

Lake and Pond Plants



**A Guide to Vermont's Common Aquatic Plants
and Their Natural Values in Lakes**

**Department of Environmental Conservation
Waterbury, Vermont**

SOURCES OF INFORMATION

- Fassett, Norman C. *A Manual of Aquatic Plants*, University of Wisconsin Press, 1957.
- Engel, Sandy. "Lake Use Planning in Local Efforts to Manage Lakes", *Enhancing States' Lake Management Programs*, 1989: 101-105.
- Nichols, Stanley A. "Innovative Approaches to Macrophyte Management", *Lake and Reservoir Management: Vol. 2. Proceedings of the Fifth Annual Conference and International Symposium on Applied Lake and Watershed Management*. North American Lake Management Society, 1986: 245-251.
- Nichols, Stanley A., Sandy Engel, and Tom McNabb. "Developing A Plan to Manage Lake Vegetation", *Aquatics: Vol. 10, No. 3*, 1988: 10-19.
- VT Department of Environmental Conservation. "Buying Lakeshore Property." 1999.
- VT Department of Environmental Conservation. "Controlling Nuisance Aquatic Plants and Algae", 1989.
- VT Department of Environmental Conservation. "Invasive Exotic Plant Fact Sheets: Eurasian Watermilfoil and Water Chestnut." No date.
- VT Department of Environmental Conservation. "A Key to Common Vermont Aquatic Plant Species", 1990.
- VT Department of Environmental Conservation. "Only You...Can Save Your Lake." No date.
- VT Department of Environmental Conservation. Small Pond Information Packet. No date.
- VT Department of Environmental Conservation. "A Threat To Vermont's Lakes: Eurasian Watermilfoil", 1999.

Lake and Pond Plants

*A Guide to Vermont's Common Aquatic Plants
and Their Natural Values in Lakes*

By Susan Warren

Illustrated by Susan Warren and Ann Bove

Vermont Agency of Natural Resources
Department of Environmental Conservation
Waterbury, Vermont

May 2002

INTRODUCTION

The purpose of this booklet is to acquaint lake users with the diversity and benefits of the aquatic plants found in Vermont lakes. Illustrations of common Vermont aquatic plants are included for reference.

Aquatic plants are essential to the ecology of lakes, serving a multitude of purposes, including fish and wildlife food and habitat, water purification, and erosion control. At times, however, plant growth is considered by lake users to be a nuisance. This booklet provides a process for deciding if the plants in a particular lake or pond are, in fact, a problem meriting control measures, and specifically where in the lake such problems occur. Although not intended to be an exhaustive discussion, brief descriptions of methods to control nuisance plant growth are also included.

Anyone with further questions about aquatic plants, or potential plant problems in a lake, is encouraged to call or write the Department of Environmental Conservation's Lakes and Ponds Section:

Water Quality Division
103 South Main Street, 10 North
Waterbury, VT 05671-0408

(802) 241-3777

or visit the Lakes and Ponds Section website at:

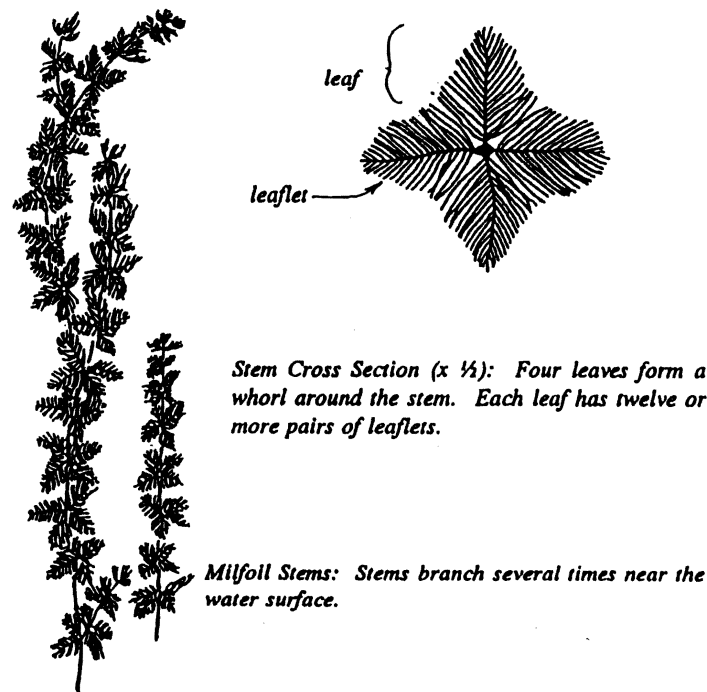
www.vtwaterquality.org/lakes.htm

The Vermont Department of Environmental Conservation is an equal opportunity agency and offers all persons the benefits of participating in each of its programs and competing in all areas of employment regardless of race, color, religion, sex, national origin, age, disability, sexual preference, or other non-merit factors.

This document is available upon request in large print, braille or audio cassette.

VT Relay Service for the Hearing Impaired
1-800-253-0191 TDD > Voice - 1-800-253-0195 Voice > TDD

The Lakes and Ponds Section has initiated an extensive education program to control the spread of Eurasian watermilfoil and other invasive plants and animals. Lake residents can take advantage of the Aquatic Nuisance Species Program, in which volunteers are trained to search for Eurasian watermilfoil and other invasive plants and animals in yet uninfested lakes. If a new milfoil infestation is found before it has spread lakewide, successful control may be possible.



Stem Cross Section (x 1/2): Four leaves form a whorl around the stem. Each leaf has twelve or more pairs of leaflets.

Milfoil Stems: Stems branch several times near the water surface.

Eurasian watermilfoil (Myriophyllum spicatum)

Contact the Lakes and Ponds Section for further information about Eurasian watermilfoil and how to prevent further spread of this and other nuisance aquatic plants in Vermont.

EURASIAN WATERMILFOIL: A THREAT TO VERMONT LAKES

A number of Vermont lakes contain a nuisance rooted aquatic plant called Eurasian watermilfoil. A native of Europe and Asia, spread of Eurasian watermilfoil in North America has occurred quickly since its introduction in the mid 1940's. Watermilfoil is highly invasive; its aggressive growth habits easily out-compete desirable, native plant species. Once introduced to a lake, Eurasian watermilfoil growth almost always reaches nuisance proportions.

Unfortunately, once Eurasian watermilfoil has become established in a lake, there is no known way to eradicate it. The control measures discussed previously are available to combat its profuse growth.

Eurasian watermilfoil is easily spread from lake to lake when fragments of Eurasian watermilfoil caught on boating equipment are introduced to uninfested lakes.

Boaters are urged to carefully check their boat motors and trailers for fragments of plants before and after launching, particularly if they have just been boating in a lake where Eurasian watermilfoil is known to occur. Boaters are warned that transporting Eurasian watermilfoil, as well as zebra or quagga mussels, or water chestnut, is illegal and carries heavy penalties (pursuant to V.S.A. Title 10, Section 1266). Violators are subject to a fine of \$150 (plus a \$17.50 surcharge).

As of March 2002, the movement, sale and or distribution of Eurasian watermilfoil, as well as a number of other invasive aquatic and wetland plants is now prohibited in Vermont (V.S.A. Title 6, Chapter 84).

For more information, please visit:
www.vtwaterquality.org/ans/ans-index.htm

CONTENTS

What Good Are Plants?	1
Plant Ecology: Why Do Plants Grow Where They Do?	4
Common Aquatic Plants In Vermont:	
Emergent	8
Submersed	10
Floating-leaved	13
Algae - Plants Without Leaves or Stems	15
When Is A Plant A Weed?	17
How To Control Nuisance Plants	20
Assistance With Aquatic Nuisance Control	25
Eurasian Watermilfoil: A Threat To Vermont Lakes	26
Sources Of Information	28

ASSISTANCE WITH AQUATIC NUISANCE CONTROL

The Vermont Aquatic Nuisance Control Program was established by the legislature in 1978. Administered by the Department of Environmental Conservation, this program provides technical and financial assistance to municipalities, lake associations or other qualified groups that wish to institute control programs for nuisance aquatic plants.

Further information and advice regarding the best approach to be taken to manage an aquatic plant problem is available from the Lakes and Ponds Section. Applications for permits for control methods that require a permit from the Department of Environmental Conservation are also available. The following activities require a permit:

- *introduction of any chemical to surface waters*
- *use of bottom barriers*
- *placement of sand in surface waters*
- *mechanical weed harvesting*
- *removal or dredging of lake bottom material*
- *construction of retaining walls, boathouses, some docks, and other structures*

For further information and permit applications, contact:

Aquatic Nuisance Control Program
Department of Environmental Conservation
Water Quality Division
103 South Main Street, 10 North
Waterbury, VT 05671-0408

(802) 241-3777

Herbicides

Chemical control of aquatic plant growth is not a widely used method in Vermont. Considerations for use include cost and Federal product and label restrictions. In addition, herbicides will not completely kill the weeds; annual use is often necessary for desired levels of control. (Permit required.)

Sand fill

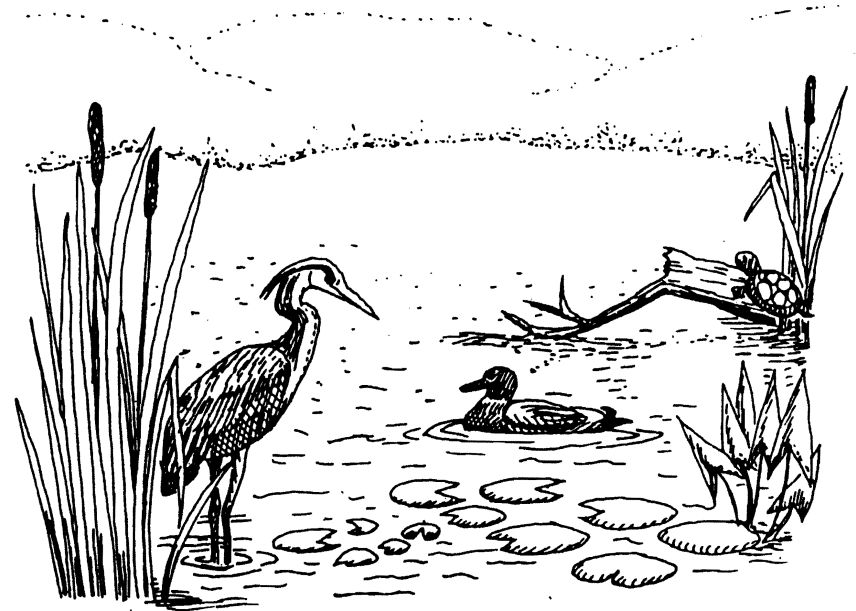
Lake residents often assume that placing sand on the lake bottom will control plant growth. However, this control method has a short-lived effectiveness as plants will quickly invade the sandy area. As this approach necessitates frequent sand applications, it is not recommended as a plant control option. Because of the alteration of the lakeshore habitat, the placement of any amount of sand below the mean water level requires a permit from the DEC's Management of Lakes and Ponds Program. Please call 241-3777 for further information.

WHAT GOOD ARE PLANTS?

Aquatic plants (plants growing in water) are depended on, directly or indirectly, by most aquatic life. These plants, including algae, are the base of the aquatic food chain, providing oxygen and converting basic chemicals from the soil and water into food for other kinds of aquatic life. Although plants are sometimes present in such abundance (due to excessive phosphorus pollution) that they are a nuisance to human lake users, their essential natural roles in lakes can be overlooked.

a. Plant beds provide wildlife habitat.

Many species of animals, waterfowl, and other birds are attracted to aquatic plant beds either to feed on the plants or on the other life found there. Many animals and birds depend on areas of aquatic plant growth for shelter, food, breeding, and migratory stopovers.



b. *Water plants provide excellent fish habitat.*

Plants harbor insects and insect larvae which most fish depend on for food. A complex habitat exists in the shallow regions of the lake where plants grow in abundance, and the plants and sediments are teeming with the insects which are the base of the fish food chain. Plants also provide shade and cooler water, important to many fish.

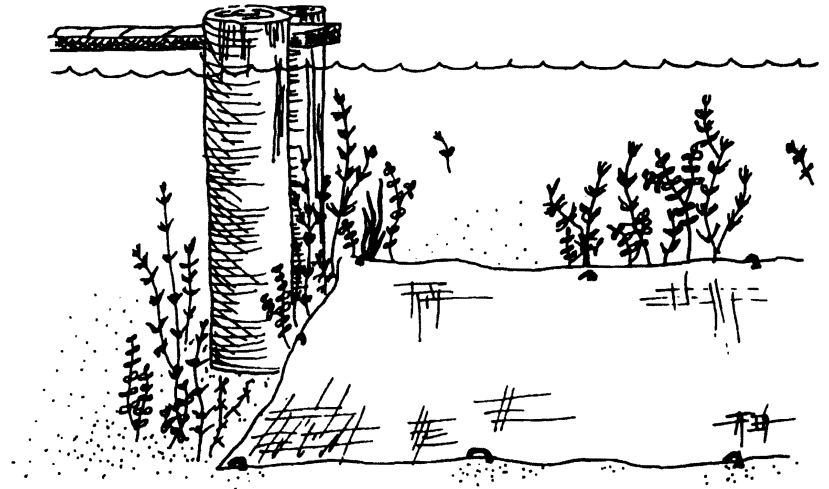
c. *Water plants provide food and protection for young fish.*

Young fish can hide among plants, gaining protection from predators at a vulnerable time in their life. In addition, fish fry feed on small insects and algae in plant beds found in shallow water.



Bottom barriers

Bottom barriers are materials (fiberglass screening, felt-like or polyvinyl chloride mats) that can be anchored to the lake bottom to stop plant growth by preventing sunlight from reaching covered plants. Nearly 100% control is achieved in the covered area, making this control method ideal for small areas around docks and beaches. Somewhat expensive in large quantities, bottom barriers are often not feasible for large areas. Bottom barriers must be maintained to be effective. (Permit required.)

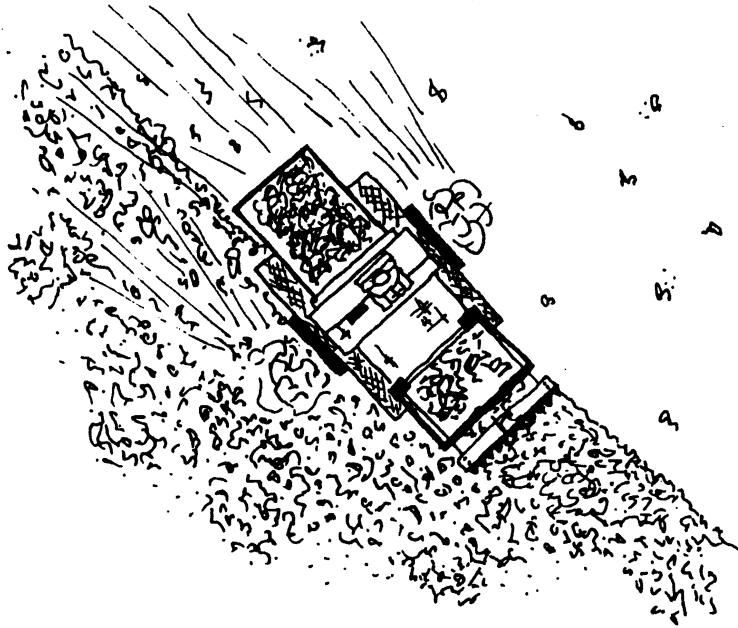


Winter drawdown

If the water is let out of a lake during the fall and into the winter, the drying and freezing action will kill susceptible species of exposed plants and their roots. However, most lakes in Vermont cannot be drawn down deep enough to make this an effective approach. In addition, drawdown can have lakewide disastrous effects on fish populations and their spawning areas and wetlands. For these reasons, drawdown is used very little in Vermont. It is, however, a method to consider in small, privately owned ponds where the fish population is not a concern. Since only certain plant species are susceptible to drawdown and others may be enhanced, consult with the Department of Environmental Conservation before implementing this type of control. (Permit may be required.)

Mechanical weed harvester

Mechanical weed harvesters are commercially available in many sizes. They range from units that fit onto an ordinary outboard motorboat to 30-foot long barges propelled by paddle wheels. The larger harvesters cut the weeds off five to eight feet under the water for removal to an approved disposal site. These larger machines are expensive, often require full time personnel and are usually only appropriate for large lakes. Several well organized lake associations in Vermont run successful weed harvesting projects with mechanical harvesters. Plant beds are generally cut two to three times each summer to alleviate nuisance conditions. (Permit required.)



d. *Water plants protect the shoreline from erosion.*

Near-shore plants, particularly emergent varieties, buffer the shoreline from wave action and slow down the erosion process. This is especially important on large lakes.

e. *Plant beds at the mouths of streams filter out sediments and nutrients.*

Aquatic plant beds develop at stream mouths and serve to slow the water and settle out incoming sediments. The plants here also take up nutrients from the water, thus preventing their entry to the open water areas. These natural filters are important for protecting the water quality of lakes.



f. *Aquatic plant beds have aesthetic value.*

Aquatic plants are often beautiful and delicately formed. Some species have lovely flowers, such as the water lily. Plants contribute immeasurably to the natural beauty of a lake. Our enjoyment of the lake is greatly enhanced by the presence of the wildlife and fish that the plant life supports.

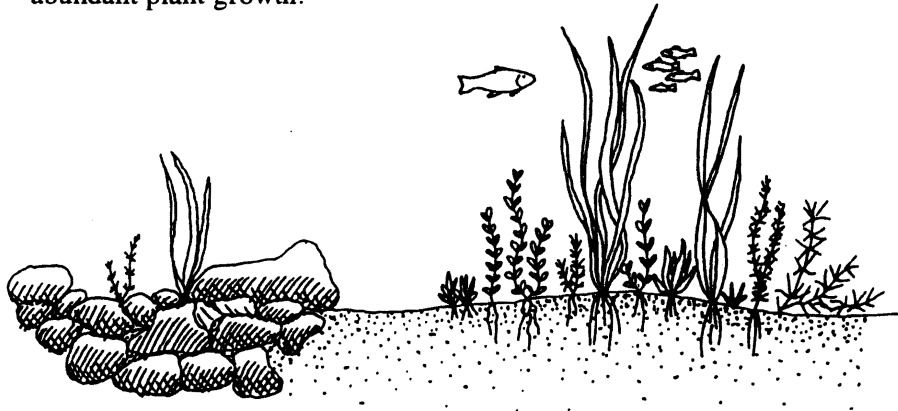
PLANT ECOLOGY: WHY DO PLANTS GROW WHERE THEY DO?

Almost all lakes have some amount of aquatic plant growth. How much growth and what type of plants depend upon the natural and human influences on the lake. In general, the more nutrient-rich a lake, the more plants that live there. Some lakes are naturally nutrient-rich and support healthy abundant plant growth. Lakes which are subject to phosphorus pollution from human sources often have increased plant growth, sometimes reaching nuisance conditions.

Natural Influences on Plant Growth

1. *Bottom type*

Aquatic plants usually prefer a soft sediment bottom. Rocky areas are often devoid of plants, while muddy and sandy areas often support abundant plant growth.

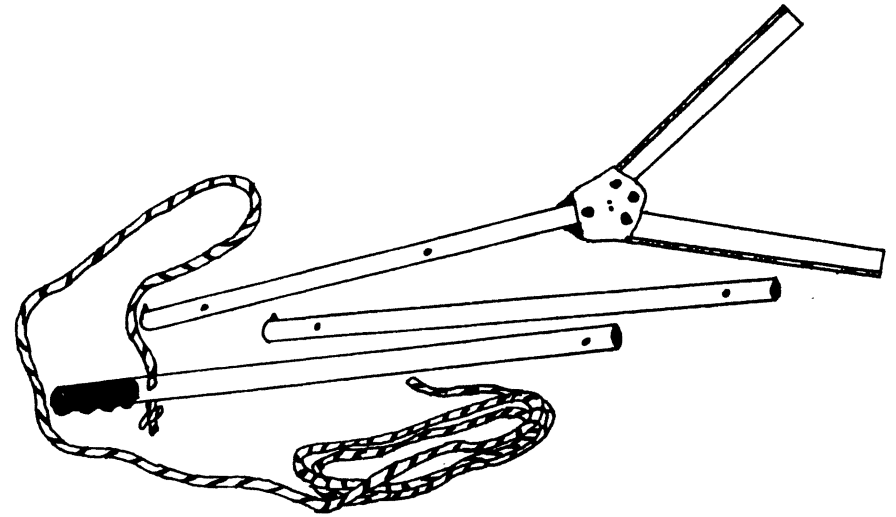


2. *Amount of nutrients*

Different plants prefer different amounts of nutrients. Some are adapted to nutrient-poor conditions. However, plants can generally grow more abundantly in nutrient-rich sediments. Since most plants can extract nutrients from the lake water as well as from the sediments, the amount of nutrients in the water also influences plant growth. Plants are often found near a source of nutrients in a lake such as the mouth of a stream, a groundwater seep, or a rotting log.

Hand operated weed cutter bar

Weed cutter bars can be constructed from scythe blades or may be purchased commercially. A cutter bar allows a somewhat larger area of plant growth to be controlled than with raking or pulling, but again its use is primarily for localized areas. Generally, cutting is necessary yearly to maintain control.



Boat-pulled weed cutter bar

A number a lake associations in Vermont have constructed large cutter bars to pull behind boats in order to cut large areas of weeds. This type of project needs an organized group of people to pull the cutter bar and rake the plants out of the water. Again, cutting must be repeated periodically to maintain control. (Permit required.)

HOW TO CONTROL NUISANCE PLANTS

Once the decisions have been made that a nuisance condition exists, there is reason to believe that control methods will be successful, and the problem is not in an area important to the fishery or wildlife of the lake, the time has come to choose a control method. There are a number of control mechanisms available to the lake resident which vary considerably in complexity and cost. Often one or more methods can be integrated for the most successful amount of control. The following brief descriptions are meant to introduce the reader to the available options. Further information about each of these control methods, and permit applications (if required) are available from the DEC's Lakes and Ponds Section.

Hand raking or pulling

Many aquatic plant problems can be handled adequately through raking or hand pulling. This is appropriate for relatively small areas around docks or swimming areas. The frequency with which this task will have to be repeated varies depending on the type of plant being controlled; some species grow back more rapidly than others.

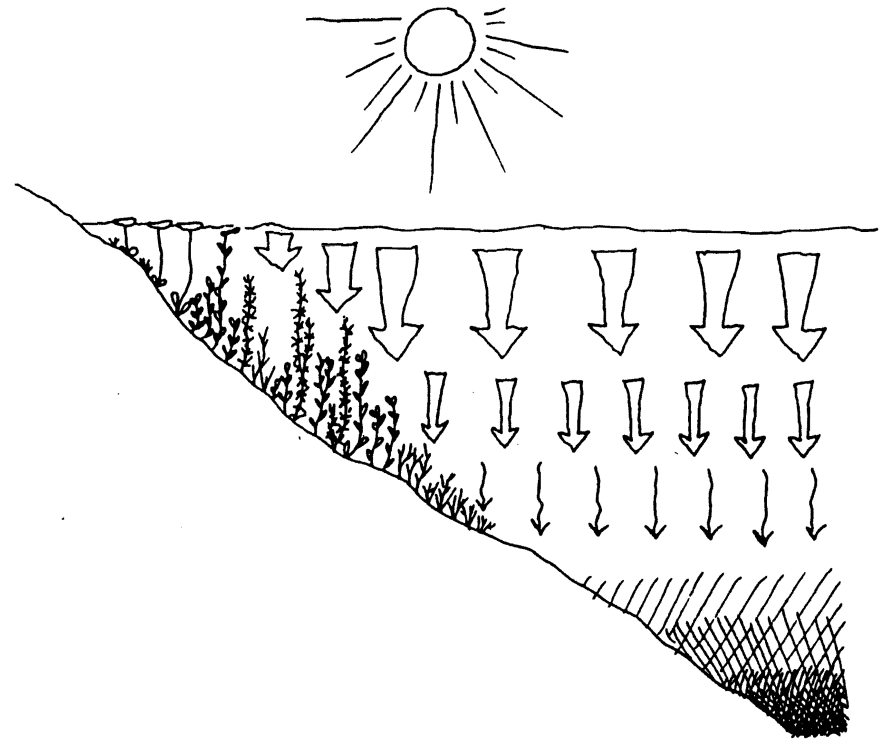


3. *Wave action*

More exposed sections of shoreline, such as points of land, tend to support fewer, shorter, and sturdier plants. Protected areas, such as coves, will be able to support more abundant, taller and more delicate plants.

4. *Light*

Plants need light to grow. Many lakes have deep water areas where rooted plants can't get enough light to survive. The maximum depth at which plants grow in a lake depends on the water clarity. In Vermont lakes, plants can generally be found growing out to water depths of 25 feet.



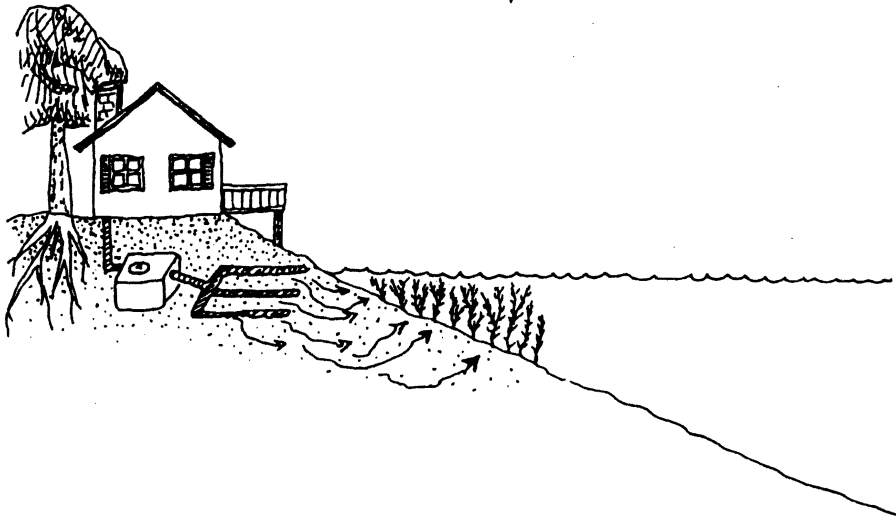
Human Influences on Plant Growth

Human activities in a lake's watershed can cause nutrient or sediment pollution which, when washed into a lake, can stimulate the growth of aquatic plants.

1. Nutrient-rich pollution

The most common form of pollution to Vermont lakes is the introduction of excess nutrients. Nutrients, such as phosphorus, are contained in abundance in human and animal wastes, and fertilizers. These stimulate plant growth when introduced into a lake. Some common sources of nutrients are:

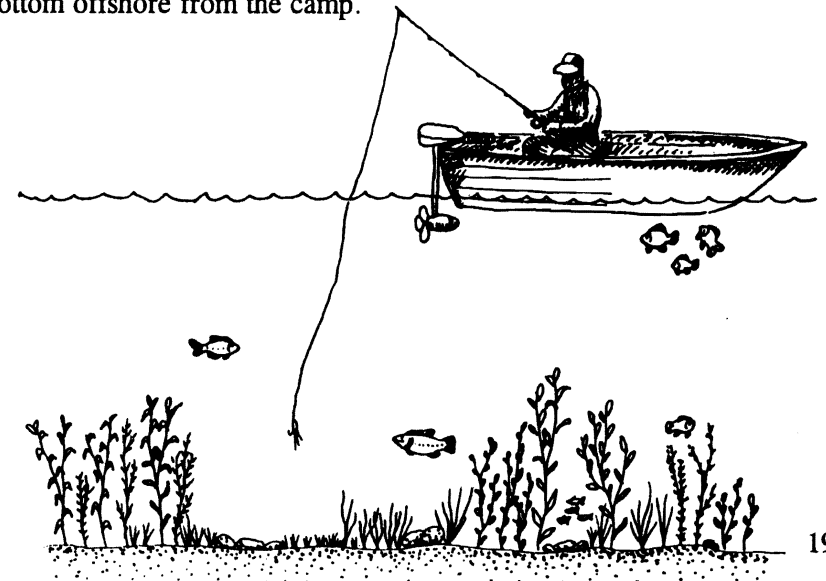
- *failing septic systems*
- *lawn and garden fertilizers*
- *agricultural runoff*
- *wastewater treatment facility discharges*



plants would naturally occur in abundance. Such areas include shallow marshy coves, areas of the lake with a marshy shoreline, and mouths of streams. Areas like these are often important to the fishery or wildlife of a lake, and usually should not be the site of plant control programs.

When plants cause nuisance conditions in a lake, there are several control methods that may be used to manage the problem. However, residents should first consider the natural condition of plant growth in their lake. Don't try to make the lake into something it's not. For instance, a shallow lake or pond with a soft mucky bottom will naturally contain abundant plant growth, and little can be done to change that. Attempting to change a natural condition can be very expensive and very frustrating. Proper management of a lake should strive to maintain a balance of plants and still retain the lake's recreational importance.

Before plant control is undertaken, lakeshore residents should be sure that their own activities are not contributing to the nuisance plant growth. For instance, lawn fertilizer used on the lake shore will stimulate local aquatic plant growth. Also, poorly maintained septic systems, even if there are no obvious problems or bacterial contamination, can contribute nutrient-rich water to lake sediments. Dense weed beds often occur in front of camps where this is happening. Another indication of septic system failure is green algae growth covering either the plants or the lake bottom offshore from the camp.



Plants may be a nuisance in very localized areas or throughout a lake. Lake residents should try to recognize those areas of the lake which support important and beneficial plant beds, and those where plants are truly a nuisance. Some steps for evaluating the extent of a lake's weed growth are listed below:

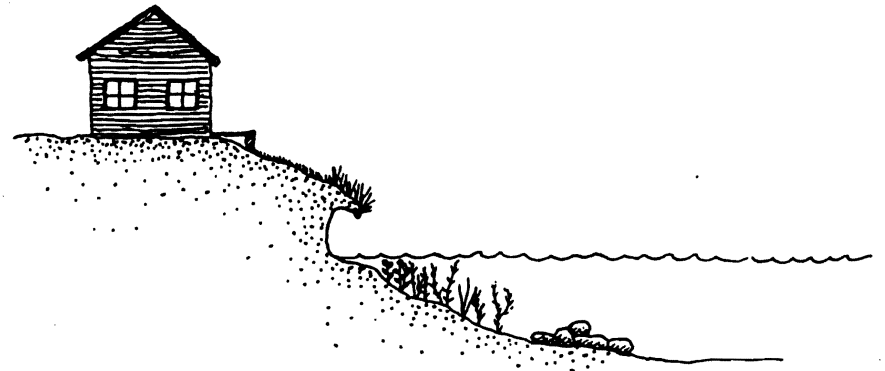
1. List the areas of plant growth that you believe interfere with human activities on the lake. Be specific about locations and uses that are limited:
 - *Do boat motors get tangled with weeds?*
 - *Is the growth prohibitively thick around docking or swimming areas?*
2. List the areas of plant growth that do not interfere with human activities. Examples of these might be marshy areas in shallow coves and at inlets that can easily be avoided by motor boats, and low growth (close to the lake bottom) around a dock or in a swimming area.
3. Learn to identify and appreciate the values of plant growth in the lake; not all plants are weeds! Look for abundant fish, insect, bird and wildlife that can be found in or near plant beds. Remember, plant growth is a healthy and a beneficial part of a lake.
4. Try to identify some of the plants using this booklet, or contact the Lakes and Ponds Section for assistance. Note the features of the plants which make them valuable for fish, wildlife and water quality.
5. Re-evaluate the list from #1 above. Could some of the uses that are limited be moved to other less weedy areas? Perhaps some boating uses should be concentrated in the areas of the lake where there are fewer plants.

The final list should include only those areas where uses are definitely impaired and where those uses cannot occur elsewhere; some areas considered by lake users to be a nuisance may in fact be areas that

2. *Soil erosion*

Any activity which exposes soil results in erosion when water washes over the raw ground during rain storms. Loosened soil washes away, entering streams and settling out in lakes at the mouths of inlets, where it provides ideal plant habitat. In addition, soil carries nutrients, particularly phosphorus, that stimulate plant growth. Excessive amounts of erosion can result in an unnatural abundance of plant growth; thus, nuisance weed conditions can be created. Some common sites of erosion are:

- *gravel roads and roadside ditches*
- *plowed farmland*
- *construction sites*
- *logging sites*
- *unstable streambanks*
- *unstable lakeshores*



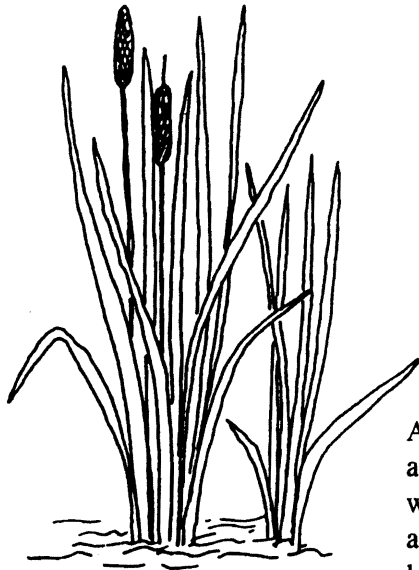
The results of these human influences can often be seen in the location of plant beds in a lake. Abundant plant beds are found at the mouths of inlet streams and road drains carrying large nutrient or sediment loads. Plants are often found more commonly in front of lakeshore cottages, than along undeveloped shores. The reason is probably a combination of the human influences listed above.

COMMON AQUATIC PLANTS IN VERMONT

Aquatic plants are grouped into three categories based on their manner of growth: *emergent*, *submersed* and *floating-leaved*. A diverse selection of plant types in a lake means a healthy and diverse fish and wildlife population. Some of the more common aquatic plant species found in Vermont are illustrated below:

Emergent

Emergent plants are those which are rooted in the shallow water at the lake's edge, with leaves that emerge from the water and extend upright into the air. This group of aquatic plants provides protection and breeding areas for waterfowl, nesting sites for songbirds, and protection of the shoreline from erosion.



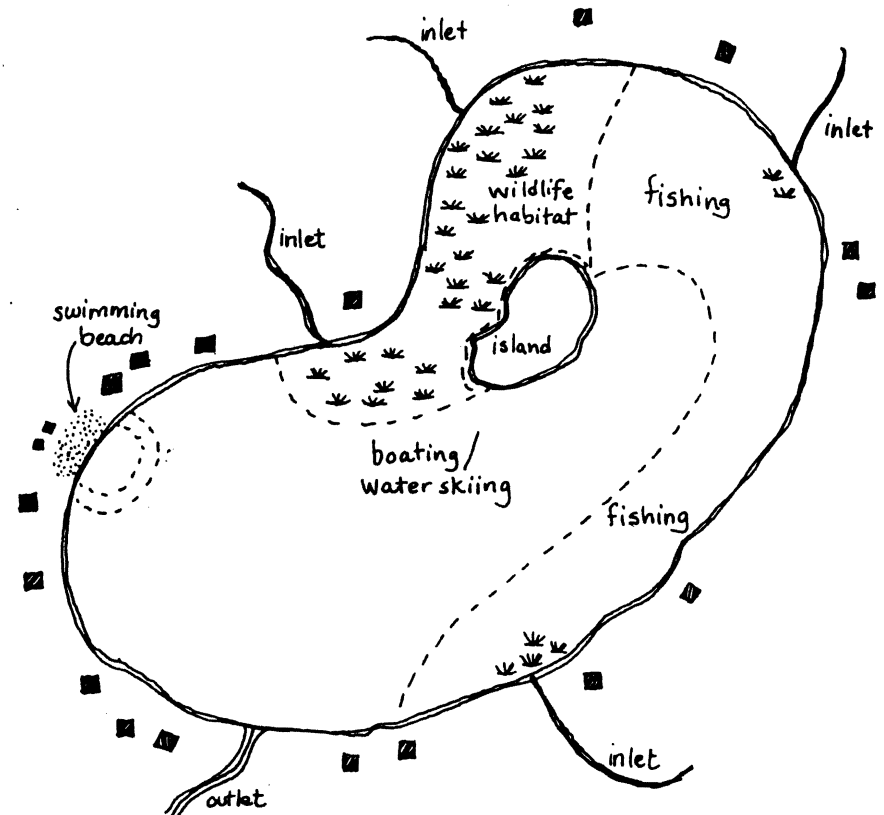
Cattail
(*Typha latifolia*)

A common sight on Vermont's lakes and ponds, cattails are excellent waterfowl habitat, provide food for aquatic mammals, and stabilize lakeshores.

WHEN IS A PLANT A WEED?

There is no scientific definition of the term "weed." An aquatic plant is commonly called a weed when its growth interferes with people's use of a lake for such activities as swimming, boating, or fishing. Plant growth which is considered to be a nuisance by some people may in fact be natural and beneficial to a lake.

Aquatic plant management involves striking a balance between the natural benefits of the presence of plants, and the desire of lake users to have an enjoyable recreational experience.



Algae growth is a natural occurrence in lakes, with some lakes supporting larger algae populations than others. As with rooted aquatic plants, the introduction of cultural sources of nutrients can stimulate algae growth to the point that nuisance conditions occur. Contact the Lakes and Ponds Section if you have questions regarding algae growth in your lake or pond.

Arrowhead
(*Sagittaria latifolia*)

There are several types of arrowheads in Vermont. These plants are a food source for waterfowl and mammals, provide shade and shelter for young fish, and stabilize shorelines.



Pickerelweed
(*Pontederia cordata*)

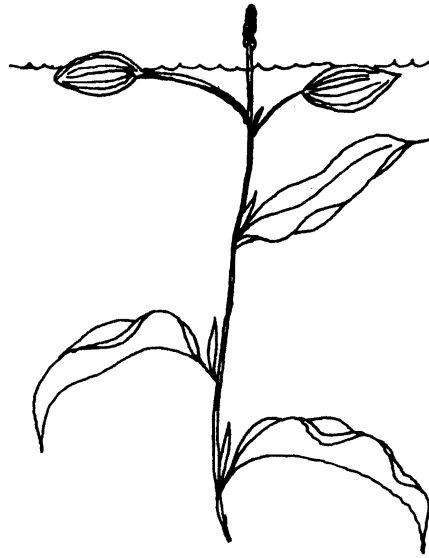
This lovely purple flowered plant provides food for waterfowl, shade and shelter for fish, and spawning areas for northern pike.

Submersed

Submersed aquatic plants grow entirely underwater, and are usually rooted in the lake sediments. There are many types of submersed plants in Vermont. They have a wide variety of leaf forms, and therefore provide a variety of habitats for insects and fish, including fish spawning areas.

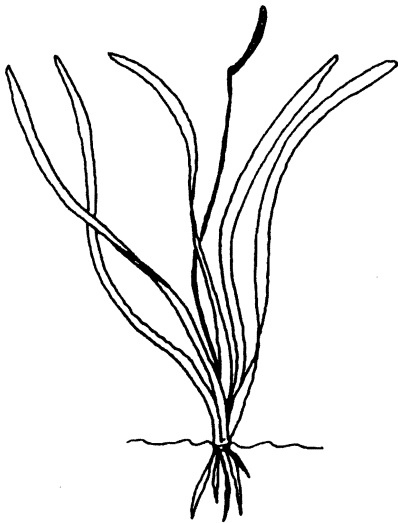
Big-leaf pondweed (*Potamogeton amplifolius*)

This common plant provides some of the best fish habitat of all aquatic plants. Its large leaves offer shade and protection, excellent spawning areas, and harbor many insects for feeding. It is also a staple food for ducks, and is eaten by many different types of mammals.



Water tape-grass (*Vallisneria americana*)

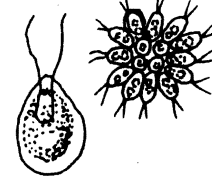
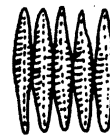
This important plant is an excellent waterfowl food, and attracts many shorebirds and mammals. It also provides good shallow water fish habitat, offering shade and shelter, and harboring insects.



ALGAE - PLANTS WITHOUT LEAVES AND STEMS

Algae are small plants that do not have true leaves, roots or flowers like the other aquatic plants. They form the basis of the food chain in lakes, being eaten by small animals and fish that are in turn eaten by larger predators. Often quite inconspicuous, algae are present in every lake or pond, floating freely in the water, or attached to submersed surfaces. In some cases, particularly during hot weather, algae can reproduce rapidly in a lake, causing what is termed an algae "bloom." Lakes and ponds with excessive phosphorus concentrations may experience regular blooms during the summer months.

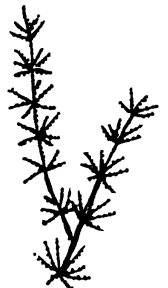
Among others, four general forms of algae are: planktonic (free-floating), filamentous, attached, and attached-erect. Planktonic algae usually appear as green or brown particles or coloration in the lake water. During a bloom, algae can color a lake "pea soup" green. Filamentous algae, often referred to as "pond scum," typically form greenish, threadlike mats on the water's surface or attached to plants or rocks. Muskgrass, an attached-erect algae, is often mistaken for a rooted aquatic plant forming dense low-growing mats on the lake bottom.



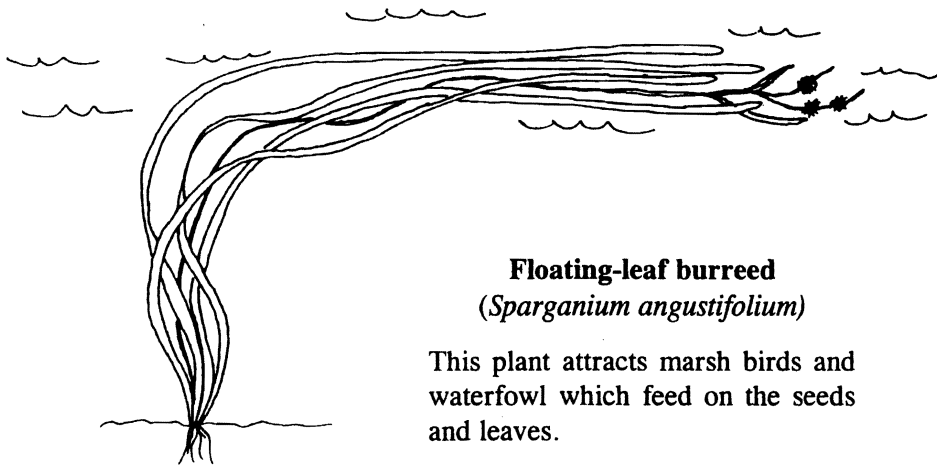
planktonic
(x 300)



filamentous
(x 200)



attached-erect
(x 1/4)



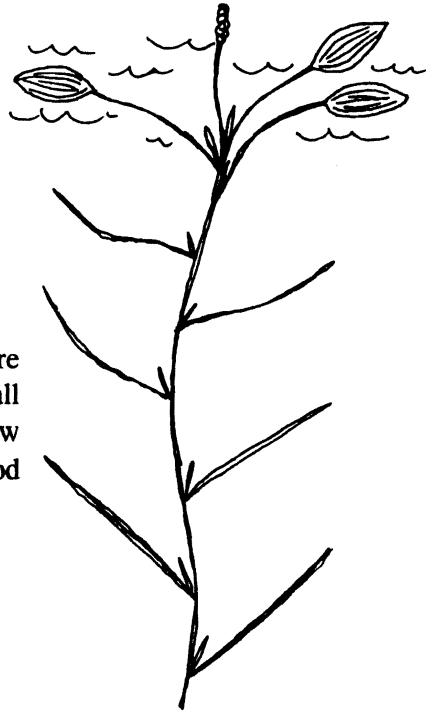
Floating-leaf burreed
(*Sparganium angustifolium*)

This plant attracts marsh birds and waterfowl which feed on the seeds and leaves.



Elodea
(*Elodea canadensis*)

This hardy plant is food for some species of waterfowl, and provides shelter for insects that are valuable as fish food.

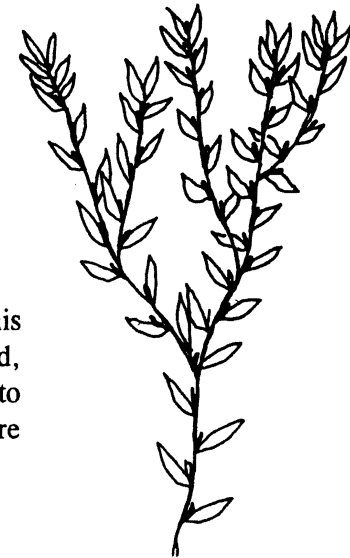


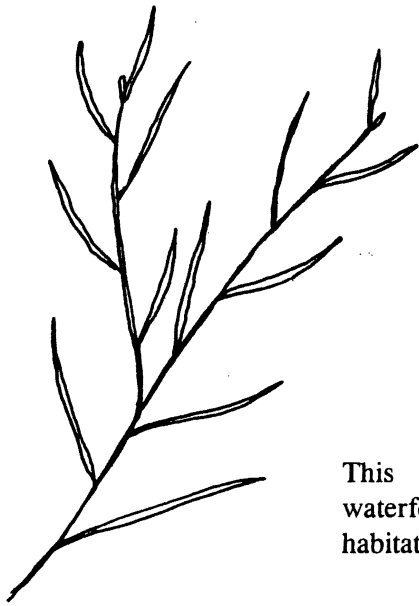
Floating-leaf pondweed
(*Potamogeton natans*)

The roots and seeds of this plant are good duck food, and the small floating leaves and narrow underwater leaves create a good environment for fish.

Variable pondweed
(*Potamogeton gramineus*)

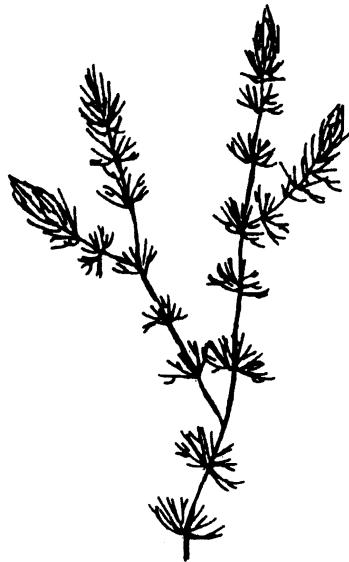
Related to Big-leaf pondweed, this plant is also good waterfowl food, and offers food, shade, and shelter to fish and fish fry. Its starchy roots are also a food source for ducks.





Water star grass
(*Heteranthera dubia*)

This thin-leaved plant is good waterfowl food and aquatic insect habitat.

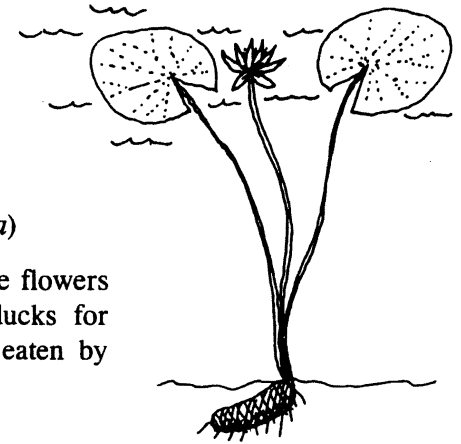


Coontail
(*Ceratophyllum demersum*)

Coontail's finely divided leaves are good insect habitat and offer protection for young fish. Both the leaves and seeds of the plant are food for waterfowl.

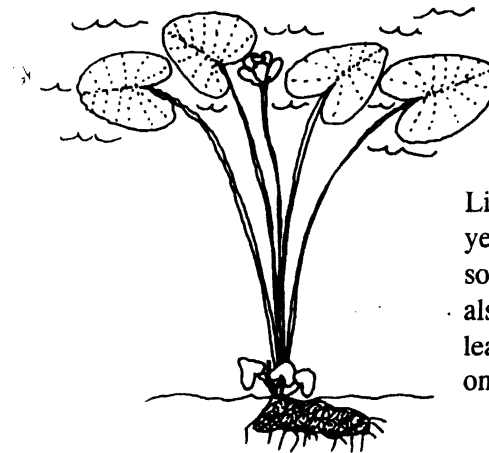
Floating-leaved

Floating leaved plants generally grow in shallow water and have long flexible stems and floating leaves. As a group, these plants serve to keep the water cool in shallow areas.



White water-lily
(*Nymphaea odorata*)

This plant's beautiful white flowers produce seeds used by ducks for food. Its large roots are eaten by various mammals.



Cow-lily
(*Nuphar variegatum*)

Like the White water-lily, this yellow flowered plant is an important source of food for mammals, and also attracts waterfowl. Its wide leaves support insects which are fed on by fish.