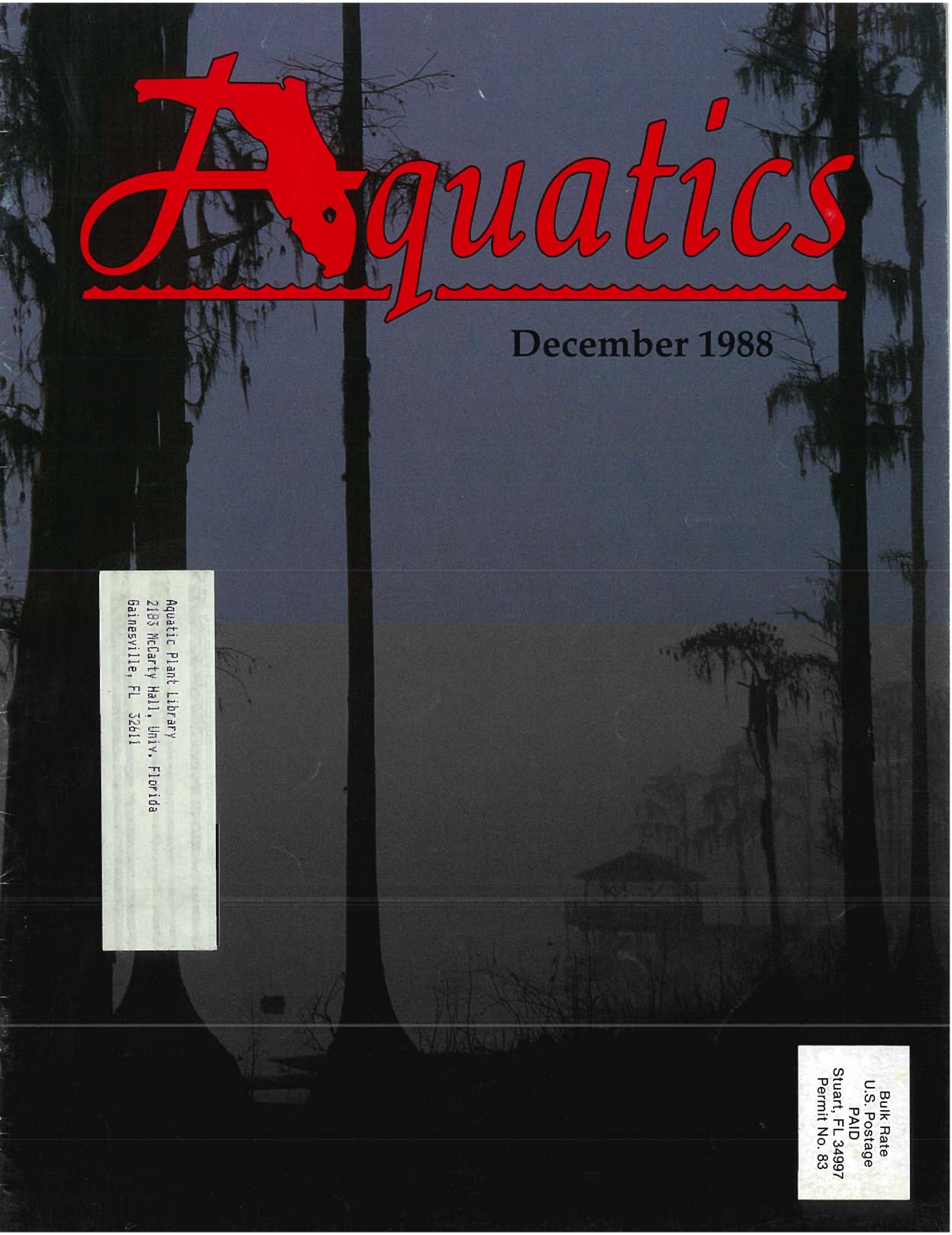

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Snover Canal — North Port Water Control District, North Port, Florida. Before and after mechanical harvesting by Adirondack Harvesters, Inc.

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EDITORIAL

We can take pride in the fact that F.A.P.M.S. is an environmental protection organization. Our motto is: ''Protecting Florida's Water Heritage''. Most members of our society are ''operational environmentalists''. We do not have the luxury of just *talking* about what is right for the aquatic environment. It is our job and responsibility to *do* what is right for the aquatic environment.

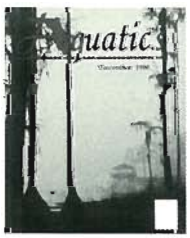
Florida's water heritage does not include nonnative, recently introduced aquatic weeds such as hydrilla and water hyacinth. These noxious aquatic plants have the potential of destroying infested bodies of water. Water can be made useless for boating, swimming, skiing, navigation, fishing and other recreational uses. Real estate values can be diminished. An unchecked heavy weed infestation in a body of water can destroy fisheries habitat, stunt sport fish, and even kill fish with an excess of rotting plants depleting dissolved oxygen. Unmanaged excessive aquatic vegetation makes excessive amounts of organic sediments. The everglades kite cannot feed on the apple snail if water hyacinth covers the water surface. Residential and other areas can be flooded after heavy rainfall if hydrilla is blocking the flow of water in drainage canals.

As professional aquatic plant managers, we understand what can happen if we do not do our job. Most members of the general public do not understand. We must continue to strive to do a better job of informing and educating the general public through personal contact, presentations at meetings, and providing educational materials. Many resources are available to support us in these efforts. Stay informed. The extension, regulatory, and research personnel in our industry are outstanding, and getting better. Contact them when you need help.

Keep up the good work. As water managers and aquatic plant managers you play a very important role in ''Protecting Florida's Water Heritage''.

Bill Moore

ABOUT THE COVER



Early winter morning on Banks Lake, Lakeland, Georgia.

Photo by: David Tarver

Aquatics

DECEMBER, 1988/Volume 10, No. 3

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AQUATICS: Published quarterly as the official publication of the Florida Aquatic Plant Management Society. This publication is intended to keep all interested parties informed on matters as they relate to aquatic plant management particularly in Florida. To become a member of the FAPMS and receive the Society newsletter and Aquatics magazine, send $10[00] plus your mailing address to the Treasurer.

EDITORIAL: Address all correspondence regarding editorial matter to Daniel Thayer, Editor, ''Aquatics'' Magazine, P.O. Box 24680, West Palm Beach, FL 33416.

Medicinal Uses of Aquatic Plants Common to Florida

By
Sue Newman
Graduate Assistant
Department of Agronomy (IFAS)
University of Florida
Gainesville, Florida 32611

Man has waged a constant battle against aquatic plants in an attempt to clear waterways for boat traffic, fishing and recreational activities. These plants are often viewed as troublesome weeds as opposed to a resource which might be exploited. Uses include; wastewater treatment, animal fodder, fuel production, soil additives and even food for human consumption. One aspect which has not been explored to any great extent is the use of these plants for their medicinal properties. This paper aims to make people more aware that medicinal uses of aquatic plants have existed for many years, even for centuries.

Floating Plants

Among this group of aquatic plants, *Pistia stratiotes* (water lettuce) receives the most attention (Figure 1). As early as 77 A.D. Pliny in Egypt recorded the use of *Pistia* for the treatment of spreading inflammations of the skin and also for the healing of abrasions.

The particular utilization of the plant depends to a great extent upon the part of the plant that is used and how it is prepared. In the majority of cases it is the leaves of *Pistia* that are employed for their medicinal qualities.

A soothing poultice prepared from the leaves is applied for treatment of inflammations. Such poultices are also used to treat hemorrhoids and venereal ulcers. Alternatively the leaves can be boiled and the resulting extractant added to a bath to reduce swellings. In India, *Pistia* leaf juices are boiled with coconut oil and used to treat several chronic diseases. The medicinal uses of this plant can be extended further with the employment of additives. The addition of rice and coconut milk to the leaves results in a medicine for dysentery, whereas the addition of rosewater and sugar produces a remedy for coughs and asthma.

A third leaf preparation is drying followed by grinding. Powdered leaves and honey are used to treat syphilitic diseases. The leaves are not the only part of the plant to be used as the roots are used as a laxative and an ointment for pain relief. Ashing of the whole plant and rubbing it into the scalp is a treatment for ringworm.

Another floating plant which has several reported uses is *Lemna minor* (common duckweed). Unlike *Pistia*, where the leaves are utilized to prepare medicinal treatment, with *Lemna* it is the entire plant which is used. This is probably due to the impracticality of cutting off the various segments of these small plants. As with *Pistia* it is used as a soothing ointment and in poultices as well as being an antisyphilitic.

An infusion of the plant is used to treat jaundice. The plant is also used to treat dropsy (an abnormal accumulation of watery fluid in certain tissues or cavities of the body) and rheumatism. In conjunction with *Spirodela polyrhiza* (giant duckweed), several uses for *Lemna* have been found in China, for example, they are used in the treatment of swollen feet, urinary difficulties and muscular aches in fevers. *Lemna* alone has been used to treat eye diseases.

The last plant to be mentioned in this section is the renowned *Eichhornia crassipes* (water hyacinth). In India this plant is used in a remedy for goiter (a malfunction of the thyroid gland) and skin diseases.

Emergent Plants

Among this group there is one plant which has a use highly pertinent to Florida, this is the use of *Sagittaria lancifolia* (duckpotato) by the Seminole Indians for the treatment of cases of shock following an alligator bite! It does, however, have other more documented applications. In Haiti the leaves are crushed and laid on the cheek covering an aching tooth, this covering should not be left on for more than three hours, otherwise blistering will occur.

In Cuba it has different uses; it is made into a poultice which is applied to infected sores, chronic itches, insect and snake bites. In contrast the only use found for *Sagittaria latifolia* (common arrowhead) was the dispersion of ulcers resulting from tuberculosis.

In herbal medicines aquatic plants are frequently found to be remedies for poisons and are also used as tonics. A review of the small amount of literature relating to aquatic plant utilization shows the preponderance of these uses. *Nasturtium aquaticum* (water cress) is renowned as an invigorating tonic. As well as being a tonic, *Ipomoea aquatica* (water spinach) has been used as an antidote for certain cases of food poisoning. *Brasenia schreberi* (water shield) has also been used to neutralize the effects of specific poisons though it does have other uses such as the treatment of cancer, hemorrhoids, boils, etc.

Another use often found for aquatic plants is as a purgative, laxative or diuretic, e.g., *Nelumbo*

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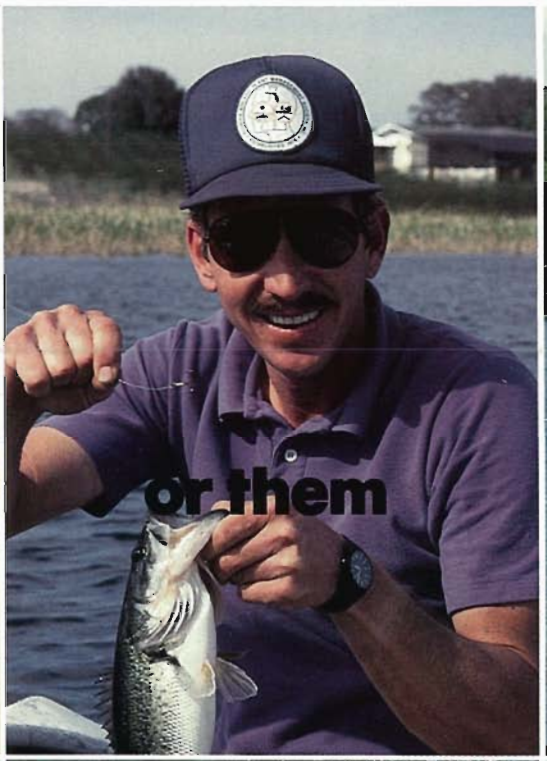

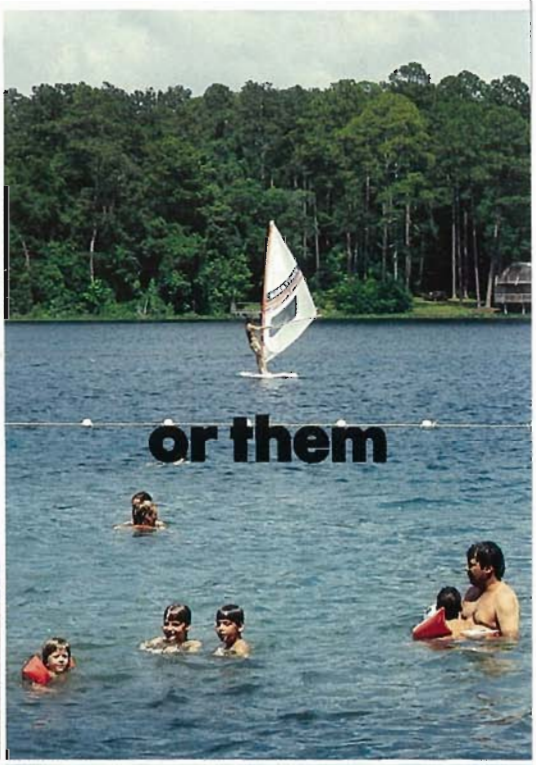

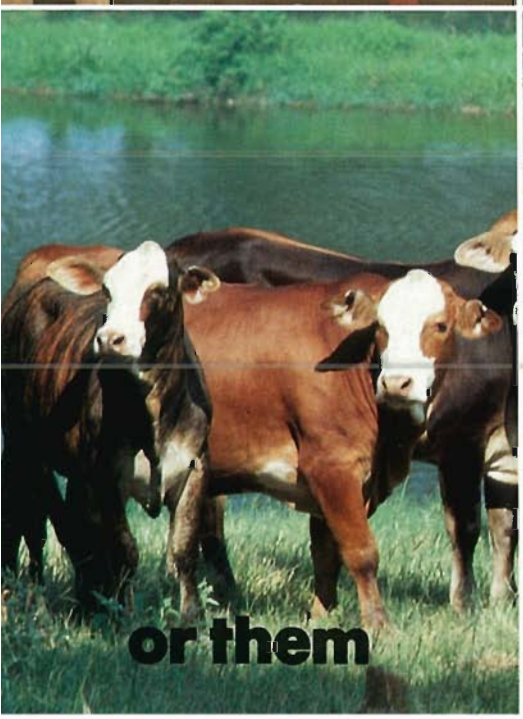

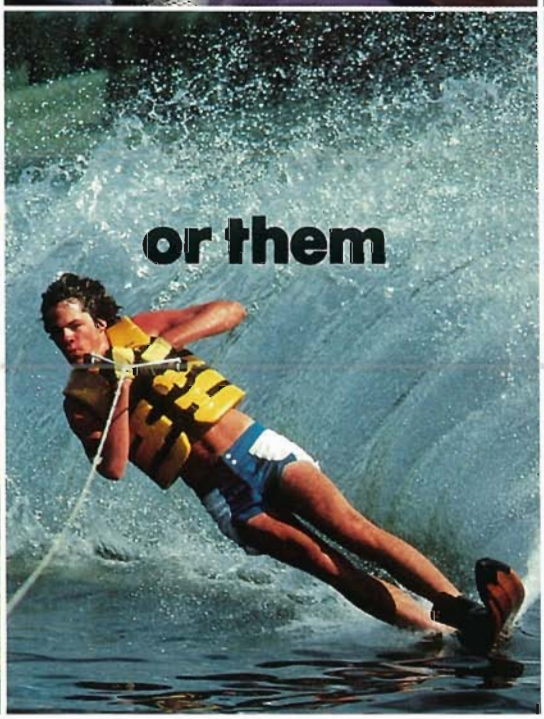

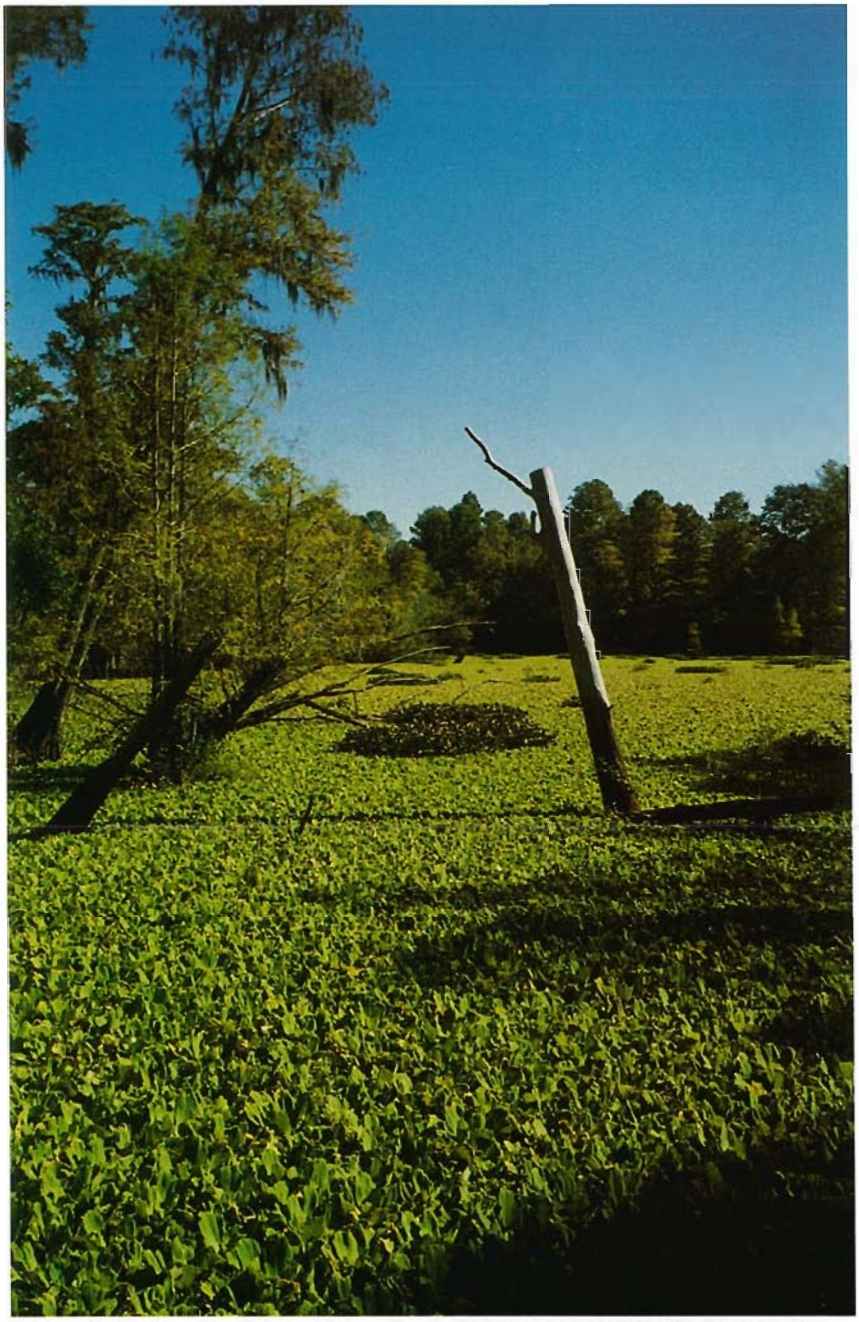

Fig. 1 Water lettuce choked lake in Pasco County. Photo by Monica Dear, Pasco County Mosquito Control.

lutea (American lotus), *Ipomoea, Nymphaea odorata* (fragrant water lily). *Nymphaea* seems to be something of a paradox, for not only is it utilized in the treatment of constipation, but it is also said to be used as an astringent in bowel complaints and is taken as a cure for diarrhea and dysentery. As a poultice *Nymphaea* can be used as a remedy for ulcers and its juices can be used as a gargle for a sore throat. It is also utilized in the treatment of catarrhal infections and venereal diseases. *Typha latifolia* (cattail) has similar properties to this plant.

Another plant known as a diuretic is *Polygonum hydropiperoides* (smartweed). In addition, the leaves have antiseptic properties and are utilized externally as a counter-irritant and internally as a stimulant. *Hydrocotyle umbellata* (water pennywort) also has internal uses in that it is taken in the treatment of diseased kidneys.

The final plant to be considered in this section is *Nuphar luteum* (spatterdock) whose leaves are macerated and used to stop bleeding. An infusion prepared from the root system is applied as a lotion for eruptive skin ailments. It is suggested that its success is due to its high concentration of tannic acid which is noted for its antiseptic action.

Submersed Plants

In general the plants in this category seem to be utilized for their soothing purgative properties with the exceptions of *Myriophyllum* sp. (watermilfoil) whose crushed young leaves are a remedy for chronic dysentery, fever and a relief of thirst. *Potamogeton pectinatus* (sago pondweed) is used in China to relieve fever of the liver.

Sedges, Grasses and Rushes

While perusing the medicinal uses of aquatic plants it is interesting to note some of the cures which are exclusive to women. *Panicum repens* (torpedograss) is eaten to treat inflammations of the ovaries and abnormal menstruation. Even related plants do not necessarily have the same uses. A tonic made from *Panicum maximum* (Guinea grass) is taken as a diuretic. This plant can also be wrapped around the head to relieve headaches. In addition, it is used in tribal cultures in the healing and rainmaking ceremony.

Phragmites australis (giant reed) is also a grass but with different uses. The utilization of this plant has altered over time. Historically it was the stalk and leaves of the plant that were the drug in the treatment of bronchitis and cholera. However, in modern medicine, it is the rhizome that the Chinese use as a drug. The root has cooling properties which result in the soothing of sore throats and high fever. It is also used to hasten the eruption of pustules in measles, as a cure for hiccups, nausea and stomach inflammations. In Taiwan it is used for infantile digestive and skin diseases.

Juncus effusus (soft rush) is a remedy for insomnia, inflammation of the throat and coughs. The leaves of *Cladium jamaicense* (sawgrass) are boiled and the resulting extract is used as a lotion for chicken pox.

Finally, *Echinochloa crusgalli* (barnyard grass) is reputed to be a

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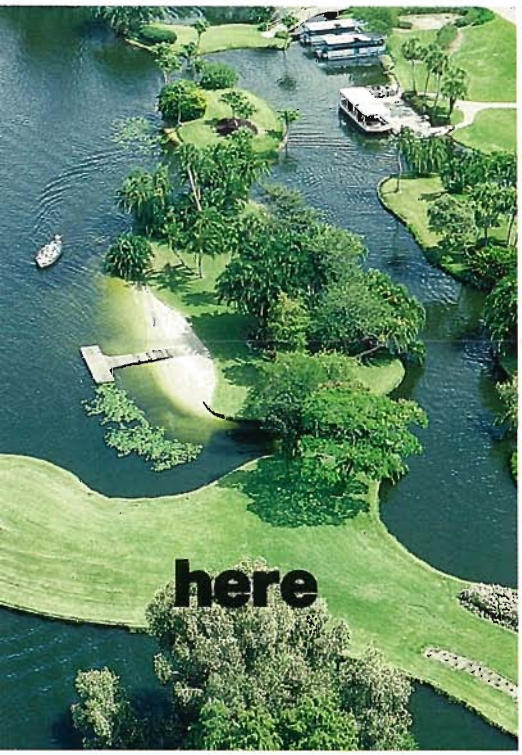

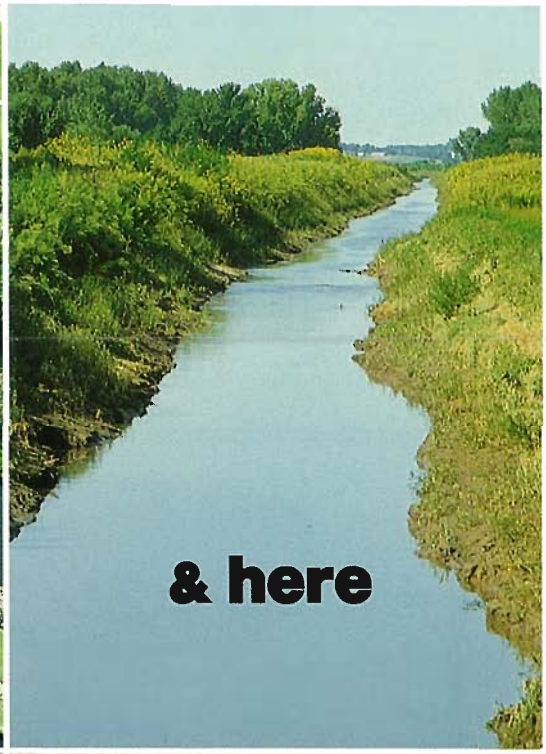

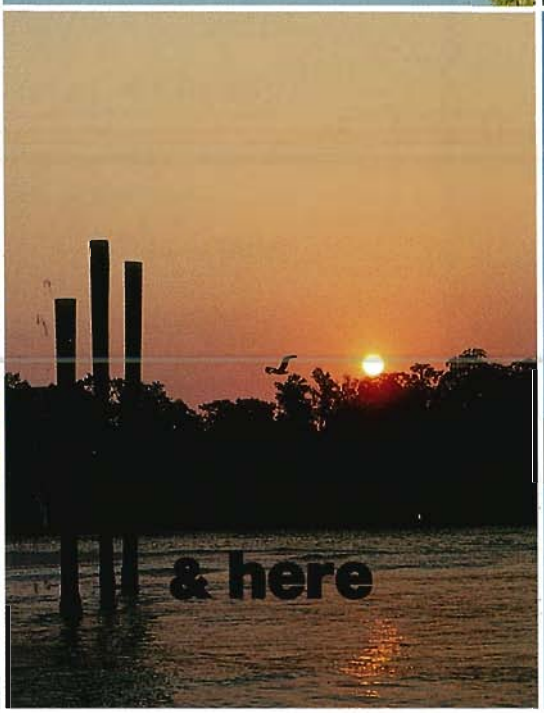

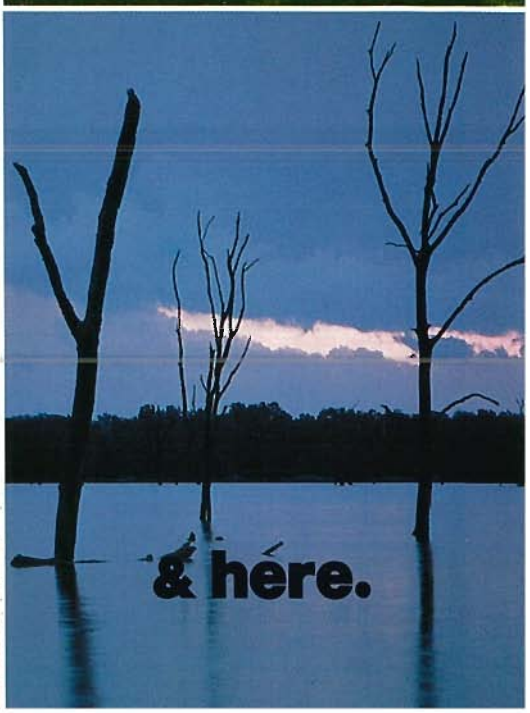

tonic which acts on the spleen and in addition, the shoots and roots can be crushed and applied to wounds to check hemorrhage.

Reading through this paper it would seem that there are many ailments that can be treated successfully by aquatic plants; however, as Sculthorpe states it is very difficult to establish to what extent the cures were achieved by the plant's properties or by superstition and psychological reassurance. "In very few instances has the therapeutic use of hydrophyte organs been acknowledged over a period of centuries. In yet fewer cases has any medicinal principle been isolated and identified from the organs used."

Remember, aquatic plants commonly found in Florida have been used in cultural ceremonies and in herbal medicine for centuries and may still be used today. So next time you have a headache and thirst after being in the hot sun or an airboat, wrap some guinea grass around your head and munch some *myriophyllum*. Personally, I would rather swallow a couple of aspirin and have a beer chaser!

This paper merely reviewed the information available in the literature and makes no attempt to judge the findings. Its main aim was to introduce the reader to an area of interest that they may have been unaware. The following glossary will likely assist in understanding some of the medicinal terms in the text.

Glossary

Catarrh -	an inflamed condition of the mucus membrane
Diuretic -	causing increase in the flow of urine
Infusion -	a liquid extract
Poultice -	a moist, soft, ground up form of plant applied to inflammations
Purgative -	medicine that empties the bowels

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Developing a Plan To Manage Lake Vegetation

By
Stanley A. Nichols
Wisconsin Geological and Natural History Survey
Madison, Wisconsin
Sandy Engel*
Wisconsin Department of Natural Resources
Madison, Wisconsin
Tom McNabb
Aquatics Unlimited
Martinez, California

What's the best way to manage aquatic plants? Herbicides, harvesters, dyes, screens, and drawdown can help. But the difference between success and failure — between attacking or controlling plants — rests on a sound management plan. Such a plan can guide lake use, save time and money, identify problems, and reduce environmental harm.

Without a plan, treatments are haphazard. Objectives remain undefined, leaving no way to gauge progress. Plant communities might be treated that need no control. Ineffective treatments are discarded without knowing why they failed. In short, the same failures are repeated each year.

A successful plan is built on four principles:

- define the problem.
- understand plant ecology.
- consider all techniques.
- monitor the results.

A plan enables progress to be measured against objectives. When not met, the plan can be revised. Failures need not be repeated, for the planners can learn from their mistakes and chart more successful strategies.

Planning means team work. Lake users and managers must work together to share information, make decisions, and reach compromises. All viewpoints must be represented for the plan to gain wide acceptance. This is particularly true for lakes with multiple use.

Getting Started

Let's begin with a quiz (Fig. 1). Most of the questions require a *yes* or *no* answer, but making the proper choice takes knowledge of your lake and a vision of how it should be used. Answering *no* to some questions means the problem is insignificant or needs to be reviewed.

Does a problem exist? Survey the plant community to reveal what species need control, how dense they are, and where in the lake they grow. Draw plant cover on a lake map to help locate problem areas.

Is the problem significant? Plants may not necessarily interfere with lake use and are valuable as fish and waterfowl habitat. Identify how the plants cause problems and whether they are worth controlling.

What are your management objectives? Divide your lake map into user areas, showing where angling, swimming, and boating occur (Fig. 2). Identify waterfowl habitat. Now develop objectives for each type of use. Consider channels in fishing areas, plantfree space for speed boaters, and undisturbed areas for waterfowl.

Are management methods available to meet objectives? Consider all control techniques for efficacy, cost, and environmental impact. Some methods work best inshore; some are too expensive for large areas; others are unselective and harm beneficial plants. Seek opinions from different specialists to answer this question.

What management techniques will be used? Choose among chemical, mechanical, habitat manipulation, or biological techniques. Several techniques can be integrated into a strategy. But each one must be used properly. Federal or state laws may restrict or ban some techniques. Your plan should specify how, when, and where each strategy will be used.

Did the management strategy meet your objectives? After conducting a treatment program, evaluate its success. Don't expect quick fixes; remember, each strategy has limitations. A mud-bottom lake is unlikely to turn from salad bowl to swimming pool. Perhaps your objectives were unrealistic.

Has the situation changed? Monitor your lake to collect data on water quality, the new plant community, and fishes and waterfowl using the lake. Monitoring can detect problems before they become unmanageable. Get help from public agencies or hire private contractors for the work. Don't neglect to survey public opinions. Such information can be used to reassess your objectives and refine your plan.

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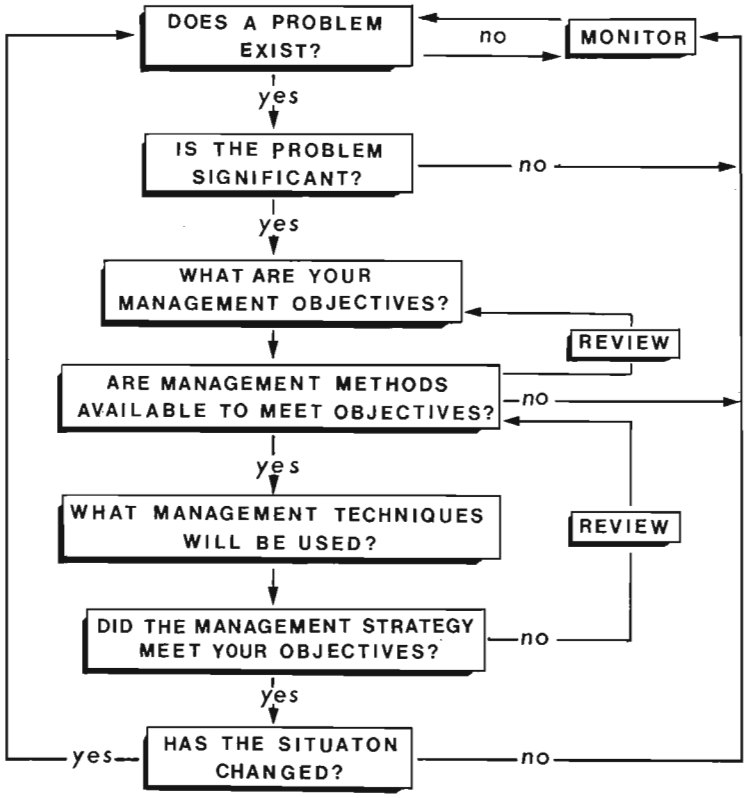

Fig. 1 A planning quiz. Answer each question and follow the appropriate arrow.

Gathering Information

Where and how do you get needed information? Start with your own planning team or form a special information-gathering team. Each member should become a bloodhound, tracking specialists in universities, federal and state agencies, and private industry. At first, persons with broad training may serve you better than those more specialized. To locate agencies, companies, and lake managers consult directories of the National Wildlife Federation[2], the North American Lake Management Society[3], and the Florida Department of Natural Resources[4].

Become a networker. Join lake societies to receive newsletters, attend meetings, and contact people from other lake groups. People may someday come to you for advice.

Seek varied opinions early in planning. Invite specialists to meet with your group, but beware of their bias and limited knowledge. Write for product literature, but watch for exaggerated claims. Consult public libraries for books about lakes or aquatic plants.

Your own lake can provide the best information. With guidance, your group can collect original data. State agencies, like the Wisconsin Department of Natural Resources[5], offer self-help programs for measuring water clarity and conducting lake surveys. Keep records of algal blooms, fluctuations in plant beds, and other water quality changes. Build a reference library to keep your notes, books, reports, newsletters, and company literature. A personal computer or word processor is handy for storing data, writing notes, and revising your plan.

Controlling Plants

Your choice of plant control strategies should be guided by three principles:

- consider all methods.

• separate management strategies by lake use.

• weigh each method's benefits against its cost and environmental impacts.

Each chemical, mechanical, habitat manipulation, and biological technique has limitations, short- and long-term consequences, and environmental risks. Beware of hidden costs for maintaining equipment, repeating treatment, and restoring habitat.

Know local, county, state, and federal restrictions before using any method. Many states, for example, ban stocking of grass carp and require a permit to apply chemical herbicides. Few states require a permit for mechanical harvesting, but local ordinances may govern where the harvest can be dumped. Nearly every technique has some restrictions.

Chemical Treatment. Herbicides can be used selectively to manage aquatic vegetation, because plants differ in susceptibility to herbicides[6]. For instance, the herbicide 2,4-D (2,4-dichlorophenoxyacetic acid) is effective against Eurasian watermilfoil (*Myriophyllum spicatum*) but not against curly-leaf pondweed (*Potamogeton crispus*)[7]. Knowing what plant species occur in your lake is vital to choosing an effective herbicide — one that will not cause resistant species to spread.

Herbicides can be applied rapidly with equipment ranging from hand pumps to helicopters. Follow directions on the label and don't exceed the recommended dosage. Because of lake dilution, treatment costs increase with water depth. This may restrict herbicide use to inshore areas. Another concern is for the environment.

Herbicides affect both plant and animal communities. They may kill aquatic invertebrates, which are vital fish and waterfowl food. Plants are also left to decay, causing fish kills and algal blooms if enough vegetation decomposes rapidly. Chemical sprays may drift into areas not needing control. Ingredients in some herbicides, such as copper sulfate, may accumulate in sediments, limiting future dredging options because of restrictions on disposing contaminated wastes.

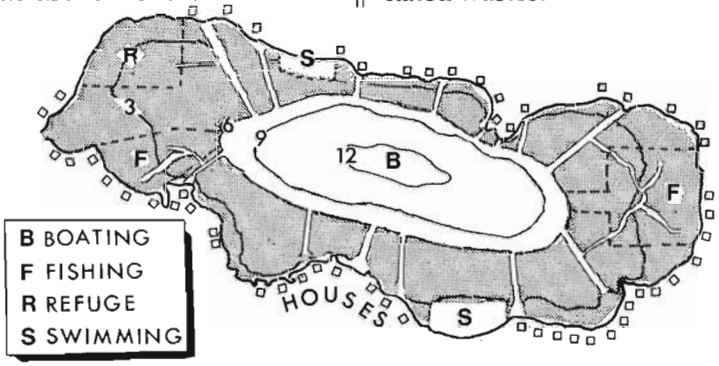

Fig. 2 Summer plant cover (shaded) on imaginary Legne Lake, showing harvested channels and areas designated for different uses. Depth contours are in feet.

Mechanical Treatment. Cutter-mounted boats are inexpensive and light enough to work inshore, but leave all plant fragments behind. Mechanical harvesters cut and remove plants, but are expensive and can be cumbersome inshore. Tiller barges (rotovators) cut into sediments to destroy roots, but have similar drawbacks of harvesters and create even more turbidity (Fig. 3).[8]

Harvesting does have many advantages. It frees areas for immediate use, without using chemicals. Few plants are left to decay. Control can be directed at specific areas or used selectively to create channels. Harvested plants, with their nutrients, can be hauled to farms or gardens and used as mulch or compost.

Mechanical harvesters affect ecosystems by destroying habitat and removing insects and small fishes trapped in the vegetation. They may create turbidity and leave fragments to drift on shore. Shoreline cleanup, using rakes and pitchforks, is often necessary with cutting and harvesting operations. Most harvesters are ineffective at removing duckweed and filamentous algae not clinging to large plants.

Habitat Manipulations. Plant growth can be controlled by altering the lake environment through deepening, shading, screening, or drawdown[9].

Dredging can control attached plants if the lake is deepened enough to prevent sunlight from stimulating bottom growth. This depth varies with water clarity and plant species. For instance, Eurasian watermilfoil in clear lakes can reach the water surface from a depth of at least 12 ft., whereas sago pondweed (*P. pectinatus*) rarely grows beyond 5 ft. deep. Dredging to just 10 ft. deep therefore might permit deepwater species to spread. Dredging also is expensive, ineffective against algae and other drifting plants, and creates a problem with disposing of bottom materials. Spot dredging, to create boat channels, is a cheaper compromise to dredging an entire lake bed.

Commercial dyes control rooted plants and algae by tinting lake water to retard sunlight penetration. Their use is limited to ponds and constricted bays of lakes with little or no flow through. The dyes seem ideal for ponds on golf courses, where herbicides and harvesting equipment might damage the greens. Unlike herbicides, the dyes are not directly toxic to plants.

Fig. 3 Barge-mounted rototillers use hydraulic, rotating discs to destroy roots.

Fiberglass screens combine shading with bottom covering[8] (Fig. 4). When firmly anchored to the lake bed, the screens cause underlying plants to decompose or fail to develop. They should be applied in spring and removed each fall for cleaning. Otherwise the screens would become buried by sediment. Use them beside

Fig. 4 Removable fiberglass screens, 7 by 100 feet, clear channels along shore and beside boat piers.

piers for boat access and along shore to create swimming areas.

Drawdown exposes the bottom of lakes and reservoirs that can be drained. Foliage is destroyed and underground plant parts are exposed to extremes of temperature, drought, and soil compaction. Instead of draining the entire lake, eliminating all lake use, try a partial drawdown of a few inches to several feet — just enough to expose boat piers. However, summer drawdown may allow emergent plants, such as cattails, to colonize the lake bed and produce a marsh. Winter drawdown permits lake use in summer, but may affect fish survival and lead to dominance by submergent plants resistant to drawdown[8]. A partial winter drawdown, repeated only as necessary, can control inshore plants and avoid some of these pitfalls.

Biological control. Can aquatic plants be controlled with animals that eat plants? Aquatic insects, snails, fishes, and even mammals have been tried with varying success. Weevils, moths, and fungi recently have been introduced into southern waters and found to stress water hyacinth (*Eichornia crassipes*). Managers now stock grass carp or white amur (*Ctenopharyngodon idella*) to control other plants.

Adult grass carp have voracious appetities for aquatic plants. They first defoliate lakes and then keep plants from sprouting; control may last over 10 years.[10]. Native to China and the Soviet Union, the carp tolerate cold, oxygen-poor water and thus could survive winters in northern states. Sterile (triploid) grass carp, with three

sets of chromosomes instead of the normal two, have been developed to block reproduction. They have been endorsed for stocking by the U. S. Fish and Wildlife Service. Consult with state authorities before releasing any grass carp, because some states prohibit stocking and others require a permit.

Grass carp stocking has many drawbacks[8, 10]. Because carp are difficult to confine in lakes, plants cannot always be saved as fish and waterfowl habitats. Stocking too many carp may reduce foliage so rapidly that algal blooms and oxygen depletion occur from decay of feces and undigested plant matter. Denuded shorelines become subject to erosion. Gamefishes may at first grow faster, but lack of vegetation robs them of prey and causes stunting.

Biological control must be approached cautiously. Control agents, like grass carp, may be difficult to remove. They may escape to lakes and marshes valued for plant cover or become established in river systems. Their behavior may be unpredictable, especially in the North where biological control has been less studied. Because northern waters lack hydrilla (*Hydrilla verticillata*), grass carp stocked in low numbers prefer pondweeds and coontail (*Ceratophyllum demersum*), leaving the less palatable watermilfoil to spread. Control agents can impact more than plants. For example, rusty crayfish (*Orconectes rusticus*) escaped into some Wisconsin lakes and not only destroyed aquatic plants but also displaced native crayfish, ate fish eggs, and reduced insect prey of fishes[11]. Only careful screening, testing, and evaluation can reveal such ecological consequences.

Restoring Plant Communities

Adding plants to lakes may be more important than removing them. Many lakes have little vegetation, undesirable species, or plants growing in the wrong places. Plants can be used to attract waterfowl, promote fish spawning, retard shoreline erosion, and improve water clarity by trapping nutrients. Short species can be planted to compete with taller ones that disrupt boating. Broad-leaved species can be grown to diversify monotonous stands of finely branched plants.

Aquatic plants can be grown from seed or transplanted as cuttings, winter buds, tubers, or whole plants. Nails or clay can be attached to sink the plants. Try native pondweeds (*Potamogeton* spp.) for a loose underwater garden.

Techniques that eradicate plants can promote desirable species and improve habitat. The herbicide 2,4-D can shift community composition from watermilfoil and coontail to beneficial pondweeds and wild celery (*Vallisneria americana*)[7]. Mechanical harvesting also can stimulate wild celery by removing a shading canopy of watermilfoil[1]. Screens and harvesters can channelize plant beds to produce island habitats, increase edge, and form cruising lanes for boaters and gamefishes. Lake shores can be resloped to promote or discourage habitat. Aluminum sulfate (alum) can reduce algae and thus improve water clarity for larger plants to grow.

Summary and Conclusion

A lake management plan is an orderly approach to plant management. It helps define the problem, set priorities, develop management strategies, and evaluate progress. As an educational tool, it can describe the what, how, why, and where of management techniques. As a team effort, a plan can focus community involvement.

Use the plan to integrate management techniques. Partial winter drawdown and screening for inshore control can be combined with offshore harvesting. Herbicides or harvesting can reduce the number of sterile grass carp needed for stocking. Spot dredging can coincide with winter drawdown. Most important, a lake management plan can be integrated with watershed management to control both internal and external nutrient loading[12].

Consider a lake management plan — thoughtfully developed and wisely executed — to breathe new life into your lake.

Acknowledgments

This article developed from two workshops on aquatic plant management, conducted by authors in November 1986 at the North American Lake Management Society conference in Portland, Oregon. We thank Douglas R. Knauer and Legne Engel for reviewing the manuscript.

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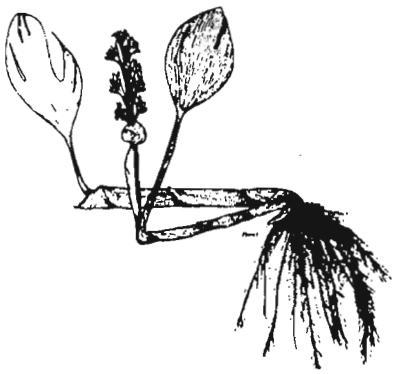
JUST ANOTHER HYACINTH?

Recently the DNR located an infestation of rooted water hyacinth *Eichhornia axurea* in southern Palm Beach County. The site was contained and easily eradicated; however, the fact that someone was capable of buying the plant is disturbing. Rooted water hyacinth is native to South America and very similar in appearance to our naturalized hyacinth. The primary difference being the lack of inflated petioles and the fact that it is generally rooted in the mud.



Highlights from the Twelfth Annual Meeting of the FAPMS

AWARD WINNERS

Photo Contest:
Operations
1st Place — Mike Hulon
2nd Place — Alison Fox
3rd Place — Mike Hulon
Aquatic Scenes
1st Place — Jim Kelley
2nd Place — Phil Chatman
3rd Place — Greg McClain

Memebership Drive:
Bill Moore
(which he donated back to the William L. Maier Scholarship Foundation)

Applicator of the Year:
Grady Vance

Applicator Paper of the Year:
Ernie Feller

Exhibitor Award:
Southern Mill Creek Products Co.

Presidential Award:
Dan Thayer

Sutton's "Tubers-in-a-Jar" Guess:
Gordon Baker

Knife Raffle:
Gordon Baker
(which he donated back to the William L. Maier Scholarship Foundation)

Scholarship Award:
Mark Mossler
Agronomy Dept.
University of Florida
Gainesville

Wayne Corbin reminds us that "It Ain't Over Till the Fat Boy Sings!"

Entertainment at the Annual Banquet was provided by "Alex West and the Weed Wackers". Weed Rap *lyrics available upon request.*

Outgoing president Eddie Knight, delivers his final address to the membership at the annual business meeting.

Orifice P. Nozzlehead reminds the applicators that supervisors have less brain tissue than most people, so to protect yourself, "Read the Label".

"HEY JOE, I THINK I'VE FOUND AN EASIER WAY TO DISPERSE FLEA BEETLES.... WHAT D'YA THINK...?"

In The Beginning

Anonymous

In the beginning
There was Earth; beautiful and wild; and then man came to dwell.
At first he lived like other animals
Feeding himself on plants and creatures around him.
And this was called *In Balance With Nature.*
Soon man multiplied.
He grew tired of ceaseless hunting for food.
He built homes and villages.
Wild plants and animals were domesticated.
Some men became Farmers so that others might become Industrialists, Artists, or Doctors.
And this was called Society.
Man and Society progressed.
With his God-given ingenuity, man learned to feed, clothe, protect and transport himself so that he might enjoy life.
He built cars, houses on top of each other and nylon.
And life was more enjoyable.
The men called Farmers grew more efficient.
A single Farmer grew food for 45 Industrialists, Artists and Doctors.
And Writers, Engineers and Teachers as well.
To protect his crops and animals, the Farmer produced substances to repel or destroy Insects, Diseases and Weeds.
These were called Pesticides.
Similar substances were made by Doctors to protect humans.
These were called Medicine.
The Age of Science had arrived and with it came better diet and longer, happier lives for more members of Society.
Soon it came to pass
That certain well-fed members of Society disapproved of the Farmer using Science.
They spoke harshly of his techniques for feeding, protecting and preserving plants and animals.
They deplored his upsetting the Balance of Nature;
They longed for the Good Old Days.
And they had emotional appeal to the rest of Society.
By this time Farmers had become so efficient, Society gave them a new title.
Unimportant Minority.
Because Society could not ever imagine a shortage of food
Laws were passed abolishing Pesticides, Fertilizers and Food Preservatives.
Insects, Diseases and Weeds flourished.
Crops and Animals died. Food became scarce.
To survive, Industrialists, Artists and Doctors were forced to grow their own food.
They were not very efficient.
People and government fought wars to gain more agricultural land.
Millions of people were exterminated.
The remaining few lived like animals.
Feeding themselves on creatures and plants around them
And this was called *In Balance With Nature.*

HALLER's HISTORICAL HIGHLIGHTS

$C_8H_6Cl_2O_3$
Begins a Revolution

No, it wasn't the fighting kind of revolution that we read about so often in newspapers, but the combination of carbon, hydrogen, chlorine, and oxygen atoms that were combined in 1940 contributed significantly to the agricultural revolution. The discovery of the first widely used organic herbicide, 2,4-D, provided for the first time the ability for man to efficiently control many weeds in many sites. With 2,4-D, a means was finally available to the aquatic plant manager to control water hyacinth and later, watermilfoil, lilies, and coontail.

How could such a simple compound, so similar to naturally occurring plant hormones, become synthesized? It all started a little over 100 years ago.

In the 1880s, the famous naturalist and scientist Charles Darwin noted that plants grow towards the light. What's more, he discovered that if the tips of growing plants were covered or kept dark, the plants didn't grow towards the light source. As simple as this discovery may seem, it stimulated the interests of plant physiologists the world over. Finally, some 30 to 40 years later it was conclusively shown that the bending towards the light by Darwin's plants was a chemical phenomenon obviously caused by a "growth substance" of unknown identity.

In the 1930s, plant auxins were discovered, identified, synthesized and derivatives (closely related chemicals) were being studied to produce such things as dwarf plants, seedless tomatoes and stimulate plant production. This "hot" new field of plant physiology and plant growth regulators produced an estimated 1,000 scientific papers a year in the late 1930s. This high level of research activity set the stage for the discovery of 2,4-D, an auxin type herbicide; a discovery that was destined to occur.

By the late 1930s it was well known that many phenoxyacetic acids were good growth regulators. Finally in 1940, Pokorny synthesized the first 2,4-dichlorophenoxy acetic acid while searching compounds for use as fungicides. Having no fungicidal properties, Pokorny dismissed 2,4-D from his tests, but published its synthesis in 1941. The biological activity of 2,4-D on plant growth was soon discovered with scientists from Dupont and American Chemical Paint Company (Amchem) filing for use patents. Dupont scientists filed for its use as a growth regulator, and Amchem filed for its use as a weed killer. By this time it was becoming widespread knowledge that several growth regulators, at higher dosages, were toxic and often selectively controlled various plants. Two, 4-D was now available in small quantities for study by other scientists, several of whom found that the material controlled broadleaf weeds. Finally, a herbicide use patent was granted on December 11, 1945 to F.D. Jones of Amchem. History indicates that the first experimental 2,4-D sold was to two USDA scientists in Beltsville, MD at a cost of $12.50 for a one pound container in 1943. By the time Jones received the herbicide use patent, Amchem had decided to offer 2,4-D to the public. Due to war time shortages, the first batch of 2,4-D formulated was bottled in wide-mouth chocolate syrup bottles and boxed for shipment under a shade tree outside of the chemical plant. This material did not at first sell well, but publicity in *Readers Digest* and *Better Homes* magazines made the public aware of its availability for control of such lawn weeds as poison ivy and dandelions.

Many people may have believed that 2,4-D was discovered secretly as a part of the war effort by the U.S. government. Certainly the War Department studied many herbicides for potential use against crop plants, but there was no secret about 2,4-D. The synthesis and early studies of phenoxies were widely published during the early 1940s.

What about aquatic use of 2,4-D? Two,4-D didn't make it as a fungicide back in 1940, so is it also possible that the first use of 2,4-D on aquatics was also the result of an error? Maybe!

Can you imagine the interest that these new herbicides created among scientists? Did 2,4-D stimulate the formation of weed science programs in American universities, stimulate formation of Weed Science Societies, stimulate the agrichemical industry as we know it today, and yes, stimulate food production so that one American farmer today feeds nearly 200 people? Discovery of 2,4-D laid the groundwork for all these things.

By 1945, Dr. Fanny Fern Davis was experienced in 2,4-D use and was hired as a consultant to the National Capitol Park Service in Washington, D.C The NCPS was responsible for maintaining the grounds and historical buildings in the D.C. area. By War's end, the turf around the White House, Washington Monument and the Mall was overrun with weeds and suffered from general neglect due to manpower shortages caused by the war. Dr. Davis sprayed 2,4-D on essentially all of these public areas to rejuvenate the turf and control weeds. Between turf applications, insecticides would be sprayed on ornamental plants in the D.C. area, including on lotus plants in ornamental pools. Insecticides were mixed in the same wooden tank that had been washed several times after spraying 2,4-D on turf. Needless to say, lotus plants sprayed with insecticide soon demonstrated curling and bending, typical of the auxin response caused by 2,4-D. Seriously, this incident in 1945 was

probably not the first "aquatic" application of 2,4-D, but it had to be close.

So what is 2,4-D? When one refers to 2,4-D, one is generally referring to a group of plant hormone-auxin type herbicides derived from 2,4-D acid. Two derivatives of 2,4-D acid are in general use in aquatic weed control. Two, 4-D dimethylamine salt and 2,4-D butoxyethanol ester are the most commonly used. Two, 4-D dimethylamine is formulated as a liquid and widely used for water hyacinth control. Two, 4-DBEE is sold as a granular formulation and most widely used for submersed weed control (milfoil and coontail) and for emergent weed control (lilies). Although a relatively simple compound, slight changes in chemical structure (and many substitutions are possible) dramatically changes the activity of the herbicide. One thing for certain, $C_8H_6Cl_2O_3$ started a revolution which has allowed the retirement of many hoes around the world.

■ **Bill Haller**

AQUAVINE

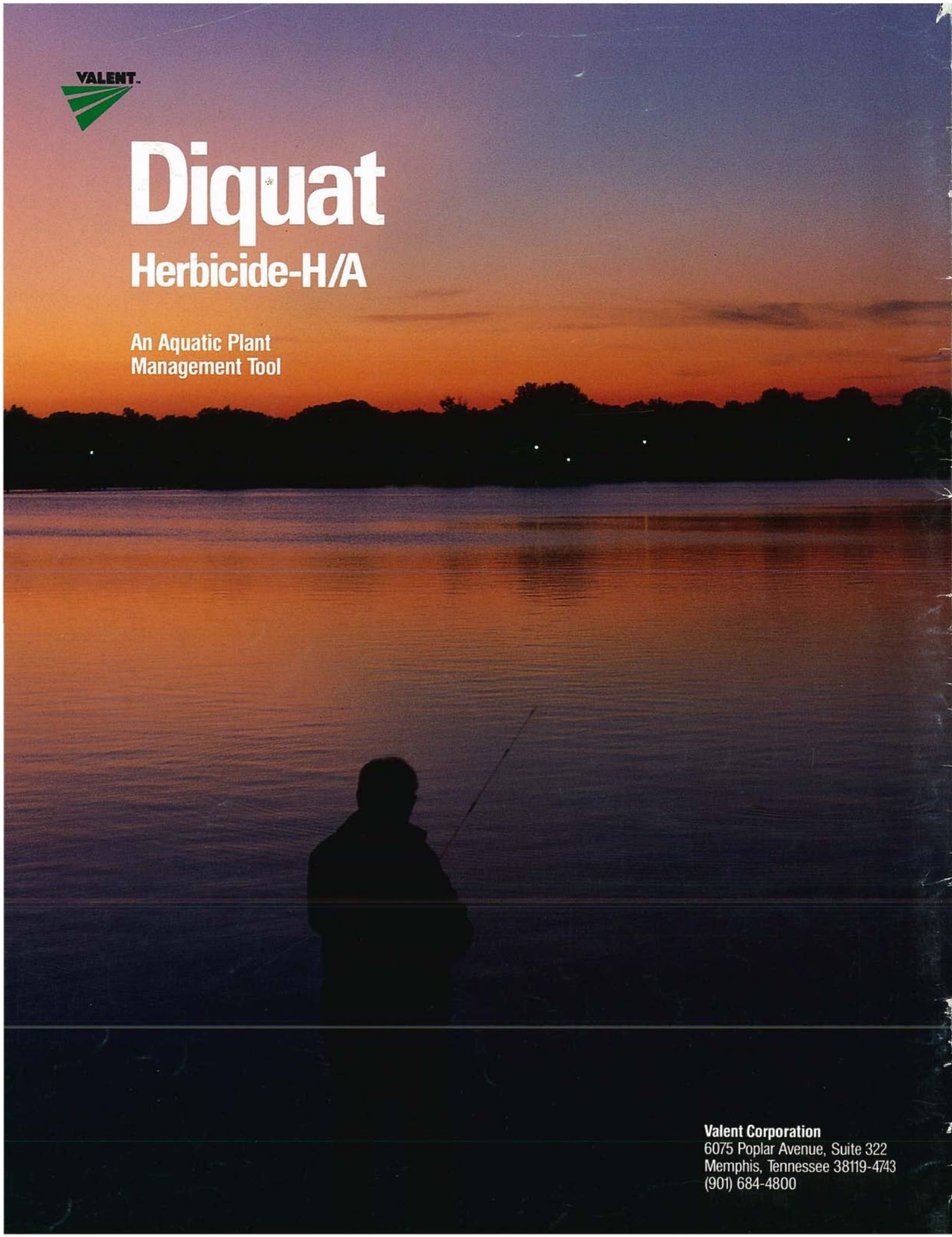
WAPMS

The Western Aquatic Plant Management Society will hold its annual meeting on March 16 and 17, 1989 at the Alamoana American Hotel in Honolulu, Hawaii. The meeting will focus on the latest technology and research findings on the management of aquatic plants that grow in lakes, reservoirs, and irrigation systems. For further information contact:

David Spencer
USDA Aquatic Weed
Control Research Lab
Botany Department
University of California
Davis, CA 95616
(916) 752-6260

10-YEAR ANNIVERSARY

The March 1989 issue of *Aquatics* will be the ten year anniversary of the magazine. I need your help with the 40th edition in order to make it a memorable issue. I'm asking that members of the FAPMS, APMS and other aquatic plant management chapters around the country dig deep into your photo files for any old and new pictures and slides of people, places and events that you may have. I'm especially interested in historical photos, operational and aquatic scenes, people pictures and photos you may have from past national society or chapter society meetings. With your help, we can make this an issue to remember. Please provide a caption, your name and your return address with photo. You will, of course, get full credit for your contribution. Thanks!



Valent Corporation
6075 Poplar Avenue, Suite 322
Memphis, Tennessee 38119-4743
(901) 684-4800