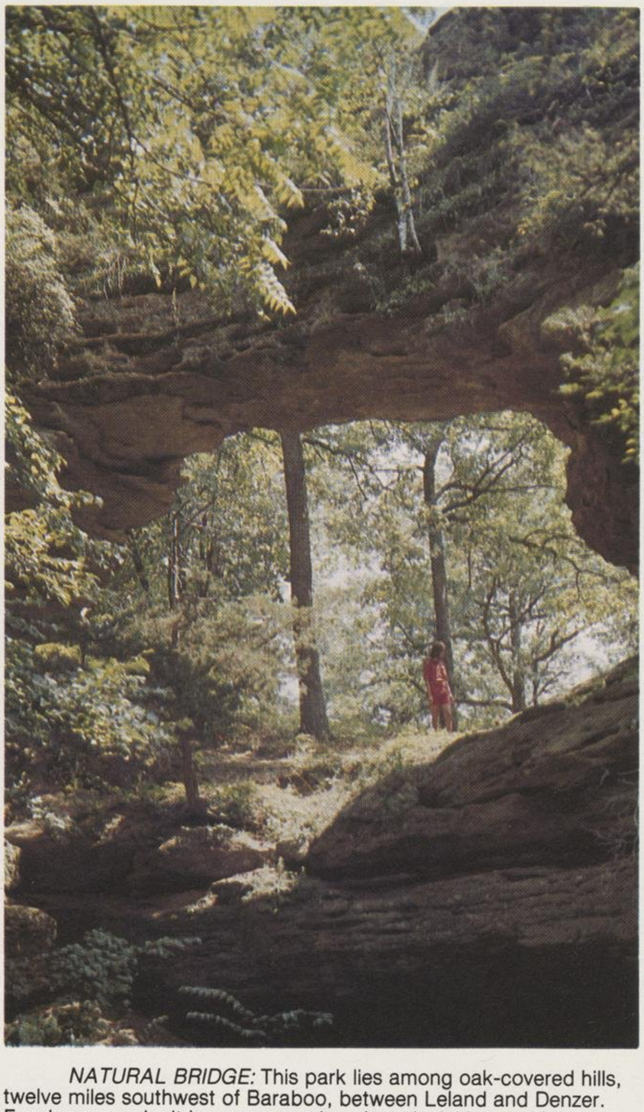
There's no doubt about it—Wisconsin has some of the most beautiful and well-known state parks in the United States! Devil's Lake, Peninsula, Governor Dodge, Wyalusing, Interstate, Pattison, Rib Mountain, Terry Andrae and High Cliff are good examples. But, state parks need not be gigantic, nor super popular to be thoroughly enjoyable. Many of the less well-known ones are very scenic, offer more solitude and serenity and have unique features of their own.

GEORGE J. KNUDSEN, Chief Naturalist, DNR



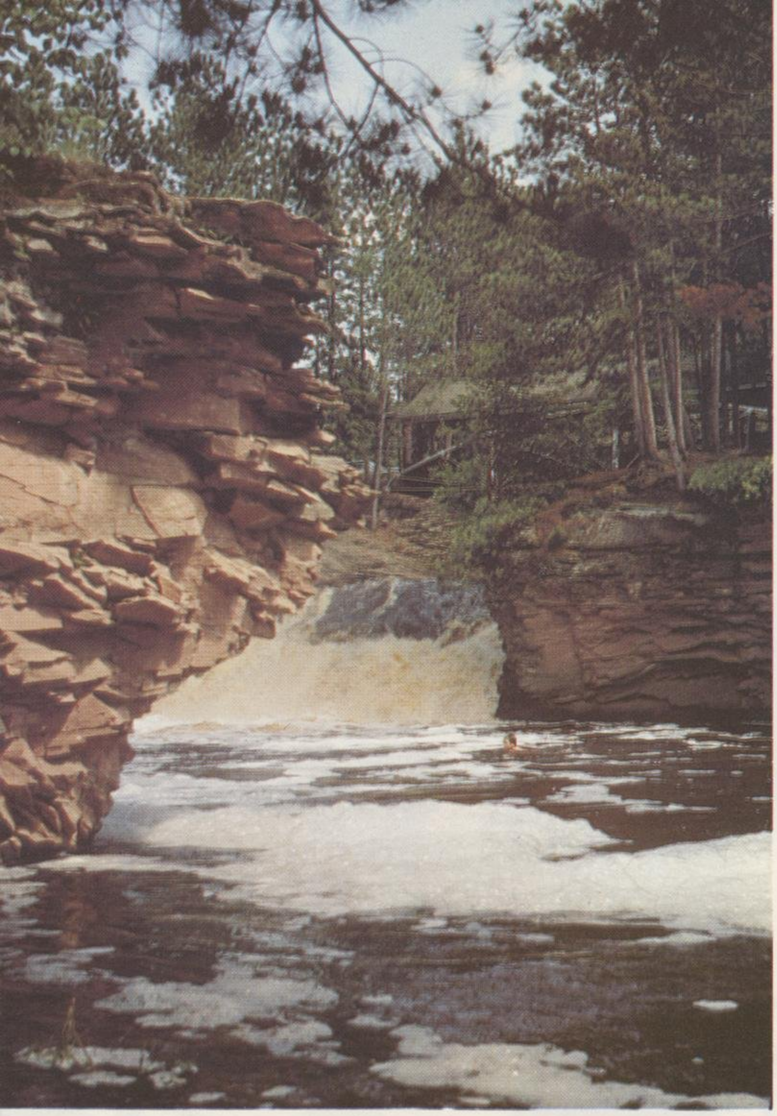
TOWER HILL: Located on the Wisconsin River two miles from Spring Green, its activities include camping, picnicking, hiking and canoeing. A smelter house has been reconstructed over a vertical shaft in sandstone; lead shot was made in this "shot tower" from 1833-1861. You may view the Wisconsin River from a pine-covered blufftop.

NELSON DEWEY: High bluffs overlook the Mississippi River, adjacent to Cassville. Nelson Dewey is an excellent nature preserve and also has campsites, picnic areas and hiking trails. Boats can be launched at Cassville. The park contains the home and estate of Nelson Dewey, Wisconsin's first Governor. Adjacent Stonefield Village, operated by the State Historical Society, depicts farming, crafts and other memorabilia of the 1890's. Upriver, north of La Crosse, Merrick State Park near Foundation City has similar features and is well worth a visit, too.



NATURAL BRIDGE: This park lies among oak-covered hills, twelve miles southwest of Baraboo, between Leland and Denzer. For day-use only, it has no campsites, but picnicking and hiking are popular. Archaic Indians lived under the natural sandstone "bridge" more than 7,000 years ago! A nature trail describes uses of plants by Native Americans. Birdlife, wildflowers and prairie plants add interest.

Photos by George Knudsen and Dean Tvedt

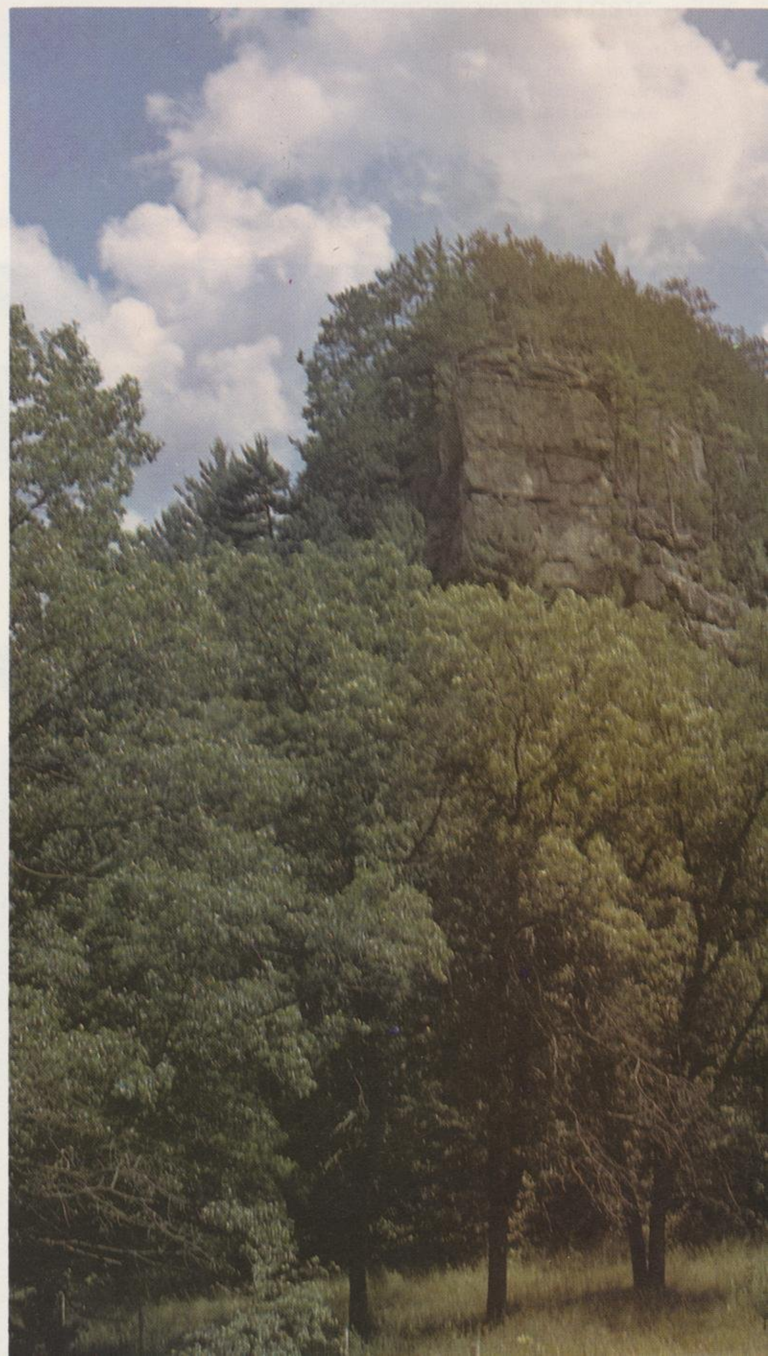


AMNICON FALLS: Located 10 miles east of Superior where the Amnicon River cascades over hardened volcanic lava, and plunges down Amnicon Falls,this park offers camping, picnicking and hiking. The falls can be viewed from a covered bridge. An excellent variety of forest types, smaller plants and wildlife can be enjoyed.

HARTMAN CREEK: Here, six miles west of Waupaca, you'll find camping, picnicking, swimming, fishing, hiking, and a nature trail. Open, sandy fields, pine plantations, rolling, boulder-strewn, oak-covered hills and three small, spring-fed lakes make nice settings for hiking and nature study. Canoes and *motorless* boats may use the three little lakes.

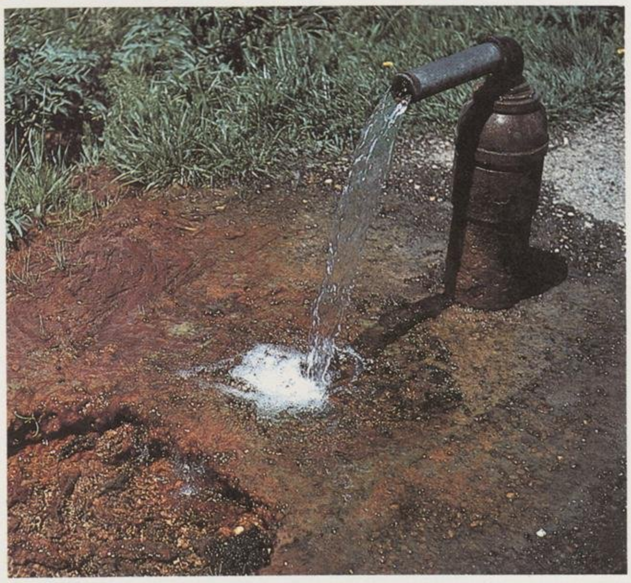
MILL BLUFF: Accessible from Camp Douglas via old State Highway 12 the park has camping, picnicking, swimming and a trail to the top of Mill Bluff. A unit of the Ice Age National Scientific Reserve, its many castellated, sandstone buttes were once islands in ancient Glacial Lake Wisconsin. The vast, flat, sandy bed of this glacial lake, and many buttes may be seen and photographed from the overlook on Mill Bluff.

HARRINGTON BEACH: Just two miles east of Belgium, on the shore of Lake Michigan, this day-use park offers picnicking, sun-bathing, swimming, strolling and beach-combing. There is no camping, and inner access to the park is by a shuttle vehicle, walking or bicycle. A deep, limestone quarry, operated from 1894 to 1925, is now filled with water, forming limestone-walled Quarry Lake. Gulls, shorebirds, songbirds and a nature trail beckon.



Wisconsin groundwater 1977: an analysis

Wisconsin is blessed with large quantities of high quality groundwater, and, if we take care of it, there should always be plenty for every legitimate use come drought or flood—not that there aren't any problems though . . .



Iron coats the ground in runoff from an artesian well.

THOMAS A. CALABRESA, Chief, Private Water Supply Section

The drought of 1976 is causing serious concern about possible water and well problems in Wisconsin. Actually, unless the drought continues in 1977 and beyond, things should be okay.

With a few local exceptions, a random check by the US Geological Survey shows water in monitoring wells around the state to be at normal levels — about as high as in 1972 and in some cases higher. In most places levels are even better than some years in the '50s and '60s. This is what was expected, although it may sound paradoxical to those whose wells have failed.

Normally, precipitation does not contribute significantly to Wisconsin groundwater recharge during a growing season. The key to the whole picture will be what happens this spring — whether there will be enough melting snow and rain to replenish soil moisture and then contribute to groundwater recharge. If not, groundwater will recharge in a subsequent year when precipitation is more nearly normal.

In most wells, a drop of a few feet in water levels does not cause loss of supply, but in some cases, might require change from a shallow well pump to a deep one.

Generally, wells that fail during a drought are the shallow ones, driven, drilled or dug. There are also failures in those constructed in granite or other igneous rocks, in quartzite and in some shallow dolomite (lime rock) wells.

Those which fail usually depend heavily on annual recharge from precipitation. The ones that don't, and that's most of them, tap aquifers where storage capacity is vast and supply dependable. Considering the overall picture, of the 500,000 to 750,000 wells in Wisconsin, only about .05% have ever required replacement or deepening.

Despite the statistics, a dry well can be a real hardship and DNR has set up an interim emergency service to provide water for stock and domestic purposes in these cases. The State Office of Emergency Government and various county officials are cooperating. As an additional help, the Farmers Home Administration will give low-interest loans to correct well problems.

Wisconsin is a water rich state with an average annual precipitation of about 30 inches which is spread across the state's entire 36 million acres. To get some idea of the staggering quantity this is, consider these numbers: a total of about 90-million acre-feet, or 29-thousand-billion (29-trillion) gallons of water drops on Wisconsin each year. An estimated one-million-billion (one-quadrillion) gallons is stored underground. Contrary to popular mythology, all of the groundwater in Wisconsin originates in the state, generally having fallen as precipitation within a few miles of where it discharges into streams, lakes and wells. Various estimates have been made of the components of the annual water budget.

An estimated 66% of the water entering Wisconsin is lost by evaporation from land and water surfaces and by vegetative transpiration. This combined loss is called "evapotranspiration."

Approximately one-third, or 10 of the 30 inches of precipitation, leaves the state as runoff in stream flow, of which about 60% comes from groundwater, slowly released to steams. *This 60% is the same as the groundwater recharge — about six-inches per year or 16-billion gallons per day.*

A small amount of groundwater is also lost by underflow to Lakes Michigan and Superior and to Illinois — about one-tenth of an inch per year.

Latest estimates of total groundwater use for farm and non-farm domestic purposes, stock watering, industrial, commercial, irrigation and other purposes range from about 590 million gallons per day (MGD) to 680 MGD, or roughly only about 4% of the daily groundwater recharge.

While these numbers are encouraging, there is another side to the story. Precipitation is not uniformly distributed over the state and groundwater is not uniformly available to all wells. Highest precipitation occurs in north central and southwestern Wisconsin. Not only that, but the occurrence, availability and movement of groundwater differs considerably with geologic formations in a given area. Permeability and thickness of water bearing rock and its relation to the strata above and below all have an effect.

Only those formations yielding water to wells are classified as aquifers. Technically, the granite rocks, quartzites and Maquoketa shale are not aquifers even though they sustain some limited wells.

Among true aquifers are sand and gravel deposits, dolomite, and sandstone.

The sand and gravel aquifer is variable in extent, thickness and productivity. Well depths in these deposits may range from very shallow to more than 500 feet in a buried preglacial valley. Some very high pumping rates are possible in this aquifer, depending upon location — from five gallons to over 1,000 gallons per minute.

In the eastern quarter of the state, Niagara dolomite extends from the Door Peninsula to the Illinois border. Well depths in the Niagara formation vary from 45 feet to over

Calabresa has a B.S. and M.S. from UW-Madison in Civil Engineering with Sanitary and Hydraulic Engineering options. He is a Wisconsin Registered Professional Engineer and a member of Chi Epsilon, honorary civil engineering society. He has been involved with Wisconsin's groundwater program as a public employe for 27 years.

DNR helping out where a well dried up.

Some background material for the article was taken from "Water Use in Wisconsin" by Harvey E. Wirth and from U.S.G.S. data.

600. Their production ranges from five gallons to a few hundred gallons per minute and this can change from one well to another within a very short distance.

Most large industries and municipalities in southeastern Wisconsin take their well water from the Cambrian sandstone. Some go down close to 2,000 feet.

Probable well yields from various kinds of deposits in Wisconsin are shown on the two maps.

Increases in population, changes in agricultural practice, industrial development and expansion of recreation will increase the demand for water in Wisconsin.

Although farms today are fewer in number, the amount of water they use has shown a steady increase over the past 30 years. Wisconsin agricultural use took a giant leap in 1957 when drillers came up with a new, inexpensive way to sink irrigation wells. Using fast drills, lightweight pipe and cheaper screens, these wells had construction features of lesser quality than required by the more stringent standards established for drinking water or food processing. They were attractive in price and together with good promotion, good financing and assistance from the UW experiment station at Hancock, created an irrigation boom that is still reverberating.

Most irrigation well development in the late '50s occurred in the sand plains from the Whiting-Plover area south to Columbia and Adams counties; in parts of western Waushara and Waupaca counties; around Antigo; and in sand and gravel deposits of the Sarona-Rice Lake-Barron-Chetek region as well as in a few other locations.

Beginning in 1958, drilling approvals jumped dramatically from about 14 per year to 147, then fluctuated around the new level until last year when drought blew the whole thing sky high — up to 330. And by the end of January, 1977, an additional 60 approvals had already been granted.

It could be that 1977 will set another record, but if the rain falls, requests for irrigation wells are expected to do likewise.

Meantime, drought or no, expansion of irrigation into new areas of the state will continue. Since the early '60s, it has spread along the Wisconsin River between Sauk City and Gotham, to Chippewa County and the Eau Claire area, to St. Croix, Green and Walworth counties and to other scattered places.

At first, irrigation wells watered only potatoes, peppers, snap beans and mint, but today they are used on sod, golf courses, hay, corn and more. High capacity wells have always been used by industry and commercial establishments and for miscellaneous purposes such as mobile home parks, recreational camps, fire protection and whatnot.

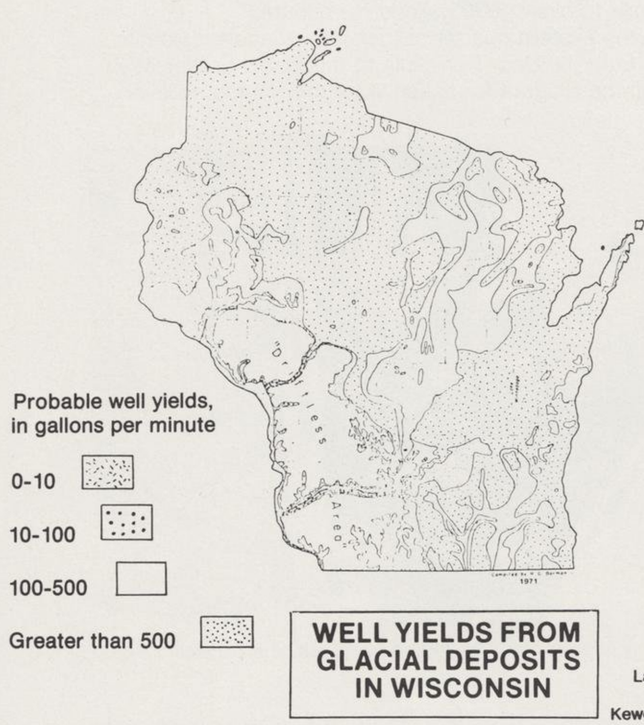
Wells that pump large quantities of water can sometimes affect other wells, affect stream flow and even groundwater quality. The recent drought coupled with the big new demand for irrigation water has caused some worry about this.

Actually, the very nature of irrigation practice encourages good well spacing. There is no known interference with water utility supplies by wells in the heavily pumped central plains. This is because those drilled in thick, highly productive sand and gravel deposits usually have a relatively small "radius of influence."

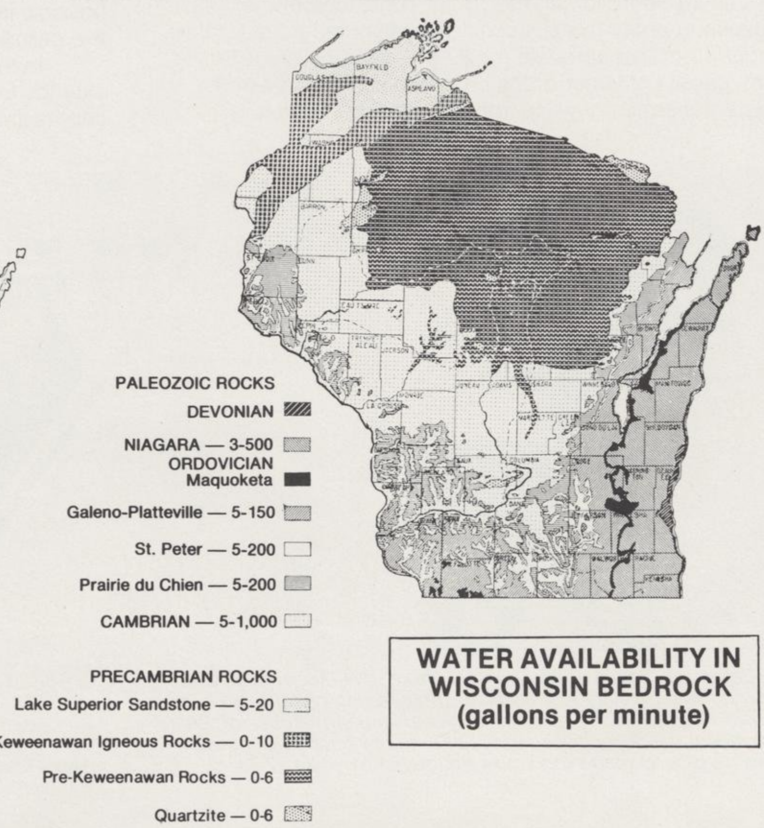
By contrast, high capacity wells in rock formations, especially those under artesian pressure, can have much wider influence. This is why applications for approvals in the rock formations of St. Croix, Eau Claire, Chippewa, Barron and Pierce counties require a very critical review before approval. Such concerns also involve the Milwaukee area and the rest of the southeast where demand for groundwater is heavy.

Irrigation is an intermittent activity that varies with normal precipitation and is carried on for only about 45 days a year. While it is considered a consumptive use that reduces the amount of water reaching lakes and streams, the depletion directly attributed to groundwater withdrawal is not easily distinguishable from other causes. Observations have shown there is no carryover from one season to the next. Annual groundwater recharge takes care of it.

State law (144.025 (2) (e)) requires prior approval from DNR if one or more proposed wells on a property will pump 70 gallons per minute (100,000 or more gallons in 24 hours.) DNR can deny approval or limit production of any wells that significantly interfere with production by public water utilities. So far, nobody has been cut off; however, in



WELL YIELDS FROM GLACIAL DEPOSITS IN WISCONSIN



WATER AVAILABILITY IN WISCONSIN BEDROCK (gallons per minute)

some cases the Department has reserved the right to curtail pumping should interference occur.

Private well owners also have substantial protection.

Under a 1973 Wisconsin Supreme Court ruling, if a property owner constructs a well whose operation significantly reduces his neighbor's water supply, the neighbor may seek relief in court. Where problems like this are likely to occur, DNR warns applicants of the liability, pointing out that department approval in no way reduces or changes liability.

Aside from the fact that you can't find equal amounts of good water everywhere, there are other problems.

They may be either natural or man-made and involve either bacteria or chemicals.

Natural quality of water is affected by iron, hydrogen sulfide, sulfates, chlorides, hardness, total dissolved solids, methane (in a limited number of cases), pH and nitrates.

Salinity and high sulfates occur naturally in the deep sandstone aquifer of eastern Wisconsin — in northern Milwaukee, Washington, Ozaukee, Sheboygan, Manitowoc and Door counties and around Lake Winnebago. Water here can have dissolved solids that range from 1,000 parts per million to more than 6,000 parts per million. The concentration of these undesirable chemicals exceeds safe drinking water standards.

The high mineral content in eastern Wisconsin is not continuous, but occurs often enough to require control of exploratory drilling in Fond du Lac, Calumet, Door and Kewaunee counties. Here wells must be cased through the Niagara and Maquoketa shale to prevent the upward migration of water on the deep aquifers.

Hydrogen sulfide is encountered in some of the Galena Dolomite in eastern Wisconsin and also in other scattered locations.

Iron is a widespread problem with concentrations in sandstone aquifers sometimes as high as 27 parts per million. Any iron over 0.3 parts per million will discolor bathroom fixtures. Filtering out these small amounts is difficult.

In the few places where methane is encountered, the judicious thing to do is completely shut off the zone where it occurs to avoid any possible explosion hazard. Wells containing methane have been found in Walworth, Waukesha and Brown counties.

So-called soft water areas of the state, generally the west central counties, have a tendency to be on the acid side. Corrosive waters are also found in a few other localities. In some instances it can be bypassed to obtain water from a different strata. Otherwise it has to be treated at the surface.

Nitrates are found throughout the state in varying concentrations and are both natural and introduced by man. They are less frequent in wooded areas of the north where there are fewer people, fewer farms and not so much organic material in the soil.

Road salt can be handled somewhat by covering storage facilities. In some places use has been discontinued to protect the water.

Most well water in Wisconsin is bacteriologically safe. But in some places where the groundwater is located in creviced rock lying at shallow depth below unconsolidated materials, coliform bacteria may be present. This can

Number of High Capacity Well and Pump Approvals
Private Installation
June 6, 1945 - December 31, 1976

Year	Industrial	Irrigation	Commercial	Miscellaneous	Annual Total
1945	5	1	0	0	6
1946	48	2	2	4	56
1947	30	6	1	0	37
1948	19	5	0	2	26
1949	19	3	1	2	25
1950	13	7	0	2	22
1951	14	1	0	5	20
1952	24	3	1	4	32
1953	22	7	2	1	32
1954	28	7	5	8	48
1955	35	8	1	8	52
1956	20	4	2	10	36
1957	28	14	1	16	59
1958	25	147	2	15	189
1959	25	91	3	10	129
1960	19	59	2	25	105
1961	14	65	4	15	98
1962	11	62	0	9	82
1963	21	83	1	21	126
1964	30	154	3	20	207
1965	28	154	3	28	213
1966	22	81	5	9	117
1967	21	60	0	16	97
1968	22	82	5	25	134
1969	22	51	2	25	100
1970	23	95	2	30	150
1971	18	100	2	51	171
1972	22	68	5	38	133
1973	17	42	3	25	87
1974	16	102	0	27	145
1975	13	118	0	29	160
1976	19	330	1	19	369
TOTAL	693	2012	59	499	3263
PERCENTAGE	21.2	61.7	1.8	15.3	100.0

Charts by US Geological Survey

1945 1958 1965 1971 197

happen even when the well is properly constructed. The immediate solution is to go deeper unless the source can be found and shut off. Control and management of domestic waste disposal is only a partial solution to this problem. Surface water can also enter and contaminate groundwater through rock outcroppings, sink holes, quarries and other openings.

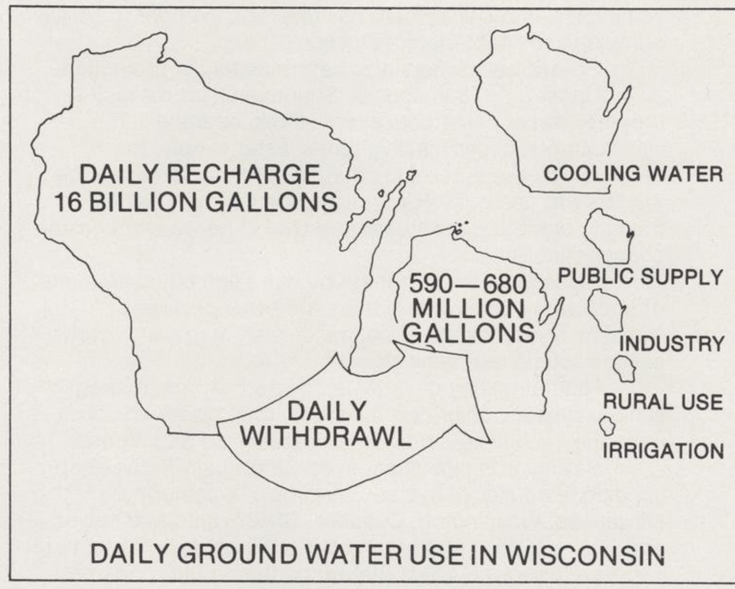
Landfill site leachates, absorption ponds for waste disposal, waste treatment ponds, waste retention ponds, spray irrigation of wastes, herbicides and pesticides and sludge disposal areas are also potential sources of groundwater pollution. So are storage stacks of corn husks and pea vines and land disposal of whey from milk plants.

In Wisconsin anything added to groundwater that changes its natural quality is considered a contaminant. Natural quality, therefore, needs to be spelled out so that we can tell when change occurs.

Waste disposal practices are an ever-present threat and groundwater monitoring programs need strengthening to find out whether any havoc is happening under ground. This is necessary even though monitoring tells only that the pollutant has already arrived — knowledge that, nonetheless, is important to consumers and to planning, management and protection of the resource.

Irrigation areas on the sand plain south of Stevens Point monitored by the US Geological Survey show some increase in certain chemicals in the groundwater, but amounts so far are relatively low. In a few cases nitrates exceed 10 milligrams per liter and to date, no herbicides or pesticides have been found in significant concentrations. Because groundwater flows, because it replenishes itself and because the irrigation season is short, observers expect that the level of chemical contamination will only reach a certain plateau and then level off. Monitoring records indicate that this appears to have happened in the sand plains.

Stream and lake levels dropped significantly in late 1976 prompting complaints that irrigation is to blame. This phenomena, however, is statewide and not just in irrigated areas. Kettle lakes, for the most part, are no lower than a few years ago before the highs of 1972 and '73 and hydrographs of streams show normal patterns comparable to past seasons.



DAILY GROUND WATER USE IN WISCONSIN

Although Wisconsin generally has abundant water, the Milwaukee-Waukesha area and the lower Fox River Valley have local supply problems. In both places the "cones of depression" that occur when water is pumped are growing deeper and wider because more and more wells are taking larger amounts of water. This means users have to go deeper. Equilibrium could be reached if volume of pumpage remained constant.

In both localities when municipal wells were shut down several years ago, natural recharge restored pressure levels.

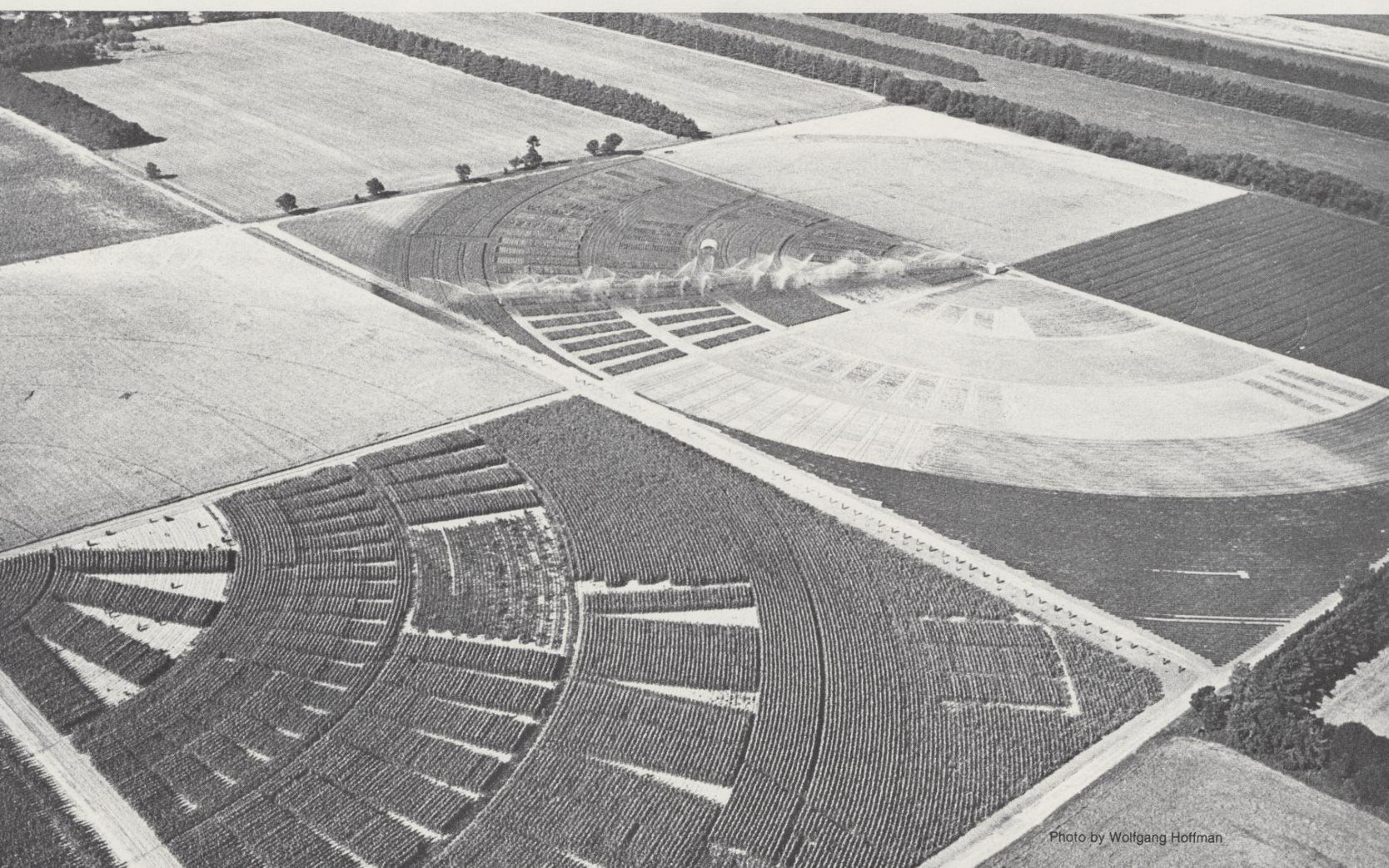
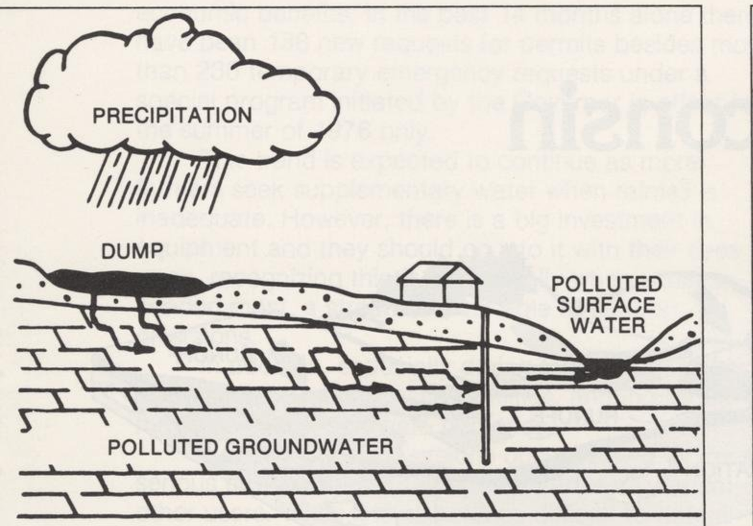
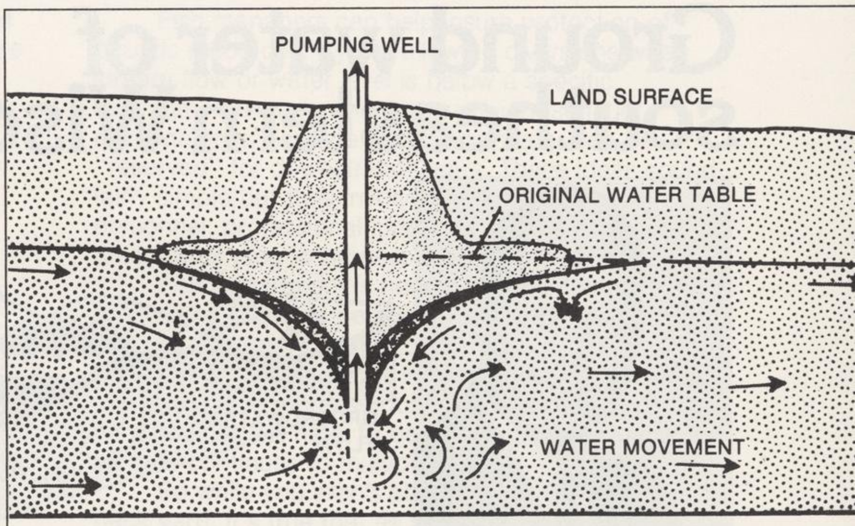


Photo by Wolfgang Hoffman



SOURCE OF POLLUTED GROUNDWATER



CONE OF DEPRESSION CREATED BY PUMPING WELL.

Since then, however, increased pumping by neighboring municipalities has continued the decline.

Because of the vast quantities in storage, estimates of a 100% increase in water use by the year 2000 would not deplete groundwater significantly even if it were all consumptively used. The principal problem would be the economics of pumping from greater depths. Doubling present figures would use an estimated 1300-million gallons of groundwater per day — only about 8% of the 16-billion gallon daily recharge.

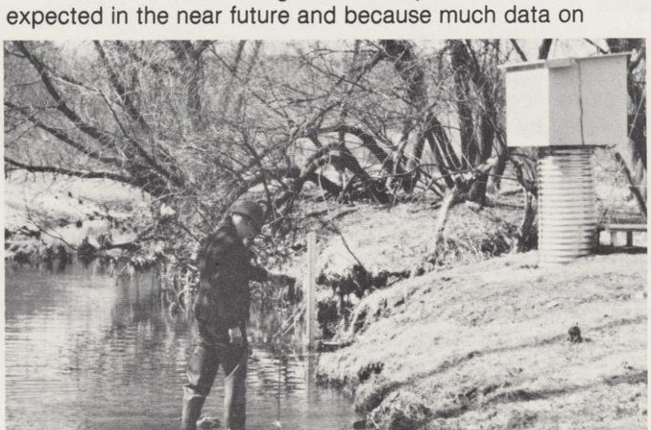
Ground and surface waters interact and it is known that a consumptive use of one affects the other. Exactly how, is difficult to determine. Generally speaking, seasonal pumping from one has no lasting serious effect on the other.

It is possible to create sophisticated aquifer system models to keep track of these things, but in most places detailed data to design the models are lacking. This is true everywhere except in the southeast and in Door County. These localities already have digital models operating and should be able to quickly and effectively determine possible effects of planned water use. Elsewhere it won't be possible without spending a lot of time and money and in any case, usefulness of such models is limited to large water systems.

Because no critical groundwater problems are expected in the near future and because much data on various areas of the state is still needed, we should be careful about passing laws that require a degree of management impossible to carry out with present information. The big need right now is to provide money to gather basic data. Once information is available, legislation requiring more intensive management could then have a real effect. Funds should also be provided to continue and expand the water quality monitoring program. Other desirable legislation should specifically protect groundwater during exploration for natural gas and oil.

And a final word of caution: Wisconsin should *never, ever* consider use of underground geological formations for waste disposal. Such deliberate contamination would be unforgivable. All Wisconsin groundwater is either useable as is or has the potential for use one day in the future when treatment becomes practical. Any claim that we have the present knowledge to manage wastes so as to predict what will happen once they are disposed of in or on the ground is sheer fiction.

In conclusion, it is advisable that we do our utmost to prevent contamination of groundwater. Notwithstanding the fact that some pollutants will unavoidably find their way into it now and then, the goal should always be zero pollution.



Stream flow measuring device.

When the well runs dry

Mrs. Dale Holmes

The well went dry at the residence of Mr. and Mrs. Dale Holmes of rural Hurley, in early September, 1976. Until a change can be made, they get their water from a DNR truck.

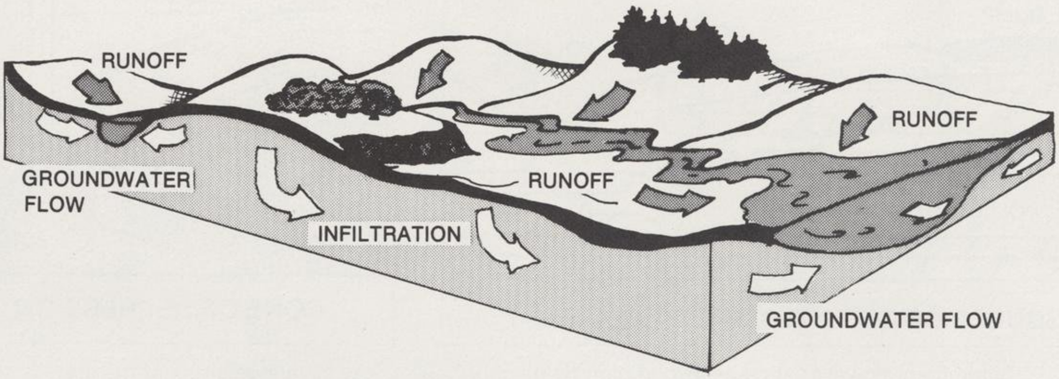
Said Mrs. Holmes: "It's not too bad hauling water in the summertime. But in winter, it's terrible. By the time you get it home, it's frozen."

What has impressed her most about the experience?

"You don't realize what you use until you have to haul water. Before, you just turn it on and it's there. You sure do waste a lot."

Photos and illustrations by Jack Green, Richard Novitzki, Dean Tvedt, Len Massie, Richard Knitter.

Ground water of southeastern Wisconsin



K. W. BAUER, Executive Director
Southeastern Wisconsin Regional Planning Commission

Southeastern Wisconsin is an intensely urbanized, seven-county region in which about 40% of the state's population lives on about 5% of the state's area.

It is richly endowed with water resources, which properly husbanded, can serve the region for all time to come. Misused and mismanaged, however, this resource can become a severe constraint on the sound social, economic, and physical development of the region. The southeast's water resources include inland lakes and streams, shallow groundwater aquifers, the deep aquifer and Lake Michigan.

Inland lakes and streams in the southeast constitute an extremely valuable recreational and aesthetic asset, but they have limited volume and flow and relatively poor water quality, and therefore, are not used to any significant degree as a source of water supply. Groundwater aquifers underlying the region, together with Lake Michigan, constitute the major sources for domestic, municipal, and industrial water users. The groundwater reservoirs not only sustain inland lake levels and provide the base flow of streams, but comprise the major sources of water supply for all land use development located west of the subcontinental divide, which traverses the region.

Well water in an amount averaging about 25 million gallons per day is supplied to an aggregate area of about 80 square miles, or about 2% of the total area of the region, and to a total population of about 190,000 persons, or about 11% of the total resident population. Forty-six of the 67 publicly owned water utilities within the region use the groundwater as a source of supply. In addition, many major industries also use it.

Aquifers underlying the region differ widely in yield of stored water. In some parts of southeastern Wisconsin, they extend to great depths and are more than 1,500 feet thick. This is an enormous reservoir of groundwater. There are three major aquifers. From land suface downward, they are:

1. Sand and gravel deposits of glacial drift.
2. Dolomite strata of the underlying bedrock.
3. Deeper sandstone, dolomite, and siltstone strata.

One and two are considered to be the shallow aquifer. The deeper lying sandstone, dolomite and siltstone strata are commonly referred to as the deep aquifer. The two are separated by a layer of relatively impermeable shale, which forms a leaky hydraulic barrier between them.

These aquifers are recharged by rain and snow. The principal source of recharge to the deep aquifer is precipitation percolating downward through glacial deposits into the deep aquifer where it is exposed beneath glacial deposits in the western portions of Walworth and Waukesha counties. Groundwater in the deep aquifer moves in a generally easterly direction from this recharge area toward pumping centers. Thus, most of the water withdrawn from the deep sandstone by communities and industries originally enter via the recharge areas to the west.

Pumping from the confined sandstone aquifer has caused a steady decline in the potentiometric surface from 1880 to 1973. (Potentiometric surface is the level to which water will rise in wells penetrating the aquifer.) Since 1880 the original potentiometric surface has been markedly altered, primarily as a result of pumpage for industrial and municipal supply. Drawdowns of up to 350 feet have occurred in the Waukesha, Brookfield, and New Berlin areas.

Pumpage has increased significantly in recent years, well beyond the proportional increase in population. Whereas the population of the seven-county region increased by about 12% from 1960 to 1970, total groundwater pumpage within the region over the same period increased by about 67%, from 19-million gallons per day in 1960 to 32-million gallons per day in 1970. Of this, over one-half is estimated to have been supplied by the deep sandstone aquifer. Given trends in land use decentralization and attendant diffusion of population and employment, withdrawals from the deep sandstone aquifer will continue to increase over the next two to three decades. It is estimated that groundwater pumpage may go up from the 32-million gallons per day taken in 1970 to 95 million gallons by the turn of the century. Total drawdown over this period may almost equal the total drawdown experienced since 1880. Natural recharge is expected to be sufficient, however, to support the anticipated pumpage *provided that the aquifer is properly developed and the recharge areas protected.*

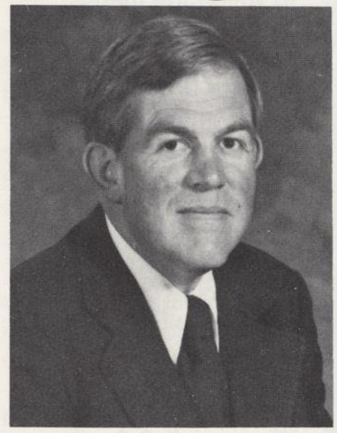
Whereas the primary source of recharge for the deep sandstone aquifer is located in the westerly portions of the region, the shallow aquifer is recharged locally by the downward percolation of surface water and precipitation falling on local catchment areas. Contrasted with the deep aquifer, the direction of water movement in the shallow aquifer is much more variable and complex. Movement occurs from a multiplicity of local recharge areas toward a multiplicity of points of discharge, such as streams, lakes, marshes, and wells. The shallow aquifer is much more susceptible to pollution by improper disposal of solid and liquid wastes than the deep one because it is nearer potential pollution sources, thus minimizing dilution, filtration, and other natural processes that reduce detrimental effects of pollutants. The shallow aquifer is also more susceptible to major declines in the water table during periods of dry weather. In some areas the water levels in shallow wells serving residential developments have had to be deepened or new wells drilled.

Lake Michigan constitutes the largest source of water supply within the region. Treated Lake Michigan water in an amount averaging almost 200 million gallons per day is supplied to an aggregate service area of about 200 square miles, or about 7% of the total area of the region and to a population of about 1.2 million persons, or about 68% of the total population of the region. Twenty-one of the southeast's 67 public utilities get water from Lake Michigan. Of these 21, seven own and operate water intake and treatment facilities, while 14 purchase water on a wholesale basis. Generally, Lake Michigan offers an unusually good source of supply to those areas of the region lying east of the subcontinental divide and within economic reach of the lake. Serious legal constraints exist on diversion of Lake Michigan water across the subcontinental divide. This means that groundwater must be used to supply development located west of the divide.

The water resource base of the Southeastern Wisconsin Region is very complex. It consists of inland lakes and streams and their shoreland and floodland areas, the multiple groundwater aquifers and Lake Michigan. Complex relationships exist between land use and the quality and quantity of water. All these factors make any planning for the protection, development, and wise use of this resource difficult. Recently, in cooperation with DNR, the Wisconsin Natural History and Geological Survey, and the US Geological Survey, a mathematical model, able to simulate the performance of the deep sandstone aquifer under various conditions of recharge and use has been completed. This will help in preparation of a long-range area wide plan. Creation of this will require close inter-governmental coordination and cooperation because of the nature of the resource base and because of the complex alternatives available for serving the region from Lake Michigan and from the multiple underlying aquifers.

Purpose of the plan will be to protect recharge areas and generally see to it that no future mismanagement warps the social, economic and physical development of the region.

The 1976 drought



VAL MITCHELL, State Climatologist

The drought of 1976 will go into the record books as one of the most intense and destructive ever.

It began in the northwest part of the state in April, reaching other areas by mid-May. Even though southeastern Wisconsin was very dry during early summer, it was spared the worst of the drought. Reasonably good crop production, especially for early-season crops, was possible in parts of southern Wisconsin due to above average precipitation in March and April. Although rain fell in other areas during the growing season, it was spotty and often didn't come when crops needed it most.

Droughts are of two different types: agricultural, where there isn't enough moisture to produce crops; and hydrologic, where lake and river levels are low and ground tables drop.

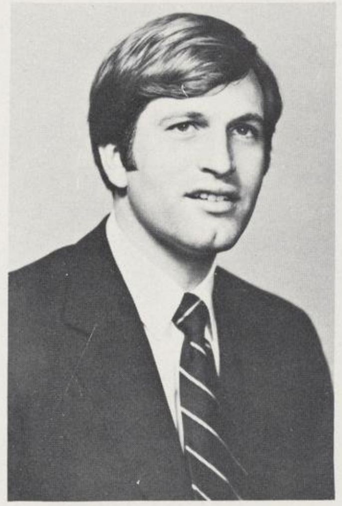
The 1976 drought was both agricultural and hydrological. Crops suffered severely in most areas. River and groundwater levels also fell, nearly depleting moisture in the top six to eight feet of soil. Even with normal precipitation, recovery will not come quickly.

Very dry growing seasons or years (1976 was both) occur in isolated sections of the state on the average of once every five to 10 years. Dry years across the entire state happen about every 20 to 25 years. They don't occur in regular intervals, though, so are not cyclical.

Since 1880, there have been six times when an entire year was considered very dry across the whole state: 1895, 1910, 1939, 1948, 1958 and 1976. The year with the big reputation for intense drought, 1936, is missing from this list but shows up as one of those that had very dry growing seasons, roughly from May through August. This means that adequate precipitation fell during other months. These dry season years were: 1891, 1936, 1948, 1958 and 1976. Dry years or growing seasons for just parts of the state are common and seem to occur in groups of years.

Considering this brief historic look at drought, then, the one in question now doesn't seem quite so strange. Classify it as unusual, memorable and costly, and hope it doesn't happen again soon.

From the board



Chairman Thomas P. Fox

It's hard in this day of complex technology to weigh the many factors critical to deciding which course is best for protecting the environment.

Citizen participation adds an even more challenging dimension to public policy development.

Your Natural Resources Board tried to weld both recently as it considered how best to protect and manage Wisconsin's 3.2 million acres of state and county forests.

There are many different ideas on how to harvest and replant our forestlands—public *or* private. Most citizens recognize that forests are important not only for fiber production, but also for wildlife habitat, soil conservation and recreation.

In Wisconsin, as elsewhere, there is a diversity of opinion about forest management. When the Board set out to involve the general public as well as those with specific interests in forest policy development, it was an especially challenging—and controversial—task.

We went beyond routine public hearings required under statute and solicited comment and suggestions from hundreds of concerned persons and interests. In addition, press releases, articles, photographs and other means were used to generate public involvement.

The process once again proved that public participation helps develop policies which are not only enlightened, but also better understood and supported.

Water resources are another area of Board concern. Many Wisconsinites take both the quantity and quality of our water for granted. This is blind overconfidence. Water is needed for domestic use, for agricultural irrigation, for receiving treated wastewater from municipalities or industry, for utilities, manufacturing, cooling, food processing and, of course, recreation.

These are competing demands and this breeds conflicts, particularly when dry conditions persist, such as they have in the last year.

We must be aware of—and care for—both the water we see in our lakes and streams, and the water we do not see—the groundwater that supplies Wisconsin wells.

The health and welfare of citizens today, and tomorrow are at stake and vigilance is necessary. The Board will do its best to provide that vigilance.

Editorial

Among the forms of outdoor recreation, that of hunting seems to be decreasing in importance, expecially among younger participants. So says Dr. Bill Shaw in a study of hunting attitudes done at the University of Michigan. Shaw sees the problem as one of declining public support for wildlife management with hunting license fees,if the increasing rate of nonparticipation continues and if the anti-hunting interests continue to generate support among the nonhunters. To this end he focused his research on the phenomenon of hunting opposition and its implications for wildlife managers.

Shaw's study method consisted of a mail-back questionnaire to three groups of people — Michigan Deer Hunters, Fund for Animals (the Cleveland Amory group) — the two extremes — and to Michigan Audubon Society (a moderate group). Two hundred people were randomly selected from each group and mailed a detailed questionnaire. The response rate was interesting — 90% for Michigan Fund for Animals, 79% for Michigan Audubon Society members, and 63% for Michigan Deer Hunters. (Apathetic hunters?)

We don't have the space to go into the questions and methods used, but a general analysis of the returns showed that no one simple parameter or attitude about biology or hunting stood out as the primary reason for the anti-hunting attitudes. The anti-hunter's position seemed to be determined by a broad range of background,experience, beliefs and attitudes.

Other analyses showed several interesting things:

- Some 68% of the anti-hunters would like to see sport hunting actually made illegal.
- Of all the reasons for being opposed to sport hunting — dislike for the type of people who hunt was least important. (Now that's news to us.)
- While the human, biological and ecological reasons are important to anti-hunters, the issues that concerned them the most were animal suffering and cruelty to the animals.
- All groups — hunters, anti-hunters and moderates — rated legal hunting as unimportant to the future of "animals." All groups rated loss of habitat, pollution and poaching as very important.

Most important, Shaw points out that it would be seriously wrong to think that the anti-hunter is biologically naive and that if we educate him or her to the biological facts of life — harvestable surplus, limiting factors, annual crop etc. — he will agree with us. 'Taint so. His study underlines the fact that the anti-hunting attitude is due to a wide range of interrelated factors and as such the attitude is very difficult to change.

While Shaw studied three groups and concludes that influencing them is difficult — if not almost impossible — he recognizes that the great mass of uncommitted Americans — those who have no commitment to either position — are the most subject to being influenced by the extremists. He goes on to say that wildlife managers should staff up to deal with these noncommitted, non-consumptive users.

Knowing what makes the anti-hunter tick could save a lot of wasted time, money and energy in our battle to save hunting and perhaps even the hunted resources themselves.

Guest Editorial by Charles Hjelte
Editor, Colorado Outdoors

The readers write

Readers are invited to express opinions on published articles. Letters will be edited for clarity and conciseness and published at the discretion of the magazine. Please include name and address. Excerpts may be used in some instances. "Letters to editor" should be addressed to Wisconsin Natural Resources magazine, Box 7921, Madison, Wisconsin 53707.

This magazine is not only for sportsmen, but for everyone interested in our natural resources. **ELEANOR BROWY; National Council of State Garden Clubs.**

What is your idea of a gang hunt? I don't think there is anything wrong with a well-organized deer drive and what about the hunters who go to their hunting cabins every year? I know some men who have hunted together for over 50 years. It would be a sad thing to see that come to an end because of too many rules and codes. **KENNETH BRUNNER; Boyd.**

We would like to see more sections pertaining to recipes for game and fish. We do a lot of fishing and would like to try different recipies. **WALTER PADNIEWSKI; Oak Creek.**

As for those who complain about paying this slight sum for such a well-edited outdoor publication . . . do they expect that they will ever again get a free lunch with a 5¢ beer? **GEORGE WELLAUER; Milwaukee**

Each time I see a piece of litter, I pick it up and deposit it in a trash can or put it in a litterbag in my car. If more people would do the same instead of just complaining about litter, much clean-up could be accomplished. **CARL KAISER; Kewaskum.**

If you are sincerely interested in protecting our environment, help us find ways to replace appointed people in the DNR with elected people who know one end of a gun or fishing pole from another. **GORDON CAESER; Milwaukee.**

I want to voice my strong objection to the fifth point of the Hunter Ethics Code to require back tags for all hunters. This is ridiculous for small game hunting. The coat one wears depends on the weather. To change frequently poses a problem. **HARRY FECK; Eau Claire.**

There exists a grave misunderstanding that hiring another officer, passing another law or making another study are the solutions to many problems. I do not think these will provide the answers. What I visualize is the promotion of a basic "individual responsibility." The longer people trust and believe that the solution to all our dilemmas is vested in organizations, we will continue to see others chasing around trying to clean up someone else's garbage. **HAROLD OLSEN; Green Bay.**

Since (our) magazine is in the process of change, now is the time to add a Sportsmans Forum . . . we need a column in the DNR magazine where we can sound off as individuals even though it may step on the toes of certain groups or even the DNR. I have a comment to get things rolling. Many trout fishermen who fish streams throughout the state feel the DNR has neglected the stream stocking program in order to concentrate resources and money on stocking Lakes Michigan and Superior. Many of us see this as a waste of tax and license money. **JOHN PIEPER; Janesville.**

For shame! to the "opposers." I've had extolled pleasure from the magazine for years which was introduced to me by an old aquaintance, Otis Bersing. I am more grateful to be able to donate what is called a subscription fee for such a fabulous magazine. Love the new edition. **NORMAN J. PAZDERSKI, SR.; Chicago, IL.**

You can't pump the stream dry

Drought plus economics have made Wisconsin surface water a hot item. DNR's ticklish job is to protect the water but also to allow reasonable use if there's no harm done. Public involvement is invited.

ROBERT W. RODEN, Environmental Engineer, Madison

Is our state really turning into a desert? Probably none of us would say so in spite of past and future drought conditions. However, many are finding that when most needed, the available surface water in our lakes and streams is not sufficient. Even in "normal" times, allocating water among various users is a tough task. But when times are dry, the job gets even tougher for the DNR and for all others involved.

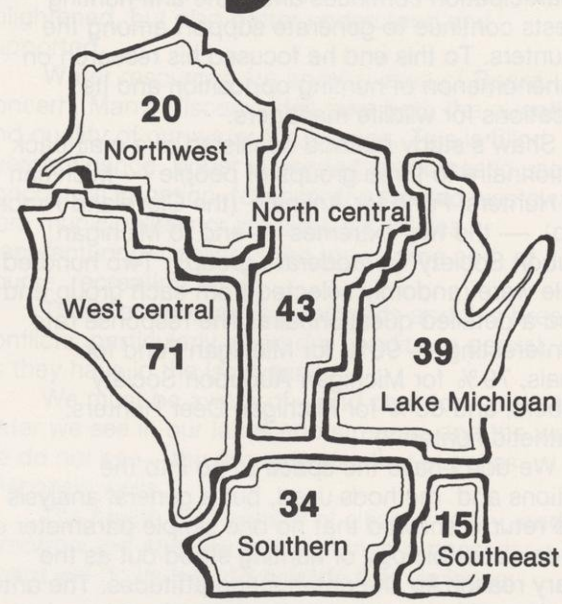
Uses of surface water include irrigation and agriculture, dilution of municipal and industrial wastes, public water supply, household (domestic) purposes, power generation and industrial cooling. Added to these are water recreation, enjoyment of scenic beauty, and protection of the aquatic environment.

In the early years of statehood, Wisconsin had plenty of water compared to the demand for it. When conflicts developed, courts were able to apply what is called the "reasonable use" doctrine. If a riparian (an owner of land on a stream) was found to be making a "reasonable, beneficial use" of the water, he could do so even when his use damaged someone downstream. The basis for this approach was that there was usually enough for everyone's purposes if each user made some concession to others nearby.

As time passed, more people used surface water and the nature of the use changed. Early settlers used water to power mills or transport logs and other products to market. But now, agricultural uses dominate.

Most early uses were non-consumptive. That is, the water essentially remained in the stream. But many agricultural and all irrigation uses are consumptive in nature—the water is not normally returned to the stream. These uses reduce flow, particularly during dry periods.

In the drought of the 1930's a surface water diversion law was passed, now section 30.18, Wisconsin Statutes. It established a permit program regulating diversions for irrigation or agriculture. Before issuing a permit, the administrative agency (the Public Service Commission before 1967; DNR



Stream diversion permits in DNR districts

since then) must find that the diversion will not injure public rights in the stream (lakes with outlets are treated as streams under this statute). In addition, the water must be surplus (water which is not being beneficially used) or, if it is not surplus, all riparians beneficially using it must consent to the diversions. The statute therefore protects public rights and lets private beneficial users protect theirs.

In two recent cases, the Wisconsin Supreme Court upheld the statute and emphasized that rights of existing beneficial users are to be given priority when new applications are considered. The Court, while acknowledging that the requirement for consent from beneficial users is not consistent with the reasonable use doctrine, nevertheless stated that the decisions to protect prior rights in this manner was within the discretion of the Legislature. Prior users thus have a "superior" right compared to a new applicant. Among those with diversion permits, the person with the oldest one in effect would have the best right. Within the irrigation permit system, therefore, the rule of prior appropriation (first in time, first in right), developed in the west, is now to be used in Wisconsin. With the increasing number of requests for permission to irrigate, it's obvious that difficult decisions—and possible disputes—face us in the immediate future.

From the time the permit program began in the '30's until last summer, only about 250 permits had been issued. Since then, however, there has been an explosive demand caused by drought and irrigational economic benefits. In the past 14 months alone there have been 138 new requests for permits besides more than 230 temporary emergency requests under a special program initiated by the Governor in effect for the summer of 1976 only.

This trend is expected to continue as more farmers seek supplementary water when rainfall is inadequate. However, there is a big investment in equipment and they should go into it with their eyes open, recognizing this fact: generally when water is needed most, a stream is least able to support diversions.

In addition, especially during these times, other users such as municipalities, utilities, and industries may also make legitimate demands.

If unauthorized diversions occur, they may cause serious environmental damage and adversely affect other users. While it is sometimes difficult to detect violations, law enforcement personnel find most illegal diverters and make arrests. As with any other law though, the permit system relies mostly on the cooperation of the irrigator, even though penalities may be severe.

In administering the program, DNR must be extremely careful not to issue certain permits—those that cause environmental damage or that take non-surplus water without consent of all affected beneficial users. Statutes contain authority to modify or even revoke permits should these situations arise. If this happened, someone's investment in costly irrigation equipment could be jeopardized.

Fish managers can help insure protection of aquatic resources. By not allowing diversions when stream flow or water level is below a specific minimum, the department can prevent serious environmental damage. Additional water can be "reserved" for downstream users. These ideas sound fairly simple but they involve a major investment of personnel, professional judgement and substantial amounts of time to process most applications.

The department is now modifying its approach in processing irrigation permits to better protect public and private water use rights. Dialogue with other state agencies and with various interest groups is underway. The intent is to increase public involvement because hard choices will have to be made as the requests for permits continues to multiply.

So while you aren't about to see cactus in the back yard, it's true that as far as surface water use is concerned, Wisconsin is really becoming a little more "arid" each year. Just how far it goes will depend on the weatherman and the way you want DNR to administer the law.

The first musky

DICK WENDT, Area Fish Manager, Woodruff

That Sunday started out the same as most any other day. I left my "nest" a little before 5:00 A.M.

It was just beginning to get daylight. I'd have time for one more cup of coffee before I woke my son Jimmy to take him musky fishin'!

The night before when Jimmy kissed his mother and me good night it's a good thing he didn't have a crystal ball. He wouldn't have slept a wink.

Many times before, Jim had accompanied me with high hopes of tricking a musky but he'd never caught one. He was well aware that musky fishing is tedious and tiring, and that muskies are tempermental. Although only 11, Jim is familiar with their antics. He knows that unlike his little dog "Bubbles", they don't crave human companionship, nor come bounding when whistled for.

We have fished together when it was difficult to convince him that there were really muskies there. Sometimes on the brink of success his fish only chose to follow as far as the boat. In a poof it was gone, and dreams shattered.

Jim has been with me on successful days. Although I may have been too preoccupied to teach much, Jim always watched closely from strike to finish.

It was this craving for muskies and musky fishing that sparked Jim into learning the art of tying up and making his own bucktails. Saturday afternoon Jim showed me several of his new creations. They looked good. I even got the bug myself and tied up a new one too. Next morning we'd put them to the test.

"Jimmy, wake up—it's 5:30!"

He grabbed his new bucktails off the kitchen table and we were on our way.

We headed up the lake to a known "hot spot" which for some reason only a musky can explain had chilled down the last few days.

We each snapped on one of the new bucktails concocted the previous day. In the first few casts, Jim had a follow. In his lingo the fish was a "looker" estimated at 32 to 34 inches.

Jim's next cast ended in a backlash. I let him pick away at it a while, then asked if he could use help. In a disgruntled mumble I could decipher "Ya I guess so."

I knew the edge we were working well. I also knew we were just now drifting up onto the good area. I made one more cast and started the retrieve—KAPOW!! I had one on! It felt like a good one. Jim forgot about his backlash and pulled his line in hand over hand to get it out of the water. To make a story short, the musky just welcomed aboard measured 40 inches—tricked on a bucktail that had hardly been used.

We got back to Jim's backlash. Seems hard to comprehend how a line could have become so snarled. But with a lot of pickin' and pokin', we were finally back in business.

We zipped across the lake to another bar. The sight of the musky in the boat apparently gave Jim an extra shot of fever. He was really laying 'em out and reeling 'em in. A couple of times we went through the phrase, "Dad, I sure wish I could catch one like that" and a couple of times I said, "I sure wish you could too—keep casting!"

Then it happened! The musky that lived on this bar was in the mood to eat one of Jimmy Wendt's bucktails. She wanted it—and she grabbed it!

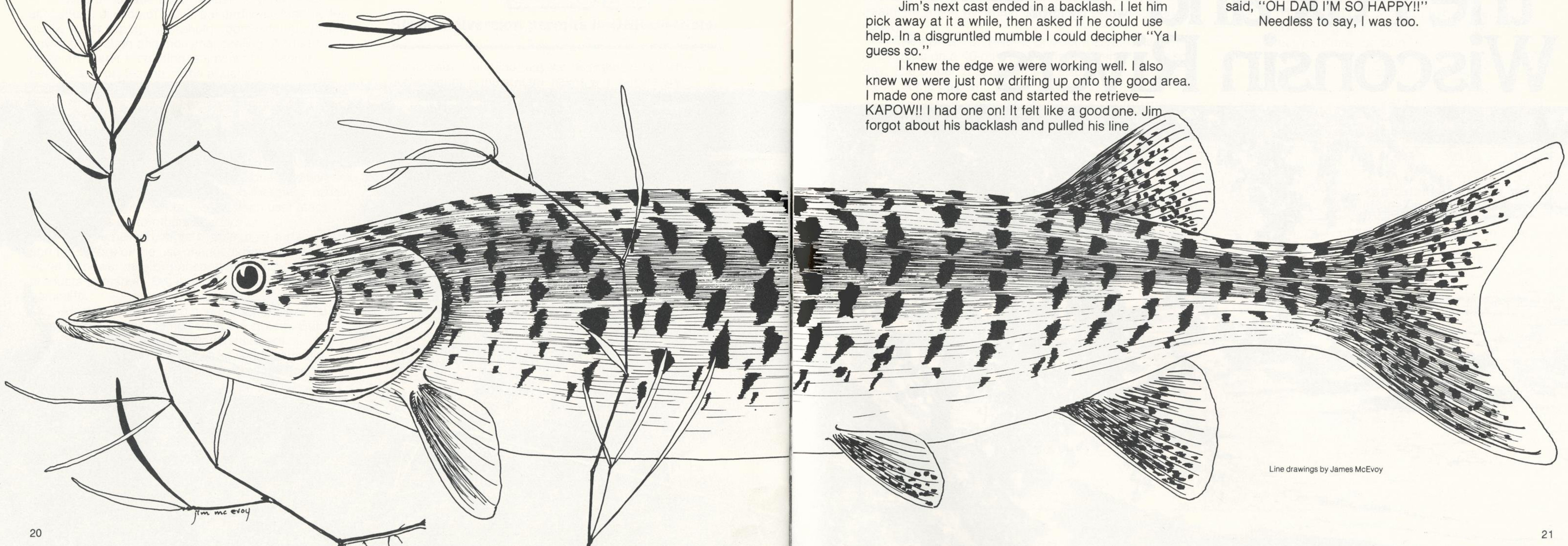
Jim's reaction was automatic—he set the hooks and cranked. On one end of the line we had a little fellow struggling for a reputation. On the other end we had a musky fighting for freedom. The bout lasted only a few minutes, which to me resembled eternity.

Everything went fine. Not until I gaffed the musky into the boat was I confident enough to declare a winner.

We ran the tape down that fish —past 30, all the way up to 34 inches right on the button.

I knew Jim was pleased. His next reaction said it all. He threw his arms around my neck and hugged for all he was worth. Bubbling with genuine enthusiasm he said, "OH DAD I'M SO HAPPY!!"

Needless to say, I was too.



Line drawings by James McEvoy

Cleaning up the Fox and Wisconsin Rivers

Cleaning up these two streams is complicated and controversial and requires the public to make excruciating choices, but it must be done. The objective is "fishable and swimmable" water by 1983.

ROY CHRISTIANSON, Water Quality Planner

The Lower Fox and Upper Wisconsin River Valleys, dominated by the greatest concentration of pulp and paper mills in the world, are vital to the industrial and economic health of Wisconsin.

However, vast amounts of waste from the mills and from city sewage plants overtax the cleansing powers of the two rivers. Thus, other legitimate water uses are impaired—swimming, fishing and boating to name a few.

Just how bad it can get was underscored by last winter's fish kill on the Wisconsin River. A deadly combination of drought and low water plus early ice cover sealed out fresh oxygen. With the river unable to assimilate pollutants, dissolved oxygen that fish need to survive dropped to near zero. Extremely expensive restocking will now be necessary. And the cost in lost recreational opportunities can, of course, never be adequately assessed.

Although water on the two streams has improved markedly in the past three years, the fish kill occurred anyhow. Quality is still poor and yet industries and municipalities have constructed many improved wastewater treatment systems. The fish kill makes it obvious that even more must be done.

In improving water quality, the ability of a river to cleanse itself is a vital concept. Natural biological processes absorb a certain amount of waste. Exactly how much depends on many factors: the amount of water flowing in the river, how fast it flows, temperature, and the presence of algae. DNR measures this so-called "assimilative capacity" by using a computer model which simulates what happens when a river receives given doses of pollutants.

Two critical and controversial questions are involved in the cleanup effort. The first involves assessing how much waste each river segment can absorb and the second, determining the portion of that waste load each discharger will be allowed. This "waste load allocation" process is necessary under federal and state law.

In 1972, the US Congress enacted amendments to the Federal Water Pollution Control Act, a comprehensive law, referred to as Public Law 92-500. It provides overall direction for each state's water

pollution control program with a two-track approach for both industries and municipalities.

One track requires a baseline level technology. The other defines water quality.

For municipal sewage treatment plants, there is only one baseline technology level required secondary treatment.

For industries, however, there are two major stages:

1. A Best Practicable Treatment (BPT) level required by July 1, 1977.
2. A Best Available Technology (BAT) level by July 1, 1983.

The BAT level will be more restrictive (i.e. will result in less pollution) and more expensive than will the BPT level. Use of the terms "Best Practicable" and "Best Available" can be confusing. Best Available Technology (BAT) is simply a treatment level for an industrial discharger more restrictive than the BPT level. The US Environmental Protection Agency will define BPT and BAT for each industry. Specific definitions of BAT are currently being developed for the pulp and paper industry. Objective is to establish uniform minimum treatment requirements for the entire nation, reducing the threat of industry moving from one state to another to avoid environmental controls.

The second track has a legislated water quality goal of "fishable and swimmable" by 1983. A number of measures have been developed to define fishable and swimmable. The most important is the level of dissolved oxygen. This second track becomes operable if BPT and BAT are not adequate to provide treatment which will attain fishing and swimming water quality.

The Lower Fox River is one such area. It has 16 paper mills on a 40-mile stretch from Neenah to Green Bay. The Upper Wisconsin River also has 16. As a result, some pulp and paper mill dischargers on both streams may be required to install more sophisticated, and therefore more costly, treatment systems than those necessary to comply with the BAT requirement.

In Wisconsin, the major cleanup tool is the discharge permit which DNR issues for a three to five year period to any polluter. The permit specifies how much of different types of pollutants can be discharged into a stream.

It is illegal for anyone to discharge wastes without a permit or to exceed the permit limit. Fines can and do result from violations.

Permits call for decreased waste discharge amounts over a fixed number of years.

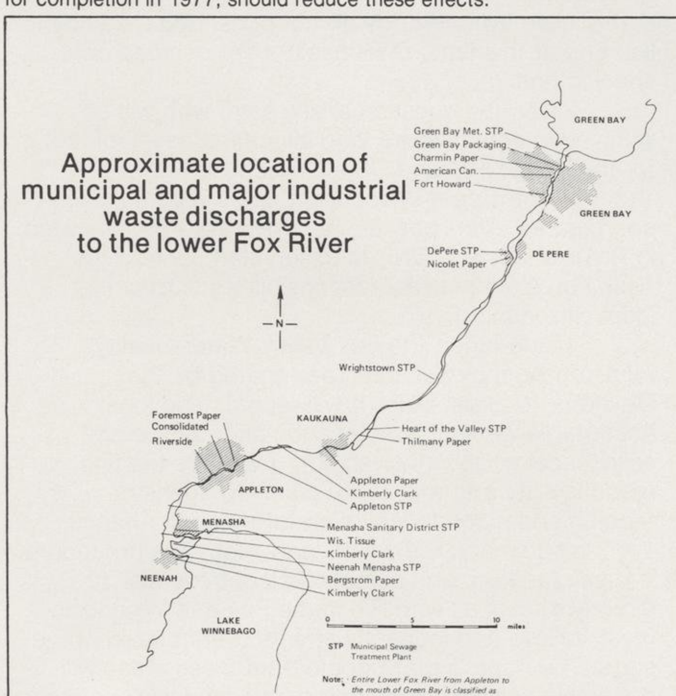
The first round of permits was issued to Wisconsin pulp and paper mills during 1974. These expire December 31, 1978. The next permits will reflect even tighter discharge requirements — BAT, to be in place by 1983 — or a waste load allocation if BAT is not sufficient to achieve the desired water quality *at all times*.

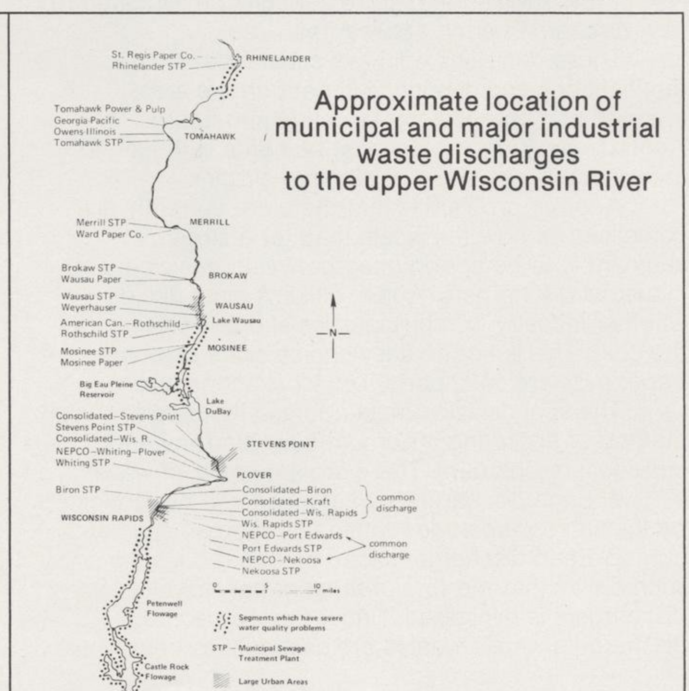
Never before has a pollution discharge permit system rested on limits imposed by the natural capacity of the river system. This raises new and critical questions:

1. Which is more important — cleaner water or accelerated economic growth potential?
2. Will a waste load allocation really diminish future economic growth in the Fox or Wisconsin River basins?
3. Should existing industries be required to reduce their pollution enough to allow new polluting industries to be built?
4. Who should pay what portion of the cost of cleaning up each river — industries, municipalities, or both?
5. How do you allocate the pollution load "pie" among all the affected dischargers?

These are some of the tough questions citizens of both the Fox and Wisconsin River basins are being asked and the answers will have an important bearing on both local economies and future water quality.

◄ Swirls of foam photographed in 1973 by a DNR river survey team downstream from Thilmany Pulp and Paper Company at Kaukauna on the Fox River. Improved treatment facilities scheduled for completion in 1977, should reduce these effects.





Although, by law, DNR must ultimately answer these questions it should and is doing so with guidance from local citizens.

Guidance is especially needed for the most crucial policy decision: how to allocate the allowable total waste load for a particular river segment among individual dischargers. Simply put - who can dump what into what part of the river for how long. Two basic options are immediately obvious: either all of the stream's capacity to absorb wastes may be used by existing municipal and industrial dischargers *or* a portion may be held back for future growth.

If all assimilative capacity goes to existing dischargers, they will need less costly and sophisticated treatment systems. However, this would mean that additional "wet" industrial growth could not be permitted unless existing dischargers find a way to cut their waste load.

This could happen if an industrial discharger found it advantageous to reuse some of its water. Green Bay Packaging Company, for example, says it has increased production sixfold while reducing waste discharge to the Fox River by more than 60 times. Through development of a system which reuses water, the company reduced discharge of pollutants by about 98% and lowered maintenance, energy, and water costs by 15 to 25%. However, there is no guarantee that any other discharger will go this route.

Preserving a portion of the stream's assimilative capacity for future growth will require higher, more costly levels of treatment for existing dischargers. But if their financial health is severely threatened, providing for future growth is not very palatable. It *could* put a company out of business and employment and economies would suffer.

Reserving assimilative capacity also brings up other questions:

-Should it be saved only for industrial growth or for municipal growth too?

-How much should be held back?

-How should the reserve capacity be allocated to new discharge permit applicants?

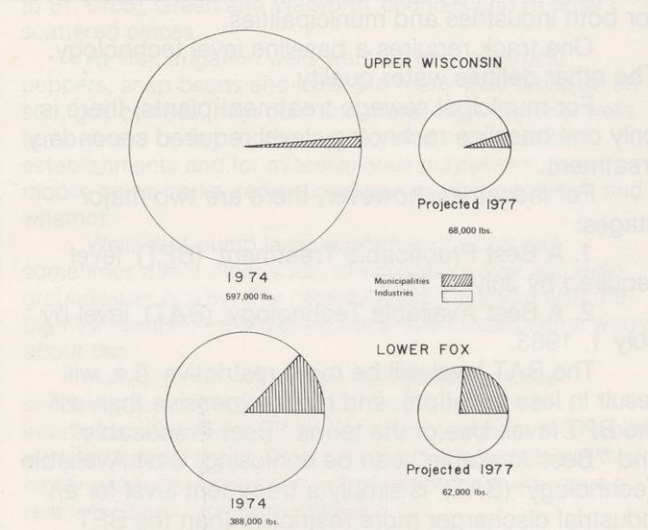
These decisions will have substantial ramifications and economic impact on the areas involved and on polluters—existing and future. Accordingly, judgements must be made with full knowledge of the views of affected citizens.

Another problem is that there are currently no guidelines on how the waste load for a stream segment is to be apportioned between municipal and industrial dischargers. Again, citizens must decide whether industry or municipalities should bear most of the cost. This is not an easy choice since pulp and paper mills are so important to local economies.

The final decision must address the precise method of allocating maximum daily load limits to individual dischargers. There are a number of ways:

1. Each discharger's waste load can be reduced by the same *percentage* within the affected segment.

2. Each discharger's load can be reduced in such a way that the *total treatment cost* for all dischargers is minimized. Under this procedure, dischargers whose wastes are cheapest to treat would have a greater load reduction percentage. This is the most economically efficient but does not consider the basic financial health of the individual discharger.



Average Daily Waste (BOD) Discharges to the Lower Fox and Upper Wisconsin Rivers from Industries and Municipalities 1974 and 1977

3. Each discharger's waste load can be reduced by an equal number of pounds within a given river segment.

4. Discharge loads can be reduced in such a way that each discharger would pay an equal amount of money for additional wastewater treatment.

5. A last alternative would simply be to "hit the largest discharger first," a practice used in New York State. The largest discharger of pollutants is forced to go to the next higher level of treatment. If this doesn't result in the proper water quality standard, then the second largest discharger is pushed to the next higher level. This process continues until standards are attained.

These five methods do not constitute a complete list, and at this time, DNR has not yet decided on a specific one.

Finally, the question arises as to who will be involved in actual waste load allocation development for the Lower Fox and Upper Wisconsin.

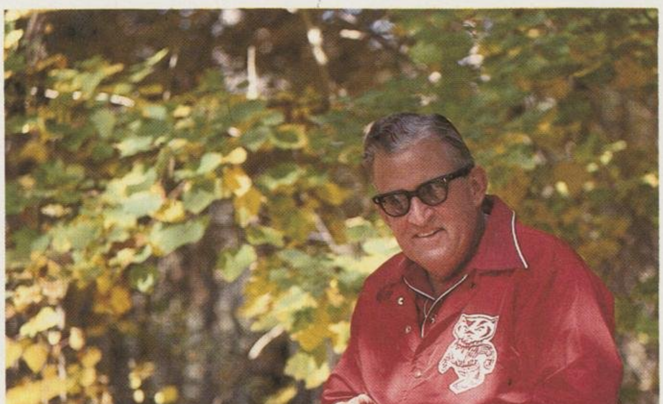
For the Upper Wisconsin there will be a closely coordinated effort between a DNR Task Force located in Rhinelander and DNR Madison staff. One of the Task Force's most vital responsibilities is to gather local citizen input.

For the other, the Fox Valley Water Quality Planning Agency has been designated by the Governor to assist DNR. It will recommend locally acceptable waste load allocation alternatives and solicit local citizen involvement. DNR has the final responsibility and will review planning agency recommendations to insure statutory conformance.

In summary, the waste load allocation procedure is many faceted, and sometimes controversial. It directly affects all who live in the Fox and Wisconsin River Valleys and indirectly affects every citizen of the state. The hope is that people from these areas will become closely involved before critical decisions are made.

Water dripping from icicles on the eves freezes on a porch railing. It forms miniature sculpture.

Spring



Dr. Weaver the photographer.

Photo by James Kent

DR. JOHN C. WEAVER, President, University of Wisconsin

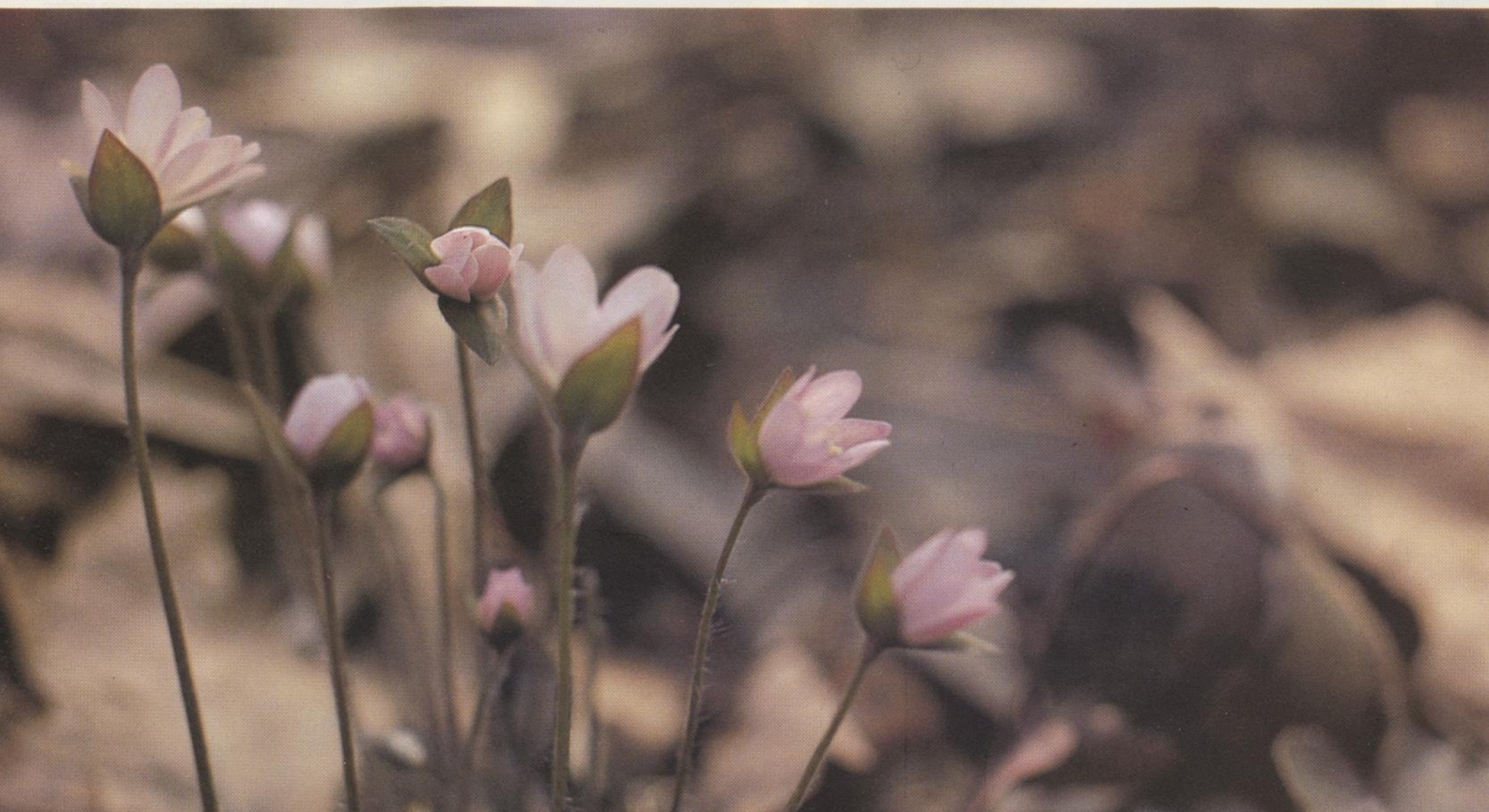
After the spring equinox,heat from the high sun grows sturdy and winter in Wisconsin ends at last. Here the camera of retiring University of Wisconsin President Dr. John C. Weaver takes a close look at the warmup and awakening from melting ice to June butterfly.

As an amateur photographer, Dr. Weaver has snapped thousands of pictures all over the world, taught a special photography class at UW-Madison and had his work exhibited and published.

He will retire July 1 after seven years as UW President and looks forward to teaching again and spending even more time taking pictures.

The first oak leaves.

A lone swallowtail butterfly lands on a clover. It is nearly summer.



Under the trees, wild flowers hurry to decorate the woods before leaves block the sunlight. This is Hepatica in early May.

Looking like a tiny, cloak-wrapped soldier, a mayapple comes to life. In a few weeks a big white flower will appear under the leaves. →

Wisconsin's endangered plants

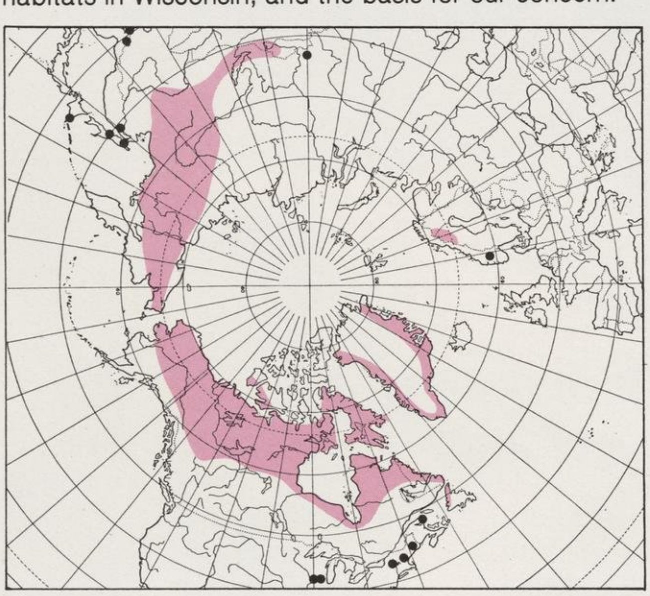
The National Endangered Species Act protects endangered and threatened plants. Legislation to follow suit is pending in Wisconsin.

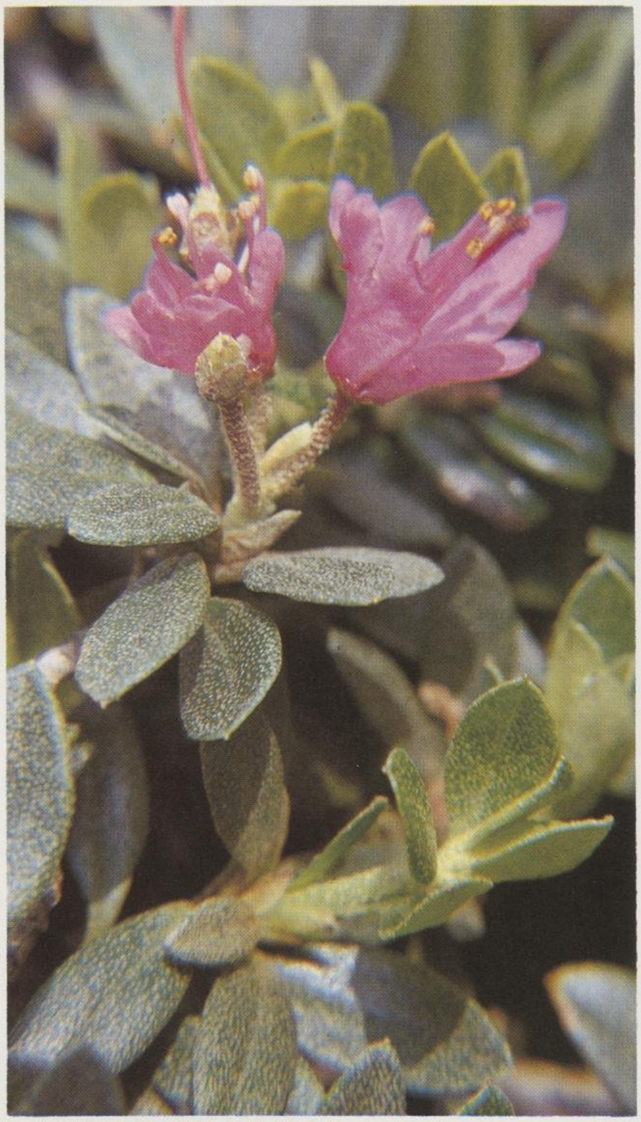
ROBERT H. READ, Natural Areas Botanist

The green mantle of vegetation covering Wisconsin is composed of over 1,800 species of "higher" plants (i.e., ferns and seed-producers). This great floral diversity is a diversity that most of us take for granted despite our tremendous dependence on green plants. In spite of our unconcern, there are approximately 250 species in Wisconsin believed to be in danger of disappearing. These are Wisconsin's endangered and threatened plants.

Once biological diversity is destroyed all the magnificence of modern technology cannot restore it. For this reason, biologists and legislators at both state and national levels are increasingly concerned over the large number of plants and animals headed for extinction or extirpation. It is a frustrating, but challenging concern because not much is known about the reasons for apparent species endangerment, other than the obvious loss of habitat caused by man's pervasive activities. Also, in most cases, little research has been conducted on possible uses of endangered and threatened plants for human benefit. Indeed, to many people the personal enjoyment of the flower itself may be the ultimate use. We should not close our options to enjoy and study these plants by allowing them to become irretrievable parts of the past.

This article features a few of them, their critical habitats in Wisconsin, and the basis for our concern.





Lapland rosebay *(Rhododendron lapponicum)*.

Relic Species

One of the two Wisconsin localities for the state's only native rhododendron, Lapland rosebay *(Rhododendron lapponicum)*, is at the Dells of the Wisconsin River, where it clings to the edge of a sandstone ledge in one small colony. Termed Wisconsin's "Eskimo" the plant is remarkably separated here in the unglaciated portion of southwestern Wisconsin from its closest arctic habitats and highest New England mountains some 900 miles distant. Many experts believe that Lapland rosebay has persisted on these unglaciated refuge cliffs for thousands of years as relics of an ancient flora. The shading on the polar projection map depicts the main range, while scattered dots show the few outlying locations.

Disappearing habitat

Loss of habitat plagues many native plants and animals throughout the world. Typical is the prairie white fringed orchid *(Habenaria leucophaea)* which is restricted in Wisconsin to damp, deep soil prairie remnants in the southeastern quarter of the state. Prior to large-scale European settlement of Wisconsin which commenced in the mid-1800's, native grasslands covered over two million acres in the south and west central portions of the state. The fertile soil of the prairies meant early conversion to cropland and pasture, and today only small scattered prairie patches remain to delight the eye such as this unprotected remnant in Green Lake County. The intricate flower of the prairie white fringed orchid signifies a complex structure evolved to attract insect pollinators. In some orchids (as well as other specialized flowers), insect and plant have co-evolved together so that extinction of one member of the "team" means doom to the other partner as well.

Fringed orchid *(Habenaria leucophaea)*
Wet-mesic prairie remnant, Green Lake County.

Restricted range and habitat

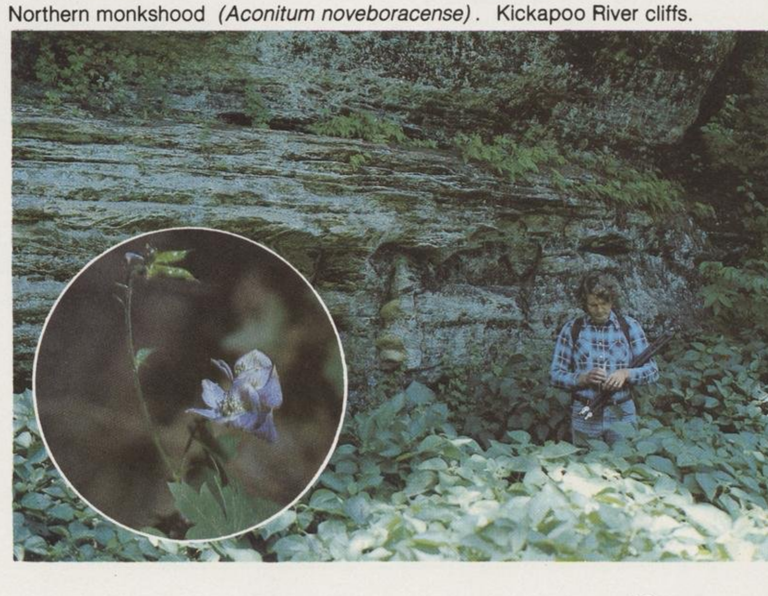
In May and June, the delicate fleur-de-lis of the dwarf lake iris carpets portions of the shoreline of upper Lakes Michigan and Huron. Within this restricted range the species is further restricted in its habitat preference to damp, gravelly or sandy calcareous beaches and ridges. Such a precise habitat exists in Wisconsin only on the upper Door Peninsula and adjacent archipelago, like the wet, sandy shoreline of Washington Island. Will increased recreational development in one of Wisconsin's favorite vacation areas destroy the remaining unprotected habitats of this diminutive wildflower, whose closest relative is found in the deciduous forest of the southeastern United States?

Dwarf lake iris *(Iris lacustris)*. Jackson Harbor, Washington Island.

General rarity

With northern monkshood *(Aconitum noveboracense)* there is concern for the future of an entire species. Despite a range spanning half a continent — from New York westward to Iowa — the plant is known to exist in only 11 localities, four of which are in southwestern Wisconsin. In all natural habitats northern monkshood is associated with shaded, damp cliffs and rock strewn slopes, a fact which is puzzling, since many such habitats exist in the range which do not contain it. It has been suggested that such factors as low seed viability, slow maturation and high juvenile mortality, a poor seed dispersal mechanism, or precise growth conditions may account for northern monkshood's rarity, but as of yet there are no definitive solutions to this species' apparent plight.

Northern monkshood *(Aconitum noveboracense)*. Kickapoo River cliffs.



Photos by Ruth Hine, Robert Read, Kitty Kohout, William Tans

Frogs sing in spring and they need help

RICHARD VOGT, UW-Madison Research Asst. in Herpatology

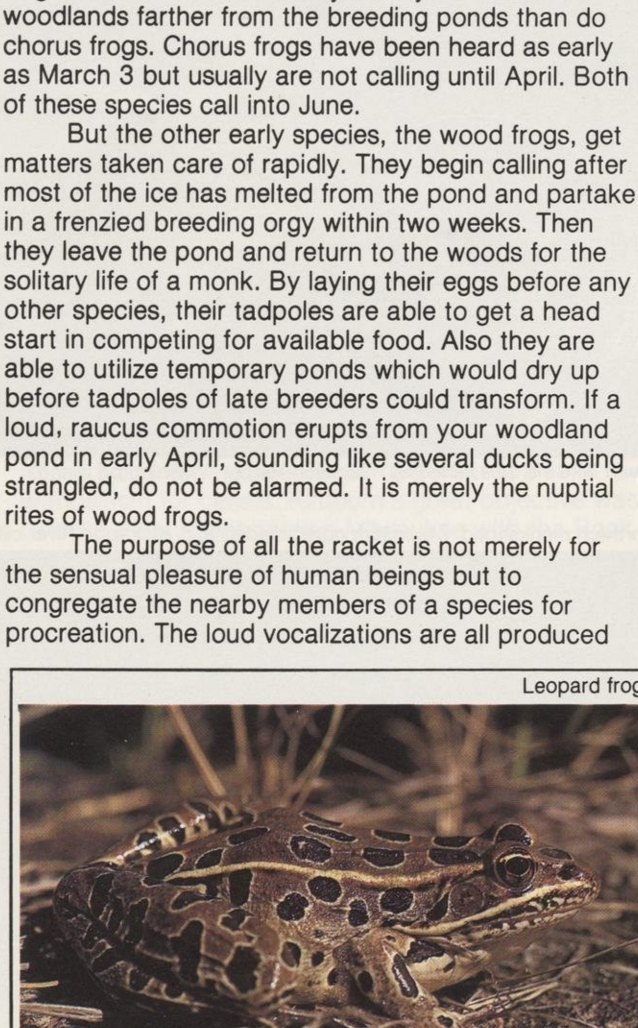
Soon after the spring thaw is signified by the sound of water trickling down hillside gorges and long before any wild flowers poke their heads into the sky, the rasping calls of chorus frogs spill joyfully across the marsh. They have been lying torpid nearby throughout the winter. They are the first to reach the breeding ponds, having been roused to activity by a torrent of ice water filling their sleeping quarters. The spring peeper's heralding "peep" joins the chorus frog's refrain within three days. They hibernate in woodlands farther from the breeding ponds than do chorus frogs. Chorus frogs have been heard as early as March 3 but usually are not calling until April. Both of these species call into June.

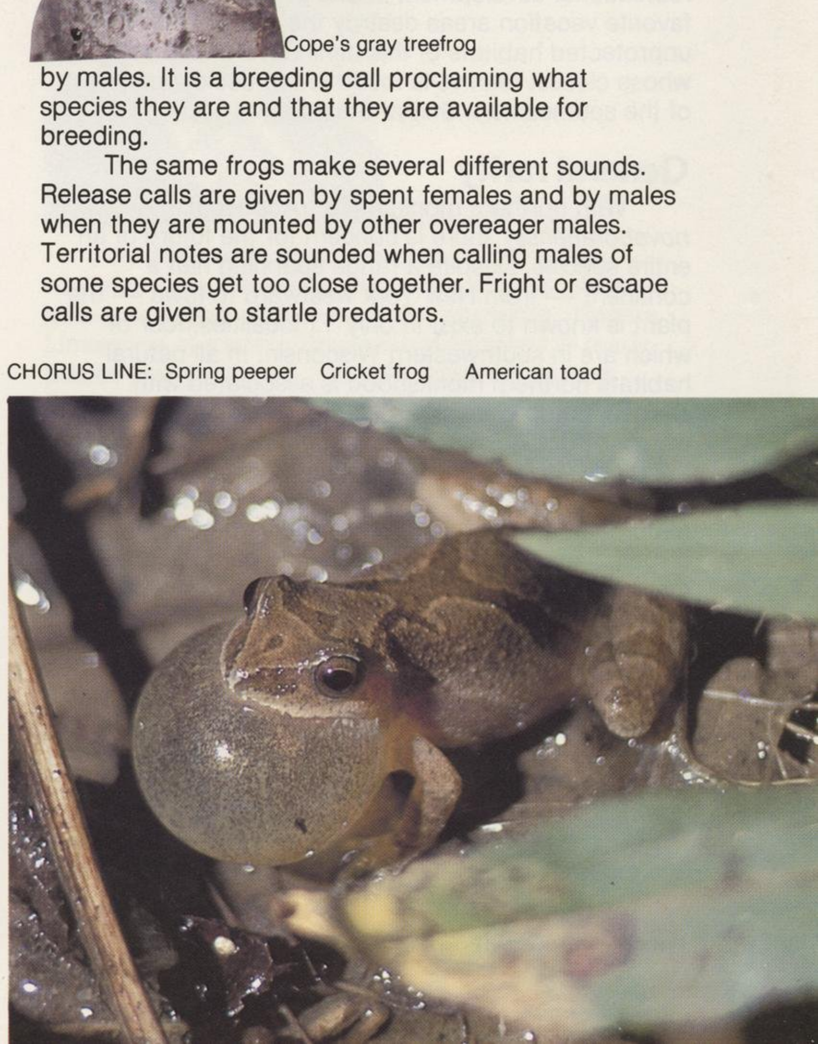
But the other early species, the wood frogs, get matters taken care of rapidly. They begin calling after most of the ice has melted from the pond and partake in a frenzied breeding orgy within two weeks. Then they leave the pond and return to the woods for the solitary life of a monk. By laying their eggs before any other species, their tadpoles are able to get a head start in competing for available food. Also they are able to utilize temporary ponds which would dry up before tadpoles of late breeders could transform. If a loud, raucus commotion erupts from your woodland pond in early April, sounding like several ducks being strangled, do not be alarmed. It is merely the nuptial rites of wood frogs.

The purpose of all the racket is not merely for the sensual pleasure of human beings but to congregate the nearby members of a species for procreation. The loud vocalizations are all produced by males. It is a breeding call proclaiming what species they are and that they are available for breeding.

The same frogs make several different sounds. Release calls are given by spent females and by males when they are mounted by other overeager males. Territorial notes are sounded when calling males of some species get too close together. Fright or escape calls are given to startle predators.


Cope's gray treefrog

Leopard frog


CHORUS LINE: Spring peeper Cricket frog American toad


At the end of April two more species are added to the calling calendar. Leopard frogs migrate from the deep lakes or springs where they spent the winter to small, semi-permanent breeding ponds or marshes and start to call for mates. They attract females with a low hoarse "snoring" sound. The pickerel frog sounds similar but slightly higher pitched, softer, and does not carry as far. Pickerels begin calling about the same time as leopard frogs but are usually associated with cold spring water.

When temperatures begin to rise in early May the more conservative frogs venture out, jamming the air waves with music most delightful to a naturalist's ears. The enchanting trill of the eastern gray treefrog has confused many a budding birder who often searches high in the trees for an illusive warbler with a beautiful song. Both it and its close relative, Cope's treefrog, begin calling from woodland ponds by the second week of May, but they have been heard as early as April 28. Cope's gray treefrogs sound similar to eastern gray treefrogs, but to the trained ear Cope's have a faster and more nasal trill.

About the same time as the treefrogs begin, the whirring trill of the American toad can be heard accompanied by the "twang" of the green frog. American toads peak by mid-May, then return to a silent terrestrial life for the summer. Green frogs, however, remain along permanent bodies of water where they breed intermittently throughout the summer. For this reason they must lay their eggs in permanent water so that tadpoles of the late breeders can overwinter under the ice.

Early in June the mink frog from Wisconsin's northern bogs begins its "knock-knock-knock" solicitation from the edge of sphagnum mats. At about the same time in southern Wisconsin the bellow of the bullfrog can be heard echoing across wetlands. It is presently an uncommon frog in southern Wisconsin, surviving well only in areas where land owners or the law have given protection. Bullfrogs were once heard over most of Wisconsin but seem to have been edged out by man from over exploitation and habitat alteration.

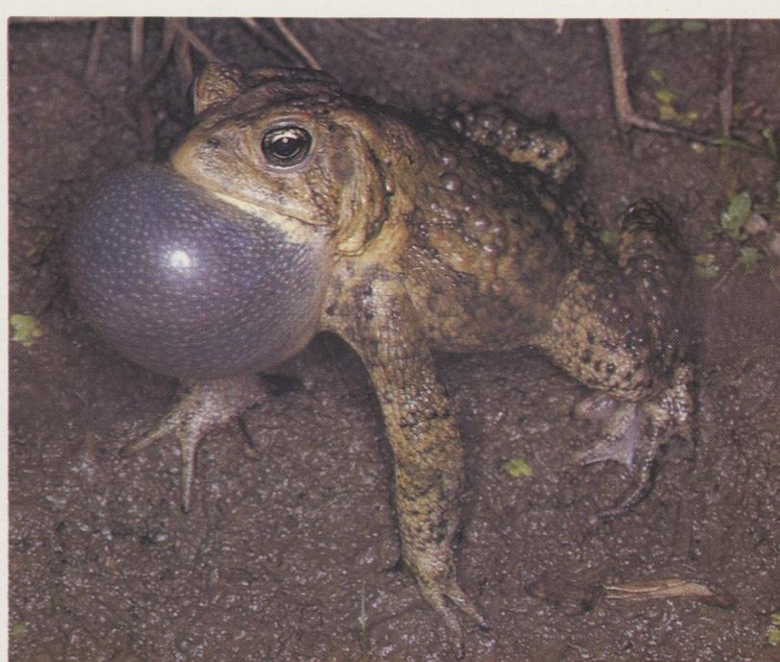
It is interesting that the smallest frog in Wisconsin, the cricket frog, is also in short supply. Not long ago they could be seen bouncing like popcorn across marshes and meadows of southern Wisconsin but within the last five years their cheery "crick-crick-crick" has been heard in only one locality. The characteristic call starts slowly, building to a crescendo then deaccelerating. Cricket frogs used to be heard from mid-May to August along the Wisconsin River flood plain.

Not only cricket and bullfrogs, but many others are disappearing. A long time has passed since a survey documented low leopard frog populations. For the past three years DNR's Fish Management Bureau, in addition to its other duties, has been conducting studies linking possible herbicide poisoning to declines in certain frog populations. No one knows exactly why the frogs are declining.

If we fail to find out, there will be a sad but inevitable day when the early sounds of trickling water will have no accompaniment and young naturalists will learn only the bird calls. Unfortunately, aesthetics do not generally generate revenue and studies cost money. So far it is mostly other frogs that listen to the call for help.

Bullfrog

Photos by Richard Vogt



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