NOVEMBER 2004 Volume 39 No. 4

THE MICHIGAN RIPARIAN

www.mi-riparian.org

DEVOTED TO THE MANAGEMENT AND WISE USE OF MICHIGAN'S LAKES AND STREAMS

Published Quarterly – February, May, August and November

LAKE SUPERIOR

SOUTH SHORELINE, MARQUETTE COUNTY
LARGEST AND DEEPEST OF THE GREAT LAKES

THE MICHIGAN RIPARIAN

www.mi-riparian.org

"THE MICHIGAN RIPARIAN (ISSN 0279-2524) is published quarterly for $2.00 per issue by the Michigan Riparian Inc., P.O. Box 249, Three Rivers, Michigan 49093. Periodicals postage paid at Three Rivers, Michigan and additional mailing offices."
POSTMASTER:
Send address changes to:
The Michigan Riparian
P.O. Box 249
Three Rivers, MI 49093

The Michigan RIPARIAN is the only magazine devoted exclusively to protection, preservation and improvement of Michigan waters and to the rights of riparian owners to enjoy their waterfront property.

The Michigan RIPARIAN is published quarterly and is mailed to subscribers during February, May, August and November.

THE MICHIGAN RIPARIAN magazine is owned and published by the Michigan Riparian Inc., a Michigan non-profit corporation.

EDITORIAL and BUSINESS OFFICE: 124½ N. Main Street, P.O. Box 249, Three Rivers, MI 49093.

TELEPHONE: 269-273-8200

FAX: 269-273-2919

ADVERTISING DEADLINE: No later than 1st of the month preceding month of publication.

ADVERTISING RATES: Sent upon request.

SUBSCRIPTION RATES:

Individual Subscription $8.00
Group Rates: 10 to 49 Subscriptions $7.00
50 or more, or all members of a Lake Association $6.00

EDITOR and PUBLISHER: Donald E. Winne

Printed by J.B. Printing, Kalamazoo, MI 49007.

In This Issue

Cover: Lake Superior, Marquette County

PLAN NOW to attend Michigan Lake & Stream Association's 44th Annual Meeting at Boyne Mountain Resort on April 22-24, 2005, Boyne Falls, Michigan.

Plans are being made to cover topics that have surfaced in the past few months, such as lowering lake levels, beach closings due to E coli bacterial infestations, key-holing issues, spread of exotic plants and animals to more inland lakes, road end abuse by non-riparians, groundwater consumption and contamination, etc.

More information will be printed in the February issue of the Riparian.

Demonstrating Alternative Shoreline Management on Gull Lake

By Jane Herbert

In response to a growing interest in more natural shorelines and alternatives to sea walls, the Michigan State University Extension Land & Water Program at Kellogg Biological Station (KBS) has created the *KBS Shoreline Management Demonstration Area* (Photo 1). With the assistance and support of many partners, 400 feet of Gull Lake shoreline has been transformed into four 100-foot long demonstration lakescapes.

1. A view of Gull Lake from the KBS Shoreline Management Demonstration Area

Lakescaping is a term used to describe alternative shoreline landscaping. It involves a more natural approach to erosion control while at the same time slowing runoff and enhancing wildlife habitat. Families of geese are discouraged by less turf and taller plantings that inhibit their ability to spot predators. The KBS Shoreline Management Demonstration Area incorporates these shoreline management concepts in its four different lakescape designs.

Permits? Public Act 451, the Natural Resource and Environmental Protection Act requires permits for certain activities in shoreline areas. For construction activities below the Ordinary High Water Mark, contact the MDEQ for a Part 301 Inland Lakes and Streams permit. When disturbing soils within 500 feet of a lake or a stream, contact your county soil erosion inspector for a Part 91 Soil Erosion and Sedimentation Control permit.

Losing ground

Shoreline erosion control was the first order of business in creating the demo area. Significant undercutting threatened eventual bank loss to Gull Lake's intense wave and ice action. With engineering assistance from the USDA's Natural Resources Conservation Service (NRCS), plans were made to install four different kinds of erosion control – three of them soil bioengineered structures incorporating dormant woody shrubs. The fourth used rock rip-rap along the stretch taking the heaviest wave and ice action. With Part 301 and Part 91 permits in place, work began in early spring 2001.

To capitalize on the installation experience, the Land & Water Program hosted a two-day workshop for shoreline property owners, landscapers and agency personnel. It was taught by NRCS experts and sponsored by the Kalamazoo Community Foundation and the MSU Extension Water Quality Area of Expertise Team. Participants spent the first day in the classroom. On the second day, 22 muddy but happy participants installed about 130 feet of live fascine (Photo 2) and 50 feet of vegetated geogrid (Photo 3). The live crib wall (Photo 4) and rock rip rap had been previously installed by KBS staff members under the direction of NRCS.

2. Workshop participants install a live fascine (photo by Steve Deming)

3. Adding soil to the vegetated geogrid (photo by Steve Deming)

4. The Kellogg Manor House overlooking the new live crib wall

Benefits of soil bioengineered erosion control

Soil bioengineering incorporates layers or bundles of dormant woody shrub cuttings such as red twig dogwood, silky dogwood and common elderberry — just to name a few. With good soil contact the cuttings form dense root masses that can withstand significant wave and ice action. Above ground, shrubs can be pruned into low hedges or allowed to grow for screening from busy lake activities. These structures slow runoff, provide shade for fish and habitat for nesting birds. Most structures can be installed without the use of heavy equipment. Hand installation causes less impact and may be more practical for property owners in high density areas. Studies suggest soil bioengineering can cost significantly less per linear foot of shoreline than traditional sea wall.

A softer approach. Information on soil bioengineered (soft engineered) erosion control may be found at www.un1.edu/nac/afnotes/spec-6/spec-6.pdf or by contacting the USDA National Agroforestry Center at 402-437-5178.

The lakescapes

With the shoreline stabilized, attention turned to the upland lakescaping. Building on a project concept plan, four lakescapes, ranging from more traditional to totally native, were installed.

Lakescape #1, designed and sponsored by the Kalamazoo Nature Center Community Wildlife Program, incorporates a small berm to retain runoff that collects during heavy rains. Planted with hundreds of native plants and grasses, including cardinal flower, purple coneflower, spyderwort, and lanceleaf coreopsis (pictured in Photo 1), Lakescape #1 promises to be a real eye-catcher. The plugs were grown in the Nature Center's greenhouses, donated to the demonstration project, and then planted by volunteers from the Nature Center and the Gull Lake Quality Organization in October 2003 (Photo 5).

5. First year maintenance of native plantings

Lakescape #2 has also gone 'wild.' Dormant seeded to short grass prairie in November of 2003, this site has been slower to get started but holds promise for birds and butterflies. It includes a sod walkway to a picnic area and viewing bench. Positioned on a high bank, Lakescape #2 (Photo 6) incorporates the live cribwall.

6. Year one for the short grass prairie

Sixty-percent of the turf in Lakescape #3 (Photo 7) was put into woody shrubs and small trees. In lakescaping lingo this is known as the *60/40 concept* — meaning that 60 percent of the shoreline area is alternatively landscaped, while 40 percent remains in turf. This design reduces the intensive maintenance associated with traditional turf while retaining an open area for picnicking and lawn games. The turf area is seeded into a long-rooted, turf-grade fescue that resists drought and withstands traffic better than bluegrass. Both the vegetated geogrid and the live fascine are located in Lakescape #3.

7. A serene view of the 60/40 design

Lakescape #4 demonstrates how the shoreline property owner can simply quit mowing to the water's edge and create a buffer of woody shrubs (Photo 8). Again, this design reduces intensive turf management along sensitive shorelines. The long root structures of the woody shrubs (or native plants) in a buffer strip hold the soil and reduce soil erosion while improving wildlife habitat. This lakescape incorporates the rock rip-rapped shoreline.

8. Buffer strip between turf and lake

If you build it they will come

Now that the lakescapes are installed the number of groups and individuals coming to visit is increasing. A generous gift from the Gull Lake Quality Organization will be used to purchase interpretive signage and educational materials to maximize the site's educational value. Every aspect of the demonstration area's development has been photo documented. That includes recent storm damage – another natural shoreline phenomenon.

The KBS Shoreline Demonstration serves as a direct instructional tool for the Land & Water Program and its many partners and will also inform and educate the casual KBS visitor. In addition, the MSU Landscape Architecture program will soon incorporate the demo area into its undergraduate curriculum. The donations of time, materials and expertise are too numerous to mention here, however the Land & Water Program thanks all who have contributed to the development of this unique teaching and learning resource.

Getting started

Shoreline property owners considering alternative landscaping can purchase "Lakescaping for Wildlife and Water Quality," a publication of the Minnesota Department of Natural Resources available at www.minnesotasbookstore.com or toll free at 1-800-657-3757. Conducting a Web search using the term *lakescaping* yields multiple references.

Jane Herbert is an MSU Extension district water quality agent with the KBS Land & Water Program and serves as coordinator for the demonstration area. She is involved with a variety of water quality Extension programs including the Michigan Watershed Management Short Course, Introduction to Volunteer Stream Monitoring, Introduction to Lakes, and the Lake and Stream Leader's Institute. Herbert can be reached by email at jherbert@msu.edu *or by phone at* 269-671-2412 x 222.

The MSU Extension Land & Water Program at KBS serves southwest Michigan through extension education and research in four topic areas: Water Quality, Forestry, Land Use and Sustainable Agriculture.

MICHIGAN STATE UNIVERSITY EXTENSION

FABULOUS LAKE SUPERIOR

MORPHOLOGY

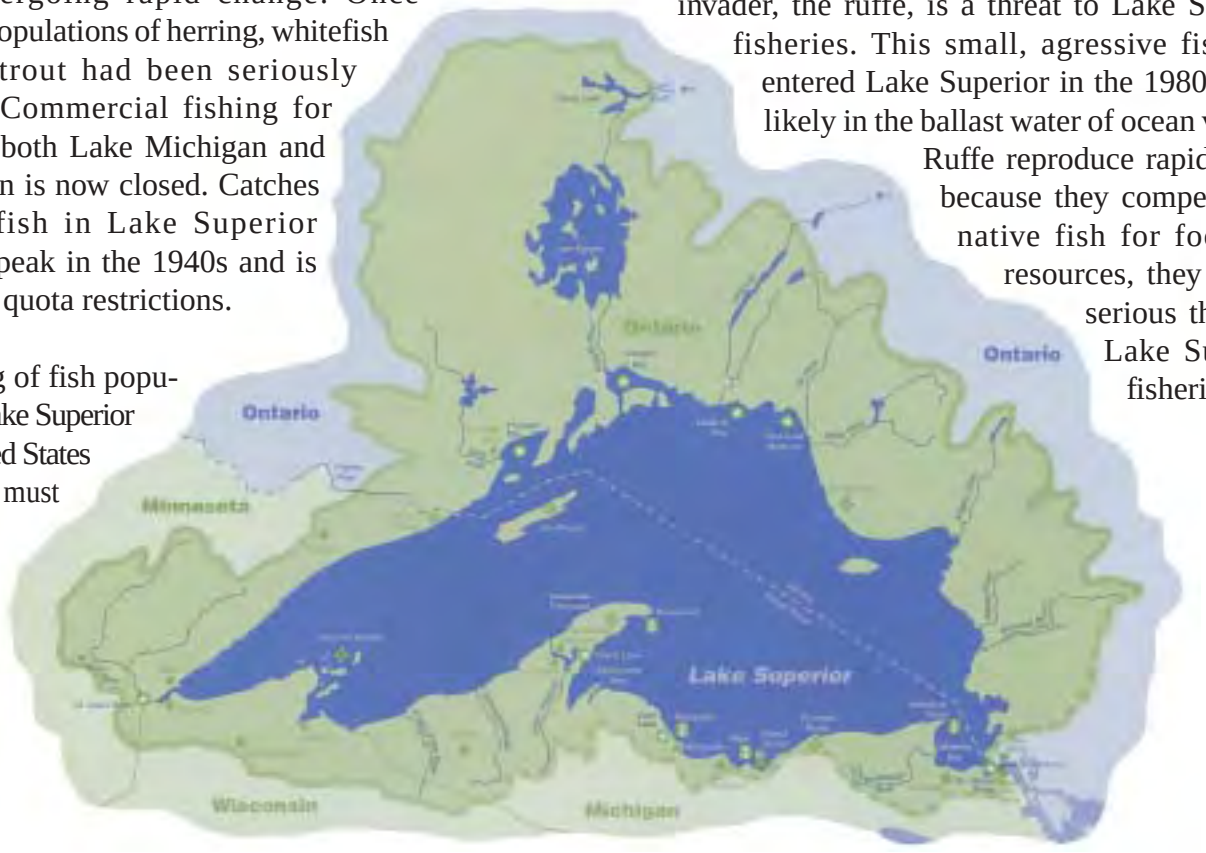
Lake Superior is the largest of the Great Lakes in both surface and volume. It is 350 miles in length and 160 miles in width — for a total of 31,820 square miles. The maximum depth is 1,333 feet deep and a volume of 2,935 cubic miles. Superior contains enough water to cover all of North and South America with one foot of water. The surface elevation was 601.77 feet above sea level in August 2004, and is maintained near that level from year to year.

FISHERIES

Lake Superior has been an important fish food resource for hundreds of years. Fish were very important in the economy of the Chippewa Indians in the early 1600s. The principal fish caught were whitefish and sturgeon. The fish were caught year round at the St. Mary's River, and especially in winter since the river did not freeze over. It was the abundance of the whitefish that attracted large numbers of people to the banks of the stream.

By the turn of the century, it was clear that the once valuable and relatively stable fishery of the Great lakes were undergoing rapid change. Once abundant populations of herring, whitefish and lake trout had been seriously depleted. Commercial fishing for herring in both Lake Michigan and Lake Huron is now closed. Catches of these fish in Lake Superior reached a peak in the 1940s and is now under quota restrictions.

Monitoring of fish populations in Lake Superior by the United States and Canada must continue if the value of the resources is to continue.



WATER QUALITY

Water quality of Lake Superior has been impacted by industrial wastes, and by toxic wastes transported by air currents and land runoff. Threats are from mercury loadings, chlordane, PCBs. The United States government along with Canadian provinces have designated seven areas of concern along the Lake Superior shoreline. The areas of concern have been identified at St. Louis River; Jackfish Bay; Thunder Bay; Peninsula Harbor; Torch Lake; Deer Lake; and St. Mary's River.

AQUATIC NUISANCE SPECIES

(*Source: MSU Extension Bulletin E-1866*)

"The sea lamprey was introduced into Lake Superior in 1938. This parasitic fish did substantial damage to Lake Superior fisheries, especially lake trout and whitefish. In the 1940s, the annual lake trout catch was 4.5 million pounds, but that number plummeted to only 500,000 by the 1960s. Lamprey control programs have reduced the eel population to 10% of its former peak, but continual control is required to maintain the current number of lake trout in Lake Superior. Another exotic invader, the ruffe, is a threat to Lake Superior fisheries. This small, agressive fish first entered Lake Superior in the 1980s, most likely in the ballast water of ocean vessels. Ruffe reproduce rapidly, and because they compete with native fish for food and resources, they pose a serious threat to Lake Superior fisheries.

Attorney Writes

By Clifford H. Bloom
Law, Weathers & Richardson, P.C.
Bridgewater Place, 333 Bridge Street, N.W., Suite 800, Grand Rapids, Michigan 49504-5360

"BUT THE REALTOR TOLD ME..."

"Puffery" normally means describing one's property (whether real or personal) to a prospective purchaser in the most pleasing or alluring fashion. It is not always easy to ascertain where puffery ends, and outright fraud or misrepresentation begins. Unfortunately, there appears to be a significant amount of misinformation (and at times fraud or misrepresentation) involved with the sale of properties near lakes where a lake access is involved. Of course, both the seller and any realtor or real estate agent involved have a financial incentive in puffing up lake access rights for backlots, given the perception that the greater the lake access rights for a given backlot, the more valuable the backlot.

It is rarely prudent or fair to generalize about a group of people. When it comes to realtors and real estate agents, the overwhelming majority of these professionals are hardworking, honest people. Unfortunately, a minority of such professionals do sometimes engage in misstatements or misrepresentations regarding limited rights attached to some backlot properties where lake access devices are involved. Sometimes the problems are caused by a lack of experience and knowledge on the part of the seller or the realtor or real estate agent, while at other times the deceit is purposeful.

By definition, a lakefront or riparian property must have frontage on a lake, river or stream (or comparable body of water). Sometimes that water frontage involves a narrow strip of land, but nevertheless, the property must have frontage on a body of water to be riparian. A non-lakefront or backlot property for which the owners can gain access to a lake by means of an easement, road end, park, alley, walkway or other lake access device is not a lakefront or riparian property. The owners of backlots normally gain access (if at all) to the waters of a nearby lake by means of three general types of lake access devices. First, some backlot properties actually have an easement which is created for or dedicated to that specific backlot or a relatively small number of backlots. Second, lake access devices are sometimes created in plats or other developments which service a significant number of backlots–for example, a private road end, park, private walkway or other common area. Finally, lake access is sometimes gained pursuant to public properties which can be used by any member of the public (not just backlot property owners), such as public road ends at lakes, public parks, public walkways and public alleys.

Sellers of property, realtors and real estate agents often use the phrase "deeded access" to mean that a backlot has access to a nearby body of water. Unfortunately, the phrase "deeded access" is something of a misnomer and is, in my opinion, often a misleading term. "Deeded access" implies that an access site exists for one particular backlot only (or a limited number of backlots) and that the access is granted by deed, which can often imply exclusivity. However, in the overwhelming majority of cases where the phrase "deeded access" is used, that access is not contained simply within the deed of the one backlot property (but rather, is usually created via a plat dedication or other document to serve many backlots or the public) and the lake access rights are normally very limited.

Different lake access devices accord backlot owners different usage rights. However, the overwhelming number of these lake access devices in Michigan only permit limited usage rights (typically, only ingress and egress–most cannot lawfully be used for installing a dock or shorestation or permanently mooring a boat, and many do not even permit lounging, sunbathing or picnicking). Of course, there are exceptions, but they are less common. What should a concerned adjoining or nearby riparian landowner do if a backlot property is listed for sale and the seller, realtor or real estate is misrepresenting to prospective purchasers (particularly in sales materials) the scope of usage rights which the purchaser of a particular backlot will have regarding a nearby lake access site? Ideally, the riparian should have his or her attorney send a letter to both the selling property owner and the realtor/real estate agent involved indicating that riparian owner's position as to what can and cannot occur at the lake access site. Both the seller and the realtor/real estate agent have a legal duty not to misrepresent such matters to prospective purchasers and putting them on notice of this issue by a letter prevents them from claiming ignorance later. Of course, having a riparian put such concerns in a letter rather than stating them verbally is superior (particularly if sent by certified mail, return receipt requested), as it is much more difficult for a seller or the seller's agent to deny the existence of a letter later as opposed to an oral statement.

ML&SA NEWS

MICHIGAN LAKE & STREAM ASSOCIATIONS, INC.

P.O. Box 249, Three Rivers, Michigan 49093
Ph 269-273-8200 Fax 269-273-2919
Email info@mlswa.org dwinne@mlswa.org
Web sites www.mlswa.org. www.mi-water-cmp.org
Donald E. Winne, Executive Director

Planning underway for a Lake and Stream Leader's Institute Class of 2005

by Howard Wandell

Michigan has a wealth of water resources, including 11,000 lakes and 36,000 miles of stream. Many of these waters have excellent quality and substantial economic and recreational value; however most have no strategic plan to guide their development and use. As use demands grow, lakes and streams will be increasingly susceptible to overuse and environmental degradation. The solution to this dilemma is collaborative management partnerships between the state agencies, local government, natural resource organizations and citizen stakeholders.

Most citizens, however, are unfamiliar with water resource management options and do not have the educational experiences needed to be local leaders and management partners. For stakeholders to be active participants in resource management, they must have access to appropriate training and informational materials.

To meet this need Michigan Lake and Stream Associations, Inc. has partnered with Michigan State University to create the Lake and Stream Leader's Institute and held its first class in 2002. Planning is now underway for the Institute's Class of 2005.

The Institute provides the participant with an educational experience that improves their understanding of local water resource management planning and program implementation. To maximize the learning experience the Institute's Class of 2005 is limited to 30 participants.

The Institute is conducted in five seminar sessions. The first seminar session will be held at the Ralph A. MacMullan Conference Center on Higgins Lake on Saturday, May 21, 2005. The next three sessions will be held on July 21, 22 and 23, 2005 at Kellogg Biological Station near Kalamazoo. Meals and lodging are provided as part of the registration fee. The last session and graduation dinner will be held at the Bengel Wildlife Center in Bath, north of Lansing on Friday, September 23, 2005. Institute participants must commit to attending all sessions, preparing an applied project, and completing the assigned homework.

The registration fee for the Institute had been set at $320. However, generous gifts from Institute supporters have allowed MLSA and MSU to reduce this year's registration fee for the Institute. For 2005, the registration fee is $195 ($100 for students). Additionally, participants will have to pay their own travel cost to attend the sessions and expect some expenses for their chosen applied project.

All applications will be evaluated as they are received and acceptance notices mailed out within two to three weeks of submittal. Applicants will continue to be accepted until the class limit is reached. An application form and the status of remaining space available in the upcoming class may be obtained from the MLSA web site www.mlswa.org or the MSU Extension Water Quality Network web site www.msue.msu.edu/waterqual/lakeleaders.html.

If you are interested in being part of the Institute's Class of 2005, complete an application form and mail it to Michigan Lake and Stream Associations, Inc., P.O. Box 303, Long Lake, MI 48743. The form may also be faxed to MLSA at 989-257-2073. It is to the applicant's advantage to apply early, as participation is limited.

If you have questions about the Institute contact:

Mr. Howard Wandell
Department of Fisheries and Wildlife
Room 332 Natural Resources Building
Michigan State University
East Lansing, MI 48824-1222
Phone 517/432-1491
Fax 517/432-1699
Email wandellh@msu.edu

RECENT MICHIGAN APPELLATE CASES OF INTEREST

by: Clifford H. Bloom, Esq.
Grand Rapids, Michigan

On October 12, 2004, the Michigan Court of Appeals issued a very important unpublished decision upholding Yankee Springs Township's anti-funneling regulations in *Yankee Springs Township v Fox* (unpublished opinion–Case No. 249045). The Court agreed that the anti-funneling regulations contained in the Township's zoning ordinance prevented eight families from purchasing and utilizing a 103-foot wide piece of property on Gun Lake in Barry County for lake access. The Court also denied claims that the ordinance provision was unreasonable, ambiguous, overly-broad and vague, as well as the assertion that the Township waited too long to enforce the ordinance. The Court also rejected arguments that the Township could not enforce its anti-funneling regulations because Gun Lake is located in more than one township and the lake has numerous public access sites. This case is a major victory for the concept of anti-funneling regulations and riparians in general. Hopefully, this case will prompt townships which have been reluctant to adopt such regulations into doing so.

In a past issue of the *Riparian Magazine*, I mentioned a case where the Michigan Court of Appeals held that there could not be a dedication in a plat of a private park, private road, private walkway or other common property for use only by lot owners within the plat. That decision could potentially have wiped out all such privately dedicated items at lakes, with property formerly comprising those private plat dedication sites going to the adjoining landowners. Had that decision stood, it would have had huge implications for plats on lakes throughout Michigan. However, that decision by the Michigan Court of Appeals was overturned by the Michigan Supreme Court in *Martin v Beldean*, 469 Mich 541 (2004). The Michigan Supreme Court ended this controversy and held that parks, private roads, walkways and other common use devices could be created by private plat dedication for the use of lot owners only within a plat.

Eurasian Water-milfoil

Don Garling and Ted Batterson
Department of Fisheries and Wildlife
Michigan State University
East Lansing, MI 48824
(517) 353-1989

Eurasian water-milfoil (*Myriophyllum spicatum*) has become a significant nuisance in many Michigan lakes and ponds. It crowds out desirable native plants species making recreational activities on lakes and ponds less desirable, if not impossible. The plant can spread through a body of water by breaking into pieces with each piece sinking, rooting, and growing into a new plant. Plants can be transported between lakes and ponds by becoming entangled on boat trailers and motor props. Attempts to remove Eurasian water-milfoil by aquatic weed harvesters has made the problem worse by accelerating its spread to uninfested areas of the lake or pond. However, there are plants that closely resemble water-milfoils that can be harvested effectively. Aquatic labeled herbicides are currently recommended when infestations are small as an effective control for Eurasian water-milfoil. You may be required to obtain a permit from the Michigan Department of Environmental Quality, Inland Lakes and Remedial Action Unit, Aquatic Nuisance Control Program before you treat your lake or pond with chemicals.

Eurasian water-milfoil is not native to North America. The plant was apparently introduced in North America late in the 19th century. Eurasian water-milfoil was first collected in Michigan in 1965; but, probably occurred here earlier and was confused with Northern water-milfoil (*Myriophyllum sibiricum [= exalbscens]*). The two water-milfoils are also confused with another aquatic plant common to Michigan, coontail (*Ceratophyllum demersum*). The plants all have basically similar looking leaves placed in a whorl around the stem (Figures 2-4). The exact form of these plants can vary as a result of differences in water depth, clarity, nutrient levels, annual variation in climate and other factors, making them somewhat difficult to identify.

It is important to identify which of these aquatic plants you might have in your lake before decisions on aquatic plant management are made.

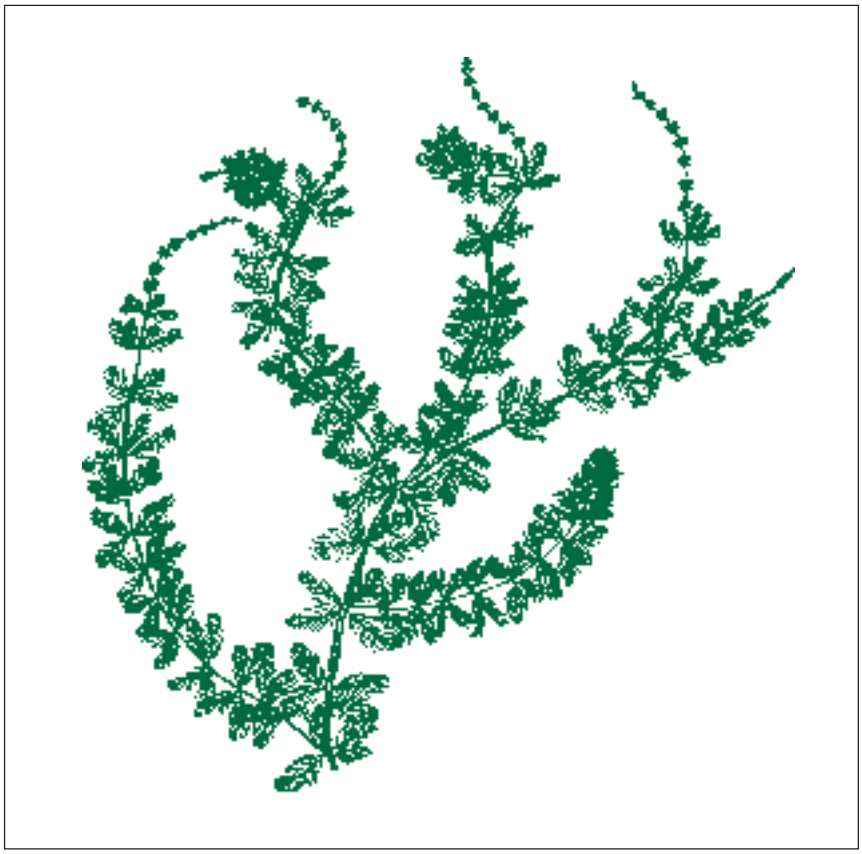


Figure 1. Eurasian water-milfoil[1]

[1]All figures taken and modified from the U.S. Department of Agriculture's book entitled "Common Weeds of the United States" published in 1971 by Dover Publications, Inc., New York.

Eurasian Water-milfoil *(cont. from page 14)*

Water-milfoils can be easily distinguished from coontail by the following characteristics:

1. Lateral leaf segments with serrated edges on one or both sides (Figure 2), 5 to 12 leaves per whorl ..... Coontail

1. Lateral leaf segments (Figures 3 and 4) smooth, 3 to 5 leaves per whorl ..... (Milfoil) 2

Voss[2] separates the very similarly appearing Eurasian water-milfoil from Northern water-milfoil based on the following characteristics:

2. Lateral segments of leaves 5-11 on a side (Figure 3) and turions (parts resembling small green pine cones) produced late in the fall ..... Northern water-milfoil

2. Lateral segments of most well-developed leaves 14-17 (Figure 4) on a side; turions never produced ..... Eurasian water-milfoil

Figure 2
Coontail

Figure 3
Northern water-milfoil

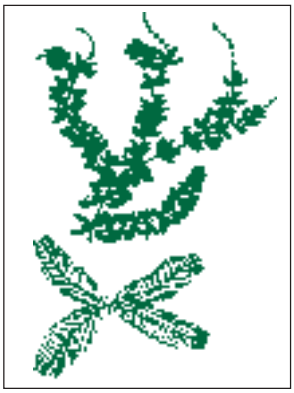


Figure 4
Eurasian water-milfoil

[2]Voss, Edward G. 1985, Michigan flora: a guide to the identification and occurrence of the native and naturalized seed-plants of the state. Part II. Dicots (*Saururaceae-Cornaceae*). Cranbrook Institute of Science Bulletin 59 and University of Michigan Herbarium.

*The authors of this article, Dr. Don Garling and Dr. Ted Batterson are members of Michigan Lake & Stream Association Science Advisory Committee.

Hydrilla: A new threat?

by Ted R. Batterson
Department of Fisheries and Wildlife
Michigan State University

Is there a new threat out there in the waterscape waiting to negatively impact the waters of Michigan? That is certainly a concern of many who have heard that hydrilla (*Hydrilla verticillata* (L.f.) Royale), a submersed aquatic plant, has been able to overwinter and prosper in Maine. In North America hydrilla is a non-native, or nonindigenous, aquatic nuisance species that has wreaked havoc on aquatic systems throughout the south causing tens of millions of dollars of damage and expense for its control. It is a member of the Frog's-bit family (Hydrocharitaceae), a small family of aquatic plants, which includes *Vallisneria* (tape-grass, wild celery, or eel-grass) and *Elodea* (waterweed), both native to Michigan and the Great Lakes region. It is remarkably similar in appearance to *Elodea* and it is difficult to differentiate between the two without close examination (Figure 1). One striking difference between the two plants is that hydrilla produces tubers (underground vegetative structures) whereas *Elodea* does not. The correct identification of hydrilla is essential and the Michigan Sea Grant program in association with Michigan State University and the Michigan Lake and Stream Association has launched a well-publicized campaign called the Hydrilla Hunt just for that purpose. Anyone suspecting that they might have come across the plant can submit a small sample to Michigan Sea Grant's laboratory for analysis. For more information about the Hydrilla Hunt please visit www.miseagrant.umich/ans.

Figure 1. The dioecious biotype of *Hydrilla* has four or five leaves at each node (a.), leaves with visible teeth (b.), and small spines on the lower midvein (c.) whereas *Elodea* has only three leaves at each node (d.), the leaf edge appears smooth (e.), and the midvein is smooth underneath (f.). Original line drawings from the University of Florida Institute of Food and Agricultural Sciences Center for Aquatic and Invasive Plants.

Hydrilla is a truly submersed aquatic plant that does not develop aerial leaves and grows in a variety of habitats (Cook and Lüönd 1982). It usually grows in clusters (sometimes quite densely) under a wide range of water quality conditions from nutrient poor oligotrophic conditions to very enriched, eutrophic waterbodies. It is also well adapted to photosynthesizing at low light levels (Van et al. 1976, Bowes et al. 1977) and can, therefore, typically grow at greater depths than many other submersed plants even though it normally grows in shallow water, usually less than 1.5 ft.

Hydrilla has two different life forms or biotypes: it is both monoecious (where both male and female flowers are borne on the same plant) as well as being dioecious, having separate

(cont. on page 16)

Hydrilla: A new threat? *(cont. from page 15)*

male and female plants. The predominate life form of populations of hydrilla in the southeastern United States are dioecious female plants whereas most populations north of South Carolina are plants that are monoecious (Madeira et al. 2000). Typically either one or the other biotype is found in any single waterbody, however, this isn't always the case. Ryan et al. (1995) report on the coexistence of both biotypes in two waterbodies in North Carolina and Virginia. They also mention that the two different biotypes in Lake Gaston were morphologically different. The dioecious plant had longer leaves, a shorter distance between nodes, heavier pigmentation, and appeared to be more robust than the monoecious form growing in close proximity (Ryan et al. 1995). Similar to many other aquatic plants, hydrilla displays phenotypic plasticity which not only causes problems in properly identifying the plant but also can cause confusion as to its biotype. Les et al. (1997) discuss the misidentification of hydrilla in Connecticut where the plant was originally thought to be Egeria densa (another closely related member of the Frog's-bit family). Genetic analysis indicated that the Connecticut plants were the dioecious biotype but Les (personal communication) still has some doubts because the plant lacks spines on the lower midvein and the leaves are longer and narrower than is typical of dioecious plants. Interestingly, Voss (1972) states that all species of Vallisneria and Elodea found in Michigan are dioecious. It appears that the common dioecious type of hydrilla originated from the Indian subcontinent whereas the monoecious type is most likely to have originated from Korea (Madeira et al. 1997).

It has spread widely from its native areas in the Old World and was first discovered in the United States in 1960 at two Florida locations (Blackburn et al. 1969). Since then it has become a severe pest in many waters it has invaded, because as Langeland (1996) has said, it is "the perfect aquatic weed." There are a number of factors that make this plant such a terrible pest. First, it has a growth habit that allows it to out-compete other submersed aquatic plants for light. It can rapidly elongate (up to an inch per day), quickly reaching the water's surface, where it branches profusely forming a dense canopy that shades out other plants (Langeland 1996), similar to Eurasian watermilfoil. Haller and Sutton (1975) reported that half of the total hydrilla biomass occurred in the upper 1.7 ft of the water column.

Probably the most important characteristic for making hydrilla such a major nuisance is its ability to reproduce in different ways under a variety of conditions, including fragmentation, tubers, turions, and seeds. Sexual reproduction and development of seeds is probably the least likely way that this plant will disseminate itself, at least here in North America. In most cases, vegetative reproduction serves as the means of the plant spreading both within and between waterbodies, particularly via stem fragments that rapidly develop into new plants which attach themselves to the sediments by fine, unbranched adventitious roots (Cook and Lüönd 1982). Many times these fragments are stowaways on recreational boat motors and trailers. Cook and Lüönd (1982) describe the hibernacula that are formed by this plant. These hibernacula are more commonly referred to as tubers and turions and are a cluster of densely packed leaves growing in an ovoid-conical shape (almost football-like in appearance). Tubers grow at the ends of subterranean branches or rhizomes and are typically brown in color, whereas turions grow in leaf axils or at the ends of erect stems and are green. Langeland (1996) cites several studies indicating the hardiness of hydrilla tubers; they can remain viable for several days out of water and for over four years if left undisturbed in the sediments as well as surviving ingestion and regurgitation by waterfowl and herbicide applications.

Unfortunately, once this plant has been able to establish itself in a system it has been able to invade, there are usually severe negative impacts, including displacement of native aquatic vegetation and impeding recreational boating. A number of management strategies have been employed to fight these invasions, including physical, chemical, and biological means, and most are costly. Therefore, the best solution is to not let this plant get established in any of Michigan's waters. The state is taking a very proactive approach and has recently established a task force to address the potential invasion of hydrilla. Members of the task force represent a variety of institutions, including the Michigan Office of the Great Lakes, Michigan Sea Grant, Michigan Department of Environmental Quality's Water Division, Michigan Department of Transportation, Michigan State University's Department of Fisheries and Wildlife, the Great Lakes Fishery Commission, the Great Lakes Commission, NOAA's Great Lakes Environmental Research Laboratory, and the Michigan Lake and Stream Association. The Hydrilla Task Force met for the first time in February 2004. The purpose of the task force is to guide the development and implementation of an early detection and rapid response plan with the intent of keeping the plant out of the state or, if detected, eradicated before it can become established and proliferates. By taking this approach it is hoped that the plant can be kept at bay and there is evidence that California has been successful in eradicting this plant in some of the waterbodies it has infested.

References

Blackburn, R.D., L.W. Weldon, R.R. Yeo, and T.M. Taylor. 1969. Identification and distribution of certain similar-appearing submersed aquatic weeds inFlorida. Hyacinth Control Journal (now the Journal of Aquatic Plant Management) 8:17-21.

Bowes, G., A.S. Holaday, T.K. Van, and W.T. Haller. 1977. Photosynthetic and photorespiratory carbon metabolism in aquatic plants. Pages 289-298 in Proceedings of the 4th International Congress of Photosynthesis, Reading, United Kingdom.

Cook, Christopher D.K., and Ruth Lüönd. 1982. A revision of the genus *Hydrilla* (Hydrocharitaceae). Aquatic Botany 13:485-504.

Haller, William T., and David L. Sutton. 1975. Community structure and competition between Hydrilla and Vallisneria. Hyacinth Control Journal(now Journal of Aquatic Plant Management) 13:48-50.

Langeland, Kenneth A. 1996. *Hydrilla verticillata* (L.f.) Royle (Hydrocharitaceae), "The Perfect Aquatic Weed." Castanea 61:293-304.

Les, Donald H., L.J. Mehrhoff, M.A. Cleland, and J.D. Gabel. 1997. *Hydrilla verticillata* (Hydrocharitaceae) in Connecticut. Journal of Aquatic Plant Management 35:10-14.

Madeira, Paul T., Colette C. Jacono, and Thai K. Van. 2000. Monitoring hydrilla using two RAPD procedures and the Nonindigeneous Aquatic Species Database. Journal of Aquatic Plant Management 38:33-40.

Madeira, Paul T., Thai K. Van, Kerry K. Steward, and Raymond J. Schnell. 1997. Random amplified polymorphic DNA analysis of the phenetic relationships among world-wide accessions of *Hydrilla verticillata*. Aquatic Botany 59:217-236.

Ryan, Frederick J., C.R. Coley, and S.H. Kay. 1995. Coexistence of monoecious and dioecious hydrilla in Lake Gaston, North Carolina and Virginia. Journal of Aquatic Plant Management 33:8-12.

Van, T.K., W.T. Haller, and G. Bowes. 1976. Comparison of the photosynthetic characteristics of three submersed aquatic plants. Plant Physiology 58:761-768.

Voss, Edward G. 1972. Michigan flora, part I: gymnosperms and monocots. Cranbrook Institute of Science Bulletin 55, Bloomfield Hills, Michigan.

New Septic Systems Approved For Lake Front Property

Issue 3 in a Series of 3 — Autumn 2002
Gosling Czubak Engineering Sciences, Inc.

INTRODUCTION

In previous newsletters we provided information about Benzie and Leelanau County's new ordinances allowing septic systems for property that would not "perc." We also provided some technical information about the principles of operation for alternative on-site wastewater treatment systems. This article will discuss alternative systems that are commercially available, how they operate, their advantages and disadvantages and their cost.

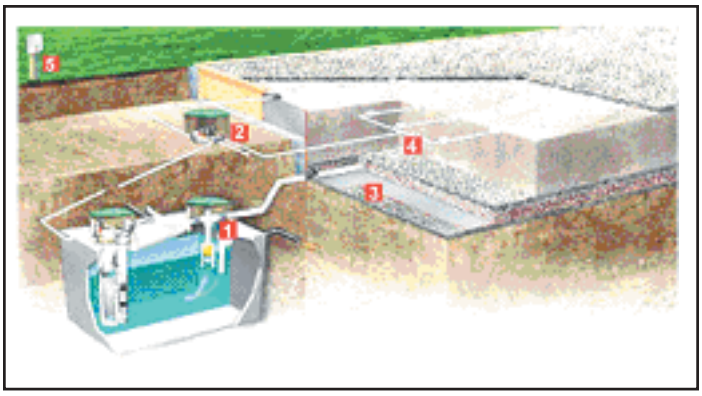
SAND FILTERS

There are two types of sand filters: "single-pass" systems and "recirculating" systems. The single pass system utilizes a traditional septic tank for initial treatment. The tank usually discharges to the pump chamber and the liquid is pumped to a network of pipes on top of a lined pit containing coarse sand. At the bottom of the lined pit, drainpipes collect the liquid after it filters down through the sand. The drainpipes then discharge to a drainfield and the treated waste migrates to the groundwater.

A recirculating sand filter also uses a septic tank. The tank usually releases to a pump chamber and the liquid is pumped to a pipe network on the top of a bed of fine gravel. A liner at the bottom of the gravel bed collects the liquid. Drainpipes collect the liquid and the treated waste is then pumped back to the septic tank and recirculated through the system. A portion of the discharge is periodically diverted from the bottom of the gravel bed to another drainfield (absorption field) where the treated waste migrates to the groundwater.

Advantages & Disadvantages of Sand Filters

Single pass sand filters are relatively easy to operate and require little more than routine maintenance. Recirculating sand filters are only slightly more complex. Sand filters occupy a fairly large area (about twice the area of a conventional system). BOD_5 and TSS effluent quality is very good. Some reduction in nitrogen is provided by both systems, but recirculating systems do a better job. Fecal coliform count is also reduced significantly. Little phosphorus removal is provided by these systems.



1. Recirculating Valve
2. Distribution Box
3. Liner and Collection System
4. Sand Filter
5. Control Panel

MECHANICAL (AEROBIC) TREATMENT UNITS

Mechanical treatment systems usually involve aeration of wastewater to encourage bacteria (aerobic bacteria) that ingest the contaminants in wastewater. After ingesting the contaminants, they die off and form sludge. Solids in the wastewater are removed by natural settling, and chemicals may be added to precipitate solids, adding to the sludge layer in the treated wastewater. The sludge is removed periodically and the treated wastewater is discharged to a tile field or other soil infiltration system.

Advantages & Disadvantages of Mechanical Systems

Mechanical systems provide a high degree of treatment, but also require a higher level of maintenance. Package units can be provided in a relatively small size. Additional treatment units are usually required in order to provide phosphorus removal and disinfection.

PACKED BED FILTER

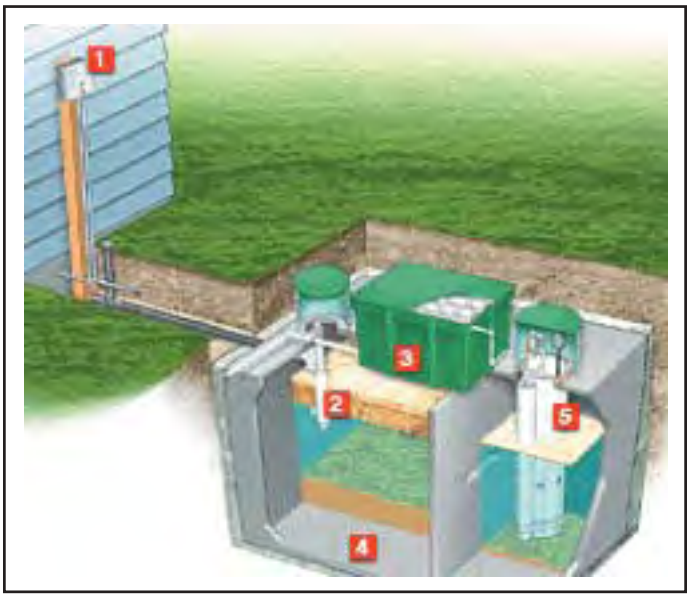
The packed bed filter treatment system is similar to sand filter systems, except it utilizes a manufactured media bed in place of fine gravel. The manufactured media allows oxygen to penetrate deeper in the media bed. This encourages more biological growth and better treatment.

The result is a system that operates the same as a sand filter (both single pass and recirculating), but requires less

(cont. on page 18)

New Septic Systems *(cont. from page 17)*

area. Different types of media and recirculation schemes are available, depending on the level of treatment required. One configuration offers a hybrid of sand filter technology and mechanical treatment technology by using air fans to promote aerobic biological activity.



1. Control Panel
2. Recirculating Valve
3. Treatment Unit
4. Septic Tank
5. Effluent Filter and Pump

Advantages & Disadvantages of Packed Bed Filters

Packed Media Filter Beds offer high quality effluent from a smaller size system. Effluent quality is similar to sand filters, however, on systems configured with aeration fans and recirculation schemes, additional nitrogen removal is provided. Very little phosphorus is removed in these units and fecal coliform reduction is not well documented. This technology is relatively new, but its use is increasing throughout the country.

PHOSPHORUS REMOVAL

Phosphorus removal processes are common in the wastewater treatment industry, but systems and equipment designed for single family residences are relatively new. Generally, these units remove phosphorus by chemical precipitation or through absorption using a filter media. Case study reports show significant reductions in phosphorus, but very little data exists on the long-term reliability and effectiveness.

DISINFECTION

Disinfection methods are also common in the wastewater treatment industry and application at home sites is new. Two types of disinfection are typically used. One uses chlorine tablets that dissolve in the wastewater to kill any remaining bacteria (similar to systems used in swimming pools). Another method uses ultraviolet light to kill bacteria. Chlorination has the advantage of simple operations, but requires the periodic handling of chemicals. Ultraviolet disinfection eliminates the use of chemicals, but requires some routine maintenance and uses electricity.

OPERATION AND COST

All of the alternative wastewater treatment systems have a notably higher cost than a conventional septic system. Depending on the installation conditions and the equipment selected, construction costs can be as high as $15,000 to $25,000. The operation of these systems is much more sophisticated than regular systems. They require more upkeep and attention than conventional systems, and will cost more to operate. Depending on the system selected, operating expenses range from $5 to $25 per month.

MORE INFORMATION

For more information, contact Doug Coates,
at Gosling Czubak Engineering Sciences, Inc.,
1-800-968-1062
or email dacoates@goslingczubak.com.

You may also find additional information concerning alternate wastewater systems at the following websites:

National Sanitation Foundation
www.nsf.org/wastewater/

Decentralized Wastewater Treatment Systems
www.epa.gov/owm/mtb/decent/index.htm

Manuf. Of Alt. On-Site Treatment Systems
www.orenco.com

National Small Flows Clearing House
www.nesc.wvu.edu/nsfc/

WISCONSIN UPDATES GROUNDWATER PROTECTION

Wisconsin legislature passed Act 310 on April 22, 2004 that amended previous groundwater protection legislation. Wisconsin took its first step to protect groundwater in 1984 when it passed its Comprehensive Groundwater Protection Act. This Act provided for a groundwater protection Council, required the Wisconsin DNR to establish groundwater quality standards, and responsibility for controlling groundwater pollution.

The new legislation (Act. 310) provides that the WDNR may require a well applicant to submit an environmental impact report if the area exceeds 40 acres, or the estimated cost of the project exceeds $25,000, or the applicant is requesting approval for a high capacity well—a well that has a capacity of more than 100,000 gallons per day. The capacity of such a well would exceed 70 gallons per minute. The Act defines a "well" as a drillhole that extends more than 10 feet below the ground surface and is constructed for the purpose of obtaining groundwater. No one shall construct or withdraw water from a high capacity well without the approval of the WDNR.

Another provision of the Act requires the WDNR to promulgate rules identifying Class I, Class II and Class III trout streams. Also, create accurate images of groundwater protection areas.

Another requirement of the Act states that the DNR shall, with the advice of the groundwater coordinating council, conduct monitoring and research related to all of the following:

(a.) Interaction of groundwater and surface water.
(b.) Characteristics of groundwater resources.
(c.) Strategies for managing water.

Finally, the Act provides for a groundwater advisory committee of fourteen members. The members shall be appointed as follows:

> Three by the Governor, 4 by the speaker of the assembly, 4 by the majority leader of the Senate, one appointed by the minority leader of the assembly, one by the minority leader of the senate, and the secretary of natural resources.

It is recognized that there are gaps in this legislation to protect groundwater, but officers of the Wisconsin Association of Lakes take the position that it is a step in the right direction.

Information from Susan Tesarik, Wisconsin Association of Lakes, Madison, Wisconsin.

APPEALS COURT DECISION IN ALCONA COUNTY CASE IS NOT NEW

The law on exposed bottomland of the Great Lakes was established by the Michigan Supreme Court in *Hilt v Weber*, 252 Mich 198 (1930) (See summary included)

COURT NARROWS STROLLS ALONG MICH. BEACHES

By Doug Guthrie and Steve Eder, Detroit News, May 28, 2004

The Detroit News carried an article in the May 28, 2004 issue entitled "Court Narrows Strolls Along Michigan Beaches." Often times articles in newspapers include inaccurate statements. This article is no exception. For example, "Under Michigan law, the soil submerged beneath lakes and streams belongs to the public."

Two Michigan Court cases expose the inaccuracy of the above statement. The Michigan Supreme Court in *Lorman v Benson* on January 9, 1860 decided that the bottomland of the Detroit River belonged to the shoreline property owner to the middle thread of the Detroit River.

In *Hilt v Weber* (1930), the Michigan Supreme Court decided that the owner of the banks along the Great lakes owns the beach from the ordinary high water mark to the water's edge where ever it may be at any time. The State has ownership of the bottomland of the Great Lakes from the water's edge to the boundary line between Michigan and Canada. The ordinary high water mark for Lakes Michigan and Huron was established by Act 247, Public Acts of 1955 at 578.9 feet above sea level. The Great Lakes shoreline property owner cannot install any permanent structure on the beach between the ordinary high water mark and the water's edge.

The article further states that, "Along 3,288 miles of Great Lakes shoreline, walking on beaches is considered a right of heritage." The phrase "right of heritage" does not occur as a description of property rights in court cases in Michigan since Michigan became a State in 1837.

It is implied that the Alcona case cited in this article sets a new rule for walking on the beaches of the Great Lakes, and cited a Lake Huron shoreline property owner as saying, "It's good to have this new rule to follow, just in case." This "new rule" became State law in 1930, and has remained State law for 73 years.

Prepared by Donald E. Winne, Executive Director
Michigan Lake & Stream Associations
June 2, 2004

Nature and Science, August 1980

Lightning – Part I

by John Sedgwick

LIGHTNING BOLT STRIKES FATHER IN YUCATAN TEMPLE

One June day in 1978 in the ancient Mayan city of Chichén Itzá in Mexico's Yucatán, a storm blew up, scattering leaves across the grass by the massive stone temples. Dennis Puleston, an American archaeologist, was visiting the site that day with his two young sons. When the rain started to fall and the first thunderclaps began to rumble through the jungle, Puleston suggested that the three climb up to a small enclosure crowning the tallest temple, a hundred-foot pyramid dedicated to Kukulcán, the god of the winds, to watch the storm.

Puleston's ten-year-old son didn't want to go. He'd heard the villagers never went up there because the place was sacred. Besides, weren't there murals inside of priests cutting out people's hearts to offer to Kukulcán? Puleston told his son not to worry: that was just superstition. He started up the ninety steps to the summit, and reluctantly, his sons followed. At the top, Puleston ducked under the stone roof held up by four snarling jaguars—Mayan symbols of mystery—and peered out over the jungle. As his sons watched horrified, the sky burst open with a blaze of light; there was a tremendous crack, as if the very air were being torn apart, and suddenly their father lay dead, killed by a lightning bolt.

The god of the winds had claimed another victim.

What could be more awesome and spectacular than a burst of lightning on a summer afternoon? The sky goes dark, the air grows chill. Then, out of nowhere, there is a burst of blinding light and a deafening roar, and the world is awash in a torrent of water. No wonder the Mayans thought it the work of the gods.

LIGHTNING HEATS AIR UP TO 30,000 ℃ WHEN IT STRIKES

Scientists are no less impressed. "It's the scariest and most spectacular thing I know," says Martin Uman, professor of electrical engineering at the University of Florida and author of several books on lightning. "Sometimes the more you know about something the less interesting it is," Uman goes on. "But with lightning, it just gets better and better."

As Uman and other researchers have discovered, the bolts that pierce the air are actually channels of pulsing electric energy two inches across. They may be as short as two hundred feet or as long as twenty miles. They may be forked, branched, beaded, or ribboned. In the glimmering instant it takes for lightning to strike, the electricity heats up the surrounding air to a scorching 30,000 ℃, five times the temperature of the surface of the sun. Hitting a tree, the blast instantly sets the sap boiling so fiercely the tree just bursts apart.

Lightning explodes 50 year old oak tree

It has been known to blow open ten-foot craters in the ground and split huge boulders in two. The lightning strike zips through the air at ninety thousand miles per second, nearly half the speed of light. (At that clip, it's impossible to see what special high-speed cameras have shown—that the bolt is actually traveling from the ground up to the clouds.) And it produces enough light to illuminate the countryside for miles around. Although three quarters of the bolt's energy is used up in heat, enough remains to deliver a full 125 million volts of electricity to earth.

With one hundred lightning bolts blasting the earth every second—that's eight million a day—lightning provides more than twice the voltage put out by all the United States' electric generators combined. (Unfortunately, no one has found a way to harness this now-you-see-it-now-you-don't energy source.) The *Apollo XI* astronauts returning from their pioneer voyage to the moon were astonished at one point to see both sides of the earth lit up—one by the steady glare of sunlight, the other by a vast network of lightning flashes.

LIGHTNING REPLENISHES EARTH'S NITROGEN

Physicists speculate that this electrical bombardment may well have figured in the creation of life. Laboratory experiments have shown that powerful electrical jolts, like those produced by lightning, are capable of breaking down the four gases that formed the world's primordial atmosphere—methane, ammonia, hydrogen, and water vapor—to produce amino acids, the building blocks of living organisms. Later on, lightning certainly sustained early man by providing his only source of fire. Even now, lightning alone is responsible for maintaining the earth's negative

charge, crucial for the production of nitrogen, which is an essential ingredient for the growth of most plants. Without lightning to replenish the supply, all of the earth's charge would drift off into the upper atmosphere in less than an hour.

But lightning gives, and it takes away. Lightning starts more than three quarters of the forest fires in the United States, accounting for the destruction of more than 30 million dollars' worth of marketable timber every year. It also blasts 20 million dollars' worth of other property. Lightning is the major cause of power blowouts in this country as well, bursting transformers with its sudden surges of power. (It is blamed for the twenty-five-hour New York City blackout of 1977.) Lightning's capriciousness poses other hazards besides, such as nearly short-circuiting one moon-bound *Apollo* space capsule a few moments after blast-off with two strikes to the command module. Lightning was one thing the National Aeronautics and Space Administration officials didn't think of. "They really were on the block after that," chuckled Professor Uman. Since then, twenty lightning research groups have been invited down to Cape Kennedy for consultation.

180 AMERICANS KILLED BY LIGHTNING ANNUALLY

But, the biggest threat of all is the threat to human life. On average, one hundred eighty Americans are killed by lightning every year, archaeologist Puleston being just one example. That's more than the death toll of tornadoes, hurricanes, blizzards, or any other weather formation. Lightning kills by paralyzing the heart with its blast of current—so powerful it often blows off one shoe as it departs. Four victims out of five are male, because males spend more time outside—golfing, camping, fishing, working. As more women venture into the great outdoors, equal opportunity should level off the ratio.

Because of all that current—ten thousand times the amount used in the electric chair—no one who is hit directly by a lightning bolt will live to tell about it. If hit by lightning that has mostly spent itself on a nearby house, or rock, or tree, a person probably will. Just ask Roy C. "Dooms" Sullivan, a sixty-six-year old former ranger in Virginia's Shenandoah National Park. Dubbed the Human Lightning Rod, Dooms has been "struck" no less than seven times by lightning, a Guinness World Record.

"Number two, number five, and number seven—those were the worst," says Sullivan. Number two (1969) only singed his eyebrows. But number five (1973), striking him as he stepped out of a truck, was livelier. "It set my hat and hair on fire," he said at the time. "Then it went down my left arm and leg, knocked off my shoe, and crossed over to my other leg. It also set my underwear on fire." Dooms had to douse himself with a water bucket to put all the fires out. Number seven (1977) flattened him while he was fishing, searing his head and shoulders and sending him to the hospital for four days—the only time he'd ever been laid up by lightning. "That last one was pretty hot," he observes.

One restaurant in the Shenandoah Valley refuses to let Dooms onto the premises during thunderstorms, but the ex-ranger doesn't think lightning will strike him again. Why? "Seven is my lucky number."

As the ancient Greeks explained it, Hephaestus forged the lightning bolts on his anvil, giving them to Zeus to hurl at his enemies. Zeus was supposedly so pleased with his new weapon that he gave the smith his daughter Aphrodite in return. (The idea of lightning bolt as weapon survives; it is pictured in the American eagle's talons on the back of the one-dollar bill.) Norsemen believed lightning was created by Thor hurling his magic hammer down from the sky. Even today the Bantu people of Africa hold it is the streaking flight of the divine thunderbird.

BELL RINGERS DISPATCHED TO BELFRIES TO BREAK UP LIGHTNING

Aristotle, unimpressed by the mythological explanation, postulated in the fourth century B.C. that lightning was a hot "exhalation" from the sphere of fire in the nether regions of the sky. In the Middle Ages it was assumed that lightning passed down a long invisible tube of air from the clouds. Nothing wrong with that. The trouble was that as a preventative measure bell ringers were dispatched to their belfries in hopes that the clanging might break up the lightning paths. (That's why bells of the period bear the inscription *Fulgara frango*—"I break up the lightning.") Since church steeples were among the tallest objects around, the ringers' job had clear occupational hazards. In one thirty-year period, more than a hundred bell ringers were electrocuted.

BENJAMIN FRANKLIN INVENTS LIGHTNING ROD IN 1752

But Europe didn't learn. Gunpowder was stored in what was normally the safest place in town—the church vaults. In the town of Brescia, Italy, a hundred tons of gunpowder were deposited in the crypt of the lofty Church of Saint Navarene, but there was a serious flaw in this scheme. A lightning storm that summer blew several thousand Brescians—plus a good portion of Brescia— to kingdom come. The disaster was in fact doubly tragic, for by this time Benjamin Franklin had invented the lightning rod, which would have prevented the calamity.

Franklin had toyed with a hand-cranked electrical generator for several years and noted that the long jagged sparks it produced bore a remarkable similarity to lightning. In typical fashion, he made a list of twelve common characteristics, including—number nine—the observation that both destroyed animals, for one afternoon on

(Continued on page 22)

Lightning *(Continued from page 21)*

a picnic he had zapped a turkey to impress his friends.

To test his hypothesis, Franklin sent up his celebrated kite during a thunderstorm in the fall of 1752, dangling a key from the earthward end of the string. Contrary to legend, lightning did not strike the kite to set the key glowing. If it had, more than just the key would have lit up. (A few years later a Professor Richmann, seeking to duplicate Franklin's experiment, was fatally sizzled in just this fashion.) All that happened was that Franklin noticed a few loose strands of the kite string bristling as they had in the presence of electricity that was generated by the hand crank. Franklin drew off some of this charge to store in a primitive capacitor, the Leyden jar. Sure enough, the lightning performed exactly as did the "electrical fluid" produced by the crank. Lightning was electricity.

Franklin's kite was only the beginning of modern science's frontal assault on the mysteries of the upper atmosphere. Other scientists sent up more kites higher into the clouds. Some intrepid researchers even rode balloons into the sky to examine the source of the thunderbolts first hand. (Remarkably, no fatalities were reported.) Later, down on the ground, physicists uncovered the charged particles that compose the atom—in particular the key figure in the lightning process, the electron. Later still, a British physicist, Charles Boys, developed a camera with a revolving lens capable of capturing the fleeting image of the lightning bolt. Or so he thought. The poor man lugged the bulky instrument all around England by train for thirty years without ever obtaining a single clear print. That honor fell to colleagues in South America, where lightning is plentiful, who modified the Boys camera.

The brilliant researcher Charles Steinmetz constructed an apparatus for Westinghouse that could generate lightning-like bolts fifty feet long to test methods for protecting the company's power lines. (He had become particularly interested in the subject after lightning blasted the work table in his vacation cabin.) In 1945 even the U.S. Air Force got into the act with Thunder-storm Project, which involved sending fighter planes weighing almost fifteen tons into the thunderhead to obtain wind velocity data.

Now, finally the god of the winds has yielded some of his secrets.

(To be continued in Feb. Issue)

Report Hydrilla to MSU if Sighted *(Form enclosed)*

Hydrilla Hunt I.D. Card

Name _____

Phone no. during business hrs _____

email _____

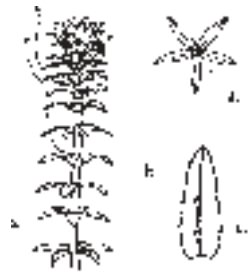
I used the identification drawings on this I.D. card to compare the plants I found in _____ _____ ❑ lake ❑ stream ❑ pond in _____ county. The nearest crossroads are _____ and _____

MICHIGAN STATE UNIVERSITY Sea Grant Michigan

Hydrilla or Elodea?

Read the Leaves to Tell the Difference

Hydrilla (Exotic)



a. 4 or 5 leaves at each node
b. Leaves have visible teeth
c. Leaf vein has small spines

Elodea (Native)

a. Only 3 leaves at each node
b. Leaf edges appear smooth
c. Leaf vein is smooth underneath