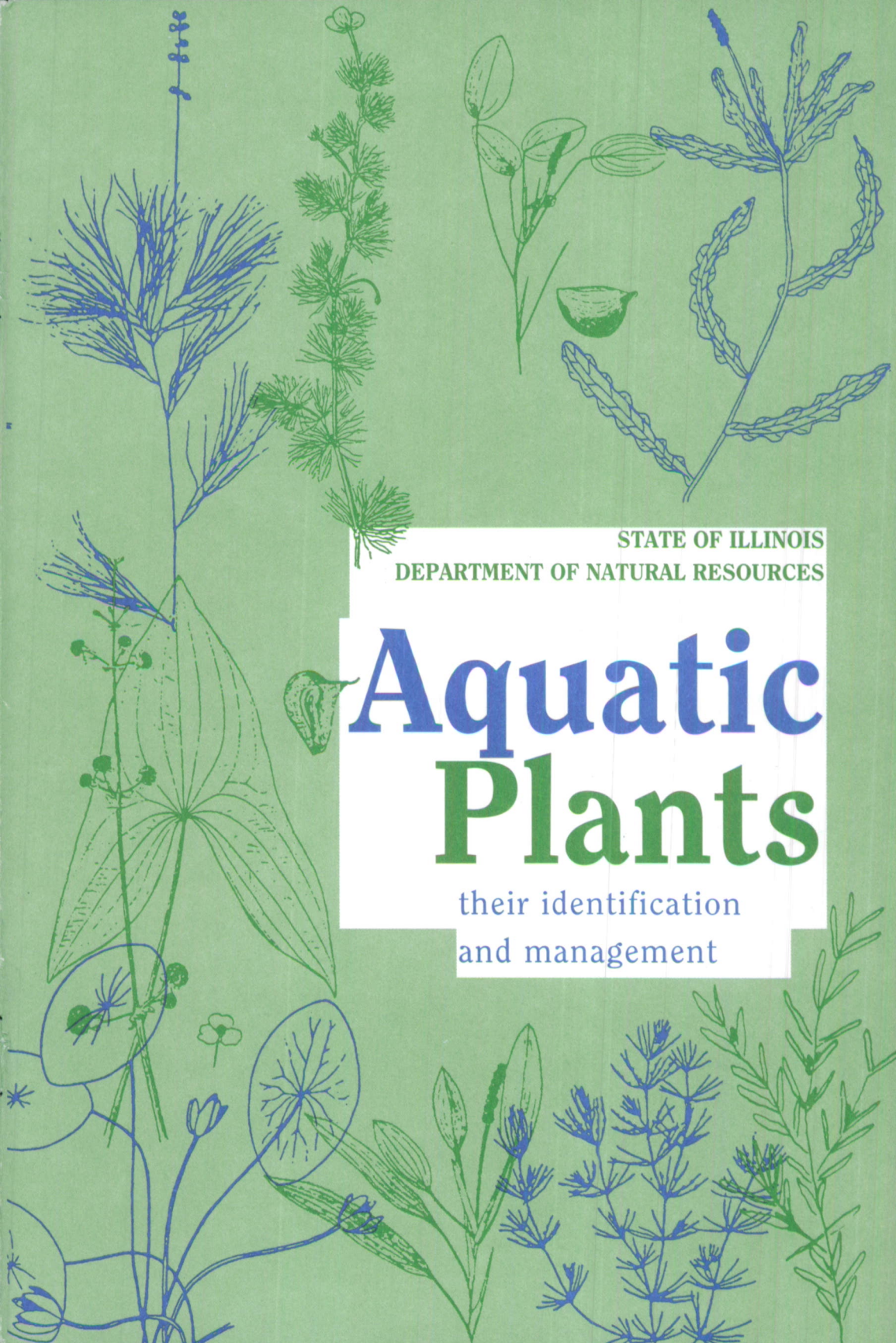


STATE OF ILLINOIS
DEPARTMENT OF NATURAL RESOURCES

Aquatic Plants

their identification and management

acknowledgements

Most of the drawings of aquatic plants are through the courtesy of the Minnesota Department of Natural Resources.

This version preempts all previous versions.

REVISED 2001

Aquatic Plants

their identification and management

ILLINOIS DEPARTMENT OF NATURAL RESOURCES
524 SOUTH SECOND STREET
SPRINGFIELD, IL 62701-1787

FISHERY BULLETIN NO. 4

Equal opportunity to participate in programs of the Illinois Department of Natural Resources (IDNR) and those funded by the U.S. Fish and Wildlife Service and other agencies is available to all individuals regardless of race, sex, national origin, disability, age, religion, or other non-merit factors. If you believe you have been discriminated against, contact the funding source's civil rights office and/or the Equal Employment Opportunity Officer, DNR, 524 S. Second, Springfield, IL 62701-1787; 217/785-0067; TTY 217/782-9175.

Printed by authority of the State of Illinois
(PRT 3204854-20M-6/01)
Printed on Recycled Paper

Rod R. Blagojevich
Governor

CAUTION:

Some aquatic herbicides may have a serious adverse effect on the environment and may be potential human health hazards. Environmental protection agencies of the state and federal governments are restricting the manufacture and use of herbicides when their effects may involve food for human consumption. Therefore, the user is cautioned to read the label on the herbicide package very carefully and abide by its instructions. Only those herbicides which have been approved by the U.S. Environmental Protection Agency and contain an E.P.A. registration number on the label are included in this manual.

DISCLAIMER:

The Illinois Department of Natural Resources does not assume any responsibility or endorse the aquatic herbicides listed in this publication. This publication is issued for the convenience of those who may desire information on aquatic plant control. It is the applicator's responsibility to assure that herbicides applied have a current U.S. Environmental Protection Agency approval number for aquatic use and are applied according to the label instructions. It is also the applicator's responsibility to obtain any necessary permits from the Illinois Environmental Protection Agency before applying herbicides that may affect waters used for drinking water supply or food processing.

APPLICATOR'S LICENSE:

A person who applies an aquatic pesticide for hire must possess an Illinois Aquatic Commercial Pesticide Applicator License. A commercial pesticide applicator for hire license is issued to a person who applies a pesticide for any purpose on property other than that owned, rented or leased by himself or by his employer. Generally, a person who applies pesticides for profit is considered a commercial applicator. For certification, a person must be at least 16 years old, pass written examinations, pay a $50 fee, and have a certificate of insurance. The license is for one calendar year and is renewable without examination at the discretion of the Director of Agriculture for three years. For additional information contact the Illinois Department of Agriculture, Bureau of Plant and Apiary Protection, P.O. Box 19281, State Fairgrounds, Springfield, Illinois 62794-9281 (217/785-2427).

BEFORE YOU TREAT...

A home owner may apply any aquatic herbicide classified as "general use" herbicide on waters that are owned, rented or otherwise controlled by 2 or fewer individuals. If the water area is owned by more than two individuals, application of any herbicide must be by an IDOA licensed applicator. In most instances, the IDOA has determined that homeowner associations and organizations fall within the Commercial Not-for-Hire category, and thus a license is required.

PESTICIDE MISUSE:

If pesticide misuse occurs on your lake or pond, you can contact the IL Department of Agriculture (IDOA) - Pesticide Misuse Hotline at 1-800-641-3934.

TABLE OF CONTENTS

Aquatic plant management in Illinois 4
Values of aquatic plants to fish and wildlife 4
Alternative Methods of Aquatic Plant Management 5
- Mechanical control methods 8
- Use of water dyes 9
- Use of fertilizers 9
- Herbicide control 9
- Biological Control 9

Procedures for herbicide control of aquatic plants 12
- Determining the area to be treated 12
- Dosage 13
- Treatment 13
- Precautions 14
- Methods of application 14

Types of aquatic plants and herbicides recommended for control 15
- Algae 15
- Floating plants 18
- Submersed plants 18
- Emersed plants 35

Sources of supply and service 44
Pond Management Consultants 46
General restrictions on use of treated waters 52
Tables of measurements 53
Regional offices 56
Aquatic plant identification and treatment form 57

AQUATIC PLANT MANAGEMENT IN ILLINOIS

The purpose of this publication is to make lake and pond owners in Illinois more aware of the importance of aquatic plants and to provide practical alternatives for the control of problem situations. Good aquatic plant management is no accident; it requires active participation on the part of the owner to ensure a balanced lake or pond ecosystem.

Aquatic plants can become problems when they interfere with the intended use of a lake or pond, whether it is for boating, swimming, fishing, irrigation, livestock watering, or general wildlife purposes. A particular aquatic plant may be fine in one part of the state and totally out of control in another part of the state. Unfortunately, many lake owners see all aquatic plants as a "nuisance" and often overreact by attempting to eliminate all aquatic plants.

Aquatic plants can interfere with fishing.

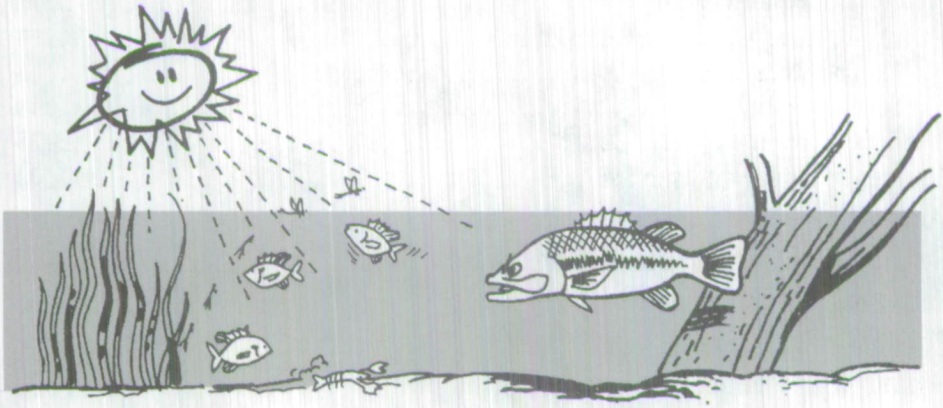
VALUES OF AQUATIC PLANTS TO FISH AND WILDLIFE

Aquatic plants are a beneficial and necessary part of Illinois lakes and ponds. Their role is very important because only plants can directly convert solar energy into stored chemical energy for use by animals. Just as important, microscopic plants produce the majority of dissolved oxygen in water for use by aquatic animals. Aquatic plants also serve as escape areas for young fishes, ensuring that some survive and mature to produce additional young.

Emergent aquatic plants such as cattail are used by waterfowl as brood rearing cover. Treat emerged plants in patches, leaving scattered clumps of cover intact. Ideally, for breeding waterfowl, clumps of emergent vegetation should cover about 1/2 of the lake's shoreline area.

Plants stabilize shorelines, prevent wave erosion, and many produce flowers or unique leaf patterns which are simply nice to look at. They can also provide important foods and nesting areas for bullfrogs, waterfowl and shorebirds.

Chemical, biological and mechanical control of aquatic plants may affect the ability



of a lake to support fish and wildlife. Waterfowl use aquatic plants such as pondweed, coontail, duckweed, water milfoil, and arrowhead for food.

Complete elimination of plants in lakes and ponds is not recommended. Rather, strips of aquatic plants may be left in areas where recreation will not be inhibited. For more information regarding the value of aquatic plants to fish and wildlife and how to attract wildlife to ponds contact your local Regional Fisheries or Wildlife Administrator.

POND ENHANCEMENT THROUGH THE USE OF AQUATIC EMERGENT PLANTS

Most ponds constructed today have a shallow area along the pond's perimeter (a "safety shelf"). Pond productivity and appearance can be enhanced through planting emergent plants in the shallow margin area. Emergent plants reduce or eliminate shoreline erosion, improve water quality through removal of dissolved nutrients, provide habitat for aquatic invertebrates that are food for many fish species, supply cover for larval and juvenile fish, serve as "hunting" areas for adult fish (and great fishing spots!), provide cover and habitat for other species of wildlife (frogs, waterfowl, wading birds, etc.), and greatly enhance the pond's appearance.

However, not all species of emergent plants are desirable or will provide these benefits. Many plant species can become a nuisance requiring control. Other species may never need control and, over time, will provide all the listed benefits. The Evaluation Rating Table (p. 6) provides information on plant species that have been evaluated in IDNR test ponds and field evaluations of native communities. Several plant species have a well established history of developing nuisance colonies thus are not included in the table (i.e. cattail *(Typha spp)*, pampas grass *(Phragmites spp)*, etc.). Also, sweet flag *(Acorus americanus)*, and dark green and hard-stemmed bulrushes *(Scirpus acutus* and *S. atrovirens)* are not included in the table due to their exhibiting very poor survival in test ponds.

Emergent plant species that can be used in nearly any pond include pickerel weed *(Pontederia cordata)*, blue flag *(Iris virginica)*, lizard's tail *(Saururus cernuus)*, arrowhead species *(Sagittaria spp)*, and water plantain *(Alisma spp)*. The leaves and stems of the lizard's tail contain a chemical, Manassantin A, that may help protect it from muskrat and geese.

Water willow *(Justicia americana)*, yellow pond lily *(Nuphar advena)*, and white water lily *(Nymphaea odorata)* may be desirable for larger and/or deeper ponds. Areas that are intended to attract waterfowl can be planted with common bulrush *(Scirpus validus)* and bur reed *(Sparganium eurycarpum)*. Although river bulrush *(Scirpus fluviatilis)* is highly undesirable in most ponds, it may be the only emergent species that will do well in barren quarry ponds.

There are many other species of emergent aquatic plants in Illinois. Often these plants naturally "recruit" into ponds. Many of these species are desirable in ponds, and some are not. When a new plant arrives in your pond, press a stem with leaves between sheets of construction pater to dry and preserve the specimen. Contact your State District Fisheries Biologist to determine the plant's identification and acquire information regarding the plant's growth characteristics.

ALTERNATIVE METHODS OF AQUATIC PLANT MANAGEMENT

PHOSPHORUS PRECIPITATION/INACTIVATION

Buffered alum, ferric alum and calcium salts have been successfully utilized to control algae by precipitating or inactivating phosphorus (a nutrient). Aluminum sulfate (alum) is often used because it retains its ability to remove phosphorus over a relatively wide range of environmental conditions. The buffered alum should be applied prior to the growth of the algae. If the water clarity is 24 inches or less, it would be best to wait until the algae bloom subsides. Water bodies which experience high sediment and nutri-

EMERGENT-AQUATIC PLANT SPECIES FOR PONDS EVALUATION RATINGS TABLE

Plants are rated as High, Moderate, Low, or a combination. (1) March, 2001

SPECIES (2) Common Name	Scientific Name	Habitat Potential	Stabilization Potential	Water Depth	Adult Height	Nuisance Potential	Flood Tolerance	Sunlight Requirements
Water Willow	*Justicia americana*	High	High	to 30 in.	2.5-3.5 ft.	Mod/High	High	100%
Lizard's Tail	*Saururus cernuus*	High	High	18-36 in.	2-3 ft.	Low	High	50%-100%
Stiff Arrowhead	*Sagittaria rigida*	High	High	to 30 in.	2-3 ft.	Low	High	100%
Blue Flag	*Iris virginica*	Low	High	to 6 in.	2-3 ft.	Low	High	50%-100%
Great Bulrush	*Scirpus validus*	Low/Mod	High	to 12 in.	3-8 ft.	Moderate	High	100%
Common Bur Reed	*Sparganium eurycarpum*	Moderate	Moderate	to 12 in.	3-5 ft.	Moderate	High	100%
Yellow Pond Lily	*Nuphar advena*	Low to Moderate	Low to Moderate	to 8 ft.	6 in. above surface	Moderate	Moderate	100%
White Water Lily	*Nymphaea tuberosa*	Low to Moderate	Low	to 5 ft.	—	Moderate to High	HIgh	100%
Water Plantain	*Alisma subcordatum*	Moderate	Moderate	to 6 in.	1-2 ft	Low	Moderate	100%
Button Bush	*Cephalanthus occidentalis*	- 0 -	High	- 0 -	to 8 ft.	High	High	100%
Common Arrowhead	*Sagittaria latifolia*	Low	Moderate	to 2 in.	3 ft.	Low	Low	100%
Pickerel Weed	*Pontederia cordata*	Moderate	Low	to 12 in.	2-3 ft.	Low	Low	100%
River Bulrush	*Scirpus fluviatilis*	Moderate	High	to 30 in.	5-7 ft.	Very High	High	100%

(1) Ratings are based on IDNR test pond experience and field evaluations.
(2) Common and Scientific names from Plants of the Chicago Region, 4th Edition, 1994. Swink and Wilhelm

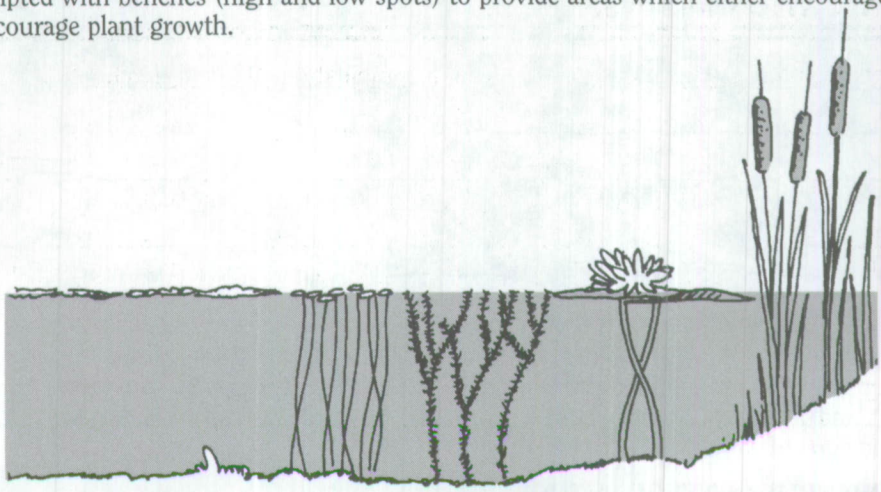
ent loading rates or which have a short retention time (frequent discharge), are poor candidates for this type of algae control. One commercially available formulation (a buffered sodium aluminate) recommends forty (40) pounds of formulation per acre-foot of water to be treated.

POND CONSTRUCTION

Since aquatic plants of some type will eventually grow in almost all ponds, the best time to plan for plants is during pond construction. Since most plant problems start in shallow water, one important pond construction feature which will provide a degree of control is to deepen the pond edges at the waterline to eliminate very shallow water. By grading the edges to a three to one slope and to a depth of three to four feet, you can reduce the chances of problems with shallow water plants.

During the construction period, a little extra time can provide long term plant man-

agement benefits. The pond bottom in shallow areas (besides being sloped) can be sculpted with benches (high and low spots) to provide areas which either encourage or discourage plant growth.



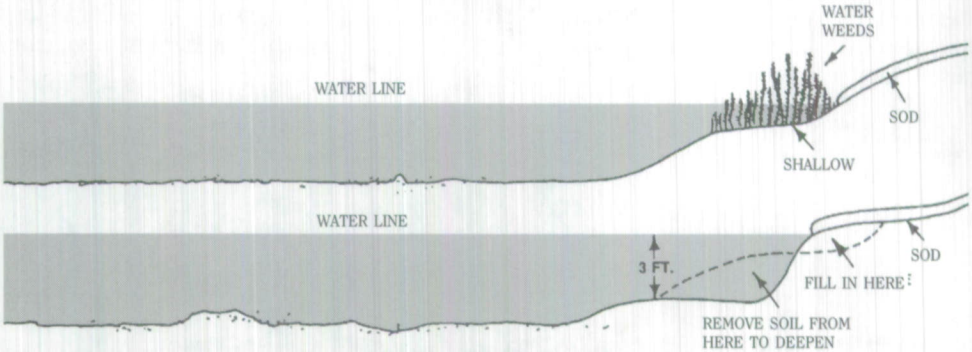
Aquatic plants of some type will eventually grow in almost all ponds.

The best approach is to have the plants interspersed with open water areas, rather than all in one spot. Imagine a checkerboard with its alternating red and black squares around the edge of a pond. Imagine the red squares as deep water to discourage plants, the black squares as shallow water to encourage plants, and you will get an idea of plant interspersion. For even more diversity, sunken islands can be built in the middle of larger ponds. Such an area of shallow water with plant growth is an ideal fish attractor. When shallow water "islands" are a part of a pond construction, the result can be beautiful as well as beneficial for fish. How much aquatic plant growth to encourage, of course, depends on the primary use of the pond or lake. A rule of thumb is that for a fishing pond, about 20 to 40 percent of the pond surface area should have aquatic plant cover.

The decision about where to encourage or discourage plant growth should be made during pond construction to help reduce future problems with unwanted plant growth. This is particularly true for pond areas where no plant growth is desired such as a swimming beach. By using a method called "blanketing" a plant free area is virtually assured. Blanketing is the process of covering portions of the pond bottom with a 6- to 8-inch layer of sand or fine gravel. Gas permeable, sediment covers can also be effective as barriers to plant growth by blocking sunlight.

Poor construction planning and lack of plant management can result in a lake choked with vegetation. Another important construction feature often overlooked is the installation of a combination water supply and drain pipe. This pipe should be large enough to drain the lake rapidly. A 6- to 8-inch pipe is recommended for ponds up to about 3 acres, and an 8- to 12-inch pipe for larger lakes. In terms of aquatic plant management, a drain allows the pond owner to lower the water level resulting in plants drying out and being killed. This procedure, called a drawdown, is especially successful if the water level can be kept low during the winter, because the physical action of freezing weather conditions increases the effect of the drawdown. A drawdown should not be considered as an annual control measure because repeated use can have negative impacts on fish populations.

Proper site selection and construction planning will pay dividends by reducing construction costs, and increasing the useful life of a pond. Allowing eroded soil to enter a pond reduces storage capacity and improves conditions for the growth of unwanted plants — these problems can be reduced by terracing and the use of cover strips between the pond and crop areas. Ponds which receive barn or feedlot drainage may eventually receive enough fertilization to cause periodic fish kills. Over the long run, they have



How shallow water may be eliminated along the shore.

perennial problems with unwanted aquatic plants, particularly scums of algae. Good construction planning cannot be overemphasized; your pond represents a substantial investment and it deserves proper attention in order to produce long term benefits which include great fishing.

MECHANICAL CONTROL METHODS

Aquatic plants such as cattails, arrowheads, and water lilies can be removed by hand by pulling the entire plant (stem and roots) when they first start growing. Hand pulling allows for the selective removal of individual nuisance plants; desirable plants can be left alone. Commercially available mechanical hand cutters cut the plants below the water surface, but the roots generally are not removed. Since the entire plant is not removed, hand cutting does not provide long term control. Depending upon the plant species, cutting may have to be done several times during the growing season. Motor powered mechanical harvesters cut and remove aquatic vegetation from the surface to a depth of 10 feet, cutting a swath from 4 to 12 feet wide. Potential disadvantages to mechanical harvesters are the high cost of initial acquisition and maintenance; inability to operate the machinery in shallow water and in areas requiring tight maneuvering (such as around docks); and the potential need to repeat cutting multiple times during the growing season. All cut vegetation should be removed from the lake to prevent fragments from taking root and potentially increasing the nuisance plant problem and to prevent the reduction of dissolved oxygen within the water column caused by decomposition of the plants. Mechanical harvesting is not recommended for removal of Eurasian milfoil.

In established lakes and ponds, extensive shallow areas may be removed by dredging. Hydraulic dredges are most often utilized on large bodies of water and draglines with clam buckets are used for small pond work. Dredging has the benefit of removing existing vascular plants and nutrient rich sediments. Drawbacks to dredging include the high cost of the equipment if purchased or contracted, limited mobility around developed shorelines and deposition of spoils (dredged materials). Both federal and state laws govern the selection of spoil sites as well as the prevention of dredged sediments form reentering the water area.

Mowing cattails after the heads are well formed, but not mature, and then following up with another mowing about a month later, when new growth is 2-3 feel height, will kill about 75% of the plants.

SEDIMENT COVERS

Sediment covers or "bottom barriers" such as opaque sheets of polyethylene, polypropylene, synthetic rubber, fiberglass screen, nylon film or burlap can be installed on a lake bottom to block sunlight and thereby kill the plants underneath. Covers can be placed in any water depth, though divers are usually needed for deeper water installations. Sediment covers accomplish immediate control of nuisance plant conditions.

Additionally, they are hidden from view and do not interfere with recreational uses. Due to the high cost of materials and labor-intensive installation, the use of sediment covers is most applicable in small areas such as around docks, in fishing areas or amongst plant beds to maintain open fishing areas. Successful use depends on the type of material and the quality of installation. The most effective materials are gas-permeable, such as polypropylene, fiberglass-PVC and burlap, to a lesser extent. Polyethylene, synthetic rubber, and nylon trap gases beneath them and therefore may become loose and float up from the bottom. Sediment covers must be placed flush with the lake bottom and staked down or anchored securely. This is easiest to do in the spring before the plants begin to grow. Installation is difficult over heavy plant growth. Applications in water much more than 3 feet deep is best done by divers (which greatly increases costs). Over time, the covers will accumulate sediments on their surface which allows plant fragments to root. The covers must then be removed and cleaned. If satisfactory control has been achieved, some cover materials can be moved to other areas, thus increasing benefits. It's easiest to leave burlap in place because it typically decomposes after one or two seasons.

USE OF WATER DYES

As an alternative to chemical control in which toxic active ingredients are utilized, dyes are available which contain only inert coloring matter. Dyes control the growth of aquatic plants by greatly reducing the amount of sunlight that penetrates the water column which, in essence, shades the green plants, thus inhibiting the process of photosynthesis. However, this method only controls the vegetation in water deeper than 3 feet. Inflowing water (rainfall, watershed drainage) or water lost due to overflow or irrigation will necessitate the use of additional dye to replace color for effective continuing control.

USE OF FERTILIZERS

Inorganic fertilizer has been used to control underwater vegetation in the southeastern United States. The theory behind the use of fertilizers is that they will produce "bloom" of microscopic algae which will shade out rooted submersed vegetation. Excellent results have been obtained with this method in some relatively infertile impoundments in southern Illinois by the addition of triple superphosphate. The fertilizer is applied before the growing season, and additional applications are made to maintain a "bloom" that will blot out the hand when submerged to elbow depth. The recommended rate of application is about 18 pounds per surface acre of water. There is danger that artificial fertilization will create a greater plant problem than existed before, especially in the fertile watersheds of central and northern Illinois. Therefore, this method of control is not recommended on a statewide basis. Also, this method is not suitable in waters used for human consumption due to the taste and odor caused by the algae.

HERBICIDE CONTROL

In recent years, new chemical formulations have appeared on the market that are designed for aquatic plant control. These herbicides, if properly used, will normally give effective control of the vegetation and will not harm the fish. The herbicides described in this bulletin give good plant control in some lakes but may give fair to poor control in other lakes. **Lake waters vary considerably in their chemical composition, so that it is not possible to give complete assurance that a given herbicide will effectively control a specific plant in a particular lake.**

BIOLOGICAL CONTROL

ORGANIC CONTROL

Yellow barley straw and yellow wheat straw have proven an effective, organic approach to algae control. Microbial growth, oxygen and warm water temperatures activate the decomposition of the straw which releases lignins. These lignins oxidize into homic acids

which in the presence of sunlight and oxygen destroy algae with no effect on higher plant and aquatic life.

Dosage: 0.08 - 1.75 ounces of straw per square yard of water surface or 20 - 441 pounds of straw per surface acre are recommended.

Start with small quantities and monitor effects. Straw bales should be placed in shallow water with one half to two-thirds of the bail submerged (this allows oxygen to reach the microbes). The straw may be placed before or after an algae problem occurs. This technique is probably best for ponds under 6 acres in size. It takes two to eight weeks (time frame dependent on numerous variables) for the straw to become active.

BACKGROUND

Control of nuisance aquatic vegetation has historically presented problems for many lake and pond owners in Illinois. Typically, aquatic herbicides were used to provide control usually at considerable expense to the owners.

In 1979, the Illinois Department of Natural Resources funded the Illinois Natural History Survey to investigate the use of biological methods (grass carp, reproductively sterile grass carp, and hybrid grass carp) for control of nuisance aquatic vegetation. Based on the results of the research, the reproductively sterile (triploid) grass carp was selected as the biological method which will control some types of aquatic vegetation effectively in the southern two-thirds of the state.

The reproductively sterile (triploid) grass carp is nearly identical to the pure (diploid) grass carp in its physical characteristics as well as in its ability to consume aquatic vegetation. The main difference between the two grass carp is that the triploid form of the grass carp is sterile and cannot reproduce in nature. Unrestricted reproduction of the grass carp (diploid) and the potential for destruction of desirable aquatic vegetation in bottomland lakes and river backwater areas was the main concern of the Department of Natural Resources in the early 1970's when the grass carp became illegal in Illinois.

TRIPLOID GRASS CARP STOCKING POLICY

It is the policy of the Department of Natural Resources to **not** permit the stocking of triploid grass carp into any natural body of water including glacial lakes, slough potholes, bottomland lakes, streams, or rivers; water areas known to harbor rare, threatened, or endangered animals or plants on the official National of State listing; any State inventory natural area; any State Nature Preserve; or any wetland

As with any method of nuisance aquatic vegetation control, **results are not guaranteed.** The private lake owner should give careful consideration before stocking triploids as results in Illinois and other states have been variable, all the way from no vegetation control to total eradication of aquatic vegetation. **Potentially serious impacts to sport fish populations can result from the overstocking of grass carp and the subsequent elimination of aquatic plants.**

TRIPLOID GRASS CARP PERMIT PROGRAM

Beginning in February, 1986, the triploid grass carp became legalized for stocking in Illinois' waters. Importation of triploid grass carp into Illinois from other states and transportation/stocking within Illinois requires a "Restricted Species Transportation/Stocking Permit" which may be obtained from the Illinois Department of Natural Resources.

Permit applications may be requested from any Regional or Springfield offices of the Division of Fisheries. Illinois licensed fish dealers will be permitted to sell triploid grass carp to the lake or pond owners for stocking purposes provided: 1) a "Restricted Species Transportation/Stocking Permit" has been obtained for the particular water body from the Department of Natural Resources; 2) the owner obtains a "Bill of Sale" from the Illinois licensed fish dealer stating the fish are triploid; and 3) the triploid grass carp have

been tested for sterility by the U.S. Fish and Wildlife Service, a public laboratory, or a private laboratory.

For the private pond owner who does not purchase triploid grass carp from an Illinois licensed fish dealer or who wishes to purchase triploid grass carp from an Illinois licensed fish dealer whose valid permit does not include the owner's pond or lake, the owner must: 1) obtain a "Restricted Species Transportation/Stocking Permit" from the Department of Natural Resources two weeks prior to the desired pickup time; 2) obtain a "Bill of Sale" from the Illinois licensed fish dealer stating the fish are triploid; and 3) have the triploid grass carp tested for sterility at the Department of Agriculture Laboratory in Centralia, Illinois, before stocking into the water body.

STOCKING RATES

The Illinois Department of Natural Resources bases the number of triploid grass carp to stock on: 1) field investigations conducted by the Department's Division of Fisheries, 2) the latest available research conducted by the Illinois Natural History Survey and Southern Illinois University, and 3) the numerous years of experience with grass carp stockings and research completed by the Iowa Conservation Commission, the Missouri Conservation Department, and the Nebraska Fish and Game Department.

Table 1 provides general stocking guidelines for an "average" aquatic plant problem in an "average" pond under 10 acres. These guidelines take into account an "average" aquatic plant community (in the context of grass carp food preference) distribution expressed as a percentage of the entire surface acreage. For ponds greater than 10 acres or in cases where the pond owner desires more precise stocking rate calculations, the pond owner must contact the local Regional Fisheries Biologist for assistance in calculating the appropriate stocking rate.

In order to calculate a more precise stocking rate, the following information about the pond must be accurately collected by the owner and transmitted by phone or in writing to the appropriate Regional Fisheries Biologist:

1. Determine the size (in acres) of the pond or lake to be stocked.
   Example: The pond to be stocked is 10 acres.
2. Determine the percentage of the pond that is vegetated when the plants are at their peak.
   Example: The pond has 40% of its surface area covered with plants.
3. Determine the percentage of the pond that is less than 8 feet deep.
   Example: 50% of the pond area is less than 8 feet deep.
4. Determine the county of the State where the pond may be found.
   Example: The pond is located in Saline County.
5. Determine the dominant plant (the one targeted for control).
   Example: The dominant plant is sago pondweed.

TABLE 1

Suggested regional stocking rates for grass carp (8-12", if bass are present) into lakes and ponds in Illinois.

Percent Plant Coverage	No. of Triploid Grass Carp per Lake Acre		
10 - 20	Stocking not recommended; mechanical or chemical spot treatment as necessary.		
20 - 40	3 (South),	4 (Central),	5 (North)
40 - 60	5 (South),	7 (Central),	10 (North)
Over 60	7 (South),	10 (Central),	15 (North)

If the lake or pond owner is in doubt as to the need to stock triploid grass carp, or how many to stock, they should contact their local Regional Fisheries Biologist, or write to the Division of Fisheries, Illinois Department of Natural Resources, 600 North Grand Avenue West, Springfield, Illinois 62706.

Remember that aquatic vegetation control with triploid grass carp will take time. Monitoring the changes in the abundance of aquatic vegetation following stocking should be done each year. If the desired results are not achieved within three summers following stocking, consider increasing the number of triploid grass carp in the lake or pond, but do not exceed the maximum shown in Table 1. Triploid grass carp will live for many years in your lake or pond. However, sometime in the future (approximately 7 years), restocking will probably become necessary to continue the desired level of control.

Obtaining the desired level of aquatic vegetation control by stocking triploid grass carp must be accomplished gradually over time. Attempting to reduce the number of aquatic plants quickly by stocking large numbers of triploid grass carp will work, but at the expense of the bass, bluegill, and channel catfish, whose well-being are dependent upon about 20 to 40 percent of the aquatic vegetation remaining in the lake or pond.

TABLE 2
PLANTS AND ALGAE WHICH GRASS CARP ARE CONSIDERED TO CONTROL

Bladderwort	Naiads
Chara	Parrot feather *(Myriophyllum)*
Coontail *(Ceratophyllum)*	Pond weeds *(Potamogeton)*
Elodea	Spikerush
Fanwort	Widgongrass
Hydrilla	

TABLE 3
PLANTS AND ALGAE WHICH GRASS CARP WILL NOT EFFECTIVELY CONTROL

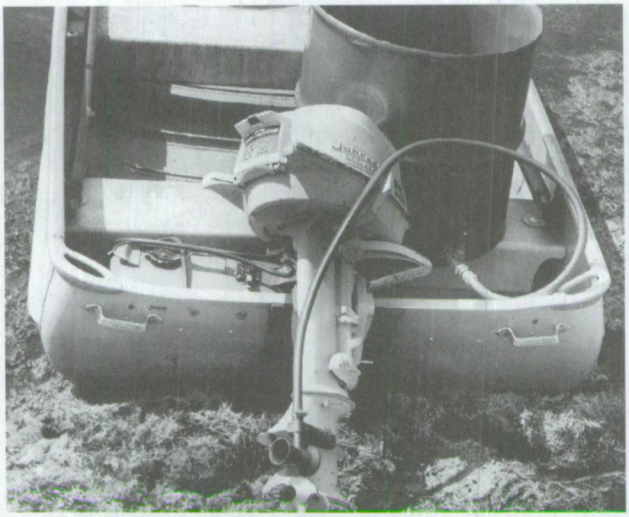
Alder	Frogbit	Southern watergrass
Alligatorweed	Madencain	Torpedograss
American lotus	Pickerelweed	Water shield
Arrowhead	Planktonic algae	Water hyacinth
Buttonbush	Rushes	Water pennywort
Cattails	Sedges	Water primrose
Filamentous algae*	Smartweed	Willows
Fragrant water lily	Spatterdock	White water lily

*Filamentous algae may be controlled by grass carp 2-4 inches in length in ponds without predators. Larger fish may consume filamentous algae, but it is not a preferred food and effective control may be unpredictable.

PROCEDURES FOR HERBICIDE CONTROL OF AQUATIC PLANTS

DETERMINING THE AREA TO BE TREATED

The volume of most bodies of water can be expressed in *acre feet.* For example, a lake that has ten acres of water and an average depth of 7 feet contains *70 acre feet* of water. If only a portion of the water area is to be treated, this portion can be figured the same way by obtaining its surface area and multiplying by its average depth in *feet.* The average depth for most small lakes and ponds is about half of the maximum depth. The average depth of a lake can be determined by taking a number of soundings with an electronic echo sounder, a long pole or weighted rope marked in feet. These measurements can be totaled and then divided by the total number of soundings made to obtain an average depth.



Boat bailer attached to outboard motor for treating aquatic plants.

The surface acreage of an area can be figured by multiplying the average length in feet times the average width in feet and dividing by 43,560. (One acre contains 43,560 square feet.) The area of a circular shaped water can be figured by multiplying 3.1416 times the radius in feet, squared and dividing by 43,560. The area of a triangular shaped water can be figured by multiplying the base times the altitude in feet and dividing by two. The resulting figure can then be divided by 43,560 to obtain the acreage.

DOSAGE

Herbicides are available in liquid, wettable powder, pellet or granular form. The liquid formulations are expressed as pounds of active ingredient per gallon of liquid. Wettable powders, pellet and granular formulations are expressed as the percent of the active material. All dosages of herbicides are figured on the amount of active chemical ingredient. **The herbicides recommended in this bulletin are listed in the back under the section "SOURCES OF SUPPLY AND SERVICE" by the common name, chemical name, amount of active ingredient, trade name and manufacturer.**

After the acreage or acre feet of the water to be treated has been determined, this figure can be multiplied by the recommended dosage (in gallons for pounds) to obtain the total amount of herbicide needed. For ease in calculating dosages, the concentration of most herbicides for *submersed* aquatic plant control is expressed in *parts per million.* Parts per million means one part of the chemical (active ingredient) per one million parts of water. The expression of parts per million equals 2.7 pounds or 2.7 pints per acre foot ($43{,}560 ft^3$). The herbicide and dosage required will vary with the specific plant being treated.

TREATMENT

Applications of most aquatic herbicides should be done in the *spring* when the plants are young, growing rapidly, and before they have reached the seeding stage. After the plants are mature, the herbicides may not be as effective. In Illinois, most aquatic herbicide applications should be done *before July first.* The actual application should be done early in the day, under sunny conditions, and when the water temperature is above 60°F. One application of herbicide may control the plants for the growing season, but several successive monthly treatments may be necessary, particularly when the vegetation is quite dense. Yearly treatments may be required because mature seeds are not killed by

the herbicide. Treatments of algae plants may have to be done periodically throughout the summer for effective control.

The lake owner can expect to treat plants annually as they are similar to land plants which have to be controlled year after year. Sometimes, when one plant is controlled, another plant may take its place. Herbicide applications may be *partial* or *complete*. With large bodies of water, it is more practical to treat only those shoreline areas and bays that are being heavily used for recreational purposes, while small ponds may be treated completely.[1]

PRECAUTIONS

The user of herbicides is cautioned to *follow the directions on the manufacturer's label.* Some of the chemicals are quite toxic to man and animals in their package (concentrated) form. Post signs or notify residents if the water is to be restricted for any of its uses.

A permit from the Illinois Environmental Protection Agency is required for treatments within 20 miles upstream of any pottable water supply or food processing water supply.

A person who applies an aquatic pesticide for hire must possess an Illinois Aquatic Commercial Pesticide Applicator License. A Commercial Not-for-Hire aquatic applicator's license is required for any body of water controlled by three (3) or more persons.

Most herbicides are toxic if taken internally, and direct contact with the chemical should be avoided. If it comes in contact with the skin, it should be washed off immediately with water. Rubber boots, gloves and a face mask should be used while applying chemicals on the vegetation. **Humans, pets, cattle and other animals should be kept from treated water for a period of time as specified by the manufacturer's label.**

Some of the herbicides, such as copper sulfate, are highly corrosive to metals, so that wooden, painted, enameled or copper lined containers may have to be used for mixing and applying the solution. The sprayer should be thoroughly cleaned after each operation to prevent damage. The herbicide container should be triple rinsed and *properly discarded* according to label directions. Never reuse an empty pesticide container.

Water from the treated lake should not be used for watering shrubs or lawns for several days as the concentration of the herbicide may be strong enough to kill such plants.[2]

When aquatic plants cover an extensive area of the lake, only a portion should be treated at one time to avoid a fish kill due to oxygen depletion. The oxygen depletion will result from the decaying plants. The remaining portion can be treated a week or two later.

Many aquatic plant control chemicals will substantially reduce fish food organisms (insects, plankton) and in some instances, the control of one kind of plant will promote the increase of another kind (e.g., kill submersed vegetation and end up with an algae bloom).

METHODS OF APPLICATION

Liquid herbicides can be applied to small lakes and ponds by a small hand sprayer, back pack sprayer or by "broadcasting" the herbicide solution with a small pan or dipper. For more extensive areas and large lakes, a small, motor-powered pump can be used on the discharge side of the pump. This hose can also be attached to a length of pipe with small holes drilled in it to act as a boom sprayer in front of a boat to treat submersed vegetation. Tractor sprayers and orchard sprayers can also be used in applying aquatic herbicides.

There are boat bailers on the market that can be attached to the outboard motor so that as the boat moves through the water the chemical solution can be drawn into the water in the wake of the motor. This method is simple and very effective if the growths

[1]Sonor will not be effective in partial treatments; use in whole volume treatments only.

[2]Certain formulations are safe for turf irrigation. Check the label.

are not too massive.

In some areas, commercial applicators are available to furnish and apply the necessary herbicide. The applicator should be licensed by the Illinois Department of Agriculture to do aquatic plant control.

Most herbicides should be diluted with water or a recommended carrier before they are applied to obtain even coverage. The herbicide can be diluted prior to or during the application. Granular herbicides can be broadcasted or spread with a seeder that is operated by hand or motor. *When treating submersed vegetation, it is important that the deeper water areas receive more chemical in order to have a uniform concentration.*

TYPES OF AQUATIC VEGETATION AND HERBICIDES RECOMMENDED FOR CONTROL

There are four general types of aquatic plants: algae, floating plants, submersed plants and emersed plants. Since no one herbicide will control all types, **it is very important that the plant be identified before application of the herbicide.** Help in identification of aquatic plants can be obtained by sending a sample of the plant along with a completed copy of the form at the end of this booklet to the Regional Fisheries Biologist or the Division of Fisheries of the Illinois Department of Natural Resources. The plant specimens mailed for identification should be kept moist in plastic wrapping.

An illustration, a brief description and recommended herbicide dosage for each type of the more common aquatic plants follow:

Aquatic plants look very similar.

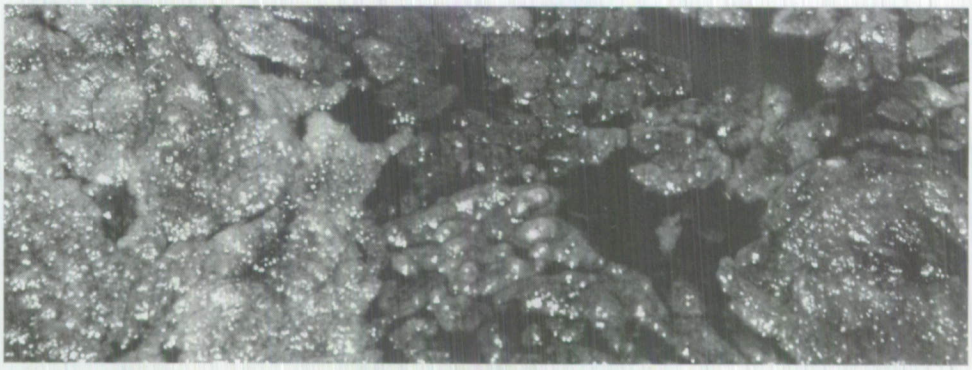
(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Plankton Algae Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Copper sulfate pentahydrate[1]	0.27 - 0.54	3.0 - 6.0 pounds/surface acre applied as a solution
Cutrine Plus (liquid)	0.2	0.6 gallons/surface acre
K-TEA	0.2 - 0.5	0.7 - 1.7 gallons/acre-foot
Clearigate	0.1 - 0.5	0.9 - 4.4 gallons/acre-foot
Captain	0.2	0.6 gallons/acre-foot

[1]Corrosive to metals.

ALGAE:

Algae are small, primitive plants which do not have true leaves or flowers and reproduce by means of minute spores. They can be found floating or attached to submerged surfaces in most lakes, ponds and streams. In many waters, particularly in hot weather, these plants multiply rapidly.



Plankton Algae

Excessive growth of microscopic plankton algae, often referred to as a "bloom," may cause the water to appear soupy green or brown. Common examples of "bloom" include blue-green algae such as *Microcystis* and *Anabaena*. Plankton algae can be controlled by treating only the upper two feet of water with an algicide (NOTE: The treatment of plankton algae is likely to result in dissolved oxygen depletion within the water column which may result in a fish kill.) or by phosphorus precipitation/inactivation.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Filamentous Algae Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Copper sulfate pentahydrate[1]	0.27 - 0.54	3.0 - 6.0 lbs./acre-foot applied as a solution
Cutrine Plus (liquid)	0.2	0.6 gal./acre-foot
Cutrine Plus (granular)	—	60 lbs./surface acre
K-TEA	0.5 - 1.0	1.7 - 3.4 gal./acre-foot
Hydrothol 191 (liquid)[2]	0.05 - 0.2	0.6 - 2.2 pints/acre-foot
Hydrothol 191 (granular)[2]	0.05 - 0.2	3.0 - 11.0 lbs./acre-foot
Reward[3]	0.75 - 1.5	1 - 2 gal./surface acre
Weedtrine-D[3]	0.5 - 1.5	3.5 - 10.5 gal./surface acre
Clearigate	0.2 - 0.6	1.8 - 5.3 gal./acre-foot
Captain	0.2 - 0.4	0.6 - 1.2 gal./acre-foot

[1]Copper sulfate can be applied as a saturated solution—all the copper sulfate that will dissolve in a given volume of water. It is corrosive to metals.
[2]Suggested for use by commercial applicators only.
[3]Controls certain filamentous algae.

Filamentous Algae

Filamentous algae, commonly known as pond scum, consists of growths of long, stringy, hair-like strands. Some of the green and brown scums may be slimy or cottony in appearance. Common examples are: *Cladolphora* — cotton mat type; *Spirogyra* — slimy and green; *Hydrodictyon* — water net; and *Pithophora* — horsehair clump type.

Copper sulfate (bluestone, blue vitrol) is the cheapest chemical for the control of most types of algae. In hard water, copper, when dissolved in the lake water, unites with carbonates in the water to form an insoluble precipitate and is not available for the control

of algae. Applying citric acid along with copper sulfate enables copper to stay in solution for a longer period, enhancing its algicidal effect. A ratio of copper sulfate to citric acid of 2:1 by weight is effective. The most effective method of applying copper sulfate is in a solution and spraying it from a boat or the shoreline. Copper sulfate crystals can be placed in a burlap bag and dragged behind a boat, but *many* of the small undissolved crystals will sink to the bottom where they are not effective. Crystalline copper sulfate is available in crystals the size of rock salt, fine crystals, flakes or powder. The smaller the crystal the easier it is to dissolve in water. A *commercial grade* of copper sulfate should be used in algae treatments. Good results have also been obtained when the *powdered* form of copper sulfate is applied directly to the lake surface.

Copper sulfate is more effective when the water temperature is 60° F or above.

After the algae plants absorb the copper, their color fades from green to grayish white, indicating that the plants are in the process of dying. A dosage chart for shoreline application follows:

DOSAGE CHART FOR SHORELINE TREATMENTS OF FILAMENTOUS ALGAE WITH COPPER SULFATE							
Width of Treatment Area (feet)	Length of Shoreline (feet)						
	500	1000	2000	3000	4000	5000	5280 1 mile
50	3	6	12	18	25	32	34
100	6	12	25	38	50	62	66
150	9	18	37	56	74	93	98
200	12	24	49	74	99	124	131
250	15	30	61	93	124	155	164
300	18	36	74	112	149	187	185
	POUNDS OF COPPER SULFATE REQUIRED						

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Chara Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Copper sulfate[1]	1.0 - 1.5	2.7 - 4.1 lbs./acre-foot applied as a solution
Cutrine Plus (granular)	—	60 lbs./surface acre
Cutrine Plus (liquid)	0.4	1.2 gal./acre-foot
K-TEA	0.5 - 1.0	1.7 - 3.4 gal./acre-foot
Hydrothol 191 (liquid)[2]	0.05 - 0.8	0.6 - 1.1 gal./acre-foot
Hydrothol 191 (granular)[2]	0.05 - 0.2	3.0 - 11.0 lbs./acre-foot
Captain	0.4	1.2 gal./acre-foot
Clearigate	0.4 - 0.8	3.6 - 7.9 gal./acre-foot

[1]Corrosive to metals.
[2]Suggested for use by commercial applicators only.

Chara

Advanced forms of algae, such as *Chara* and *Nitella*, grow from the lake bottom with stems and branches and feel bristly. *Chara* has a musky odor and is usually found in hard water. Common names of *Chara* are muskgrass and stonewart. *Chara* and *Nitella* are often mistaken for underwater plants such as coontail or milfoil. These plants are sometimes difficult to kill, even when the proper herbicide has been used.

FLOATING PLANTS:

Floating plants include those that are not attracted to anything and freely float on the surface of the water.

Duckweed and Watermeal

(*Lemna spp.*) (*Wolffia spp.*)

Duckweed (*Lemna spp.*) and Watermeal (*Wolffia spp.*) are floating plants which often form a green blanket on the water surface. Duckweed has tiny leaves (fronds) with rootlets that hang down in the water. Watermeal appears as minute green grains floating on the water and is the smallest of all flowering plants.

Both of these plants may be found growing together, and frequently, their growth is so abundant that a layer of plants one to two inches thick may occur on the water surface. The wind and currents will concentrate duckweed and watermeal in certain portions of a lake. Because of this drifting and subsequent layering, these plants are *very* difficult to control. Duckweed and watermeal can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Duckweed & Watermeal Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward[1]	—	1 gal./surface acre
Sonar A.S. (liquid)[2,3]	0.01 - 0.09	1.0 - 7.7 oz./surface acre
Weedtrine-D[1]	—	2 oz./gallon of water, thoroughly wet plants
Clearigate	—	4.4 - 8.7 gal./surface acre
Avast! (liquid)[2,3]	0.06 - 0.15	0.16 - 0.4 qts./surface acre
Nautique	0.6 - 1.0	1.8 - 3.0 gal./acre-foot

[1]Mix with nonionic surfactant.
[2]Controlled only with a surface application.
[3]Watermeal partially controlled at maximum label rate.

SUBMERSED PLANTS:

Submersed aquatic plants are usually, but not always, rooted to the bottom. Their stems and leaves may fill the water to the surface. These plants are commonly called moss, sea weed, bass weed or water grass. They include many different species of pondweed, coontail, milfoil, waterweed, naiad, water stargrass, horned pondweed and water buttercup. Some of these plants have floating leaves. Submersed plants have three distinct types of leaf attachments: *whorled, opposite* and *alternate*. Whorled leaf attachments are those that have more than two leaves attached at the same point on the main stem. Opposite leaf attachments are those that have *only* two leaves attached to the same point on the main stem. Alternate leaf attachments are those that have one leaf attached singly at different heights on the stem. The leaves are in a staggered arrangement and they are never opposite each other.

Due to the toxicity to fish, the use of Hydrothol 191 for control of submersed aquatic plants is suggested only by commercial applicators on a marginal or partial basis rather than a complete or overall type treatment. The remaining herbicide concentrations and dosages listed for all of the submerged aquatic plants are for complete or entire treatments of vegetated areas.

PLANTS WITH WHORLED LEAF ATTACHMENTS

Coontail

(*Ceratophyllum demersum*)

The common name of coontail comes from the resemblance of a branch of the plant to the tail of a raccoon. It is also called hornwort. This plant grows entirely under water and has a central hollow stem with thread-like forked leaves. The stems may be 20 feet long. Extensive growths of coontail resemble an underwater forest of "Christmas trees." Coontail grows in clear water to depths of 10 to 15 feet. *Do not confuse coontail with chara or milfoil.* Coontail is a common plant throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Coontail Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward	—	2.0 gal./surface acre
Aquathol K (liquid)	1.0 - 2.0	0.6 - 1.3 gal./acre-foot
Aquathol K (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000ft^2
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot
Komeen	0.5 - 1.0	1.7 - 3.34 gal./acre-foot
Weedtrine-D	—	10 gal./surface acre
Navigate (granular)[3]	—	150 - 200 lbs./surface acre
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Aquathol K Super (granular)	1.8 - 2.0	7.95 - 8.8 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.10 - 0.09	1.0 - 7.7 oz./acre-foot
Sonar SRP (pellets)	0.16 - 0.09	0.9 - 5.0 lbs./surface acre

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.
[3]Repeat treatment maybe necessary.

Eurasian Milfoil
(Myriophyllum spicatum)

This exotic has fine, feather-like leaflets which are dark green, with tips distinctly red, mostly straight and nearly equal length. Eurasian milfoil may grow in depths of 15 to 20 feet.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Eurasian Milfoil Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Navigate (granular)	—	100 - 200 lbs./surface acre
Aquathol (granular)	2.0 - 3.0	54 - 81 lbs./acre-foot
Aquathol K (liquid)	2.0 - 3.0	1.3 - 1.9 gal./acre-foot
Aquathol K Super (granular)	2.0 - 4.0	8.8 - 17.6 lbs./acre-foot
Reward	—	1 - 2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft.^{2}
Avast! (liquid)[2]	0.01 - 0.02	0.87 - 1.6 oz./acre-foot
Avast! SRP (pellets)	0.016 - 0.045	0.9 - 2.5 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.045	0.9 - 2.5 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.02	0.9 - 1.6 oz./acre-foot
Aqua Kleen (granular)	—	100 lbs./acre
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot
Clearigate	0.8 - 1.0	7.1 - 8.7 gal./acre-foot
Weedtrine-D (liquid)	—	5 - 10 gal./surface acre

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

Water Milfoil
(Myriophyllum spp.)

The long hollow stem of water milfoil has fine feather-like leaflets which are usually bright green with tips usually not red tinged and which curve toward and extend nearly to the leaf tip. Milfoil grows entirely under the water and may be found growing in depths of 8 to 10 feet. Milfoil is commonly found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Water Milfoil Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Aquathol (granular)	2.0 - 3.0	54 - 81 lbs./acre-foot
Aquathol K (liquid)	2.0 - 3.0	1.3 - 1.9 gal./acre-foot
Aquathol K Super (granular)	2.0 - 4.0	8.8 - 17.6 lbs./acre-foot
Reward	—	1 - 2 gal./surface acre
Weedar 64 (liquid)	—	2.5 - 10 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft.^{2}
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Aqua Kleen (granular)	—	100 lbs./surface acre
Navigate (granular)	—	100 lbs./surface acre
Weedtrine-D (liquid)	—	5 - 10 gal./surface acre
Clearigate	0.8 - 1.0	7.1 - 8.7 gal./acre-foot
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

American Elodea
(Elodea canadensis)

American elodea is also called water weed, anachris and ditch moss. It grows entirely under water with four leaves attached to a center stem. The margin of the leaves have microscopic barbs. Elodea can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

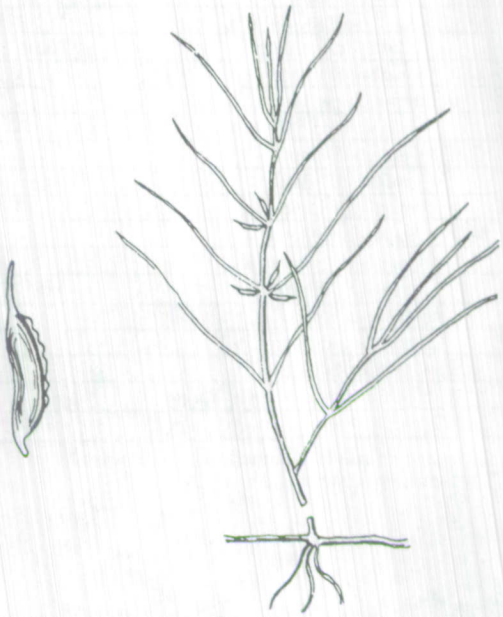
American Elodea Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Reward	—	2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Komeen	0.5 - 1.0	1.7 - 3.34 gal./acre-foot
Weedtrine-D (liquid)	—	10 gal./surface acre
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

PLANTS WITH OPPOSITE LEAF ATTACHMENTS

Horned Pondweed
(Zannechellia palustris)

Horned pondweed has thread-like stems with the long narrow leaves arranged on the stems opposite of each other. This plant can be easily distinguished from others by its seeds being in clusters in the axils of the leaves. The mature seeds show a distinct horn-like projection from which this plant derives its name of horned pondweed. This plant is more commonly found in the northern half of Illinois.



(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Horned Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Aquathol K (liquid)	1.0 - 2.0	0.6 - 1.3 gal./acre-foot
Aquathol Super K (granular)	1.0 - 3.0	4.4 - 13.2 lbs./acre-foot
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Nautique	0.6 - 1.0	1.8 - 3.0 gal./acre-foot

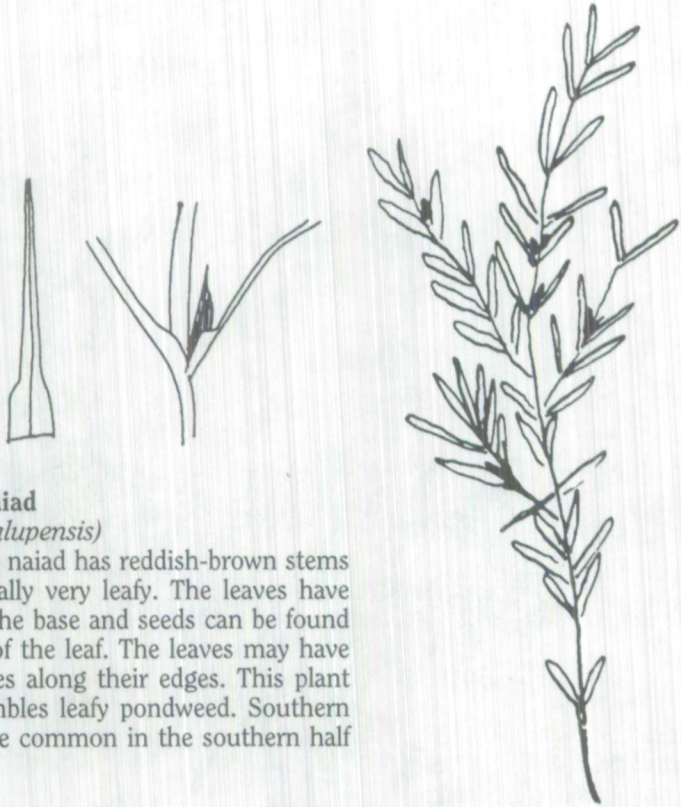
[1]Suggested for use by commercial applicators only.

Waterstargrass
(Heteranthera dubia)

Waterstargrass has flat, grass-like leaves and stems. It is a rooted plant that grows underwater and has tiny pale yellow flowers the shape of a star. The leaves have almost a complete lack of a mid-vein. Waterstargrass is more common in the northern half of Illinois. The plant may flower July through October. Waterstargrass is also called mudplantain and ducksalad.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Waterstargrass Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	2.0 - 3.0	54 - 81 lbs./acre-foot
Aquathol K (liquid)	2.0 - 3.0	1.3 - 1.9 gal./acre-foot
Aquathol K Super (granular)	2.0 - 4.0	8.8 - 17.6 lbs./acre-foot
Reward	—	0.35 gal./surface acre
Navigate (granular)	—	100 - 200 lbs/acre



Southern Naiad
(Najas guadalupensis)

Southern naiad has reddish-brown stems that are usually very leafy. The leaves have sheathes at the base and seeds can be found in the axils of the leaf. The leaves may have minute spines along their edges. This plant closely resembles leafy pondweed. Southern naiad is more common in the southern half of Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Southern Naiad Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward	—	1 - 2 gal./surface acre
Komeen (liquid)[1]	0.5 - 1.0	1.7 - 3.3 gal./surface acre
Aquathol (granular)	0.5 - 1.5	13 - 40 lbs./acre-foot
Aquathol K (liquid)	0.5 - 1.5	0.3 - 1.0 gal./acre-foot
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Hydrothol 191 (liquid)[2]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[2]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[3]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Weedtrine-D (liquid)	—	5 gal./surface acre
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Aquacide (pellet)	—	2.5 - 4.0 lbs./1,000 ft.^{2}

[1]Fish may be killed at application rates; toxicity to fish generally decreased with increase in water hardness.
[2]Suggested for use by commercial applicators only.
[3]Treat entire volume of water.

Brittle Naiad
(Najas minor)

Brittle naiad has long pointed leaves with *visible spines*. The leaves are usually recurved in appearance. This plant is *very brittle* and breaks easily on handling. Naiad grows in shallow water and can be found more commonly in the southern two-thirds of Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Brittle Naiad Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	0.5 - 1.5	13 - 40 lbs./acre-foot
Aquathol K (liquid)	0.5 - 1.5	0.3 - 1.0 gal./acre-foot
Reward	—	1 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Weedtrine-D (liquid)	—	5 gal./surface acre
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Aquacide (pellet)	—	2.5 - 4.0 lbs./1,000 ft.^{2}

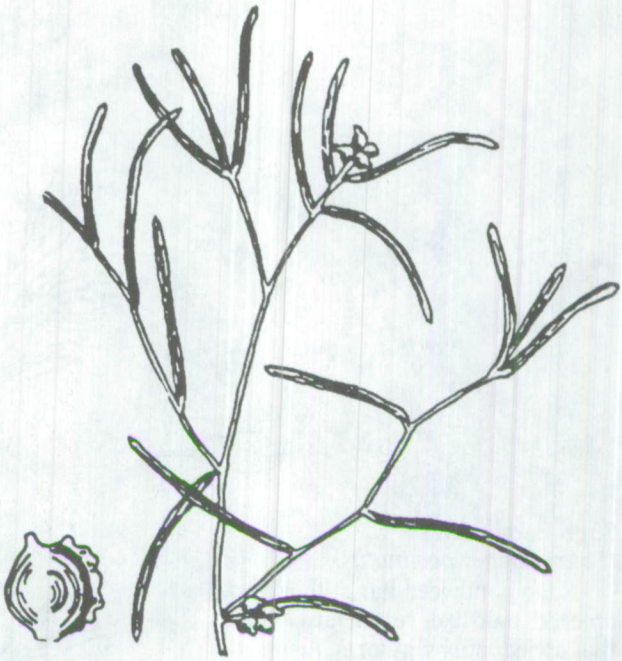
[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

PLANTS WITH ALTERNATE LEAF ATTACHMENTS

Illinois has approximately 20 species of pondweeds *(Potamogeton spp.)*. Pondweeds grow under the surface of the water with some having floating leaves as well. The same herbicide cannot be applied to all the pondweeds as some are more susceptible than others and some require specific type chemicals. For identification purposes, the pondweeds are divided into three general groups: those with floating leaves which have various shaped leaves floating on the surface; those with fine leaves completely submersed; and those with broad leaves completely submersed. One common factor is that all of the leaves of this family are attached to the center stem in *alternate arrangement,* although the floating leaves and submersed leaves may be widely different in shape and texture. In Illinois, alternate leaf attached plants are not usually affected by 2, 4-D and chemically related compounds.

Pondweed showing grass-like growth.

PONDWEEDS WITH FINE LEAVES COMPLETELY SUBMERSED



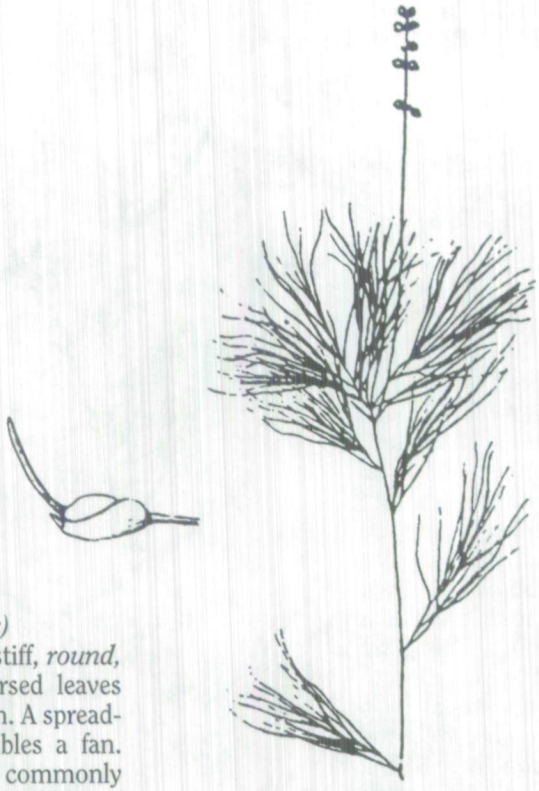
Leafy Pondweed
(Potamogeton foliosus)

Leafy pondweed has short, grass-like submersed leaves. During the summer, a clump of 4 to 8 fruiting bodies are attached to a center stem by a *short* seed stalk. Very few, if any, of these seeds ever reach the water surface. This plant grows from the shoreline to depths of approximately 4 feet. Leafy pondweed is the most common of all the pondweeds and is found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Leafy Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Aquathol K (liquid)	1.0 - 2.0	0.06 - 1.3 gal./acre-foot
Reward	—	2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Weedtrine-D (liquid)	—	10 gal./surface acre
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.



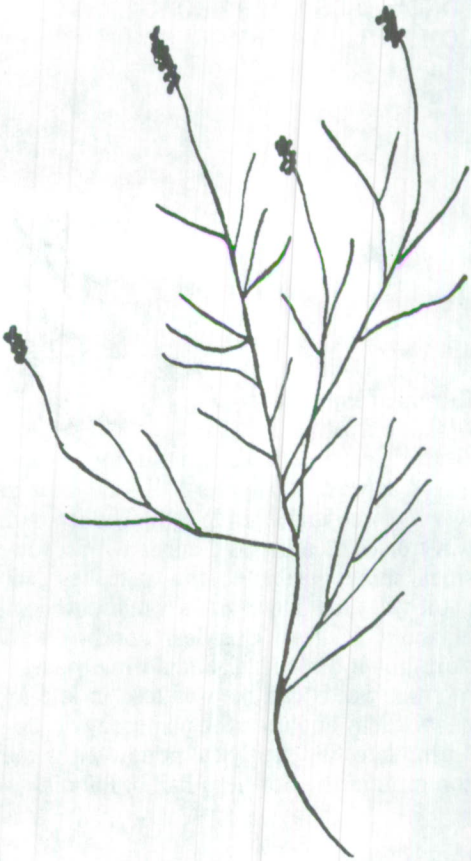
Sago Pondweed
(Potamogeton pectinatus)

Sago pondweed has stiff, *round, tapered* hair-like submersed leaves that appear bushy in form. A spreading of the leaves resembles a fan. This pondweed is more commonly found in the northern two-thirds of Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Sago Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Aquathol K (liquid)	1.0 - 2.0	0.06 - 1.3 gal./acre-foot
Reward	—	2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Weedtrine-D (liquid)	—	10 gal./surface acre
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Nautique	0.5 - 1.0	1.5 - 3.0 gal./acre-foot
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Aquathol Super K (granular)	1.0 - 3.0	4.4 - 13.2 lbs./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.



Small Pondweed
(Potamogeton pusillus)

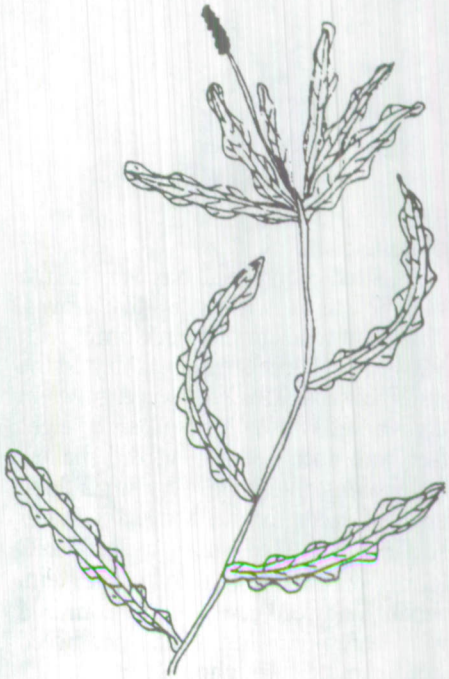
Small pondweed has very tough slender stems with grass-like leaves. This plant tends to grow in clumps with a large number of stems reaching to the water surface. This pondweed grows in deeper water, usually about six to eight feet, and does not inhabit the shallow water along the shore. Very small flowers and seeds extend above the water surface. The seeds have a seed stalk located on the terminal end of the stem. Small pondweed can be easily confused with leafy pondweed. Small pondweed can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Small Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Aquathol K (liquid)	1.0 - 2.0	0.06 - 1.3 gal./acre-foot
Aquathol K Super (granular)	1.0 - 3.0	4.4 - 13.2 lbs./acre-foot
Reward	—	2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Weedtrine-D (liquid)	—	10 gal./surface acre
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Aquaquat	—	2 pints/1,000 ft^2
Avast! (liquid)[2]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

PONDWEEDS WITH BROAD LEAVES COMPLETELY SUBMERSED



Curlyleaf Pondweed
(Potamogeton crispus)

Curlyleaf pondweed has thin membranous leaves approximately one-half inch wide and two to three inches in length. The leaves are wavy or curly along the edges with a row of small spines visible to the naked eye. This plant will grow along the shoreline to depths of about 12 feet. Curlyleaf pondweed may start growing in the fall and during the winter months. Seeds can be produced in late April or early May and then the plant may die down during late July. Curlyleaf pondweed is more common in the northern half of Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

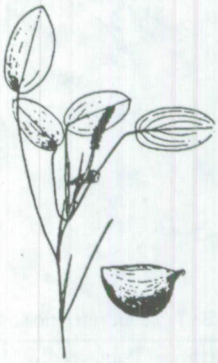
Curlyleaf Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	0.5 - 1.5	13 - 39 lbs./acre-foot
Aquathol K (liquid)	0.5 - 1.5	0.3 - 0.9 gal./acre-foot
Aquathol K Super (granular)	0.5 - 3.0	2.2 - 13.2 lbs./acre-foot
Reward	—	2 gal./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellet)	0.016 - 0.045	0.9 - 2.5 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.02	0.87 - 1.6 oz./acre-foot
Weedtrine-D (liquid)	—	10 gal./surface acre
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Avast! (liquid)[2]	0.01 - 0.02	0.87 - 1.6 oz./acre-foot
Avast! SRP (pellet)	0.016 - 0.045	0.9 - 2.5 lbs./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

PONDWEEDS WITH FLOATING LEAVES

American Pondweed
(Ponamogeton nodosus)

American pondweed has submersed leaves that are very thin and linear in shape and floating leaves that are large and elliptic in shape. This is the most common of the floating leaf pondweeds in Illinois and is state wide in occurrence.



Floatingleaf Pondweed
(Potamogeton natans)

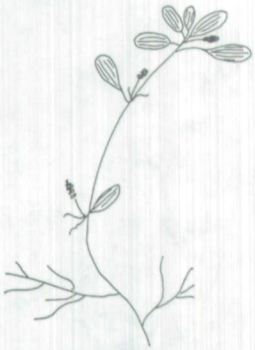
Floatingleaf pondweed has long and narrow submersed leaves and elliptic-shaped floating leaves. This plant is found throughout Illinois.

Illinois Pondweed
(Potamogeton illinoensis)

Illinois pondweed has long and narrow submersed leaves and wide oval-shaped floating leaves. This pondweed can be found throughout Illinois.

Largeleaf Pondweed
(Potamogeton amplifolius)

Largeleaf pondweed has large, elliptic-shaped floating leaves and broad, partially folded submersed leaves. This plant is more commonly found along the eastern edge of Illinois.



Waterthread Pondweed
(Potamogeton diversifolius)

Waterthread pondweed has thread-like submersed leaves and small, round floating leaves. The floating leaves may be three-fourths to one inch in length and one-fourth to one-half inch in width. They are usually seven-nerved. Waterthread pondweed is more commonly found in southwestern Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

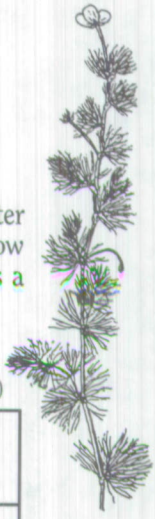
Waterthread Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquathol (granular)	1.0 - 2.0	27 - 54 lbs./acre-foot
Aquathol K (liquid)	1.0 - 2.0	0.6 - 1.3 gal./acre-foot
Aquathol K Super (granular)	1.0 - 3.0	4.4 - 13.2 lbs./surface acre
Hydrothol 191 (liquid)[1]	0.5 - 2.5	0.7 - 3.4 gal./acre-foot
Hydrothol 191 (granular)[1]	0.5 - 2.5	27 - 136 lbs./acre-foot
Sonar SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Sonar A.S. (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Clearigate	0.5 - 1.0	4.4 - 8.7 gal./acre-foot
Avast! (liquid)[2]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot

[1]Suggested for use by commercial applicators only.
[2]Treat entire volume of water.

MISCELLANEOUS SUBMERSED PLANTS

Water Buttercup
(Ranunculus spp.)

Water buttercup is also called water crowfoot and white or yellow water buttercup. This plant grows completely underwater. Small white or yellow flowers bloom at the surface from June to October. Water buttercup has a hollow stem which supports tufts of thread-like leaves.



(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Waterthread Pondweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward	0.5	0.7 gal./acre-foot
Rodeo[1]	—	1.5 pints/surface acre as a broadcast solution or 0.75% - 1.5% solution applied with hand-held equipment.
AquaPro[1]	—	2 pints/surface acre as a broadcast solution or 0.75% - 1.5% solution applied with hand-held equipment.
Accord[1]	—	0.75% - 2% by volume apply with hand-held equipment

[1]Add nonionic surfactant.

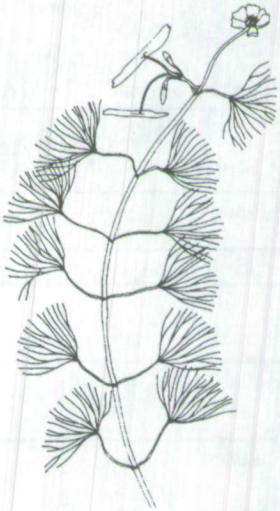
Bladderwort
(Utricularia vulgaris)

Bladderwort has stems that float horizontally beneath the water surface and may extend three feet or more. The leaves are alternate and divided many times. Some of the leaf segments have *bladders* on them that assist in floatation of the plant. This plant blooms from July through August with yellow flowers extending above the surface. Bladderwort is more commonly found in northern Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Bladderwort Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward	—	1 - 2 gal./acre
Sonar A.S. (liquid)[1]	0.01 - 0.09	1.0 - 7.7 oz./acre-foot
Sonar SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Avast! (liquid)[1]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Aqua-Kleen	—	150 - 200 lbs./surface acre
Weedtrine-D	—	5 - 10 gal./surface acre

[1]Treat entire volume of water.



Fanwort
(Cabomba spp.)

Fanwort has fan-shaped leaves. Leaflets are forked and wider at the tip than at the base. Sometimes small floating leaves are present. Plants have a gelatinous slime. Flowers are white to lavendar.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Fanwort Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft^2
Sonar A.S. (liquid)[1]	0.10 - 0.09	1.0 - 7.7 oz./acre-foot
Sonar SRP (pellets)	0.016 - 0.09	0.9 - 5.0 lbs./acre-foot
Avast! (liquid)[1]	0.06 - 0.15	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)	0.016 - 0.09	0.9 - 5.0 qts./acre-foot

[1]Treat entire volume of water.

Emersed Plants

Emersed aquatic plants are those that grow above water in the shallow areas of lakes and ponds and along the shoreline. These plants may be annual or perennial types. Some of the emersed plants include cattails, lotus, water lily, creeping water primrose, smartweed, bulrush, waterwillow, willow, and buttonbush. Treatments for the specific types of plants follow:

Cattail

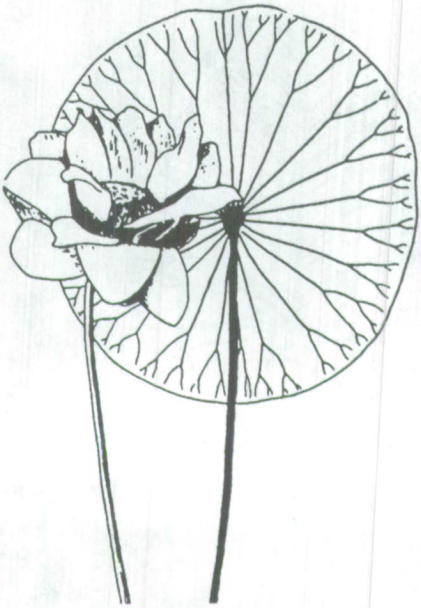
(Typha spp.)

Cattails are tall erect plants with leaves long and flat about one inch in width. They usually produce a long stalk with a seed spike at the end. There are two types of cattails in Illinois, narrow-leaf and broad-leaf. The latter is more common and both types can be found throughout the state. Cattails grow along the water's edge in shallow water. *Cattails should be treated before they have formed seed spikes.*

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Fanwort Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Reward[1]	—	1 - 2 gal./acre; spray to wet entire plant
Aquacide (pellets)	—	2 - 3 lbs/1,000 ft^2
AquaPro[1]	—	4.5 - 6 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	4.5 - 6 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	4.5 - 6 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Avast! (liquid)[2]	0.075 - 0.15	0.2 - 0.4 qts./acre
Avast! SRP (pellet)[2]	0.045 - 0.09	2.5 - 5 lbs./acre
Sonar A.S. (liquid)[2]	0.075 - 0.15	0.2 - 0.4 qts./acre
Sonar SRP (pellet)[2]	0.045 - 0.09	2.5 - 5 lbs./acre
Weedtrine-D	—	5 oz./gal. of water; mix with 1.0 oz. of surfactant/10 gal. of spray solution; wet foliage thoroughly

[1]Add nonionic surfactant
[2]Intermediate susceptibility.



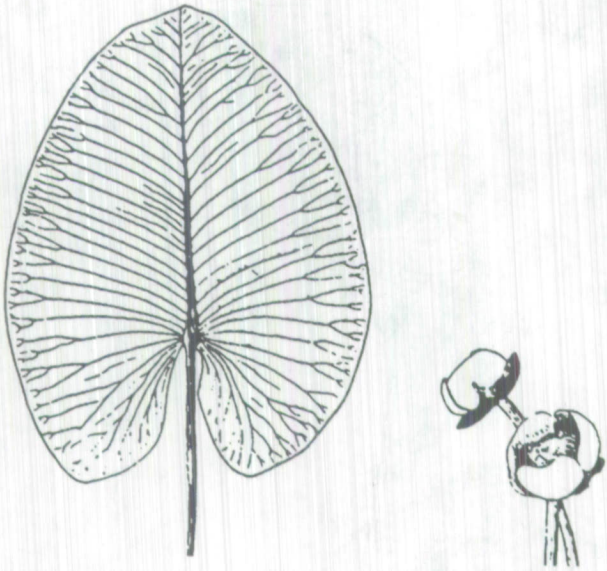
American Lotus
(Nelumbo lutea)

Lotus has large round leaves (up to 2 feet in diameter) that extend above the water; it produces a yellowish-white flower and later a large seed pod. The plant stem is attached in the center of a large *completely circular* leaf which is frequently cup-shaped. The leaf veins radiate from the junction of the stem in all directions and divide near the edge of the leaf. This plant has an extensive underground root stock. Lotus can be found throughout Illinois. It is also called yonkapen, yockernut, wankapen, duck acorn, water nut, and rattlenut from the nutlike seeds it produces. Lotus will grow in fairly deep water. *Lotus should be treated when the plants are in the flowering stage.* More than one treatment is usually necessary.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

American Lotus Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
AquaPro[1]	—	4.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	4.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	4.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Avast! (liquid)[2]	0.045 - 0.09	3.8 - 7.7 oz./acre-foot
Avast! SRP (pellet)[2]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Sonar AS (liquid)[2]	0.045 - 0.09	3.8 - 7.7 oz./acre-foot
Sonar SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot

[1]Mix with nonionic surfactant.
[2]Partially controlled.



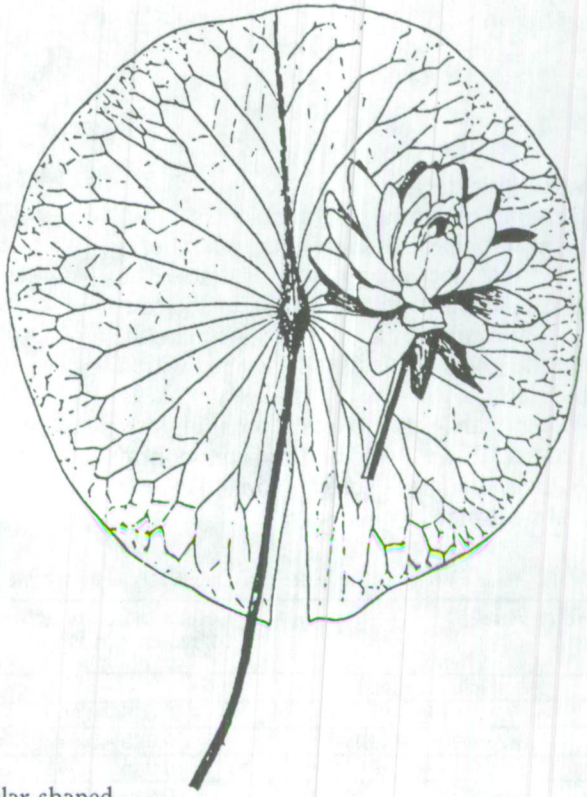
Spatterdock
(Nuphar advena)

Spatterdock has a *heart-shaped* leaf. The leaves may float or extend above the water surface. The stem is attached to the notch between the lobes of the leaf and extends to the tip of the leaf. From this main leaf vein, lateral veins extend to the edge where they are divided. The yellow flowers form a ball with petals that curve inward. Spatterdock is also called yellow pond lily and cow lily. More than one treatment is usually necessary. This plant is found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Spatterdock Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
AquaPro[1]	—	6.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	6.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	6.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Avast! (liquid)	0.06 - 0.09	0.16 - 0.4 qts./acre-foot
Avast! SRP (pellet)[2]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Sonar AS (liquid)	0.06 - 0.09	0.16 - 0.4 qts./acre-foot
Sonar SRP (pellet)[2]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Navigate (granular)[2]	—	150 - 200 lbs./surface acre

[1]Mix with nonionic surfactant.
[2]Partially controlled.



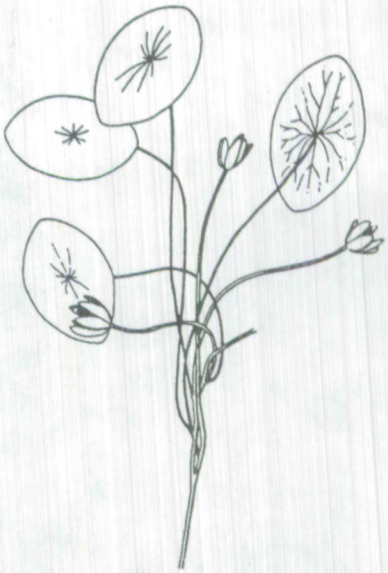
Water Lily
(Nymphae spp.)

Water lilies have large circular-shaped floating leaves with a *slit* from the edge to the center of the leaf. The stem is attached to the center of the leaf from which veins radiate. The veins are branched or subdivided at the edge of the leaf. This plant produces a pink or white flower that *floats* on the water. Water lilies can be found throughout Illinois. More than one treatment is usually necessary.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Water Lily Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquacide (pellets)	—	4.0 lbs./1,000 ft^2
Avast! (liquid)	0.45 - 0.09	3.8 - 7.7 oz./acre-foot
Avast! SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Sonar AS (liquid)	0.45 - 0.09	3.8 - 7.7 oz./acre-foot
Sonar SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Navigate (granular)	—	150 - 200 lbs./surface acre

[1]Partially controlled.



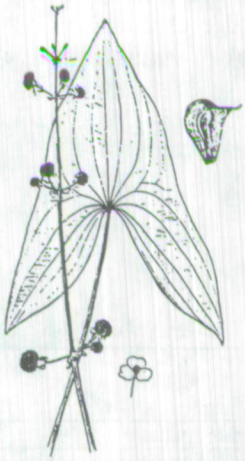
Water Shield
(Brasenia schreberi)

Water shield has leaves the *shape of a shield* that float on the water surface. The stem is attached to the middle of the leaf. The leaves may be 2 to 5 inches in length, and the underside is usually covered with a thick layer of jelly-like material. Water shield blooms with a dull purple flower in early summer. Water shield is more common in southern Illinois. Usually, more than one treatment may be necessary.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Water Shield Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft^2
Avast! (liquid)[1]	0.045 - 0.09	3.8 - 7.7 oz./acre-foot
Avast! SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Sonar AS (liquid)[1]	0.045 - 0.09	3.8 - 7.7 oz./acre-foot
Sonar SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Navigate (granular)	—	150 - 200 lbs./surface acre

[1]Partially controlled.

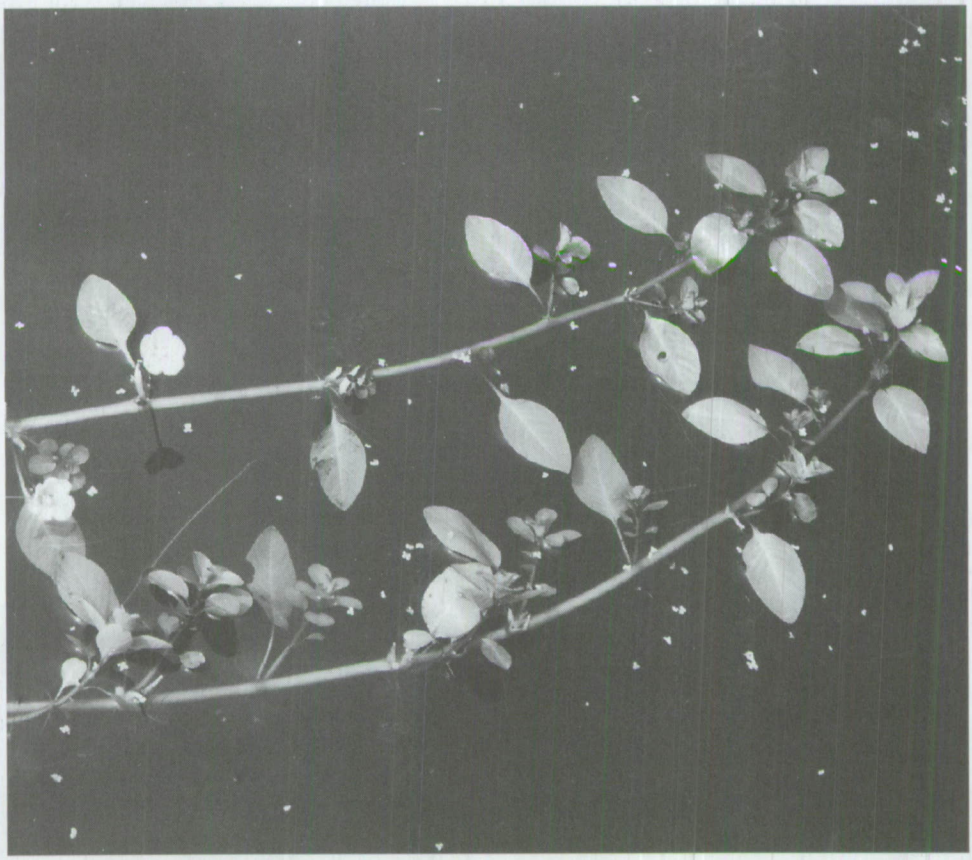


Arrowhead
(Sagittaria spp.)

Arrowhead plants usually have arrowhead-shaped leaves and tiny white flowers. The plant grows along the edge of lakes and ponds in shallow water. This plant is also called duck potato because of its tuber-like root. Arrowhead is found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Arrowhead Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Please contact your Regional office or local District office for recommendations.		



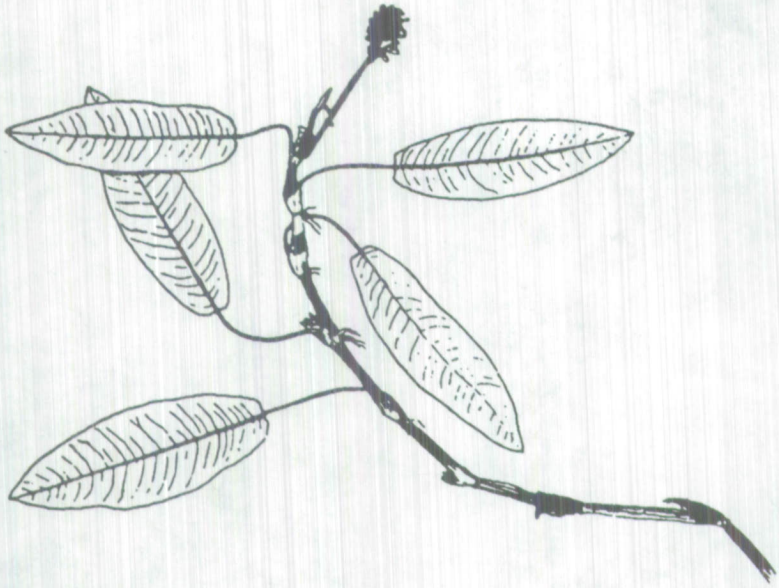
Creeping Water Primrose
(Jussiaea repens var. glabrescens)

Creeping water primrose grows in shallow water along the shorelines. The hollow red colored stems extend from the shoreline and support extensive light green leaves with bright yellow flowers in midsummer. An extensive fine root system extends below the water from the main stem. Primrose is more commonly found in the southern half of Illinois. Usually, more than one treatment may be necessary.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Creeping Water Primrose Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Avast! (liquid)[1]	0.045 - 0.15	3.8 - 7.7 oz./acre-foot
Avast! SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Sonar AS (liquid)[1]	0.045 - 0.15	3.8 - 7.7 oz./acre-foot
Sonar SRP (pellet)[1]	0.045 - 0.09	2.5 - 5.0 lbs./acre-foot
Rodeo[2,3]	—	0.75% solution applied using hand-held equipment
AquaPro[2,3]	—	0.75% solution applied using hand-held equipment
AquaNeat[2,3]	—	0.75% solution applied using hand-held equipment

[1]Partially controlled.
[2]Add nonionic surfactant.
[3]Spray to wet.



Water Smartweed
(Polygonum spp.)

Water smartweed commonly grows in shallow water along the shorelines of lakes and ponds. However, there are some species that will grow in water up to twelve feet in depth. The plant has jointed stems with conspicuous stipules located at the joints. The oblong leaves are about 4 inches in length. Smartweed flowers in mid-summer with dense pink or rose-colored flowers held erect above the water. Usually, more than one treatment may be necessary.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Water Smartweed Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
AquaPro[1]	—	1.5 - 2.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	1.5 - 2.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	1.5 - 2.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Accord[1]	—	0.75% - 2% solution applied by hand-held sprayer. Spray to wet.
Avast! (liquid)[2]	0.045 - 0.09	3.8 - 7.7 oz./surface acre
Avast! SRP (pellet)[2]	0.045 - 0.09	2.5 - 5.0 lbs./surface acre
Sonar AS (liquid)[2]	0.045 - 0.09	3.8 - 7.7 oz./surface acre
Sonar SRP (pellet)[2]	0.045 - 0.09	2.5 - 5.0 lbs./surface acre

[1]Add nonionic surfactant.
[2]Partially controlled.

Water Willow
(Justica americana)

Water willow is a perennial plant growing in dense stands along the shoreline. It has opposite leaf attachments and the leaves are long and narrow. The plant has a small bluish-white flower in mid summer. Water willow is found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Water Willow Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Granular 2, 4-D ester	—	20 lbs./surface acre
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft^2

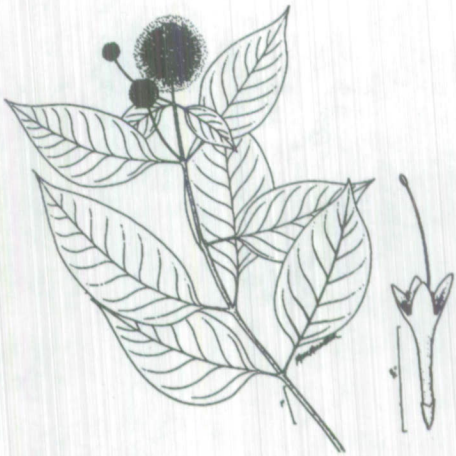
Willow
(Salix spp.)

Willows are shrubs or trees with alternate leaves. The flowers are catkins and sometimes appear in the spring before the leaves do. Willows can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Willow Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
AquaPro[1]	—	4.5 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	4.5 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	4.5 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer

[1]Add nonionic surfactant.



Buttonbush
(Cephalanthus occidentalis)

Buttonbush is also called buck brush, and it grows as a woody shrub with leaves opposite or in three's. The flowers are round balls at the end of long stalks. This is where this plant gets its name buttonbush. Buttonbush can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

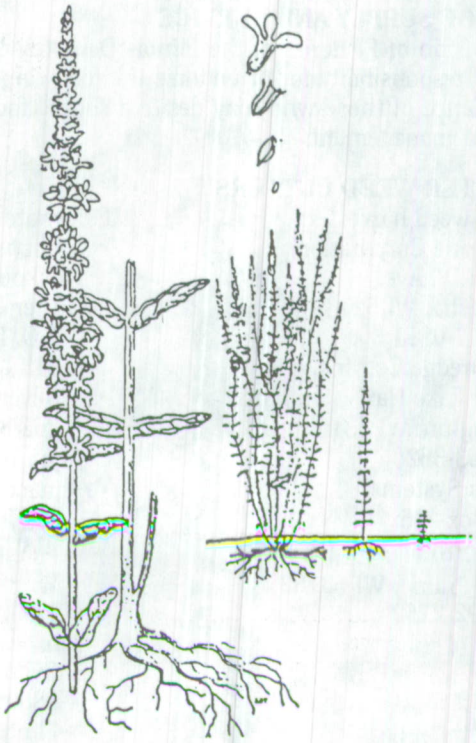
Buttonbush Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Please contact your Regional office or local District office for recommendations.		

Bulrush
(Scirpus spp.)

There are several species of bulrush, and they all grow in shallow water along shorelines. They may have triangular- or round-shaped stems and may be leafy or have no leaves at all but just long slender stems. The long stems usually will have a cluster of brownish flowers and seeds at the end of the stem. Bulrushes can be found throughout Illinois.

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Bulrush Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
Granular 2, 4-D ester	—	100 lbs./surface acre of plants
Aquacide (pellets)	—	2.5 - 4.0 lbs./1,000 ft^2



Purple Loosestrife
(Lythrum salicaria)

Purple loosestrife is an erect, perennial, wetland herb-type plant introduced from northern Europe. In recent years, it has become a serious threat to native emersed vegetation in Illinois. This aggressive weed out-competes surrounding vegetation, forming pure stands which are of little value. The plant is easily identified by its reddish-purple flower spikes, present from July through September.

By virtue of the Exotic Weed Act of 1987, Purple loosestrife has been designated an exotic weed. It is therefore unlawful for any person, corporation or political subdivision to buy, sell, offer for sale, distribute or plant seeds, plants or plant parts without a permit issued by the Illinois Department of Natural Resources.

Time of application is highly significant. Greatest control may be achieved during the period of late flowering (mid-August). Other recommended times for treatment include mid-June (prior to flowering) and mid-July (early flowering).

(NOTE: Table for reference only. Refer to chemical label for specific dosage/application technique.)

Purple Loosestrife Chemical	Concentration of Active Ingredients in Parts per Million	Dosage
AquaPro[1]	—	4.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
AquaNeat[1]	—	4.0 pints/acre as a broadcast spray or 0.75% solution applied by hand-held sprayer
Rodeo[1]	—	4.0 pints/acre as a broadcast spray or 1.0 - 1.5% solution applied by hand-held sprayer

[1]Add nonionic surfactant.

SOURCES OF SUPPLY AND SERVICE

The Division of Fisheries of the Illinois Department of Natural Resources does not assume any responsibility for or endorse the following listings but adds this listing for the convenience of those who may desire a source for obtaining the products used in aquatic plant management.

UNDERWATER WEED CUTTERS

Underwater weed harvester:

Aquamarine Corporation
1444 S.W. Ave.
Waukesha, WI 52189
262/547-0211

Inland Dredge Co., Inc.
Inland Lake Harvesters, Inc.
Burlington, WI 53105
262/763-3620

Aquarius Systems
P.O. Box 215
220 North Harrison
North Prairie, WI 53153
262/392-2162

Underwater weed mowers & weed cutters:

Hockney Underwater Weed Cutter Company
P.O. Box 1000
913 Cogswell Drive
Silverlake, WI 53170
262/862-2628

Aqua Weed Cutter
Aquacide Company
1627 9th Street
P.O. Box 10748
White Bear Lake, MN 55110-0748
1-800-328-9350

Jenson Lake Mower:
Cygnet Enterprises, Inc.
1860 Bagwell
Flint, MI 48503-4406
800-359-7531

FISH FARMING SUPPLIES (Boat Bailing)

Horton Aquatics
1-800-503-9985

Boatcycle Mtg. & Chemical
Box 494
Henderson, TX 75653
1-800-333-9154
903/657-3791

WATER DYES

Aquashade and Aquashadow:
Applied Biochemist Inc.
6120 West Douglas Avenue
Milwaukee, WI 53218
1-800-558-5106

Sky Blue Lake Dye:
Clean Flo Laboratories Inc.
2525 Xenium Lane North
Plymouth, MN 55441
612/557-6773

Select Organic Water Dye:
Cygnet Enterprises, Inc.
1860 Bagwell
Flint, MI 48503-4406
800-359-7531

Blue Vail Aquatic Ecosystems, Inc.
1767 Benbow Court
Apopka, FL 32703
407/886-3939

BLANKETING MATERIALS (Sediment Covers)

Aquascreen:
Menardi-Criswell
Aquascreen Division
P.O. Box 160
Trenton, SC 29847
706/724-8241

Correct Texel:
Cygnet Enterprises, Inc.
1860 Bagwell
Flint, MI 48503-4406
800-359-7531

CERTIFIED COMMERCIAL AQUATIC HERBICIDE APPLICATORS

For names of local commercial aquatic plant control applicators, contact the Regional or District Fisheries Office; or the Illinois Department of Agriculture, P.O. Box 19281, State Fairgrounds, Springfield, Illinois 62794-9281, 217/785-2427.

NOTES

Pond Management Consultants

Name of Firm	Type of Service					
	Chem. Sales	Pond Shocking	Weed Control	Aeration Equip.	Pond Constr.	Aquatic Plants
Aquacide Company P.O. Box 10748 White Bear Lake, MN 55110 800/328-9350	X		X	X		
Aquatic Biologists, Inc. N 5174 Summit Court Fond du Lac, WI 54935 800/442-6648	X	X	X	X	X	X
Aquatic Control, Inc. P.O. Box 100 Seymour, IN 47274 812/497-2410	X	X	X	X		
Aquatic Eco-Systems, Inc. 1767 Benbow Court Apopka, FL 32703 800/422-3939				X		
Aquatic Ecosystems Mgt., Inc. P.O. Box 82 Golf, IL 60029 847/724-0646		X	X	X		X
Aquatic Weed Technology P.O. Box 72197 Roselle, IL 60172 630/893-0810	X		X	X		
Aquatics Unlimited 18811 Crowley Road Harvard, IL 60033 815/943-6677			X	X		
Berns, Clancy & Associates 405 E. Main Street, Box 755 Urbana, IL 61801-0755 217/384-1144					X	

Pond Management Consultants (continued)

Name of Firm	Type of Service					
	Chem. Sales	Pond Shocking	Weed Control	Aeration Equip.	Pond Constr.	Aquatic Plants
Country Road Greenhouses 19561 East Twombly Rochelle, IL 61068-9697 815/384-3311						X
Crystal Palace Perennials P.O. Box 607 St. Johns, IN 46373 219/374-9419						X
Cygnet Enterprises, Inc. 1860 Bagwell Street Flint, MI 48503-4406 800/359-7531	X					
DM&J Aquatic Weed Control, Inc. P.O. Box 294 Hebron, IL 60034 815/648-4083 or 943-4384	X			X		
Environmental Aquatic Management 1452 North Hicks Road Palatine, IL 60067 847/991-5190	X	X	X	X		
T. Gray & Associates 822 Hillgrove Ave., Suite 205 Western Springs, IL 60558 708/784-9930		X			X	
Genesis Nursery 23200 Hurd Road Tampico, IL 61283 815/438-2220						X
Integrated Lakes Mgt. 83 Ambrogio Drive, Suite K Gurnee, IL 60031 847/244-6662	X	X	X	X		

Pond Management Consultants (continued)

Name of Firm	Type of Service					
	Chem. Sales	Pond Shocking	Weed Control	Aeration Equip.	Pond Constr.	Aquatic Plants
J&J Aquatic Nursery Box 227 Wild Rose, WI 54984-0227 715/256-0059						X
Kester's Wild Game Food Nurseries, Inc. P.O. Box 516 Omro, WI 54963 800/558-8815						X
Keystone Hatcheries 11409 Keystone Road Richmond, IL 60071 815/678-2537				X		
LaFayette Home Nursery RR 1, Box 1A LaFayette, IL 61449 309/995-3311						X
Marine Biochemists 604 E. North Street, Suite B Elburn, IL 60119 630/365-1720			X	X		
W.B. McCloud & Company 1011A W. Lunt Avenue Schaumburg, IL 60193 847/891-6260			X	X		
Miller Township Const. Co. 2625 N. 3350th Road Marseilles, IL 61341 815/357-8171					X	
The Natural Garden 38W443 Highway 64 St. Charles, IL 60175 630/584-0595						X

Pond Management Consultants (continued)

Name of Firm	Type of Service					
	Chem. Sales	Pond Shocking	Weed Control	Aeration Equip.	Pond Constr.	Aquatic Plants
Patrick Engineering, Inc. 4985 Varsity Drive Lisle, IL 60532 630/434-7050				X	X Design Only	
Prairie Nursery W5875 Dyke Avenue Westfield, WI 53964 608/296-3679						X
Pro Lake Management, Inc. Aquatic Weed Control 23097 Olive Branch Road Virginia, IL 62691 217/452-7849 or 370-4567			X			X
Richmond Fisheries 8609 Clark Road Richmond, IL 60071 815/675-6545	X	X		X		
Scientific Aquatic Weed Control 16525 Orchard Valley Drive Gurnee, IL 60031 847/662-5370	X		X	X	X	
Taylor Creek Nursery P.O. Box 256 Broadhead, WI 53520 608/897-8641						X
Wildlife Nurseries, Inc. P.O. Box 2724 Oshkosh, WI 54903 414/231-3780						X
Windy Oaks W377 S10677 Betts Road Eagle, WI 53119 262/594-2803						X

This list is provided as a public service and is not to be construed as an endorsement, approval or guarantee of the services provided by anyone listed.

Illinois Department of Natural Resources

Revised 3/13/2001 by Rob Miller, IDNR Fisheries Biologist.

HERBICIDES Trade Name	Chemical Name	Amount of Active Ingredient (by weight)	Partial List of Manufacturers
Aquathol (granular)	Dipotassium salt of endothall	10.1%	Elf Atochem North America, Inc. 2000 Market St. Philadelphia, PA 19103-3222
Aquathol K (liquid)	Dipotassium salt of endothall	40.37%	Elf Atochem North America, Inc. 2000 Market St. Philadelphia, PA 19103-3222
Aquathol Super K (granular)	Dipotassium salt of endothall	63%	Elf Atochem North America, Inc. 2000 Market St. Philadelphia, PA 19103-3222
Reward	Diquat dibromide	36.4%	Zeneca Professional Products 800 Concord Pike Wilmington, DE 19850
Komeen (liquid)	Copper-ethylene-diamine complex	8%	Griffin L.L.C. P.O. Box 1847 Valdosta, GA 31601
Sonar A.S. (liquid)	Fluridone	41.7%	SePro Corporation 11550 N. Meridian St., Suite 180 Carmel, IN 46032-4562
Sonar SRP (pellets)	Fluridone	5%	SePro Corporation 11550 N. Meridian St., Suite 180 Carmel, IN 46032-4562
Copper Sulfate Instant	Copper sulfate pentahydrate	99%	Griffin L.L.C. P.O. Box 1847 Valdosta, GA 31601
Cutrine Plus (liquid)	Mixed copper ethanolamine complexes	9%	Applied Biochemists, Inc. 6120 West Douglas Avenue Milwaukee, WI 53218
Cutrine Plus (granular)	Mixed copper ethanolamine complexes	3.7%	Applied Biochemists, Inc. 6120 West Douglas Avenue Milwaukee, WI 53218
K-TEA (liquid)	Copper-triethanolamine complex	8%	Griffin L.L.C. P.O. Box 1847 Valdosta, GA 31601
Aquacide (pellets)	Sodium, 2, 4-Dichlorophenoxyacetate	20%	Aquacide Co. 1627 - 9th Street P.O. Box 10748 White Bear Lake, MN 55110
Hydrothol 191 (granular)	Mono (N, N-dimethylalkylamine) Salt of Endothall	11.2%	Elf Atochem North America, Inc. 2000 Market St. Philadelphia, PA 19103-3222
Hydrothol 191 (liquid)	Mono (N, N-dimethylalkylamine) Salt of Endothall	53%	Elf Atochem North America, Inc. 2000 Market St. Philadelphia, PA 19103-3222
Weedtrine D (liquid)	Diquat dibromide	8.53%	Applied Biochemist Inc. 6120 West Douglas Avenue Milwaukee, WI 53022

HERBICIDES Trade Name	Chemical Name	Amount of Active Ingredient (by weight)	Partial List of Manufacturers
Aquashade (dye)	Acid blue-9 Acid yellow-23	23.6% 2.4%	Applied Biochemist Inc. 6120 West Douglas Avenue Milwaukee, WI 53218
Sky Blue Lake Dye	Organic dye	26.7%	Clean-Flo Labs 2525 Xenium Lane North Plymouth, MN 55441
Rodeo	Glyphosate in the form of ispropylamine salt	53.8%	Monsanto Company 800 N. Lindberg Blvd. St. Louis, MO 63167
Navigate (granular)	2, 4-dichlorophenoxyacetic acid, butoxyethyl ester	27.6%	Applied Biochemist Inc. 6120 West Douglas Avenue Milwaukee, WI 53218
AquaPro	Glyphosate in the form of isopropylamine salt	53.8%	SePro Corporation 11550 N. Meridian St. Suite 180 Carmel, IN 46032-4562
Accord	Glyphosate in the form of isopropylamine salt	41.5%	Monsanto Company 800 N. Lindberg Blvd. St. Louis, MO 63167
Avast! (liquid)	Fluridone	41.7%	Griffin L.L.C. P.O. Box 1847 Valdosta, GA 31601
Avast! SRP (pellet)	Fluridone	5%	Griffin L.L.C. P.O. Box 1847 Valdosta, GA 31601
Blue Vail (liquid water dye)	Organic dye	—	Aquatic Eco-Systems, Inc. 1767 Benbow Court Apopka, FL 32703
AquaShadow (Packet water dye)	Acid Blue 9 Dye Acid Yellow 23 Dye	— —	Applied Biochemists 6120 West Douglas Avenue Milwaukee, WI 53218
Clearigate (liquid)	Copper from mixed copper enthanolamines	3.8%	Applied Biochemists 6120 West Douglas Avenue Milwaukee, WI 53218
Captain (liquid)	Copper carbonate	15.9%	SePro Corporation 11550 N. Meridian St. Suite 180 Carmel, IN 46032-4562
Nautique (liquid)	Copper carbonate	15.9%	SePro Corporation 11550 N. Meridian St. Suite 180 Carmel, IN 46032-4562
Select Organic Water Dye (liquid)	Dye	—	Cygnet Enterprises, Inc. 1860 Bagwell Flint, MN 48503-4406

Table for reference only. Refer to chemical label for specific restrictions.

(Number of Days)

HERBICIDES	Human			Animal	Irrigation		
	Drinking	Swim-ming	Fishing	Drinking	Turf	Food Crop	Forage Crop
Aquathol (granular)	7	7	3	*	7	7	7
Aquathol K (liquid)	7 - 25	7 - 25	3	7 - 25	7 - 25	7 - 25	7 - 25
Aquathol Super K (granular)	7	7	3	*	7	7	7
Copper sulfate	*	*	*	*	*	*	*
Cutrine-Plus (granular)	0	0	0	0	0	0	0
Cutrine-Plus (liquid)	0	0	0	0	0	0	0
K-TEA	0	0	0	0	0	0	0
Komeen	0	0	0	0	0	0	0
Reward	1 - 3	0	0	1	1 - 3	5	5
Granular 2, 4-D ester	*	*	*	*	*	*	*
Hydrothal 191 (liquid)	7 - 25	7 - 25	3	7 - 25	7 - 25	7 - 25	7 - 25
Hydrothal 191 (granular)	7 - 25	7 - 25	3	7 - 25	7 - 25	7 - 25	7 - 25
Weedtrine D (liquid)	5	1	5	5	5	5	5
AV-70 Plus (liquid)	*	0	*	*	0	*	*
Aquacide (pellets)	*	*	*	*	*	*	*
Rodeo	*	*	*	*	*	*	*
Sonar A.S.	0	0	0	0	7 - 30	7 - 30	7 - 30
Sonar SRP (pellets)	0	0	0	0	7 - 30	7 - 30	7 - 30
Navigate	*	*	*	*	*	*	*
AquaPro	*	*	*	*	*	*	*
Accord	*	*	*	*	*	*	*
AquaNeat	*	*	*	*	*	*	*
Avast! (liquid)	0	0	0	0	7 - 30	7 - 30	7 - 30
Avast! SRP (pellet)	0	0	0	0	7 - 30	7 - 30	7 - 30
Clearigate	*	*	*	*	*	*	*
Captain	*	*	*	*	*	*	*
Nautique	0	0	0	0	0	0	0
WATER DYES							
AquaShade	*	*	0	0	0	0	0
Sky Blue Lake Dye	*	*	*	*	*	*	*
Select Organic Water Dye	*	*	0	*	0	0	0
Blue Vail	*	*	0	*	0	0	0
AquaShadow	*	*	0	*	0	0	0

TABLE OF MEASUREMENTS

1 acre = 43,560 square feet (length times width)

1 acre = a square with 208.7 feet on each side

1 acre = a circle with a diameter of 235.4 feet

1 acre-foot = 325,851 gallons

1 acre-foot = 2,718,144 pounds

1 acre-foot = 43,560 cubic feet

LIQUID MEASUREMENTS

1 gallon = 4 quarts

1 gallon = 8 pints

1 pint = 16 ounces

1 cup = 8 ounces

1/4 cup = 2 ounces

1/2 cup = 4 ounces

1 tablespoon = 1/2 ounce

8 tablespoons = 4 ounces

16 tablespoons = 8 ounces

0.1 gallon = 13 ounces

0.2 gallon = 26 ounces

0.25 gallon = 32 ounces or 1 quart

0.3 gallon = 48 ounces

0.4 gallon = 51 ounces

0.5 gallon = 64 ounces or 2 quarts

0.6 gallon = 77 ounces

0.7 gallon = 90 ounces

0.75 gallon = 96 ounces or 3 quarts

0.8 gallon = 102 ounces

0.9 gallon = 115 ounces

1.0 gallon = 128 ounces or 4 quarts

1 part per million = 2.7 pints per acre-foot

1 part per million = 8.345 pounds per million gallons of water

1 part per million = 2.7 pounds per acre-foot of water

1 gallon of water weighs 8.3453 pounds

1 pound of water equals 0.1198 gallon

SOLID MEASUREMENTS

0.1 pound = 1.5 ounces

0.2 pound = 3 ounces

0.3 pound = 5 ounces

0.4 pound = 6 ounces

0.5 pound = 8 ounces

0.6 pound = 10 ounces

0.7 pound = 11 ounces

0.8 pound = 13 ounces

0.9 pound = 14 ounces

1.0 pound = 16 ounces

GALLONS OF LIQUID HERBICIDE NEEDED (BASED ON THE POUNDS OF ACTIVE INGREDIENT PER GALLON) TO TREAT ONE ACRE-FOOT OF WATER WITH 1 TO 10 PARTS PER MILLION CONCENTRATION

Pounds of Active Ingredient Per Gallon	Parts Per Million				
	1	2	3	4	5
1	2.719	5.438	8.157	10.876	13.595
2	1.359	2.718	4.077	5.436	6.795
3	0.906	1.812	2.718	3.624	4.530
4	0.680	1.360	2.040	2.720	3.400
5	0.544	1.088	1.632	2.176	2.720
6	0.453	0.906	1.359	1.812	2.265
7	0.388	0.776	1.164	1.552	1.940
8	0.340	0.680	1.029	1.360	1.700
9	0.302	0.604	0.906	1.208	1.510
10	0.272	0.544	0.816	1.088	1.360

Pounds of Active Ingredient Per Gallon	Parts Per Million				
	6	7	8	9	10
1	16.314	19.033	21.752	24.471	27.190
2	8.154	9.513	10.872	12.231	12.590
3	5.436	6.342	7.248	8.154	9.060
4	4.080	4.760	5.440	6.120	6.800
5	3.264	3.808	4.352	4.896	5.440
6	2.718	3.171	3.624	4.077	4.530
7	3.328	2.716	3.104	3.492	3.880
8	2.040	2.380	2.720	3.060	3.400
9	1.812	2.114	2.416	2.718	3.020
10	1.632	1.904	2.176	2.448	2.720

POUNDS OF GRANULAR OR WETTABLE POWDER HERBICIDE NEEDED, BASED ON THE PERCENT OF ACTIVE INGREDIENT PER POUND, TO TREAT ONE ACRE-FOOT OF WATER WITH 1 TO 10 PARTS PER MILLION OF CONCENTRATION

Percent Active Ingredient	Parts Per Million									
	1	2	3	4	5	6	7	8	9	10
1	270.0	540.0	810.0	1080.0	1350.0	1620.0	1890.0	2160.0	2430.0	2700.0
2	135.0	270.0	405.0	540.0	675.0	810.0	945.0	1080.0	1215.0	1350.0
3	90.0	180.0	270.0	360.0	450.0	540.0	630.0	720.0	810.0	900.0
4	67.5	135.0	202.5	270.0	337.5	405.0	472.5	540.0	607.5	675.0
5	54.0	108.0	162.0	216.0	270.0	324.0	378.0	432.0	486.0	540.0
6	45.0	90.0	135.0	180.0	225.0	270.0	315.0	360.0	405.0	450.0
7	38.6	77.2	115.8	154.4	193.0	231.6	270.0	308.8	347.4	386.0
8	33.8	67.6	101.4	135.2	169.0	202.8	236.6	270.4	304.2	338.0
9	30.0	60.0	90.0	120.0	150.0	180.0	210.0	240.0	270.0	300.0
10	27.0	54.0	81.0	108.0	135.0	162.0	189.0	216.0	243.0	270.0
11	24.5	49.0	73.5	98.0	122.5	147.0	171.5	196.0	220.5	245.0
12	22.5	45.0	67.5	90.0	112.5	135.0	157.5	180.0	202.5	225.0
13	20.8	41.6	62.4	83.2	104.0	124.8	145.6	166.4	187.2	208.0
14	19.3	38.6	57.9	77.2	96.5	115.8	135.1	154.4	173.7	193.0
15	18.0	36.0	54.0	72.0	90.0	108.0	126.0	144.0	162.0	180.0
16	16.9	33.8	50.7	67.6	84.5	101.4	118.3	135.2	152.1	169.0
17	15.9	31.8	47.7	63.6	79.5	95.4	111.3	127.2	143.1	159.0
18	15.0	30.0	45.0	60.0	75.0	90.0	105.0	120.0	135.0	150.0
19	14.2	28.4	42.6	56.8	71.0	85.2	99.4	113.6	127.8	142.0
20	13.5	27.0	40.5	54.0	67.5	81.0	94.5	108.0	121.5	135.0
21	12.9	25.8	38.7	51.6	64.5	77.4	90.3	103.2	116.1	129.0
22	12.3	24.6	36.9	49.2	61.5	73.8	86.1	98.4	110.7	123.0
23	11.7	23.4	35.1	46.8	58.5	70.2	81.9	93.6	105.3	117.0
24	11.3	22.6	33.9	45.2	56.5	67.8	79.1	90.4	101.7	113.0
25	10.8	21.6	32.4	43.2	54.0	64.8	75.6	86.4	97.2	108.0
50	5.4	10.8	16.2	21.6	27.0	32.4	37.8	43.2	48.6	54.0
80	3.4	6.8	10.2	13.6	17.0	20.4	23.8	27.2	30.6	34.0
100	2.7	5.4	8.1	10.8	13.5	16.2	18.9	21.6	24.3	27.0

AREA IN ACRES

Width in Feet	Length in Feet																		
	100	150	200	250	300	350	400	450	500	550	600	650	700	750	800	850	900	950	1000
100	.230	.344	.459	.574	.689	.803	.918	1.03	1.15	1.26	1.38	1.49	1.61	1.72	1.84	1.95	2.07	2.18	2.30
150	.344	.517	.689	.861	1.03	1.21	1.38	1.43	1.72	1.89	2.07	2.24	2.41	2.58	2.75	2.93	3.10	3.27	3.44
200	.459	.689	.918	1.15	1.38	1.61	1.84	2.07	2.30	2.53	2.75	2.98	3.21	3.44	3.67	3.90	4.13	4.36	4.59
250	.574	.861	1.15	1.43	1.72	2.01	2.30	2.58	2.87	3.16	3.44	3.73	4.02	4.30	4.59	4.88	5.17	5.45	5.74
300	.689	1.03	1.38	1.72	2.07	2.41	2.75	3.10	3.44	3.79	4.13	4.48	4.82	5.17	5.51	5.85	6.20	6.54	6.89
350	.803	1.21	1.61	2.01	2.41	2.81	3.21	3.62	4.02	4.49	4.82	5.22	5.62	6.03	6.43	6.83	7.23	7.63	8.03
400	.918	1.38	1.84	2.30	2.75	3.21	3.67	4.13	4.59	5.05	5.51	5.97	6.43	6.89	7.35	7.81	8.26	8.72	9.18
450	1.03	1.43	2.07	2.58	3.10	3.62	4.13	4.65	5.17	5.68	6.20	6.71	7.12	7.75	8.26	8.78	9.30	9.81	10.3
500	1.15	1.72	2.30	2.87	3.44	4.02	4.59	5.17	5.74	6.31	6.89	7.46	8.03	8.61	9.18	9.76	10.3	10.9	11.5
550	1.26	1.89	2.53	3.16	3.79	4.42	5.05	5.68	6.31	6.94	7.58	8.21	8.84	9.47	10.1	10.7	11.4	12.0	12.6
600	1.38	2.07	2.75	3.44	4.13	4.82	5.51	6.20	6.89	7.58	8.26	8.95	9.64	10.3	11.0	11.7	12.4	13.1	13.8
650	1.49	2.24	2.98	3.73	4.48	5.22	5.97	6.71	7.46	8.21	8.95	9.70	10.4	11.2	11.9	12.7	13.4	14.2	14.9
700	1.61	2.41	3.21	4.02	4.82	5.62	6.43	7.12	8.03	8.84	9.64	10.4	11.2	12.0	12.9	13.7	14.5	15.3	16.1
750	1.72	2.58	3.44	4.30	5.17	6.03	6.89	7.75	8.61	9.47	10.3	11.2	12.0	12.9	13.8	14.6	15.5	16.4	17.2
800	1.84	2.75	3.67	4.59	5.51	6.43	7.35	8.26	9.18	10.1	11.0	11.9	12.9	13.8	14.7	15.6	16.5	17.4	18.4
850	1.95	2.93	3.90	4.88	5.85	6.83	7.81	8.78	9.76	10.7	11.7	12.7	13.7	14.6	15.6	16.5	17.6	18.5	19.5
900	2.07	3.10	4.13	5.17	6.20	7.23	8.26	9.30	10.3	11.4	12.4	13.4	14.5	15.5	16.5	17.6	18.6	19.6	20.7
950	2.18	3.27	4.36	5.45	6.54	7.63	8.72	9.81	10.9	12.0	13.1	14.2	15.3	16.4	17.4	18.5	19.6	20.7	21.8
1000	2.30	3.44	4.59	5.74	6.89	8.03	9.18	10.3	11.5	12.6	13.8	14.9	16.1	17.2	18.4	19.5	20.7	21.8	23.0

AQUATIC PLANT IDENTIFICATION AND TREATMENT FORM

Mailing Instructions

To
Regional Fisheries
Office

Mail this form along with a sample of the aquatic plant, wrapped in a sealed plastic bag, to the nearest Regional Fisheries Office.

Location of Water Area

County: _____

Township: _____

Range: _____

Section: _____

Nearest Town: _____

Date: _____

OWNER: _____

ADDRESS: _____

TELEPHONE NUMBER: AREA CODE (_____) _____

SIZE OF WATER AREA WHEN FULL (SURFACE ACRES): _____

MAXIMUM DEPTH (FT.): _____ MINIMUM DEPTH (FT.): _____

SIZE OF AREA TO BE TREATED (SURFACE ACRES): _____

AVERAGE DEPTH (FT.): _____

DO NOT WRITE BELOW THIS LINE

PLANT'S COMMON NAME: _____

PLANT'S SCIENTIFIC NAME: _____

RECOMMENDED TREATMENT (HERBICIDE): _____

AMOUNT: _____ CONCENTRATION (PPM): _____

IDENTIFIED BY: _____ DATE: _____

Now Available for purchase

Get your
White-tailed Deer and Bass
Sporting Series License Plates!

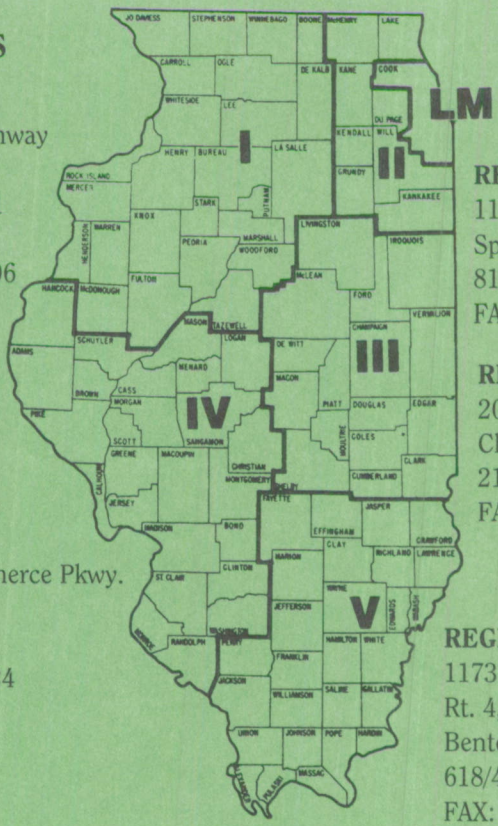
Interested in getting the Goose, Duck, Pheasant or Turkey license plates? Contact the Secretary of State for more information.

Sporting Series License Plates

Call Secretary of State for information at 1-800-252-8980, TTY 1-800-252-2904.

All proceeds from the Sporting Series License Plate sales go to the Illinois Habitat Fund.

IDNR REGIONS



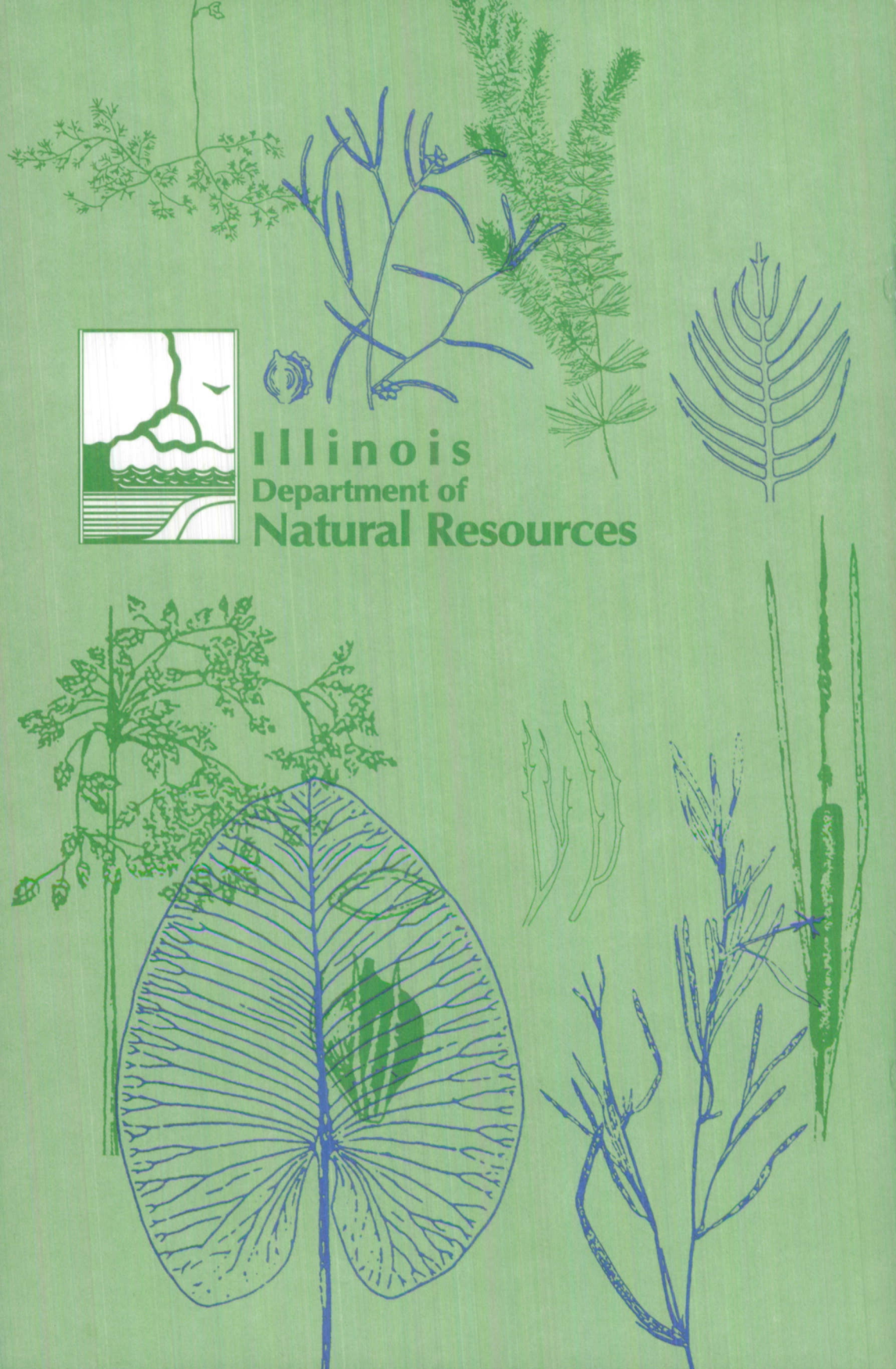
REGION I
2317 East Lincolnway
Suite A
Sterling, IL 61081
815/625-2968
FAX: 815/625-0706

REGION II
110 James Road
Spring Grove, IL 60081
815/675-2385
FAX: 815/675-2495

REGION III
2005 Round Barn Road
Champaign, IL 61820
217/278-5773
FAX: 217/244-5792

REGION IV
4521 Alton Commerce Pkwy.
Alton, IL 62002
618/462-1181
FAX: 618/462-2424

REGION V
11731 Hwy. 37
Rt. 4, Box 208
Benton, IL 62812
618/435-8138
FAX: 618/439-7376


Illinois
Department of
Natural Resources