WS-25

MANAGING AQUATIC PLANTS IN INDIANA LAKES

Prepared by
Gwen M. White and Sue M. Gerlach, Division of Soil Conservation, Indiana Department of Natural Resources; and Carole A. Lembi, Department of Botany & Plant Pathology, Purdue University*

Purdue University • Cooperative Extension Service • West Lafayette, Indiana
in cooperation with the Indiana Department of Natural Resources

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Introduction

Balanced populations of native aquatic plants are very beneficial—in fact, necessary—to maintaining the health of a lake. Only a few species (usually the "exotics") are apt to cause problems. When overabundant plants start impairing a lake's recreational usage, there's a tendency to attack the symptoms rather than the conditions responsible for that excessive growth.

Aquatic plants are an integral part of a lake's ecosystem. Therefore, their indiscriminate removal can severely disrupt the natural balance in the system. That balance is directly affected by the way that land adjacent to the lake is used or managed. Poor management of the land can negatively affect a lake, resulting in lower property values, impaired fishing quality, and reduced aesthetic appearance. Mismanagement of the aquatic and shoreline plants will disrupt fish and wildlife habitat, possibly leading to impacts as dramatic as fish kills.

This publication addresses aquatic plant management in Indiana lakes. *Section 1* discusses the types of aquatic plants in a lake environment; their benefits to the lake, where different species grow in the lake, what factors affect their growth, and concerns about threats to their survival.

Section 2 looks at the problem of excessive aquatic plant growth and keys to maintaining a healthy (but not over-productive) plant community. Then presented, in table form, are four management options—physical, chemical, biological, and education—for controlling excessive plant growth. This is followed by a discussion of concerns to be considered before implementing any control options plus information about regulations and required permits.

Section 3 describes the effects of poor land management on a lake's ecosystem, the components of a good aquatic plant managment plan, and an introduction to shoreline landscaping. The *Appendix* provides a listing of sources of information/assistance, a glossary of terms, and a list of related publications.

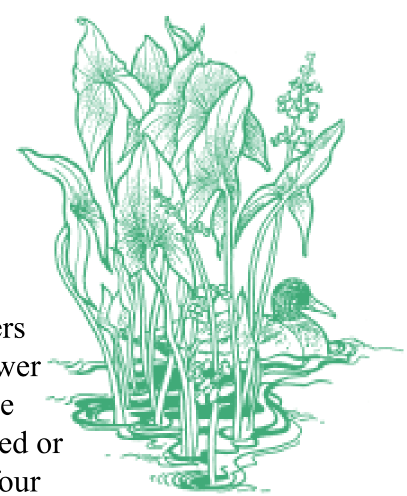
I. Importance of Aquatic Plants to a Lake

Types of Aquatic Plants

Aquatic plants are divided into two major groups: *algae* and *macrophytes*.

Algae are simple plants that have no true roots, leaves, or flowers. The three kinds of algae are:

- Phytoplankton—microscopic plants suspended in water.
- Filamentous and colonial forms—microscopic plants that create visible "mats" on the water surface or on structures.
- Stoneworts—erect-growing visible plants that attach to the lake bottom without true roots.



Macrophytes, on the other hand, have true roots, leaves, and flowers (although the flower structures of some species are reduced or modified). The four categories of macrophytes are:

- Free floating—e.g., duckweed and watermeal.
- Submergent—e.g., water milfoil, coontail and pondweed.
- Rooted with floating leaves—e.g., spatterdock, water lily and lotus.
- Emergent—e.g., cattail and bulrush.

How Aquatic Plants Benefit the Lake Environment

In the process known as photosynthesis, algae and macrophytes use sunlight, carbon dioxide, and water to produce food in their cells. Although each plant group benefits the lake differently, they act in combination to provide a healthy aquatic ecosystem. A lake's overall "productivity" is based on the rate at which these two groups produce oxygen and perform the following important functions:
Algae—(a) serve as primary producers of food in an aquatic environment and are at the base of the food chain; (b) produce oxygen in open water where rooted plants cannot grow; and (c) provide a food source for zooplankton (microscopic animals) and many plant-eating macroinvertebrates, such as aquatic insects, snails, leeches, and crayfish.

Macrophytes—(a) provide habitat and protective cover for fish and wildlife; (b) produce oxygen in shallow water; (c) control erosion by stabilizing banks, trapping eroded soil, and slowing stormwater flow; (d) dissipate wave energy; (e) remove nutrients from soil and water to produce plant tissue: (f) create aesthetic beauty and visual interest; and (g) are food sources for plant-eating fish and wildlife, which, in turn, are food sources for larger animals.

Where Aquatic Plants Grow in a Lake

Aquatic plant species are adapted for growth in particular parts of a lake, wetland, or other water body, depending on its physical characteristics. Limnologists (i.e., people who study lakes and streams) categorize different habitat types by water depth (littoral and pelagic zones) and by the extent to which sunlight can penetrate the water (photic and aphotic zones). These "zones" are defined as follows:

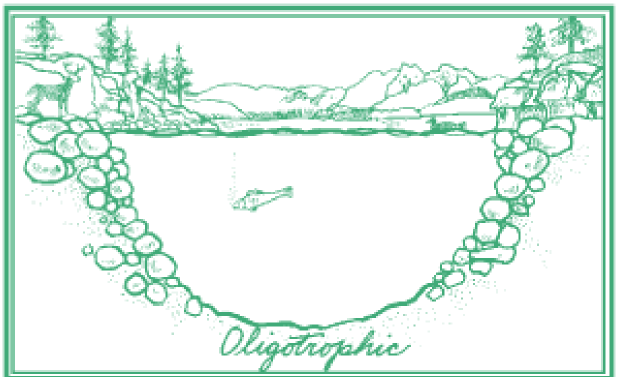
- ***Littoral zone***—shallow water from the lake shore to the maximum depth where rooted plants can grow. Plant diversity, density, and productivity in this region is high.
- ***Pelagic zone***—open water beyond the littoral zone. Plant growth in this area consists mostly of phytoplankton.
- ***Photic zone***—shallow areas or upper water that extends to the depth where light levels are about 1% of the amount available at the surface. This region supports nearly all plant growth.
- ***Aphotic zone***—deeper water that receives less than 1% of the sunlight available at the surface. Daily weather variations and human activities can greatly influence the depth of this zone. Plant growth and oxygen levels diminish because the light is too dim for photosynthesis. However, this area is not lifeless; for instance, some bacteria that contribute to lake processes live only in sediments or deep water without oxygen.

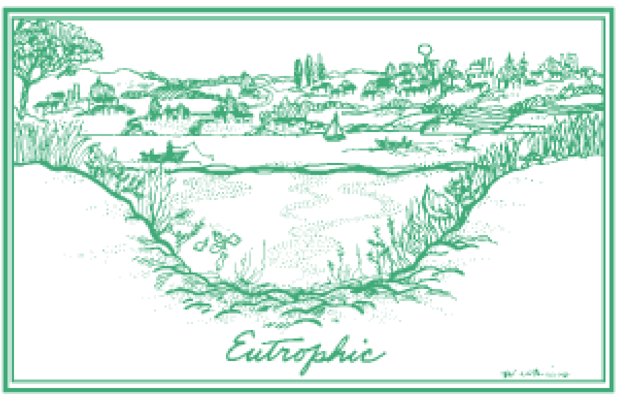
Factors Affecting Aquatic Plant Growth

The abundance and distribution of algae and macrophytes in a lake depend on light availability, water clarity, water depth, nutrient availability, type of substrate (bottom material), and degree of disturbance. Human activities in and around the lake and its natural physical characteristics (e.g., shape and size) influence these factors.

Light availability is the single most important factor regulating plant growth. Most underwater plants cannot survive with less than 1% of the sunlight that enters the water's surface. Seasonal patterns of light (and temperature) cause different plant species to grow at different times of the year.

Water clarity (or degree of turbidity) determines how much sunlight can penetrate the water. Dissolved substances and suspended matter in the water column affect clarity. For instance, an increase in phytoplankton or soil particles eroded from the watershed or shoreline will block sunlight, reducing its availability to submerged macrophytes. Some fish species, such as carp, stir bottom sediments when feeding. An overabundance of carp can cause cloudy water and disrupt growth of rooted aquatic plants. Without rooted plants and light, fish and wildlife diversity can disappear from the lake.





Water depth (along with shoreland and underwater slope, surface area, and shape) affects a lake's chemical and biological attributes by determining the size of the shallow water, or littoral, zone. Overall, shallower lakes are more productive with respect to algae and macrophyte growth. Deep lakes with steep sides and few bays tend to have fewer aquatic plants.

Nutrients are required for aquatic plant growth. Although nitrogen stimulates growth of both land and aquatic plants, it is the addition of phosphorus that usually stimulates excessive growth of aquatic plants. These nutrients occur naturally in lakes as a result of biological and physical processes. However, their presence in excessive amounts is usually due to human activities in a watershed. Cropland tillage, livestock production, lawn and field fertilization, septic system use, and shoreline vegetation removal all can increase the amount of nutrients entering a lake. Since phosphorus binds to soil particles and nitrogen dissolves in water, both can be transported by runoff from surrounding land. Once in the lake, they may be recycled by plant decay or the mixing of deep and surface waters. Excessive levels of nutrients result in excessive plant growth and increased eutrophication, both of which can impair the lake's desired uses.

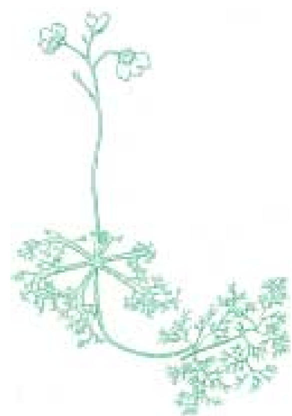
Substrate (or type of bottom material) greatly influences growth or productivity of aquatic plants and animals. Plants root more readily and spread faster in soft soils. In addition, the substrate's chemical and physical composition affects the amount of nutrients available, influencing both plant distribution and growth rate. For instance, marl areas support few aquatic plants, rocky lake beds will likely have fewer plants than ones with silt substrates, and eroded soil can contribute to the increased spread or density of nuisance aquatic plants. Sandy lake beds mixed with some organic matter usually support the greatest diversity of native aquatic species.

Water movement (or current) can also influence plant growth and distribution. Macrophytes need to be rooted in the soil to obtain nutrients and maintain a position at specific light and depth levels. Waves, strong currents, and power boating can tear plants from the lake bed. However, loss of rooted plants and water mixing caused by currents, waves or high-speed boating may promote phytoplankton growth by enabling floating algae to stay suspended in the water column and use available sunlight and nutrients.

Concerns About Some of Indiana's Aquatic Plant Species

Over 150 aquatic plant species native to Indiana's lakes, streams, and associated wetlands are listed as endangered, threatened, or rare. Among those on that list are: *whitestem pondweed* (endangered); *water velvet, Richardson's pondweed,* and *flatleaf pondweed* (threatened); and *slender pondweed, purple bladderwort,* and *horned pondweed* (rare).

While much may be known about these plants at a particular location, knowledge of their distribution statewide is limited. Therefore, it's important to be cautious when engaging in activities that affect aquatic plants. Actions in and around a lake may inadvertently destroy some of these special species. For example, large stands of bulrush have been disappearing over recent decades, probably due to boat traffic in the shallow areas of lakes.



Did You Know That...?

...White-stem pondweed *(Potamogeton praelongus)* is a northern species sensitive to water quality changes. Research indicates that it cannot survive in turbid or muddy waters (Davis and Brinson, 1980). Because white-stem pondweed will disappear from disturbed systems, it serves as a "canary in a coal mine" (or indicator species) for degraded water quality. The plant still exists in several Indiana lakes.

...Richardson's pondweed *(Potamogeton richardsonii)* was named after its discoverer, Sir John Richardson, a Scottish surgeon, explorer, and natural historian. About him, D.A. Stewart wrote: "Plants of northern Canada named by and for Richardson would make a garden of respectable size, and animals named by and for him a considerable zoo."

...The genus name for bladderwort *(Utricularia),* is derived from the Latin word "utriculus," which means "small bag." This refers to the plant's sack-like traps, which can snap closed in 1/500 of a second. These bladders trap microinvertebrates, which the plant digests to obtain sufficient nitrogen for its growth. Lift a mass of bladderwort out of the water and you'll hear a crackling sound as the traps are "sprung" and air fills the bladder. Worldwide, there are over 300 species of bladderwort, some growing in rather remarkable places. For instance, in tropical regions, they can be found growing in the water cups of plants growing on tree trunks.

For more information on these and other aquatic plant species, see "Through the Looking Glass…A Field Guide to Aquatic Plants," by Borman, Korth, *et al*. (1997).

II. Controlling Excessive Aquatic Plant Growth

When Aquatic Plants Become a Problem

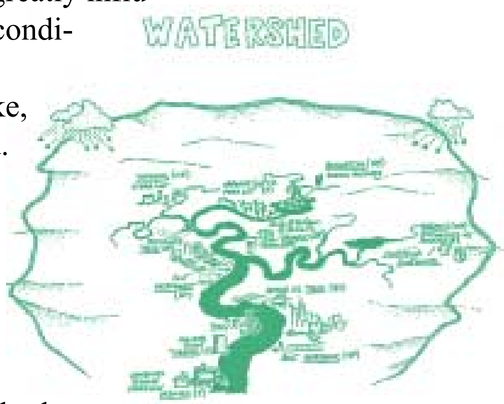
Although native aquatic vegetation is generally beneficial, excessive growth can not only be a nuisance, but also drastically alters the use and ecology of a lake. Here are the problems that can occur as a result of excess plant growth.

- Accelerated eutrophication, leading to dramatic and detrimental biological and physical changes.
- Overpopulation and stunting of some fish species.
- Impaired recreational activities.
- Accumulation of sediments as plants die, thus reducing water depth.
- Recycling of nutrients into the water column.
- Reduced water speed, thus increased siltation and flooding in drainage ditches.
- Domination of the aquatic plant community (1) by invasive species (e.g., Eurasian water milfoil, curlyleaf pondweed, purple loosestrife, and reed canary grass) when native species are eradicated, and (2) by bluegreen algae when rooted plants are destroyed, causing algae to form unsightly scum, produce undesirable taste and odors, and decrease water clarity.
- Increased levels of toxic phytoplankton, which can affect drinking water supplies for wildlife, domestic animals, and humans.
- Increased numbers of nuisance insects (e.g.,

mosquitoes) due to reduction in water circulation and loss of insect predators.
- Decreased property values due to impaired aesthetic quality and recreational use of a lake.

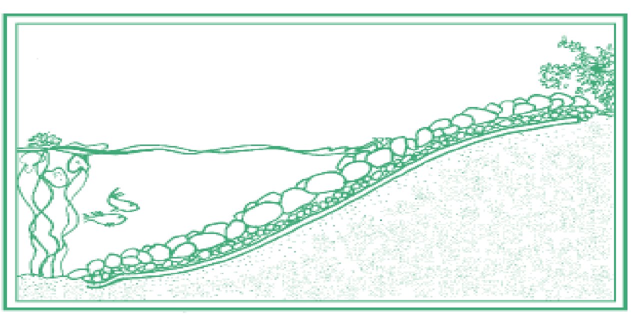
How to Maintain a Healthy Plant Community

To optimize a lake ecosystem's value and use requires protecting the desirable native plants and controlling the nuisance plants. The watershed (i.e., land area that drains into a particular body of water) greatly influences the condition of the stream, lake, or wetland.



"Best management practices" (BMPs), applied in both the water and the watershed, allow various human activities to continue while maintaining a healthy balance in the aquatic resources. They must be tailored to the needs of a particular water body and to the area's regulations. Examples of such BMPs include:

- Establishing a limited "boat cruising lane" through an aquatic plant bed to minimize negative effects on the plants.
- Establishing and enforcing idle (or no-wake) zones to prevent damage from watercraft wakes near the shoreline and in other shallow areas.



- Restricting watercraft numbers, size, or time of use.
- Maintaining native shoreline vegetation.
- Requiring regular maintenance of septic systems or connection to an advanced sewage treatment facility.

- Minimizing runoff of soil and nutrients from watershed lands.
- Ensuring proper application of lawn chemicals and use of fertilizers that contain little or no phosphorus.
- Preventing livestock from entering streams and lakes by fencing and providing other watering sources.
- Maintaining buffer strips of trees, shrubs, and grasses to trap stormwater, eroded soil, and nutrient runoff.
- Installing erosion and sediment control devices (e.g., sediment traps, silt fences, and rip-rap) in disturbed or eroding areas.
- Removing plant fragments and bilge water from watercraft and trailers before leaving the lake to prevent spread of undesirable species, such as Eurasian water milfoil and zebra mussels.

Management Options for Control of Undesirable or Excessive Aquatic Plant Growth

Control of excess growth can range from simply hand-pulling nuisance plants around dock areas to chemically spraying the entire lake. The choice of control methods depends on the types of plants to be managed, desired uses of the lake, and available resources or technology. On the following pages, **Table 1** (adapted from materials written by Dr. Ken Wagner, ENSR, Inc., Wilbraham, MA) outlines the various aquatic plant control options.

Table 1. Management Options for Control of Aquatic Plants*

Options	Mode of Action	Positive Impacts	Negative Impacts
Physical Control			
1. Benthic Barriers	• Mat laid on bottom of target area, preventing plant growth. • Can remain in place from just a few months to permanently. • Maintenance improves effectiveness. • Not really intended for use in large areas; usually applied around docks, boating lanes, and swimming areas. • Must be anchored adequately.	• Can be removed. • Reduces turbidity from soft bottoms. • Can cover undesirable substrate. • May improve fish habitat.	• May cause loss of oxygen at sediment-water interface. • May limit benthic invertebrates (e.g., mussel, crayfish). • Interferes with all plants in target area. • May inhibit spawning and feeding by some fish species. • Can provide substrate for increased rooted plant growth.
2. Drawdown	• Lowering of water over winter allows desiccation, freezing, and physical disruption of plants, roots and seed beds. • Duration of exposure and degree of dewatering of exposed areas are important. • Variable species' tolerance to drawdown; emergent species and seed-bearers less affected. • More effective on annual plants if done every 3 years. • Can be combined with burning or raking to enhance effectiveness.	• Control with some flexibility. • Opportunity for shoreline clean-up and structure repair. • Flood control utility. • Affects plants that spread by runners; limited impact to seed-producing populations.	• Possible impact on adjacent emergent wetlands. • Possible effects on overwintering reptiles or amphibians. • Possible impairment of well water production. • Reduces potential water supply and fire fighting capacity. • Alters downstream flows. • Possible overwinter water level variation. • Can enhance growth of exotic or invasive species. • May affect use of piers.
3. Mechanical Removal	• Plants uprooted by mechanical means, possibly with disturbance of soils. • Collected plants must be composted or otherwise dispose of. • Wide range of techniques employed, from manual to highly mechanized. • Application once or twice per year usually needed.	• Can target specific areas. • May remove other debris. • Can balance habitat and recreational needs.	• Possible impact on aquatic animals. • Non-selective removal of plants in treated area. • Possible spread of undesirable species by fragmentation (e.g., Eurasian watermilfoil). • May generate of turbidity. • Disposal sites may not be available.
a) Hand-pulling	• Plants uprooted by hand ("weeding") and removed.	• Highly selective technique.	• Labor intensive.
b) Harvesting equipment	• Plants cut at depth of 2-10 feet and collected for removal from lake.	• Allows plant removal on a greater scale.	• Usually leaves fragments, which may re-root and spread infestation. • May impact lake fauna. • Not selective within applied area. • Creates substantial turbidity. • Relatively expensive. • Requires maintenance and storage equipment.

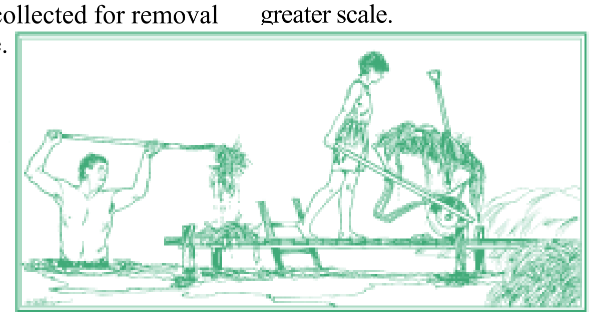


Table 1. Continued.

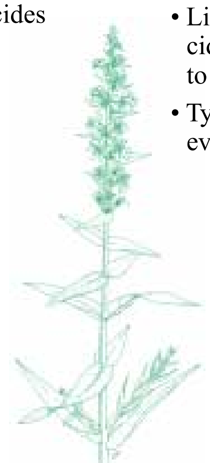
Options	Mode of Action	Positive Impacts	Negative Impacts
4. Dredging	• Sediment is physically removed by wet or dry excavation, and placed in a containment area for dewatering. • Dredging can be applied on a limited basis but is most often a major restructuring of a severely impacted system. • Plants are removed, and regrowth can be limited by light and/or substrate limitation.	• Plant removal with some flexibility. • Increases water depth. • Can reduce pollutant reserves. • Can reduce sediment oxygen demand. • Can improve spawning habitat for many fish. • Allows complete renovation of aquatic ecosystem	• Temporarily removes benthic invertebrates and habitat. • May create turbidity. • May eliminate fish community during dredging drawdown (dry dredging only). • Possible impacts of discharge from dewatering area. • Interfers with recreation or other uses during dredging. • Can be very expensive. • Requires permits.
5. Dyes	• Water-soluble dye is mixed with lake water, thereby limiting light penetration and inhibiting plant growth. • Dyes remain in solution until washed out of system or by photodegradation.	• Limits light levels without changing turbidity or depth. • May achieve some control of algae. • May achieve some selectivity for species tolerant of low light	• Only effective in small, enclosed water bodies. • May not control shallow water rooted plants. • May cause overheating in shallow ponds. • May facilitate oxygen loss at sediment interface with water.
Chemical Control			
1. Herbicides 	• Liquid or pelletized herbicides applied to target area or to plants directly. • Typically requires application every 1-5 years.	• Wide range of control is possible. • May be able to selectively eliminate species by timing of application in growth phase of plants or by effectiveness on specific species. • May achieve some algae control. • Can be selective for exotic species.	• Possible toxicity to non-target species of plants or animals. • Possible downstream impacts; may affect non-target areas. • Restrictions on water use for varying time after treatment. • Increased oxygen demand from decaying vegetation. • Possible recycling of nutrients for future growth. • May require permits. • Selective action may depend on timing of permit approval and chemical application.
a) Contact herbicide	• Absorbed in leaves but not roots. • Applied as wide variety of liquid or granular formulations, often in conjunction with polymers or other herbicides.	• Moderately to highly effective control; used for all the groups, but primarily for submersed species.	• Non-selective in treated area. • Temporary reduction in plant growth, but no long-term elimination of species.
b) Translocated herbicide	• Readily absorbed and transferred throughout plant leaves and roots. • Applied as liquid or granules during early growth phase of plants.	• Moderately to highly effective control of various emerged, floating, and submersed species. • Can be selective.	• At higher doses, may impact non-target species.

Table 1. Continued.

Options	Mode of Action	Postive Impacts	Negative Impacts
2. Algaecides	• Contact herbicide. • Applied as wide variety of liquid or granular formulations of copper compounds, often in conjunction with polymers or other herbicides.	• Can remove algae and leave other types of plants.	• Depending on concentration, formulation, and water chemistry, may be toxic to aquatic animals. • Ineffective at colder water temperatures. • Copper ion persistent; accumulates in sediments or moves downstream.
Biological Control			
1. Biological Introductions	• Fish, insects, or pathogens which feed on or parasitize plants are added to system to affect control. • Grass carp is the most commonly used organism, but the larvae of several insects have been used more recently.	• Provides potentially continuing control with one treatment. • May produce more fish as an end product.	• Typically involves introduction of exotic species. • Effects may not be controllable. • Plant selectivity may not match desired target species. • May adversely affect beneficial species.
a) Sterile white amur/ grass carp	• Sterile juveniles stocked at density which allows control as they grow. • Growth of individuals offsets losses or may increase grazing pressure.	• May greatly reduce plant biomass in a single season. • May provide multiple years of control from a single stocking. • Sterility intended to prevent overpopulation allow later adjustments	• May reduce all plant biomass or impact non-target species more than target forms. • Funnels energy into largely unused biomass (i.e., carp). • Fish may escape to new habitats upstream or downstream. • May not always be sterile; population control uncertain. • May stir bottom sediments and increase turbidity
b) Weevils/moths/ beetles	• Larvae or adults stocked at density intended to allow control with limited growth. • Intended to selectively control target species.	• May involves species native to region or even targeted lake. • Expected to have no negative effect on non-target species.	• Population ecology suggests incomplete control likely. • Oscillating cycle of control and regrowth likely. • Predation by fish may complicate control. • Still being tested
c) Waterfowl	• Swans or white Chinese geese consume algae mats and submerged vegetation.	• One pair of swans can maintain an acre weed-free. • Presence of swans may deter nuisance Canadian geese.	• Requires supplemental feeding. • Aggressive during breeding season. • Droppings litter shoreline and fertilize water. • Water may become turbid.
Education	• Distribution of information through classroom instruction, meetings, workshops, or written materials.	• Inexpensive. • Prevents potential spreading of problems and may prevent problems before they start. • Facilitates personal commitment to appropriate lake management	• May not completely reduce destructive activities. • Format of information must effectively gain attention of the target audience.

Considerations Before Implementing a Control Option

Regardless of the option chosen, it's important to address these three risks or concerns prior to treatment.

Over-eradication of aquatic growth can be dangerous to a lake's ecological functions. For instance, killing too much vegetation at one time can result in damage due to decay of the plant material left in the lake. Bacteria consume oxygen in the water as they decompose the vegetation. This decreases the amount of oxygen available for other organisms in the water (e.g., fish and invertebrates) and can cause a fish-kill. Decomposition also returns nutrients to the water column that were stored in the plants. These released nutrients become available to stimulate growth of more phytoplankton or plants.

Inadvertent spread of unwanted vegetation can result when small fragments of some species are left behind after hand pulling, cutting by boat propellers, or mechanical harvesting. They then can begin to grow in other areas of a lake that were once free of vegetation. Invasive nuisance plants (e.g., Eur-asian water milfoil) are particularly well adapted to dispersal through fragmentation.

Differing social perspectives also needs to be taken into account. For instance, people may differ on what is aesthetically pleasing. Some may not want to remove the vegetation (or as much of the vegetation) because of the benefits to fishing. Others may feel plants are a nuisance, a hindrance, or even dangerous to boating and swimming.

These and similar treatment risks illustrate why aquatic plant control should be conducted as part of a long-term lake management plan—one that reflects the diverse interests of all lake users, especially in a public lake.

* If the water body is used as a public drinking water supply, IDNR cannot issue a permit for chemical control of aquatic plants without prior written approval from the State Department of Health.

How Aquatic Plant Control Is Regulated

The state of Indiana recognizes the value of natural lakes and other waters as an irreplaceable public and private resource. Since 1947, the Indiana Lake Preservation Act has declared that:

> *The natural resources and the natural scenic beauty of Indiana are a public right, and the public of Indiana has a vested right in the preservation, protection, and enjoyment of all the public fresh-water lakes of Indiana in their present state, and the use of such waters for recreational purposes* (IC 14-26-2).

The Indiana Department of Natural Resources (IDNR) provides assistance in managing public-access lakes through technical advice, grant programs, and permit processes for aquatic plant control and for construction along lake shorelines and stream floodways.

Permits are currently required for the mechanical control of aquatic plants (i.e., by pulling or cutting). However, they are required for chemical control of aquatic plants in public waters and boundary waters of the state, except in these two situations:

- Treatment of a privately owned lake, farm pond, or public or private drainage ditch.
- Treatment of a public lake by a landowner or tenant in the immediate vicinity of a boat

landing or bathing beach on or adjacent to their real estate and where the area to be chemically treated does not exceed one-half (1/2) acre or fifty percent (50%) of the existing area of aquatic vegetation, whichever is less (IC 14-22-9-10).

An application for an aquatic vegetation control permit must be made on an IDNR form and include: (a) common name of the plants to be controlled; (b) acreage to be treated; (c) maximum depth of the water where plants are to be treated; and (d) name and amount of chemical to be used. Applications are reviewed by professional staff in various state agencies to determine the potential impact on fish, wildlife, and recreational uses of the water body.*

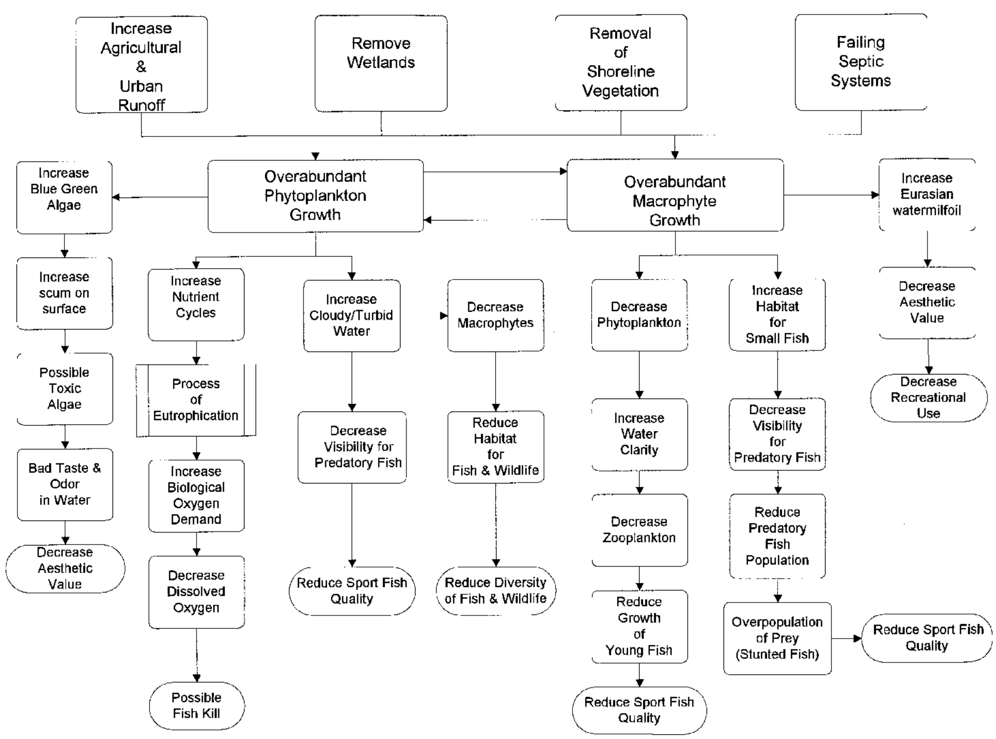
Since aquatic plant treatment can be complicated and exacting, consider hiring a licensed professional applicator to ensure safe and appropriate use of chemicals. However, if you do choose to treat aquatic plants yourself, be sure to: (a) only apply chemicals labeled for use in water; (b) follow all directions for mixing and application; (c) wear proper protective gear; and (d) post clearly visible signs at the treatment area at least five (5) days prior to application indicating substance used and necessary precautions.

(To obtain an aquatic vegetation control permit application form or a list of state-licensed applicators and/or to ensure that your planned treatment activities comply with state and local laws, contact your local IDNR conservation officer or district fisheries biologist.)

III. Lakeshore Land Use Management Planning

Effects of Poor Land Management on Lakes

The following flowchart illustrates the effects of improper land management on or around a lake. When the lake becomes overloaded with nutrients, its appearance as well as its biological characteristics are affected. The results include degraded water quality, lower property values, poorer sport fishing, and fewer tourist dollars spent in the community.



The four inappropriate practices listed—(a) increased agricultural and urban runoff; (b) removal of wetland vegetation; (c) removal of shoreline vegetation; and (d) failing septic systems—are ones that all-too-commonly occur around Indiana lakes. Any of these practices can increase either phytoplankton or macrophyte growth.

Components of Good Aquatic Plant Management Plan

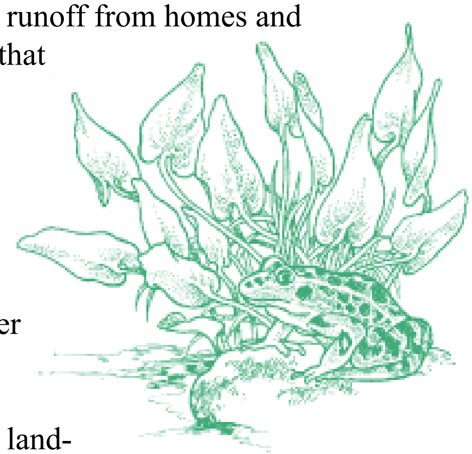
The most effective way of dealing with excess aquatic plant growth is to develop a long-term lake management plan. Such a plan, if well formulated, will help identify problem areas, save time and money, reduce undesirable ecological changes, resolve conflict among those involved in the decision-making process, and aid in implementation of best management practices (BMPs).

Here are the six suggested components of an integrated aquatic plant management plan, according to the North American Lake Management Society (1997):

- Identify the desired uses of the water body and determine how aquatic vegetation affects those uses.
- Understand plant ecology and other natural processes in the water body.
- Set long-term management goals and action plans, with consensus of the community of users.
- Consider all management techniques, selecting those most appropriate for the defined problem.
- Develop an action plan plus a program to monitor the success or failure of the management activities undertaken.
- Establish a long-term education program regarding the value and management of aquatic plants.

Landscaping with Aquatic and Shoreline Plants

A number of "traditional" landscape maintenance activities at a lakeside or riverside property may negatively affect water quality and fisheries resources, such as manicuring the lawn to the water's edge, applying fertilizer and pesticides near the water, stabilizing the shoreline with artificial materials, and removing all downed branches. Chemical- or sediment-laden stormwater runoff from homes and businesses that are a good distance away from the water can also adversely impact water quality.



In contrast, landscaping with water quality in mind will not only contribute to lake protection, but actually increase property values. For instance, lawns can be designed to allow development of a shoreline buffer zone, increase ease of maintenance by reducing mowing and watering, and eliminate dependence on potentially harmful chemicals. Careful planning and placement of small shrubs, trees, and ground covers can allow a view of the water while enhancing lake beauty amd ecological health.
Restoring desirable native trees, shrubs, and tall grasses around a lake improves environmental quality many ways, such as:

- Filtering pollutants that wash off of roofs, driveways, and other hard surfaces.
- Reducing or slowing stormwater runoff.
- Decreasing nutrient runoff, thus reducing the opportunity for algae mats to form and other overabundant aquatic plants to grow.
- Providing shade at the shoreline that benefits life both on the land and in the water.
- Absorbing noise.
- Reducing shoreline soil erosion and ice damage.
- Providing an aesthetically pleasing "privacy screen" while framing a view of the lake.

- Shedding larger branches and extending root wads into the water that create habitat for fish and wildlife.
- Reducing use of a shoreline by nuisance waterfowl, such as Canada geese.
- Reducing wave energy and scouring by slowing wind across the lake.

Many native plants that grow in lakes and other wet areas have aesthetically pleasing foliage and flowers. Examples include blue flag iris, button bush, cardinal flower, cinnamon fern, St. John's wort, marsh marigold, arrowhead, fragrant water lily, spatterdock, pickerelweed, marsh milkweed, jewelweed, and many rushes.

Invasive exotic species (e.g., purple loosestrife, amur honeysuckle, garlic mustard, giant reed grass, reed canary grass, Eurasian water milfoil or curly leaf pondweed) are damaging to a water body and should never be planted. In fact, to plant purple loosestrife is now illegal in Indiana. If you think there are invasive exotics along your shoreline, contact a licensed nursery, plant control specialist, or IDNR district fisheries biologist so the problem can be confirmed and the most effective removal method identified.

Improper management of seawalls and beaches may also be detrimental to shoreline and aquatic plants. Where needed to prevent shoreline erosion, a seawall of stone instead of concrete or steel will allow spaces for growth of native plants and provide a more natural appearance along the water's edge. The type of seawall materials is regulated by law on public freshwater lakes and requires permit approval before installation.

Underwater and on-shore beaches create bare areas that are not protected from erosion. Such areas should be kept small and designed to retain a border of vegetation around the seawall or beach. In Indiana, the only material permitted for construction of an underwater beach is pea gravel, which provides a longer lasting surface for aquatic recreation.

In most cases, lakes will naturally develop a diverse array of native flowering plants if left alone. A number of plant nurseries in Indiana can provide beneficial species for replanting shorelines that have lost flowering vegetation. For a current list of such suppliers, contact your local IDNR district fisheries biologist.

Appendix

Sources of Aquatic Plant and Lake Management Information and Assistance

World Wide Web Sites

Conservation Technology Information Center "Know Your Watershed" Program—*www.ctis.purdue.edu/CTIC/CTIC.html*
Illinois/Indiana Exotic Species/Sea Grant Program—*www.ansc.purdue.edu/sgnis*
Indiana Department of Environmental Management—*www.state.in.us/idem*
Volunteer Lake Monitoring Program—*www.state.in.us/idem/owm/assessbr/vlakemon.html*
Indiana Department of Natural Resources—*www.state.in.us/dnr/*
Division of Law Enforcement for the Indiana boating guide
Division of Water for searchable permit database, regulations, publications, etc.
Division of Fish & Wildlife for fishing regulations, fish stocking plans, etc.
Division of Soil Conservation for Hoosier Riverwatch volunteer river/stream monitoring program
Indiana Lakes Management Society—*www.nalms.org/member/chapters.htm#IN*
Indiana State Department of Health—*www.ai.org/doh/index.html*
Fish consumption advisories, contamination testing at public beaches, etc.
North American Lake Management Society—*www.nalms.org*
University of Florida Center for Aquatic and Invasive Plants—*aquat1.ifas.ufl.edu/*
U.S. Army Corps of Engineers Waterways Experiment Station—*www.wes.army.mil*
U.S. Environmental Protection Agency
EPA Surf Your Watershed—*www.epa.gov/surf*
EPA Volunteer Monitoring—*www.epa.gov/owow/monitoring/vol.html*
U.S. Fish & Wildlife Service—*www.fws.gov*
U.S. Geological Survey (Indiana District) Stream Gauge Data—*www-dinind.er.usgs.gov/rts_table.html*
U.S. Natural Resources Conservation Service (Indiana Office)—*www.in.nrcs.usda.gov*
U.S. Water Quality Information Center—*www.nal.usda.gov/wqic*

Permitting Assistance

ACOE wetland and lake shoreline permits—U.S. Army Corps of Engineers, Detroit District (northern Indiana), at 313-226-2432; Louisville District (south and central Indiana), at 502-582-5607.
IDEM wetland and lake shoreline permits (Section 401 water quality certification)—IDEM Office of Water Management, at 317-232-8472.
IDNR aquatic plant control permits—IDNR Division of Fish & Wildlife, Permit Administration, at 317-232-4080.
IDNR lake shoreline and river floodway permits—IDNR Division of Water, Permit Administration, at 877- 928-3755 or 317-233-5635; IDNR Division of Fish & Wildlife, Environmental Unit, at 317-232-4080.
IDNR snag removal permits—IDNR Division of Water, Project Development, at 317-232-4162.

Technical Assistance

Adopt-an-Access Site Program—IDNR Division of Fish and Wildlife, Program Coordinator, at 812-849-4586
Aquatic Plant Management and Ecological Research—Purdue University (West Lafayette campus), Department of Botany & Plant Pathology, Dr. Carole Lembi, at 765-494-7887 or *lembi@btny.purdue.edu*
Aquatic Plant Inventory and Ecological Research—Purdue University (North Central campus), Department of Biological Sciences, Dr. Robin Scribailo, at 219-785-5253 or *rscrib@purduenc.edu*
Plant and Pest Diagnostic Laboratory—Purdue University (West Lafayette Campus), Department of Botany & Plant Pathology, Peggy Sellers, at 765-494-7071

IDEM Environmental Help Line—Indiana Department of Environmental Management, at 800-451-6027 (will route to appropriate office)
Indiana Clean Lakes Program—IDEM/Indiana University School of Public and Environmental Affairs/US EPA, at 317-308-3217 or 812-855-4556
Indiana State Chemist and Seed Commissioner's Office—Purdue University (West Lafayette), at 765-494-1492.
Lake and River Enhancement and "Clean Water Indiana" Programs—IDNR Division of Soil Conservation, Program Chief, at 317-233-3870
Nonpoint Source Program—IDEM Watershed Management Section, Project Coordinators, at 317-232-0019
Soil and Water Conservation Districts for local soil, water, and related natural resource protection assistance—Listed in telephone directory under the U.S. Department of Agriculture (USDA), Natural Resources Conservation Service
U.S. Fish and Wildlife Service—Northern Field Office at 219-269-7640 or Southern Field Office at 812-334-4261

Education Assistance

Go FishIN Youth Education Program—IDNR Division of Fish and Wildlife, Program Coordinator, at 317-290-3223
Hoosier Riverwatch and Adopt-A-River Programs—IDNR Division of Soil Conservation, Program Coordinator, at 317-541-0617
Indiana Lakes Management Society—207 Hoosier Dr. Ste. 2A, Angola, IN 46703-9315
Midwest Aquatic Plant Management Society—P.O. Box 100, Seymour, IN 47274 or phone 812-497-2410
North American Lake Management Society—P.O. Box 5443, Madison, WI 53705 or phone 608-233-3186
IDEM/IU SPEA/US EPA Volunteer Water Quality Monitoring Program—Project Coordinators at 317-308-3191; Training and Data Management Specialist at 812-855-4556

Aquatic Plant Catalogs and Suppliers

See telephone book Yellow Pages listings under "Lake and Beach Cleaning and Improvements" or "Ponds and Pond Supplies" or for companies with expertise in bioengineering, vegetation, and/or landscaping
Contact USDA Natural Resources Conservation Service (Indiana Office) at 317-290-3200 or visit its web site at *www.in.nrcs.usda.gov* for the "National Directory of Wetland Plant Vendors"
Call Indiana Department of Natural Resources, Division of Fish & Wildlife, District Fisheries Biologists, at 317-232-4080 or Division of Soil Conservation, Aquatic Biologist, at 317-233-3870.

Glossary of Terms Regarding Aquatic Plants

Algae—A general category of small aquatic plants without true roots, leaves, or flowers and made up of one cell or multiple cells as individuals, colonies, or mats.
Anoxia—A condition of no oxygen in the water. Often occurs near the bottom of a lake.
Aphotic zone—A lake's deeper murky waters without adequate light to support plant growth.
Benthic—Relating to the bottom of a body of water.
Biological (biochemical) oxygen demand (BOD)—A measure of the amount of oxygen consumed in the biological pro cesses that break down organic matter in water. The greater the degree of organic pollution, the greater the BOD.
Contact herbicide—An herbicide that is generally lethal to all cells of a plant that come into contact with the chemical.
Diversity—The relative abundance and number of different species in a given area.
Dissolved oxygen (DO)—The oxygen dissolved in water. Generally, proportionately higher amounts of oxygen can be dissolved in colder waters than in warmer waters.
Dissolved substances—Minerals or other chemicals that are in solution affect the hardness of water and provide necessary nutrients for plants and animals.
Ecosystem—A specific biological community and its physical environment interacting in an exchange of matter and energy.
Endangered species (state listed)—Plant or animal species known to occur currently at five or fewer sites in Indiana.
Eutrophic—Condition of a body of water characterized by becoming, naturally or by pollution, rich in dissolved nutrients.

Also called *cultural eutrophication* when human activity adds higher levels of nutrients and sediment runoff, speeding up the natural process of eutrophication.

Exotic species—A non-native plant or animal species that has been introduced to an area through human action and that may be self-sustaining. Once established, an exotic species is usually very difficult to remove completely.

Extirpated species (state listed)—A plant or animal species believed to be originally native to Indiana for which there are currently no known populations within the state.

Herbicide—A substance used to kill or inhibit plant growth.

Invasive species—A plant or animal that invades a region it had previously not inhabited, often with negative effects.

Invertebrate—Any animal without a backbone.

Limnologist—A person who studies inland lakes and streams and the life within aquatic systems.

Littoral zone—The shallow zone in a body of fresh water where light penetration is sufficient for the growth of plants.

Macroinvertebrate—Any animal without a backbone that is visible without a microscope, such as aquatic insects, leeches, snails, crayfish, or mussels.

Macrophyte—A plant that is visible without a microscope and which has true roots, leaves, and flowers.

Native—A plant or animal species naturally present in a given area.

Nutrients—Elements or compounds essential as raw materials for growth and development of plants or animals, such as carbon, oxygen, nitrogen, and phosphorus.

Marl—A deposit of calcium carbonate that precipitates out of the water and settles on plant leaves and the sediment in a lake, primarily in the littoral zone.

Muck—Fine, dark-colored, well decomposed organic soil material.

Pelagic zone—The deeper open waters of a lake, beyond the shallow littoral zone.

Photic zone—The sunlit upper waters extending from the lake surface down to where light dims to about 1% of the light level at the surface.

Phytoplankton—Microscopic algae that float freely in open water of lakes and oceans.

Piscivore—An animal that feeds on fish, such as bass which eat minnows.

Planktivore—An animal that feeds on plankton, such as shad or paddlefish which eat microscopic organisms by filtering water over the gills.

Primary producers—Photosynthetic plants, algae, and some kinds of bacteria that contribute biological matter (biomass) to an ecosystem.

Productivity—A measure of the amount of biological matter (biomass) produced in a given area during a given period of time.

Rare species (state listed)—An animal or plant species known to occur currently at only eleven to twenty sites in Indiana.

Rip-rap—A layer, facing, or protective mound of stones placed to prevent erosion, scour, or sloughing of a structure or embankment.

Runoff—Water from rainfall, snowmelt, or irrigation that flows over the ground surface.

Selective herbicide—An herbicide used to kill or control a specific type of plant.

Silt—Soil material composed of particles larger than clay particles but smaller than sand grains.

Suspended solid—Particles floating in and carried by water. The origin of suspended matter may be human and industrial wastes or natural sources such as silt.

Threatened species (state listed)—An animal or plant species known to occur from only six to ten sites in Indiana.

Translocated herbicide—An herbicide absorbed into the living portion of a plant and transported within the plant to affect cells beyond the initial point of contact.

Turbidity—The measure of the ability of light to penetrate water, indicating the amount of living and nonliving suspended solids and dissolved substances in the water.

Watershed—The entire surface drainage area that contributes water to a stream, lake or wetland.

Zooplankton—Microscopic animals which float freely in lake water and that graze on detritus particles, bacteria, and algae (phytoplankton); may be consumed by fish.

Related Publications

Aquatic Plant Ecology

"Aquascaping: Planting and Maintenance" (Circular 912). D. Butts, *et al*., Florida Cooperative Extension Service, Institute of Food and Agriculture.

"Aquatic Plant Management" (WS-21). C. Lembi, Purdue Extension Service. Available from Purdue University Media

Distribution Center, 765-494-6794.
"Aquatic Plant Management in Lakes and Reservoirs." North American Lake Management Society and Aquatic Plant Management Society, 1997.
"Aquatic Pest Control: Indiana Commercial Pesticide Applicator Training Manual" (Category 5). C. Lembi, Purdue Extension Service, 1994. Available from the Purdue University Media Distribution Center, 765-494-6794.
"Limnology." A. J. Horne and R. C. Goldman, 1994. McGraw Hill, Inc., New York.
"Restoration and Management of Lakes and Reservoirs." G. D. Cooke, *et al*., Lewis Publishers, 1993.
"Pond and Brook: A Guide to Nature in Freshwater Environments." M. J. Caduto, University Press of New England, 1990.
"Textbook of Limnology." Cole, G., Waveland Press, Inc. 1983.
"The Lake and Reservoir Restoration Guidance Manual" (EPA 440/5-88-002). U.S. Environmental Protection Agency, 1988.
"Water Plants for Missouri Ponds: Identification, Unique Features, Values, and Uses." J.R. Whitley, et al., Missouri Department of Conservation, Jefferson City, Missouri.
"Wetland Planting Guide for the Northeastern United States: Plants for Wetland Creation, Restoration, and Enhancement." G. A. Thurnhorst, Environmental Concern, Inc., St. Michaels, Maryland, ph. 410-745-9620.

Aquatic Plant Identification

"Aquatic Plant Identification Deck" and "Grasses, Sedges and Rushes of Wetlands Identification Deck." University of Florida, ph. 904-392-1799.
"Through the Looking Glass: A Field Guide to Aquatic Plants." S. Borman, et al., 1997. Available from Wisconsin Lakes Partnership, University of Wisconsin-Extension, Stevens Point, WI, ph. 715-346-2116.
"Wetland Plants and Plant Communities of Minnesota and Wisconsin" (2nd Edition). S. D. Eggers and D. M. Reed, U.S. Army Corps of Engineers (St. Paul District), 1997.

Coorperative Extension work in Agricultur and Natural Resources and Consumer and Family Sciences, state of Indiana, Purdue University, and U.S. Department of Agriculture cooperating; David Petritz, director, West Lafayette, IN. Issued in furtherance of the acts of May 8 and June 30, 1914. The Cooperative Extension Service of Purdue University is an affirmative action/equal opportunity institution.