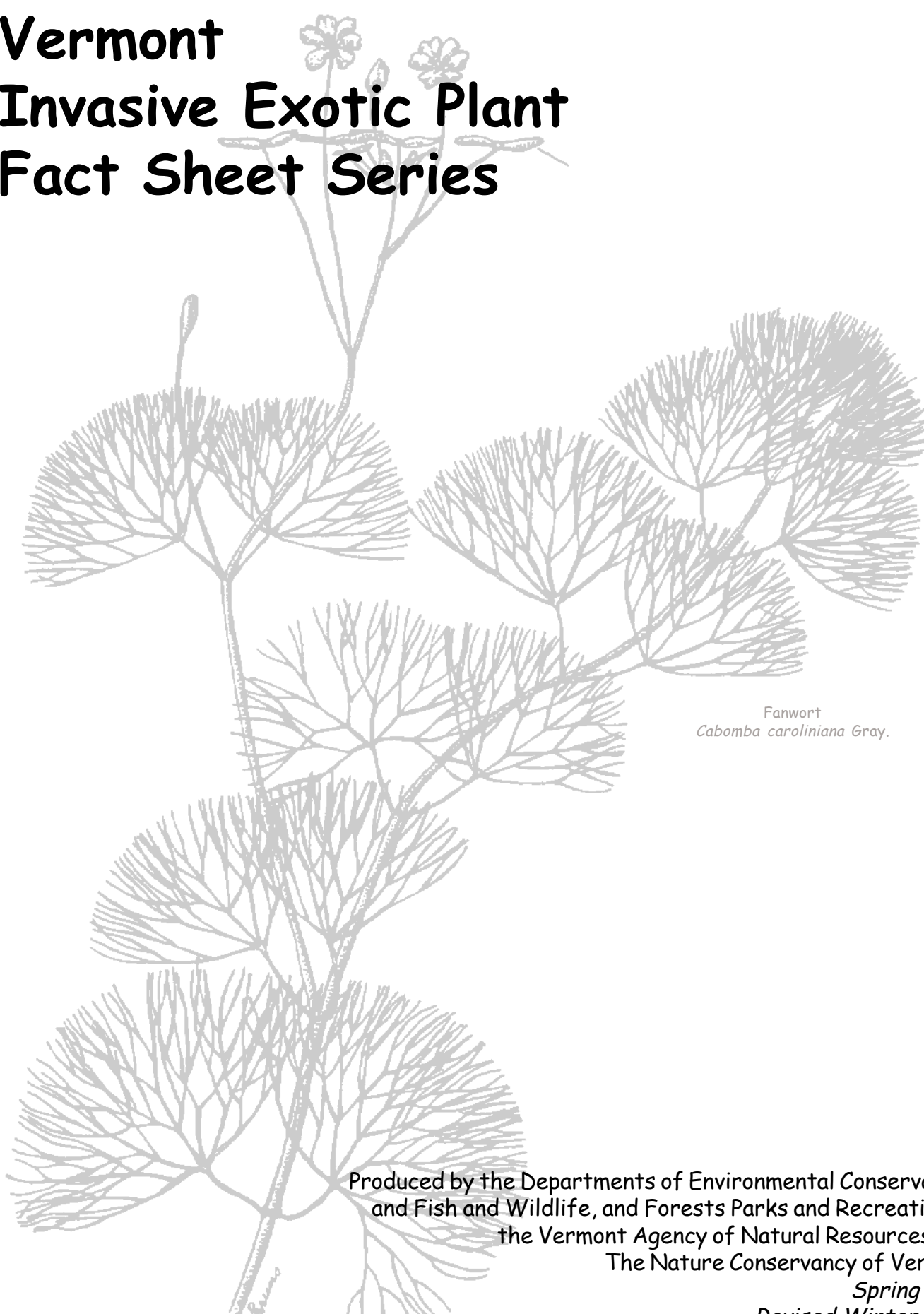


Vermont Invasive Exotic Plant Fact Sheet Series



Fanwort
Cabomba caroliniana Gray.

Produced by the Departments of Environmental Conservation,
and Fish and Wildlife, and Forests Parks and Recreation, of
the Vermont Agency of Natural Resources, and
The Nature Conservancy of Vermont

Spring 1998
Revised Winter 2003



Special thanks to The Nature Conservancy of Connecticut
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Vermont Invasive Exotic Plant Fact Sheet Series Table of Contents

Frequently Asked Questions About the Quarantine Rule.....	1
Invasive Exotic Plants - Give Them a Niche, and They Take a Mile.....	3
Invasive Exotic Plants - What You Can Do To Help.....	5

Class A Noxious Weeds

<i>Cabomba caroliniana</i> , fanwort.....	7
<i>Egeria densa</i> , Brazilian Elodea.....	9
<i>Hydrilla verticillata</i> , hydrilla.....	11
<i>Hygrophila polysperma</i> , East Indian hygrophila.....	13
<i>Myriophyllum aquaticum</i> , parrot feather.....	15
<i>Myriophyllum heterophyllum</i> , variable-leaved milfoil.....	17
<i>Salvinia</i> spp., (four species) giant salvinia.....	19
<i>Vincetoxicum hirundinaria</i> , pale swallow-wort.....	21

Class B Noxious Weeds

<i>Aegopodium podagraria</i> , goutweed.....	23
<i>Ailanthus altissima</i> , tree-of-heaven.....	25
<i>Alliaria petiolata</i> , garlic mustard.....	27
<i>Butomus umbellatus</i> , flowering rush.....	29
<i>Celastrus orbiculatus</i> , Oriental bittersweet.....	31
<i>Fallopia japonica</i> , Japanese knotweed.....	33
<i>Hydrocharis morsus-ranae</i> , frogbit.....	35
<i>Lonicera</i> spp., (four species) honeysuckle.....	37
<i>Lonicera japonica</i> , Japanese honeysuckle.....	39
<i>Lythrum salicaria</i> , purple loostrife.....	41
<i>Myriophyllum spicatum</i> , Eurasian watermilfoil.....	43
<i>Nymphoides peltata</i> , yellow floating heart.....	45
<i>Phragmites australis</i> , common reed.....	47
<i>Potamogeton crispus</i> , curly leaf pondweed.....	49
<i>Rhamnus</i> spp., (two species) buckthorn.....	51
<i>Trapa natans</i> , water chestnut.....	53
<i>Vincetoxicum nigrum</i> , black swallow-wort.....	21

Frequently Asked Questions About the Quarantine Rule

Why has Vermont Passed a Noxious Weed Quarantine?

In order to regulate the importation, movement, sale, possession, cultivation and/or distribution of certain invasive plants. These plants either pose a threat to the Vermont environment or are already negatively impacting waterways and natural areas in the state. Many of these plants are becoming such a problem that there is no alternate prevention method. This rule will also prevent plants not yet found in Vermont from being introduced, and will protect the state from the many environmental, agricultural, recreational, and/or economical problems associated with their presence.

What are Noxious Weeds?

As defined by the Noxious Weed Quarantine Rule, noxious weeds are: any plant in any stage of development, including parasitic plants whose presence whether direct or indirect, is detrimental to the environment, crops or other desirable plants, livestock, land, or other property, or is injurious to the public health. Noxious weeds are generally exotic, invasive species that are very good at establishing in natural areas and then out-competing native species. Once established, these weeds take over and can greatly decrease the amount of biodiversity in an area, therefore reducing the native species and altering the entire ecosystem.

What does it mean?

The quarantine makes it illegal to buy, sell, transport, cultivate, etc. the plants on the list. There are two parts of the list: Class A and Class B species. Class A plants are exotic species that are currently on the Federal Noxious Weed List and are not known to occur in Vermont. The movement, importation, sale, possession, cultivation, and/or distribution of these plants are prohibited. Class B species are exotic plants that are known to occur in Vermont and are considered to pose a serious threat to the State. The movement, sale and/or distribution of these plants are prohibited.

How was it developed?

A committee was formed in order to look into quarantine rule development. The committee was made up of representatives from: The Nature Conservancy (TNC), the Vermont Department of Environmental Conservation (VTDEC), Vermont Department of Forest and Parks (VTFPR), Vermont Department of Fish and Wildlife (VTFW), The Vermont Association of Professional Horticulturists (VAPH), Vermont Department of Agriculture, Food and Markets (VDAF&M), United States Department of Agriculture (USDA), and others. The proposed plants were assessed for invasiveness and risk to crops, livestock, land, and the environment of Vermont. The proposed species were evaluated against a set of criteria based upon the National Plant Boards' "Principles of Plant Quarantine." This initial evaluation narrowed down the proposed species list from 54 to 32 species.

Public comment and suggestion were sought on the proposed 32 plant species and subsequent criteria. Interested parties such as: VAPH, U.S. Fish and Wildlife Service (USFWS), American Nursery and Landscape Association, TNC, and Vermont aquarium dealers were invited to comment. Comments from these organizations changed some of the species on the list in addition to altering some of the terminology and policy of the rule. A proposed rule was published late in 2001 and was adopted by VDAF&M in April of 2002. This rule includes 6 Sections (Statement of Concerns, Definitions, Designation as a Noxious Weed, Designated Noxious Weeds, Prohibitions, and Exemptions) and 32 plant species. There are 11 plant species listed as Class A and 21 species listed as Class B.

Class A Noxious Weeds

Cabomba caroliniana, fanwort
Hydrilla verticillata, hydrilla
Myriophyllum aquaticum, parrot feather
Salvinia spp., (four species) giant salvinia

Egeria densa, Brazilian Elodea
Hygrophila polysperma, East Indian hygrophila
Myriophyllum heterophyllum, variable-leaved milfoil
Vincetoxicum hirundinaria, pale swallow-wort

Class B Noxious Weeds

Aegopodium podagraria, goutweed
Alliaria petiolata, garlic mustard
Celastrus orbiculatus, Oriental bittersweet
Hydrocharis morsus-ranae, frogbit
Lonicera japonica, Japanese honeysuckle
Myriophyllum spicatum, Eurasian watermilfoil
Phragmites australis, common reed
Rhamnus spp., (two species) buckthorn
Vincetoxicum nigrum, black swallow-wort

Ailanthus altissima, tree-of-heaven
Butomus umbellatus, flowering rush
Fallopia japonica, Japanese knotweed
Lonicera spp., (four species) honeysuckle
Lythrum salicaria, purple loosestrife
Nymphoides peltata, yellow floating heart
Potamogeton crispus, curly leaf pondweed
Trapa natans, water chestnut

What is the consequence of a violation?

Violation of the rule may result in the following:

1. The issuance of cease and desist order
2. A temporary or permanent injunction **and/or**
3. An administrative fine not to exceed \$1,000 per violation

Are there exceptions?

There are a few exceptions to the rule. In addition to scientific and educational exceptions, herbarium or other preserved samples are exempt, as are varieties and hybrids that have been scientifically proven to not be invasive. Movement and disposal may be permitted as part of a management control program. However, if you would like to use a listed plant for any of these reasons, you must first contact the VT Department of Agriculture, Food and Markets for permission.

Contact Info

For questions and comments related to Vermont's Noxious Weed Quarantine Rule contact:

VT Department of Agriculture, Food and Markets
Plant Industry Division
116 State St., Drawer 20
Montpelier, VT 05620-2901
802-828-2431
www.state.vt.us/agric/

The complete Noxious Weed Quarantine Rule can be found at:
<http://www.state.vt.us/agric/invasive.htm>

Invasive Exotic Plants

Give Them A Niche, And They Take A Mile

The Problem: People have been moving plants around the Earth's continents for centuries. Plants have long been valued for their use as food, shelter, medicine and ornament, and have been widely introduced to new areas intentionally so that we may take advantage of the many benefits they offer. Additional plant species have made their way to new places accidentally in the ballast of ships, on machinery, and through various other avenues of transport.

In most cases, **exotic plants** are not a threat to **natural communities** and do not interfere with our use and enjoyment of natural resources. Most introduced plant species have remained an asset in our yards, gardens, agricultural lands and developed areas.

Among the many thousands of species that have been intentionally or accidentally introduced, however, some have an aggressive growth habit that has resulted in their spread throughout natural communities. Once established, these **invasive exotic plants** can significantly disrupt habitats. The exotics often lack the predators that keep them in check in their own native regions.

As a result, the plants can run rampant, out-competing **native plants** for space, sunlight, and nutrients. Native plants help keep an ecosystem healthy and stable and are generally more beneficial to wildlife populations.

Infestations of exotic plants can also interfere with navigation, recreation, power generation, water supplies, production on agricultural and range lands, and create public health and safety hazards. The direct monetary costs of trying to control some of these plant pests and alleviate their negative effects on human activities and the environment are enormous, running into hundreds of millions of dollars annually in the United States.

A Solution: The Vermont Invasive Exotic Plant Fact Sheet Series was developed by the Vermont Agency of Natural Resources and The Nature Conservancy of Vermont to increase awareness of existing and potential invasive exotic plant problems in Vermont, and to promote cooperative efforts to address these problems. Many individuals outside the Agency contributed to their development. The series represents a list of 32 state quarantined species.

In April 2002, the Vermont Department of Agriculture, Food & Markets adopted a plant quarantine rule to regulate the importation, movement, sale, possession, cultivation, and/or distribution of certain invasive plants. The Noxious Weed Quarantine Rule creates two quarantine categories. Class A species are not yet known to occur in Vermont and are all species on the federal noxious weed list. The movement, importation, sale, possession, cultivation, and/or distribution of Class A plants is prohibited. Class B species occur in Vermont and pose a serious threat to the state. The rule prohibits the movement, sale, and/or distribution of Class B species.

Addressing the problem of invasive exotic plants in Vermont will not be quick or easy, but it is not impossible. This effort requires cooperative work on three fronts:

GLOSSARY of TERMS

Exotic Plant: A plant species which has been purposefully or accidentally introduced outside its original geographic range.

Natural Communities: Assemblages of plants and animals that are found recurring across the landscape under similar environmental conditions where natural processes, rather than human disturbances, prevail.

Invasive Exotic Plant: An exotic plant species which is able to proliferate and aggressively alter or displace native biological communities.

Native Plant: A plant species that can be shown to have been present in the region for at least 100 years and for which there is no evidence that it is an exotic plant.

1. *Prevention of New Introductions*

Status - Invasive exotic plants that have not yet been introduced into an area

Objective - Prevent introduction

Rationale - The most successful and cost-effective solution *prevents* invasive exotic plants from getting a foot-hold in the first place

Action - Raise public awareness, practice spread prevention techniques, enforce the Quarantine Rule

2. *Eradication of New Infestations*

Status - Invasive exotic plants that have been recently introduced and the population is not yet well-established or widespread

Objective - Eradicate infestation or prevent further spread

Rationale - Attacking an infestation while its density and range are limited offers the best prospect for elimination or containment of the species, saving both money and natural resources

Actions - Train volunteers to identify invasive exotic plants, educate about Vermont's Quarantine Rule, conduct monitoring programs for early detection, have a quick response plan in place

3. *Management of Established Populations*

Status - Invasive exotic plants that are already well established and widespread

Objective - Manage the infestation

Rationale - Minimize negative effects on ecosystems and biological diversity, maximize human use and enjoyment of the infested area

Actions - Investigate long-term, site-specific control options, implement control and restoration strategies^{*}, evaluate programs to identify areas for improvement

^{*}Control efforts can vary from the use of mechanical, chemical, or biological means, to employing habitat manipulation strategies. Fighting invasive exotic plants presents special challenges, since it is necessary to ensure that the control measures themselves do not inadvertently cause further harm to sensitive species or ecosystems, or to people.

Many control activities, particularly those conducted in lakes and ponds, require a permit from the Vermont Agency of Natural Resources (802-241-3777). The use of herbicides may also require a special license from the Vermont Department of Agriculture, Food and Markets (802-828-2431). Always check with the appropriate state and local authorities before conducting any control program.

Invasive Exotic Plants

What You Can Do To Help

Know your own backyard - Learn to identify your region's most threatening plant pests. Flip the page to find out who to contact in order to report new exotic plant infestations, or to receive guidance on controlling plant pests on your property.

Landscape with native species or non-invasive ornamental plants appropriate to your region. Contact the Vermont Agency of Natural Resources for a copy of their booklet entitled *Sources of Native Plant Materials in Vermont* (802-241-3770). Also available is *Alternatives to Upland Quarantined Invasive Species*.

Never release aquarium plants into lakes, rivers, or streams. Several popular aquarium plants, such as fanwort, Brazilian elodea, and Eurasian watermilfoil, are wreaking havoc in waterways around the country. To properly dispose of these plants dry or freeze them and add them to the garbage. Never compost these plants because the seeds may remain viable.

Inspect nursery-supplied ornamental aquatic plants, such as waterlilies, that are shipped from growers in the southeastern U.S. where the invasive plant hydrilla occurs. Hydrilla has been known to hitchhike on the nursery-sold plants and would have devastating effects to our waters if introduced to the region.

Be careful not to send or receive potentially harmful plants through the mail. Use mail-order services wisely.

Remove all plant material from boats and boating/recreational equipment before transporting them from one water body to another to avoid spreading invasive aquatic plants such as Eurasian watermilfoil and water chestnut. Zebra mussels, small non-native mollusks that clog water intakes, damage boat engines and alter native species populations, can also be transported from one water body to another on aquatic plants.

Don't bring plants, seeds, fruits, or soil into the country from abroad without having them inspected by quarantine officials. Fill out agricultural declaration forms completely and honestly.

Minimize land disturbance and exposure of soils - these activities increase vulnerability to exotic plant invasions.

Spread the word! Educate yourself and others about the problem of invasive exotic plants.

Get involved! Join volunteer efforts to search for new infestations of invasive exotic plant species and to assist in their removal from lakes and natural areas. Contact The Nature Conservancy to join its Exotics SWAT Team, or the Vermont Department of Environmental Conservation to join its Aquatic Nuisance Species Watch Program (over for contact information).

For more information about Vermont's invasive exotic plant species or if you would like to know how you can help, please contact:

The Nature Conservancy of Vermont, 27 State Street, Montpelier, VT 05602
Tel: 802-229-4425

Vermont Department of Environmental Conservation, 103 S. Main St., Bldg. 10 North,
Waterbury, VT 05671-0408 Tel. 802-241-3777

Vermont Department of Fish and Wildlife, 103 S. Main St., Bldg. 10 South, Waterbury, VT
05671-0501 Tel. 802-241-3715

Vermont Department of Forests, Parks and Recreation, 103 S. Main St., Bldg. 10 South,
Waterbury, VT 05671-0601 Tel. 802-241-3678



Vermont Invasive Exotic Plant Fact Sheet

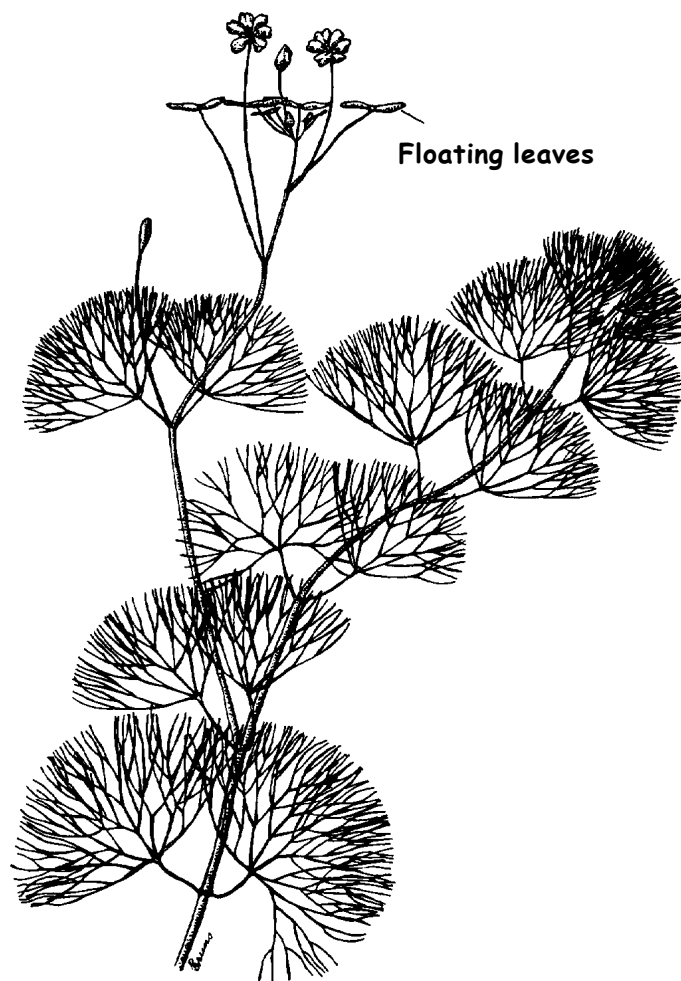
Fanwort *Cabomba caroliniana* Gray. Fanwort Family Vermont Class A Noxious Weed

Description: Fanwort is a rooted, submersed, perennial aquatic plant which grows from short, fragile underground stems with fibrous roots. Its underwater leaves are either green or reddish-purple, are opposite on the stem, and are finely divided into segments in a fan-shaped arrangement. Floating leaves may be present during flowering and are small, inconspicuous and oblong in shape. Flowers are solitary, white to pinkish in color, and are produced on stalks below the water surface. Fanwort's flowers will float on the water surface for a brief time, allowing cross-pollination to occur. Fanwort spreads most frequently by stem fragments or underground roots; however, new plants can also be produced from seed.

Habitat: Fanwort grows in freshwater lakes and ponds, and slow-moving streams and ditches in water from three to ten feet deep. In some locations, it has been found at much greater depths. Alkaline waters can inhibit its growth; it is typically found inhabiting waters with a pH between 4.0 and 6.0.

Threats: Fanwort is an extremely persistent and competitive plant. Under suitable conditions, fanwort can form dense stands, crowding out native aquatic plants. Once established, it can clog water flow and interfere with recreational and agricultural water use.

Distribution: Fanwort is a native of the subtropic-temperate regions of eastern North and South America. It is common in the southeastern United States along the coastal plain from Virginia to Florida. It is also known to occur in southern New Hampshire, Massachusetts, New York, Pennsylvania, southern Michigan, southern Illinois, Kansas, Missouri, eastern Oklahoma, eastern Texas, Washington, and northern Oregon.



(Crow and Hellquist 1983. Aquatic Plants of New England Series: *Cabomba caroliniana*,. Illustration by Pam Bruns)

Distribution continued: A popular plant in aquariums, fanwort's spread from its native range has probably been aided through the careless dumping of fish tanks. Fragment transport on recreational equipment is another means of its spread. While it has not yet been found growing in the wild in Vermont, it is frequently available through aquarium and pond internet sites.

Vermont Invasive Exotic Plant Fact Sheet

Fanwort

Fanwort Family (*Cabombaceae*)

Control: Fanwort is difficult to eradicate once established. Mechanical removal, water level manipulation, and herbicides have been tried with limited success.

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary of the Agency of Natural Resources.

References:

- Crow, G.E. and C.B. Hellquist. 1984. *Aquatic Vascular Plants of New England: Part 7. Cabombaceae, Nymphaeaceae, Nelumbonaceae, and Ceratophyllaceae*. New Hampshire Agricultural Experiment Station, University of New Hampshire, Durham, New Hampshire. Station Bulletin 527.
- Crow, G.E. and C.B. Hellquist. 2000. *Aquatic & Wetland Plants of Northeast North America*. University of Wisconsin Press.
- Hanlon, Chuck. 1990. *A Florida Native - Cabomba (Fanwort)*. Aquatics. Vol. 12, No. 4.
- Written Findings of the Washington State Noxious Weed Control Board*. February, 1996.



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Vermont Department of Fish and Wildlife, 103 S. Main St., Bldg. 10 South, Waterbury, VT 05671-0501 Tel. 802-241-3715

Vermont Department of Forests, Parks and Recreation, 103 S. Main St., Bldg. 10 South, Waterbury, VT 05671-0601 Tel. 802-241-3678

Vermont Invasive Exotic Plant Fact Sheet

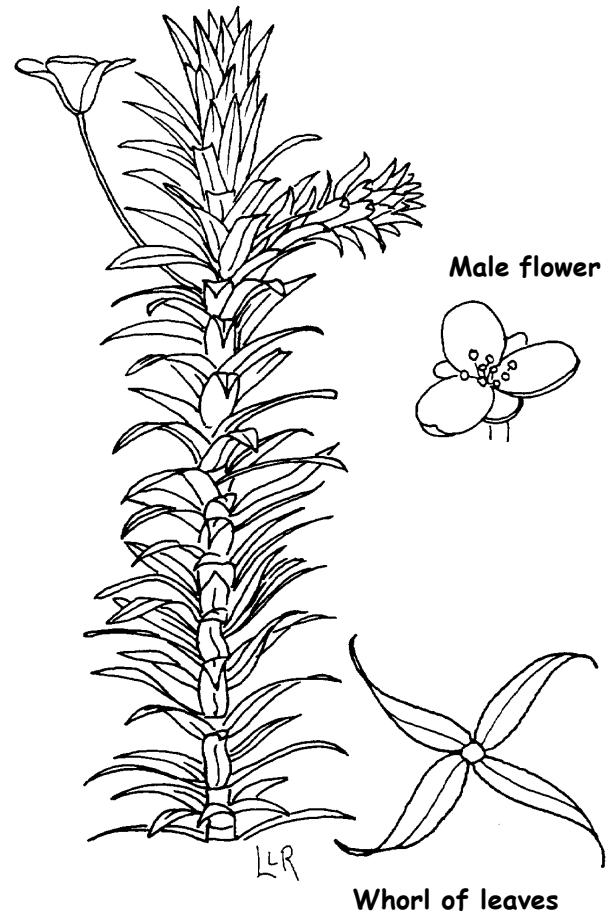
Brazilian elodea *Egeria densa* Planch. Frogbit Family Vermont Class A Noxious Weed

Description: Brazilian elodea is a submersed, rooted, aquatic perennial with round stems that can grow in water depths of up to 20 feet (6 meters). Once the plant reaches the water surface it branches profusely, forming buoyant, dense surface mats that are nearly impenetrable. Leaves are arranged in whorls of 4 around the stem, although whorls of 3 to 5 leaves may also occur. Leaves are oblong to linear in shape, less than 1 inch (2.5 cm) in length, and very finely toothed. Leaves and stems are generally bright green. Stem fragments root and can develop into new shoots. White, three-petaled flowers are produced on threadlike stalks that float or rise above the water's surface. Male and female flowers are produced on separate plants. Female flowers and seed production have not been reported in United States populations. Brazilian elodea overwinters primarily from rootcrowns.

Habitat: In its native range, Brazilian elodea prefers slow-moving, shallow waters that are somewhat acidic and enriched. Outside its native habitat, it inhabits lakes, rivers and springs.

Threats: Brazilian elodea forms dense monotypic stands that outcompete native aquatic vegetation, restrict water movement, trap sediment, cause fluctuations in water quality, and interfere with recreational uses such as swimming, boating and fishing.

Distribution: Native to southeastern South America (southern Brazil, Uruguay, and north and central Argentina), Brazilian elodea's spread from its native habitat has been aided by its popularity as an aquarium plant and a laboratory research specimen. The earliest record of a population in the United States is from Long Island in 1893. Now widespread in the United States, Brazilian elodea can be found sporadically from Massachusetts, New



(Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission)

Distribution continued: Hampshire and New York; south to Florida; and west to Illinois, Nebraska, Kansas, Oklahoma, Texas, New Mexico, Arizona, Utah, California, Oregon and Washington. It has not yet been found growing in the wild in Vermont; however it was commonly sold in aquarium stores around the state, although this activity is now illegal.

Vermont Invasive Exotic Plant Fact Sheet

Brazilian Elodea

Frogbit Family (*Hydrocharitaceae*)

Control: Many methods have been used to manage Brazilian elodea, including biological control agents, mechanical removal, physical habitat manipulation methods, and herbicides. An integrated approach combining a number of methods may provide for the most effective and successful control.

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary of the Agency of Natural Resources.

References:

- Crow, C.E. and Hellquist C.B. 1982. *Aquatic Vascular Plants of New England: Part 4. Juncaginaceae, Scheuchzeriaceae, Butomaceae, Hydrocharitaceae*. University of New Hampshire, Durham, New Hampshire. Agricultural Experiment Station. Station Bulletin 520.
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- McCann, James A., Lori N. Arkin, and James D. Williams. 1996. *Nonindigenous Aquatic and Selected Terrestrial Species of Florida: Status, Pathway and Time of Introduction, Present Distribution and Significant Ecological and Economic Effects*. National Biological Service.
- Written Findings of the Washington State Noxious Weed Control Board*. February, 1996.



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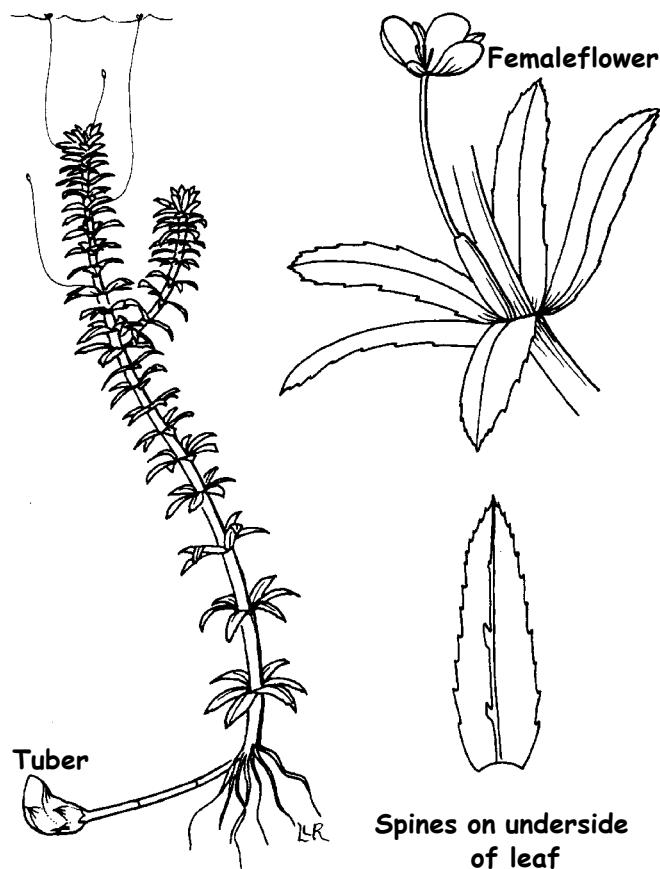
Vermont Invasive Exotic Plant Fact Sheet

Hydrilla *Hydrilla verticillata* (L.f.) Royle Frogbit Family Vermont Class A Noxious Weed

Description: Hydrilla is a submersed perennial aquatic plant with heavily branching, erect stems. It is rooted to the bottom, but broken stem pieces may be seen drifting in the water. In deep water, stems may reach 30 feet (9 meters) or more in length. Leaves occur in whorls of 3 to 8 and join directly to the stem. Leaf margins are visibly toothed, and the underside of the leaf may have one or more spines. Single, small white flowers are produced on stalks that reach the water surface. Hydrilla produces small (up to one-half-inch long), potato-like tubers at the end of underground stems. The tubers can be found from 2 to 12 inches (5 to 20 cm) below sediment level and are off-white to yellow. Spread of hydrilla occurs readily through stem fragmentation and the production of tubers.

Habitat: Hydrilla can be found in lakes, ponds, reservoirs, rivers, canals, and drainage ditches. Hydrilla is tolerant of a wide range of environmental conditions, which is why it competes so successfully with other aquatic plants. It has low light requirements and thrives in both high or low-nutrient waters. It can survive in both temperate and tropical regions.

Threats: Due to its ability to spread rapidly and completely clog waterways, hydrilla poses significant threats to the aquatic ecosystem and recreational resources. Hydrilla can reduce plant diversity by outcompeting native aquatic plants. Dense infestations of hydrilla can effect water quality and impede water flow, which can result in flooding and damage to shorelines and structures. Thick mats of hydrilla make swimming and other recreational activities difficult, if not impossible.



(Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission)

Distribution: Hydrilla is native to Australia, Asia, and central Africa. It is an introduced exotic in Europe and the United States. The U.S. introduction occurred in the early 1950s by an aquarium fish and plant dealer who released several hydrilla plants from Sri Lanka into a canal near Tampa, Florida. By 1996, more than 100,000 acres of public water in Florida were infested with hydrilla. Other states in the U.S. where hydrilla occurs are Georgia, Alabama, Mississippi, North Carolina, South Carolina, Virginia, Maryland, Delaware, Louisiana, Texas,

Vermont Invasive Exotic Plant Fact Sheet

Hydrilla

Frogbit Family (*Hydrocharitaceae*)

Distribution continued: California, Washington, and Connecticut, Tennessee, Pennsylvania, Massachusetts and Maine. Hydrilla has not yet been found in Vermont. Accidental introduction could potentially occur through the aquarium or nursery/aquatic gardening trade, or recreational activities.

Control: Hydrilla is one of the most difficult aquatic plants to control. Many methods have been employed to try to manage or eradicate this plant over the years. The most widely used means to control large infestations of hydrilla is the use of the aquatic herbicide fluridone. The herbivorous Asian fish known as the grass carp has also been used, particularly in the South (**Introduction of grass carp in Vermont is illegal because they consume other vegetation and create erosional and siltation problems**). Two leaf-mining flies, one from Australia and one from India, have been introduced as biological control agents. A tuber-feeding weevil from India and from Pakistan are also being tried. Other efforts have included dredging, mechanical harvesting, suction harvesting, and drawdown followed by dredging or fumigation for tuber removal. In spite of all these efforts and the expenditure of tens of millions of dollars, hydrilla continues to be a significant problem in many areas in the U.S.

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary.

References:

- Langeland, K.A. 1990. *Hydrilla: A continuing problem in Florida waters*. Cooperative Extension Service/ Institute of Food and Agricultural Sciences. University of Florida, Gainesville. Circular No. 884.
- Madsen, John D. and C.S. Owens 1996. *Phenological studies to improve hydrilla management*. Aquatic Plant Control Research Program. U.S. Army Corps of Engineers Waterways Experiment Station. Vol. A-96-2.



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Vermont Invasive Exotic Plant Fact Sheet

East Indian hygrophila, Oriental ludwigia,
Indian swampweed, Miramar weed, Hygro
Hygrophila polysperma (Roxb.) T. Anders.
Water-willow family
Vermont Class A Noxious Weed

Description: A rooted and rhizomatous perennial aquatic herb. Submersed to slightly emergent, growing to 6 feet (1.8 meters) long and rarely terrestrial. Grows through water column, and forms floating mats after detaching from substrate. Emerged stems are squarish, while submersed stems are round. Leaves are light green, opposite, sparsely hairy, elliptic with pointed tips, without stalks (submersed leaves may have short stalks), up to 1.5 inches (4 cm) long and 0.5 (1.3 cm) inches wide. Flowers are axillary with no stalks. Petals are white to bluish-white with two "lips," upper lip 2-lobed, lower lip 3-lobed. Fruit is a narrow capsule with 20 to 30 seeds. Plant is brittle.

Habitat: Prefers flowing water in warmer climates, but is also found in canals, ditches, marshes, and lakes. Can start growing in low light before other plants do. Tolerant of a wide range of pH and water hardness conditions.

Threats: This plant fragments easily and reproduces mainly by vegetative means from plant fragments (may also reproduce by seed). *Hygrophila polysperma* is fast-growing, and outcompetes other plants (even hydrilla in some cases). It clogs canals and culverts interfering with water flow and flood control operations, and presents a navigation barrier.

Distribution: Native to India and Malaysia. Introduced into the United States as an aquarium plant (and is still sold by aquarium dealers) about 1945. It has been well established in Florida and Texas since the 1960s.

Control: Control of this plant is very difficult. It is tolerant of many herbicides. Mechanical harvesting or any chopping fragments the plants and increases their distribution.



(IFAS, 1990. Center for Aquatic Plants, University of Florida, Gainesville)

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Vermont Invasive Exotic Plant Fact Sheet

East Indian hygrophylla, Oriental Ludwigia,
Indian swampweed, Miramar weed, Hygro
Water-willow family (*Acanthaceae*)

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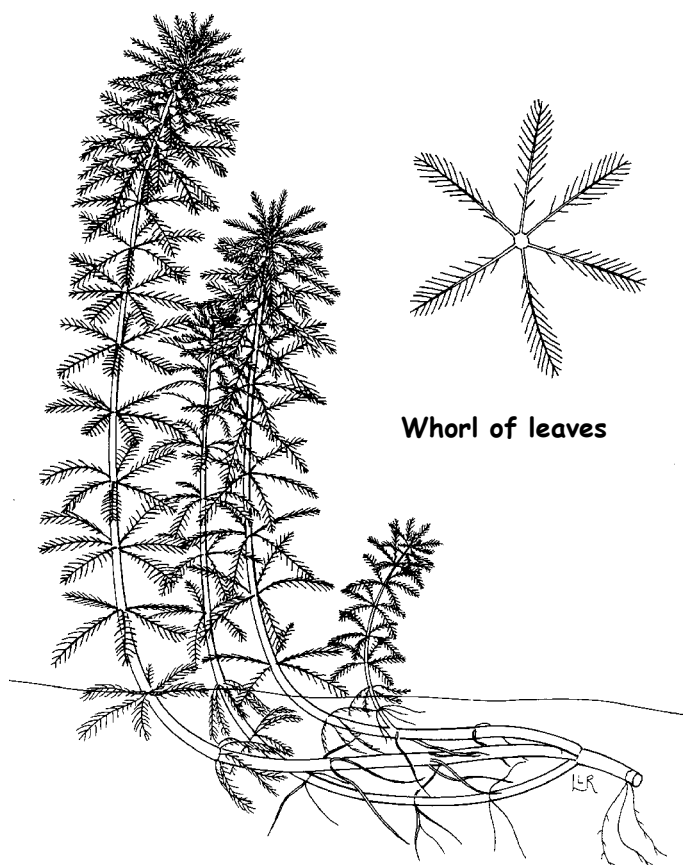
Vermont Invasive Exotic Plant Fact Sheet

Parrot-feather *Myriophyllum aquaticum* (Vell.) Verdc. Watermilfoil Family Vermont Class A Noxious Weed

Description: Parrot-feather is a perennial aquatic plant with both submersed and emerged leaves. The stems rarely branch and emerged leaves sometimes trail along mud or seepage areas. Emerged leaves are grey-green, rather stiff and arranged in whorls of 4 to 6 around the stem. The finely divided leaves give the plant a feathery appearance. Submersed leaves are limp and often appear to be decaying. The flowers are white or pinkish. In North America, parrot-feather reproduces exclusively by plant fragments. No seeds are produced.

Habitat: Parrot-feather can be found in lakes, ponds, rivers, canals, and drainage ditches. It tends to colonize slowly moving or still waters and is well adapted to moderate water level fluctuations. Under natural conditions, parrot-feather appears to prefer muddy banks and shallow water to about 7 feet (2 meters) in depth. It has the ability to survive in coastal areas where salt intrusions may occur and can grow to the exclusion of other aquatic plant species that are not as salt tolerant. Parrot-feather is reported to be hardy to -26°F (-32°C). When emerged plants are killed by low winter temperatures, plants may still be able to grow from submerged stems the following spring. Because of its attractive foliage and ease of cultivation, parrot-feather is widely used as an indoor aquarium plant as well as in ornamental aquatic landscapes outdoors.

Threats: Parrot-feather has not been reported to be a serious pest in North America. However, it can grow luxuriantly if conditions are favorable and it has the potential to cause localized problems. It is considered to be a nuisance in Japan and South Africa where it clogs rivers, water supplies, farm ponds, and irrigation channels.



Whorl of leaves

(Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission)

Distribution: Parrot-feather is native to South America. It now occurs on every continent (excluding Antarctica) as a result of introductions made through the aquarium/horticultural trade. It first appeared in the U.S. in New Jersey in the late 1800s. Other early populations in the Northeast were found in New York and Pennsylvania. Populations of parrot-feather are now found in most of the Southeastern states and all along the Gulf coastal plain.

Vermont Invasive Exotic Plant Fact Sheet

Parrot-feather

Watermilfoil Family (*Haloragaceae*)

Distribution continued: It also occurs in Arizona, California, Oregon, and Washington in the West. There is some speculation that the northeastern populations of parrot-feather have not persisted for long periods of time due to low winter temperatures. However, the plant was recently reported to have overwintered in northeastern Vermont in an ornamental setting consisting of outdoor tanks. Parrot-feather has not yet been found growing in the wild in Vermont.

Control: Parrot-feather control has been attempted through the use of aquatic herbicides and mechanical harvesting, although these methods have not always been successful. The herbivorous Asian fish, grass carp, dislikes the tough stems of parrot-feather. **(Introduction of grass carp in Vermont is illegal because they consume other vegetation and create erosional and siltation problems.)** There are several insects that feed on parrot-feather; however, little work has been done to determine if insect biological controls can be used successfully. Fungal pathogens are currently being tested.

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Vermont Invasive Exotic Plant Fact Sheet

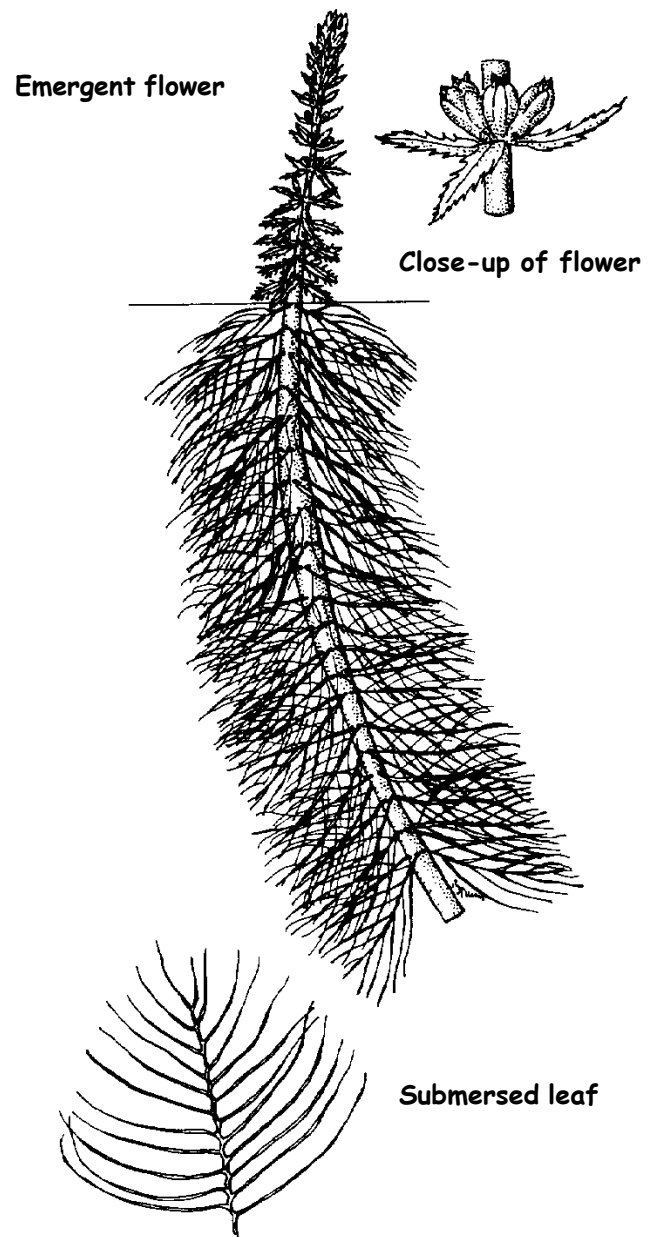
Variable-leaved Watermilfoil *Myriophyllum heterophyllum* Michx. Watermilfoil Family Vermont Class A Noxious Weed

Description: Variable-leaved watermilfoil is a rooted, submersed, perennial aquatic plant. Its name is derived from its 2 types of leaves. Under the water surface, its leaves are finely divided into segments giving them a feather-like appearance, a characteristic common to other members of the watermilfoil family. The underwater leaves are arranged in whorls of 4 to 6 around the stem. Each leaf has 7 to 11 pairs of segments. Above the water surface, the leaves are blade-like with serrated edges. Variable-leaved watermilfoil's flowers develop at the base of these above-water leaves, forming an erect, stiff spike. The flower spikes rise several inches above the water surface with male flowers arranged above female flowers on the spike. Flowers are small, inconspicuous, and are pollinated by wind. Spread of variable-leaved watermilfoil occurs via stem fragments, winter buds, roots, and to a lesser extent by seeds.

Habitat: Variable-leaved watermilfoil can be locally abundant and aggressive in ponds, lakes, streams, and springs. In New England, it has been restricted to waters of low alkalinity; west of New England it is typically found in alkaline waters.

Threats: In some waters, populations of variable-leaved watermilfoil are so dense that recreational activities such as swimming, boating, and fishing are severely limited. Thick stands of the plant can outcompete native aquatic vegetation, resulting in nearly monotypic growth with less habitat value.

Distribution: Native to some areas of eastern North America, variable-leaved watermilfoil populations have been documented in 34 states and two Canadian provinces. Its range in the United States extends from New England, where it dominates a number of lakes in southern Maine and New Hampshire, to South



(Crow and Hellquist 1982. *Aquatic Plants of New England Series: Myriophyllum heterophyllum*. Illustration by Pam Bruns)

Vermont Invasive Exotic Plant Fact Sheet

Variable-leaved Watermilfoil Watermilfoil Family (*Haloragaceae*)

Distribution continued: Dakota, Florida, Texas, Oklahoma, and New Mexico. It has not yet been found in Vermont.

Control: Variable-leaved watermilfoil is difficult to control once fully established. Mechanical removal, physical habitat manipulation methods, and herbicides have been employed with varying degrees of success.

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Vermont Invasive Exotic Plant Fact Sheet

Giant salvinia, Kariba weed, African pyle, Aquarium watermoss, Koi kandy

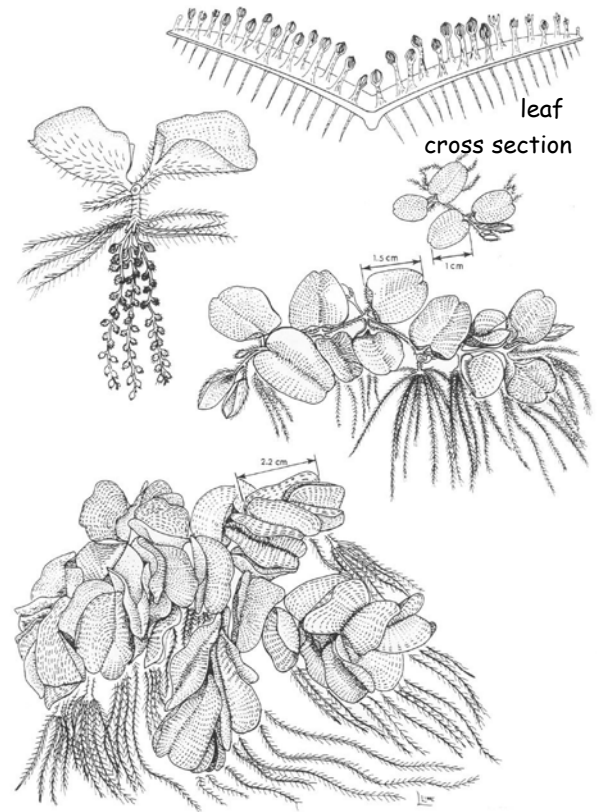
Salvinia molesta D.S. Mitchell (includes a group of closely related species, *S. auriculata* Aublet, *S. biloba* Raddi, *S. herzogii* de la Sota, and *S. molesta* D.S. Mitchell)

Water-fern Family
Vermont Class A Noxious Weed

Description: *Salvinia molesta* is a free floating aquatic fern. It consists of a horizontal stem that floats just below the water surface and produces, at each node, a pair of small spongy green floating leaves and a third submersed leaf that is brown, highly dissected and root like. The leaves are ovate to oblong in shape with a midrib that creates two leaf halves. Plants are capable of several growth forms; individual leaves can range from a few millimeters to .1-1.5 inches (4 cm) long. During early growth stages plants are small and leaves lie flat on the water surface. As plants grow, leaves curl at the edges (or fold at the midrib) and eventually become emersed as mature plants press into tight chains and form mats of many floating plants. Upper surfaces of green leaves are covered with rows of white bristly hairs that create a water-repellant covering. The stalks of each hair divide into 4 thin branches that then rejoin at the tips to form a cage, resembling tiny egg-beaters. (Look on young, unfolding leaves to find intact hairs that are descriptive for the species, as hairs on mature leaves may be damaged and uncharacteristic). Chains of egg-shaped spore cases develop among the submersed leaves. The spore cases are usually empty, resulting in plants that are sterile and reproduce by vegetative means only. The stems fragment easily and new plants grow from buds, a form of reproduction that is efficient and leads to rapid spread.

Habitat: Lakes and ponds, slow flowing streams and rivers, ditches, swamps and marshes. Prefers high nutrient levels and water temperatures around 68-86°F (20-30°C). Giant salvinia can survive freezing air temperatures, as well as reduced water levels if there is moist soil.

Threats: Giant salvinia is prolific and under ideal conditions can double the size of its mats in 7 to 10 days. These thick floating mats alter



(Copyright 2000 University of Florida Center for Aquatic and Invasive Plants)

Threats continued: aquatic ecosystems in many ways. Native, beneficial plants are usually out-competed. Dense mats block light and absorption of atmospheric oxygen into the water. Dying plants sink to the bottom and use up dissolved oxygen as they decompose, impairing fish and wildlife habitat. A lack of open water may pose a problem for migrating birds and waterfowl. Large mats of giant salvinia clog water intake pipes and can interfere with irrigation and electrical power generation. Boating, fishing, and swimming may become impossible in waterbodies where giant salvinia becomes established.

Vermont Invasive Exotic Plant Fact Sheet

Giant salvinia, Kariba weed, African pyle,
Aquarium watermoss, Koi kandy
Water-fern Family (*Salvinaceae*)

Distribution: Giant salvinia is native to South America (Brazil). It has spread throughout tropical areas of the world quickly due to aquarium disposal and cultivation. Giant salvinia was introduced into the United States in the mid 1990s, and now occurs in Texas, Louisiana, Mississippi, Alabama, Georgia, Florida, Arizona, California, Hawaii, and North Carolina.

Control: To date the most dramatic control has come from the use of the non-native salvinia weevil, *Cyrtobagous salviniae*. This weevil damages plants by feeding on buds and tunneling through stems. The weevil has been used successfully internationally and occurs in Florida (although genetic differences within this species are currently being researched). Herbicides have been used with some success, but giant salvinia is especially hard to treat chemically due to plants and buds being hidden in thick mats, and the difficulty in wetting the leaves due to their hairy surfaces. Mechanical harvesting is difficult because of the thickness of floating mats and because harvesting can create fragments that aid further dispersal.

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Vermont Invasive Exotic Plant Fact Sheet

Swallow-wort

Pale Swallow-wort *Vincetoxicum hirundinaria* Medikus,
(*Cynanchum vincetoxicum* (L.) Pers.) &
Black Swallow-wort *Vincetoxicum nigrum* (L.) Moench.
(*Cynanchum louiseae* Kartesz & Gandhi)

Milkweed Family

Description: Black and pale swallow-wort are both herbaceous perennial twining vines that can grow 3 to 6 feet (1 to 2 meters) in height depending on habitat and available support. They have opposite leaves that are 2-4 inches (5-10 cm) long, hairless and smooth, oblong to ovate in shape, narrowing to a point at the tip. Their twining habit and opposite, smooth leaves with their somewhat shiny or reflective quality, distinguish these two *Vincetoxicum* species from other native and introduced species in the northeastern quarter of the U.S. and adjacent Canada.

Flowers of both species are small, .2-.4 inches (5-9 mm) wide and borne in small clusters in the leaf axils. Black swallow-wort flowers are purple-black, with the petals about as wide as long (1.5-3 mm) with straight white hairs on the dorsal surface. Pale swallow-wort flowers are pale to dark maroon, purple or pinkish, glabrous, and longer than wide.

Both species produce slender, 1.5-2.5 inches (4-7 cm) long pods that split open lengthwise along one side to release many tufted, windborne seeds. The fruits are often borne in pairs, somewhat reminiscent of the forked tail of a swallow. The fruits of black swallow-wort are 2-2.5 inches (5-7 cm) long by .3 inches (0.8 cm) wide. Pale swallow-wort fruits are 1.5-2 inches (4-6 cm) long by .2 inches (0.5 cm) wide. Senescing plants turn a golden yellow in late summer. The dehiscent pods persist on the dried vines, especially in brushy areas.

Subterranean buds on the root crown may produce one to several shoots. Black swallow-wort is reported to have rhizomes, but investigators have been unable to verify such connections among pale swallow-wort. The fibrous roots of both species can hold tenaciously to the soil substrate.

Habitat: Both black swallow-wort and pale swallow-wort are associated with disturbances, particularly with human disturbances such as highway, rail, utility and other transportation corridors, limestone quarries, abandoned pastures



Black Swallow-wort

(Gleason, Henry A. 1952. *New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*, Hofner Press, New York. Vol. 3.)

Habitat continued: and old fields, Christmas tree plantations, nursery crops and other perennial crops. *Vincetoxicum* species can successfully invade natural areas with some type of disturbance regime. Rivers and streams that experience spring flood scouring are extremely vulnerable to invasion. Black and pale swallow-wort are ecologically similar, flourishing in sunny open areas, shrub habitats and hedges, as well as under fully shaded forest canopies.

Threats: Black and pale swallow-wort can both form dense stands that displace desirable native species. Their light and moisture tolerances are wide, and both species can occupy sites from full sun and dry soils over exposed bedrock, to wooded and shady riparian streamsides. Large monocultures can form in open, fully-exposed areas. In brushy areas, these vines can over-top and smother shrubs, outcompeting desired, native plants. Seed production is profuse and seed is wind-dispersed.

Some scientists are concerned about the impact of *Vincetoxicum* species on the Monarch butterfly (*Danaus plexippus*), whose reproduction is obligate on the genus *Asclepias*, also of the *Asclepiadaceae* or milkweed family.

Vermont Invasive Exotic Plant Fact Sheet

Swallow-wort Milkweed Family (*Asclepiadaceae*)

Distribution: Pale swallow-wort is native to the Ukraine and southwestern European Russia, and is apparently endemic to regions north of the Black Sea. The plant was first noted in Monroe and Nassau counties, New York State, in 1897. It has now been recorded in Massachusetts, Pennsylvania, New Jersey, Indiana, Connecticut, New Hampshire, Wisconsin and Michigan. Very large populations are known from central New York and the Toronto, Ontario region.

Black swallow-wort is native to western European Mediterranean regions. It occurs in New York, Michigan, Ohio, Rhode Island, Vermont, Pennsylvania, Illinois, Missouri, Connecticut, Maine, Maryland, New Jersey, New Hampshire, Indiana, Wisconsin, Kansas, Kentucky, Nebraska and California.

Control: The prevention of new infestations is the best management method and like many invasive herbaceous perennial plants, successful management once it is established can be difficult. Mechanical cutting is inadequate, as mature plants readily re-sprout. Herbicide choice will depend on site conditions, and repeated herbicide applications followed by careful monitoring are usually required. Cut-stem glyphosate (the active ingredient in Round-up) applications is a good control method for adult plants. Herbicide choice for foliar spray treatments will depend on site conditions. In degraded patches with little desirable vegetation, glyphosate (which is non-specific) may be preferred. At sites with desirable grasses that should be conserved, triclopyr ester (the active ingredient in Garlon 4, Pathfinder II) would be the herbicide of choice.

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Vermont Invasive Exotic Plant Fact Sheet

Goutweed, Bishopweed or Bishopswort
Aegopodium podagraria L.
Parsley Family
Vermont Class B Noxious Weed

Description: Goutweed is a stout, erect perennial herb, that is 1 1/2 to 2 feet (.5 meters) tall, sometimes more. The stem is round, furrowed and hollow. It has a creeping root-stock and by this means it spreads rapidly and soon establishes itself, smothering all vegetation in its vicinity.

It has large, shiny, alternate, twice compound leaves. The umbels of flowers are rather large (resembling Queen Anne's lace), with numerous, small white flowers, which are in bloom from June to August and are followed by flattened seed-vessels which when ripe are detached and blown some distance by the wind

Cultivated goutweed is a variegated form of the plant. Occasionally self-seeded plants will revert to the green form, and it is this form that becomes so tenacious.

Habitat: Goutweed (the variegated cultivar) is commonly planted as a ground cover in shaded areas. The green form spreads easily in shaded areas near homes where the variegated form was originally planted. It also escapes to natural forest areas where it can spread rapidly and become the dominant plant of the forest floor.

Threats: Goutweed is an aggressive invader that threatens forested and open areas. Goutweed has been noted in the floodplain forests of Vermont, Connecticut, and Massachusetts. Goutweed has been seen in upland hardwood forests as well, where soils are somewhat enriched. In some forests it has been observed expanding rapidly, covering up to 90% of the ground in some areas. Goutweed may endanger native vegetation in floodplain forests. As these forests are already uncommon, the potential threat to the integrity of just a few



(Gleason, Henry A. 1952. *New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*, Hofner Press, New York. Vol. 2.)

Threats continued: floodplain forests in the state could lead to a serious loss of Vermont's natural heritage.

Distribution: Goutweed is native to Europe, but has naturalized throughout the northeastern United States.

Vermont Invasive Exotic Plant Fact Sheet

Goutweed, Bishopweed or Bishopswort Parsley Family (*Apiaceae*)

Control: Goutweed is difficult to eradicate once established. Mechanical removal and herbicides have been tried with varying success. Glyphosphate (the active ingredient found in Round-up) has been used successfully in the control of goutweed, however a higher concentration (10% or greater active ingredient) of herbicide must be used.

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Vermont Invasive Exotic Plant Fact Sheet

Tree-of-Heaven *Ailanthus altissima* (Miller) Swingle. Quassia Family Vermont Class B Noxious Weed

Description: Tree-of-heaven is a small to medium sized tree with smooth gray bark in the mostly tropical Simaroubaceae family. Leaves are compound, alternate, oddpinnate, with 11-25 lanceolate leaflets. Tree-of-heaven leaves may be confused with those of sumac, elderberry, or black walnut, but the leaves of tree-of-heaven can be distinguished by glands that occur in the tips of rounded teeth at the base of each leaflet. Flowers occur in panicles at the ends of branches; male flowers produce a strong odor similar to popcorn or "burnt peanut butter." The leaves when crushed also produce this distinctive, offensive odor. Seeds are centered in a papery sheath called a samara. The samaras are slightly twisted or curled, and twirl as they fall to the ground. They can be borne on the wind great distances from the parent plant.

Habitat: Tree-of-heaven establishes itself readily on disturbed sites. These include vacant urban lots, railroad embankments, highway medians, fence rows and roadsides. In naturally forested areas, disturbance created by severe storms or insect infestations can open the way for tree-of-heaven infestations. It can also spread rapidly from cultivation by basal suckers to form island-like colonies. Although individual stems are short-lived, the colony can persist indefinitely.

Threats: One tree-of-heaven can produce up to 350,000 seeds in a year. Seedlings establish a taproot three months from germination enabling them to quickly outrace many native plant species in competition for sunlight and space. Tree-of-heaven also produces a toxin in its bark and leaves. As these accumulate in the soil, the toxin inhibits the growth of other plants. The root system is capable of doing damage to sewers and foundations. These factors combine to make tree-of-heaven a very aggressive invasive plant able to displace native tree and herb species.



(Gleason, Henry A. 1952. *New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*, Hofner Press, New York. Vol. 2.)

Distribution: Tree-of-heaven is native to a region extending from China south to Australia. It was imported into the United States in 1784 by a Philadelphia gardener. It's establishment in the western states was by Chinese immigrants who use it for medicinal purposes. Due to its rapid growth and prolific seed production, it quickly escaped cultivation.

Control: Tree-of-heaven is very difficult to remove once it has established a taproot. It has persisted in certain areas despite cutting, burning and herbiciding. Therefore, seedlings should be removed by hand as early as possible, preferably when the soil is moist to insure removal of the entire taproot. Larger plants should be cut; two cuttings a year may be necessary, once in the early growing season and once in the late growing season. Initially, this will not

Vermont Invasive Exotic Plant Fact Sheet

Tree-of-Heaven

Quassia Family (*Simaroubaceae*)

Control continued: kill the plant; it will vigorously resprout from the roots, but seed production will be prevented and the plants will be lowered in stature. If continued over a period of several years, cutting during the growing season stresses the plants and may eventually kill them.

A glyphosate herbicide, either sprayed onto the leaves or painted onto a freshly cut stump will kill the plant. However, to ensure the herbicide gets into the root system, it is best to apply this herbicide in the late growing season while the plant is translocating nutrients to its roots. Stump application of herbicides, or girdling with application of herbicides to the cut, always results in a dead stump with an army of sprouts from the roots. Roundup, applied as a foliar spray, can then be effective in finishing the job if you have time and diligence to return to the site and spray the new shoots; this seems to kill the whole root system. This method might be seen as a way of "making the tree short enough" for foliar spray of Roundup. Glyphosate herbicides are recommended because they are biodegradable, breaking down into harmless components on contact with the soil. However, glyphosate is a nonselective, systemic herbicide and will affect all green vegetation. To be safe and effective, herbicide use requires careful knowledge of the chemicals, appropriate concentrations, and the effective method and timing of their application. Consult a natural resource specialist or agricultural extension agent for more information before attempting herbicide control of tree-of-heaven.

References:

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*This fact sheet was adapted by permission from Virginia Department of Conservation, Richmond, VA and Recreation and the Virginia Native Plant Society, Annandale, VA.



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Vermont Invasive Exotic Plant Fact Sheet

Garlic Mustard *Alliaria petiolata* (M. Bieb.) Cavara and Grande Mustard family Vermont Class B Noxious Weed

Description: Garlic mustard is a biennial herb, with basal leaves that are dark green and kidney-shaped. Stem leaves are alternate, toothed, and triangular or deltoid. In the spring and early summer, leaves and stems produce a distinctive garlic odor when crushed. Flowers consist of 4 white petals that narrow abruptly at the base. Plants usually produce a single unbranched or few-branched flower stalk, and can range in height from 5 to 46 inches (13cm - 1.2 meters). Seeds, black and oblong, are contained within siliques, or narrow, four-sided, linear capsules from 1 to 4.5 inches (2.5 - 11 cm) long. Robust plants can produce up to 5,000 seeds. Seeds germinate in early April through May of the first year. Plants produce only a basal rosette of leaves during the first growing season. Garlic mustard remains green throughout the year. In the second year, plants produce a central leafy stem. Flowers bloom from May through early July. Fruit is produced in late July through August. The plants die after producing seeds.

Habitat: Unlike most invasive exotic plants, Garlic mustard thrives in shady habitats, especially those experiencing periodic disturbance, and spreads quickly along stream corridors. This plant invades moist forests, wooded stream banks, floodplain forests, roadsides, and trail edges. It cannot tolerate extremely acidic soils.

Threats: Garlic mustard poses a severe threat to natural areas because of its ability to quickly dominate the ground layer to the exclusion of native plants. Garlic mustard may threaten some butterfly species. Adults of several native butterfly species (*Pieris napi oleracea*, *P. virginiensis*) lay eggs on garlic mustard, but many or all of the larvae die before completing development. Garlic mustard



(Gleason, Henry A. 1952. *New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*, Hofner Press, New York. Vol. 2.)

Threats continued: also appears to alter habitat suitability for native birds, mammals, and amphibians, and may affect populations of these species.

Distribution: Garlic mustard is native to Europe. In North America, garlic mustard is widely distributed throughout the eastern U.S. and is found from North Carolina to southern Ontario and Quebec. It is found as far west as North Dakota, Kansas, Colorado and Utah. Garlic mustard was possibly brought to North America by early settlers who used it as an edible and medicinal plant, although no supporting evidence exists. It was first reported from Long Island in 1868.

Vermont Invasive Exotic Plant Fact Sheet

Garlic Mustard Mustard family (*Brassicaceae*)

Control: Garlic mustard should be removed from natural areas before it sets seed, as one plant can populate or repopulate a site. It appears to threaten the structure of forest communities, and should be given high management priority as soon as it is observed in or near an important natural area. No method provides 100% control. Successful control methods include burning, pulling by hand, and cutting flowering stems with a scythe or weed whip. Glyphosate herbicides may also be effective.

Garlic mustard spreads only by seed. Because the seed bank is short-lived (two to five years), control methods should be continued for a maximum period of five years to deplete the seed bank.

References:

Nuzzo, V. I. 2000. *Element Stewardship Abstract for Alliaria petiolata, Garlic Mustard*. The Nature Conservancy. <http://tncweeds.ucdavis.edu/esadocs/documnts/allipet.rtf>

*This fact sheet was adapted by permission from The Connecticut Chapter of The Nature Conservancy and the Connecticut Department of Environmental Protection.



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Vermont Invasive Exotic Plant Fact Sheet

Flowering Rush *Butomus umbellatus* L. Flowering Rush Family Vermont Class B Noxious Weed

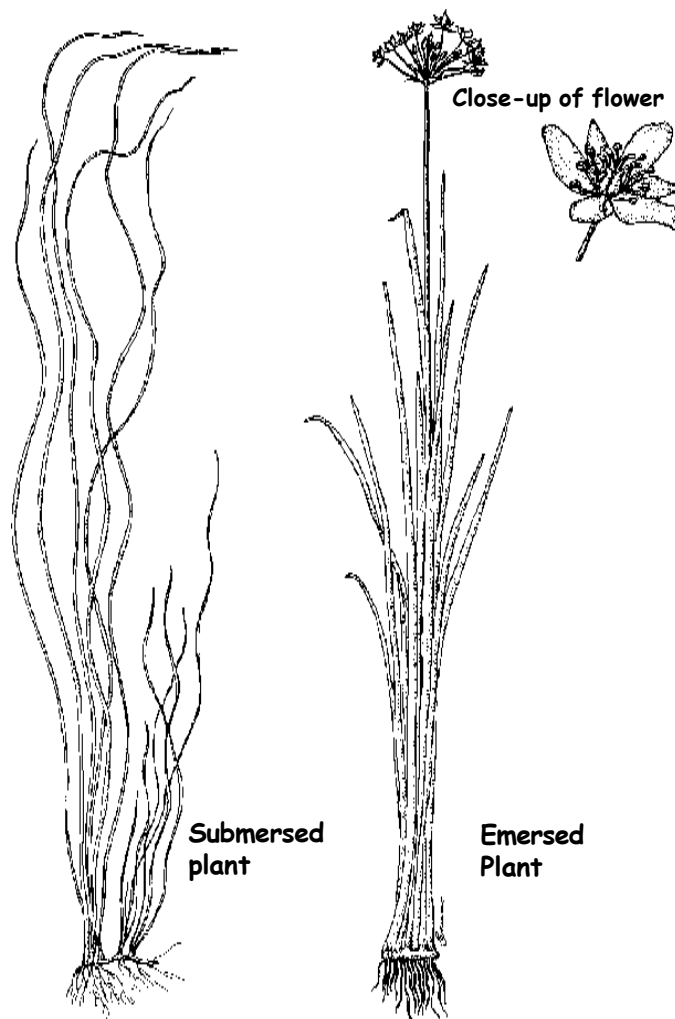
Description: Flowering rush is a perennial rush with a stout rhizome (a thickened underground stem) and grass-like leaves. The stems range from 2 to 4 feet (.5-1 meter) in height. Stems are topped with a cluster of pink flowers. Submersed non-flowering plants with limp, ribbon-like leaves are seen occasionally in the water.

Habitat: Flowering rush grows along lake shores and river banks. The submersed form can be found in shallow to moderately deep water.

Threats: Dense stands of flowering rush crowd out more beneficial plants such as wild rice and cattails, reducing plant diversity and degrading wildlife habitat.

Distribution: Flowering rush is a native of Europe and Asia. It was first found in the United States in 1928. Since its discovery, it has spread widely and is now well established in many areas of the Lake Champlain Valley and in the marshes along the St. Lawrence River. It has also spread westward throughout the Great Lakes region and beyond to the states of North Dakota and Idaho.

Control: Mechanical harvesting has been used on submerged flowering rush in Minnesota. Hand-cutting emergent flowering rush below the water level can provide season-long control. Multiple cuttings of emergent rush plants appear to reduce the height of the plants in the following year, but stem density may not be reduced. The use of herbicides to control flowering rush has had limited success.



(Crow and Hellquist 1982. *Aquatic Plants of New England Series: Butomus umbellatus*. Illustration by Pam Bruns.)

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary of the Agency of Natural Resources.

Vermont Invasive Exotic Plant Fact Sheet

Flowering Rush

Flowering Rush Family (*Butomaceae*)

References:

- Countryman, W.D. 1978. *Nuisance Aquatic Plants in Lake Champlain*. Lake Champlain Basin Study.
- Hotchkiss, Neil. 1972. *Common Marsh, Underwater and Floating-leaved Plants of the United States and Canada*. Dover Publications, Inc. New York.
- Larson, Gary E. 1993. *Aquatic and Wetland Vascular Plants of the Northern Great Plains*. USDA Forest Service. Ft. Collins, CO. Gen. Tech. Rep. RM-238.



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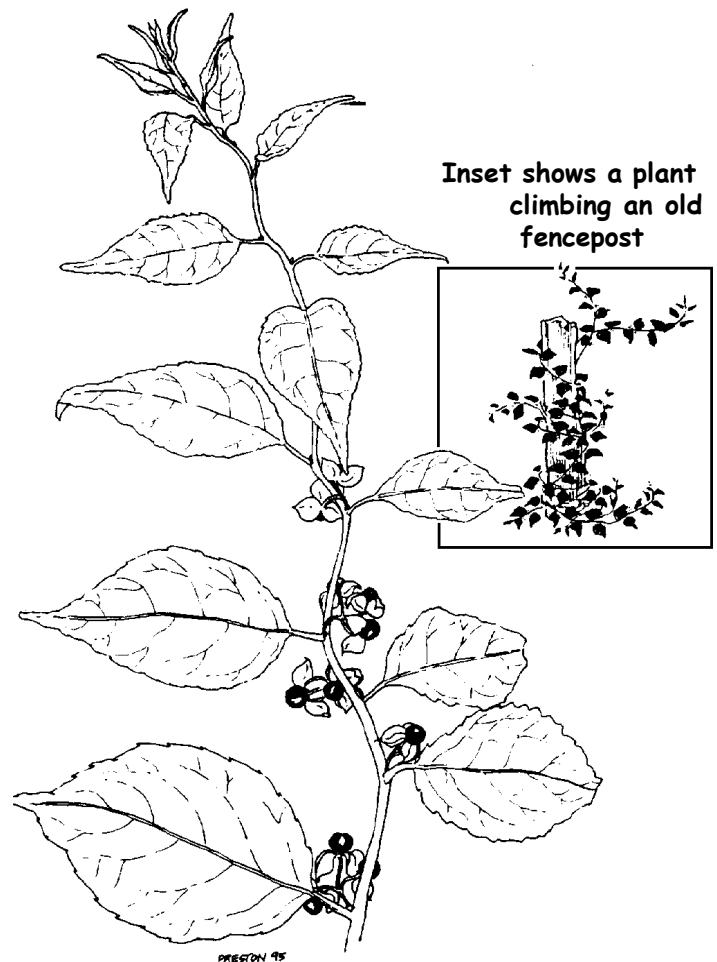
Vermont Invasive Exotic Plant Fact Sheet

Oriental Bittersweet *Celastrus orbiculatus* Thunb. Staff Tree Family Vermont Class B Noxious Weed

Description: Oriental bittersweet is a deciduous twining vine which climbs over rocks and plants, becoming a spreading trailing shrub as it matures. It has glossy, toothed, alternate leaves which turn golden yellow in the fall. Stems are round and brown. Small green flowers are clustered in the axils of leaves. The fruits, green at first, are yellow when mature and split open to reveal red seeds. Oriental bittersweet can be differentiated from the native bittersweet (*Celastrus scandens*) by its fruit: the native bittersweet has larger clusters that occur only at the end of stems, while Oriental bittersweet has three to seven clusters in the axils along the stem.

Habitat: Oriental bittersweet is successful in a wide range of habitats. It occurs along disturbed edges and corridors such as roadsides and fence rows, in abandoned fields, and in a variety of forest types, including undisturbed forest areas.

Threats: Oriental bittersweet is a highly invasive plant which entwines itself on other plants, shading out native vegetation. It also kills many of the plants it climbs, either by limiting the flow of fluids through the supporting plant, shading out the plant, or by making the plant more vulnerable to storms as a result of the added weight. Oriental bittersweet can spread quickly, as it has a high reproductive rate and the ability to grow shoots from its roots (rootsuckering).



(Illustration by Judy Preston - The Nature Conservancy of Connecticut)

Distribution: Oriental bittersweet, native to eastern Asia, was introduced to America in the mid-19th century. It escaped cultivation and has spread from Louisiana to Maine. In Vermont, it occurs in the Champlain and lower Connecticut Valleys and Taconic Mountains. It has begun to spread into the Taconic Foothills, the Champlain Hills, along the Lamoille and Winooski River Valleys, and up the Connecticut River Valley.

Vermont Invasive Exotic Plant Fact Sheet

Oriental Bittersweet

Staff Tree Family (*Celastraceae*)

Control: Small patches can be hand-pulled. Care should be used so that the root system is also removed to prevent resprouting. Low patches have been removed by cutting the vine and treating regrowth with a triclopyr herbicide. Control is more successful in taller patches when the cut stems are immediately painted with triclopyr or glyphosate. Oriental bittersweet has a substantial seedbank, so any control methods will need to be repeated for several years to be successful

References:

- Dreyer, G. 1996. *Bittersweet*. Article in: *Weeds of the Global Garden*. Brooklyn Botanic Gardens Publications. Brooklyn, New York.
- Hutchinson, M. 1990. *Vegetation Management Guideline: Round-leaved Bittersweet*. 1(20). Illinois Nature Preserves Commission.
- Shepard, C. 1996. *Invasive Plant Information Sheet: Asiatic Bittersweet*. The Nature Conservancy of Connecticut, Middletown, Connecticut.



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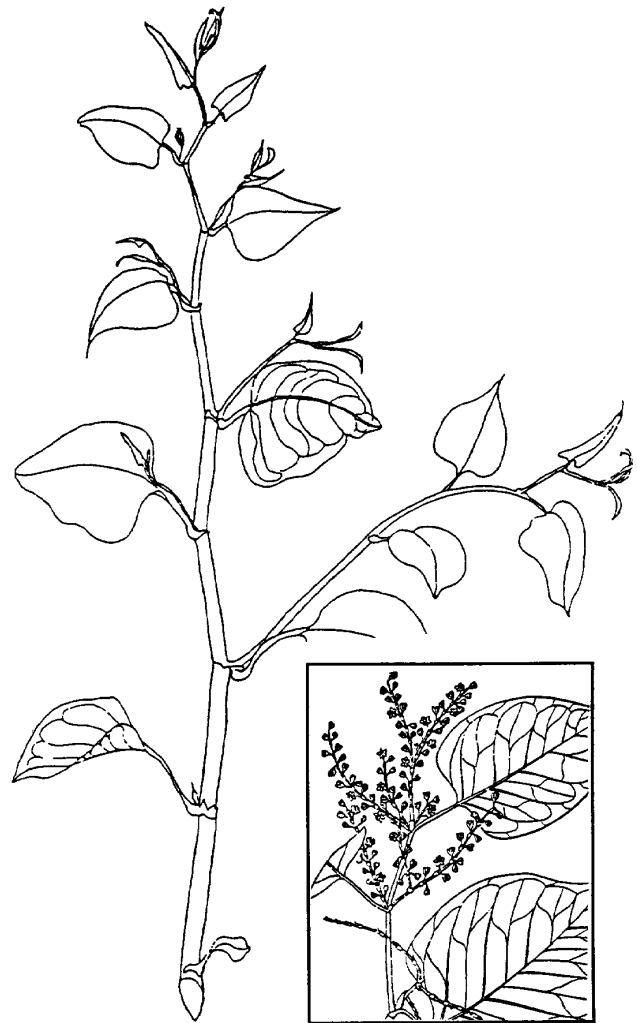
Vermont Invasive Exotic Plant Fact Sheet

Japanese Knotweed *Fallopia japonica* (Houtt.) Decraene (formerly *Polygonum cuspidatum* Sieb. & Zucc.) Smartweed Family Vermont Class B Noxious Weed

Description: Japanese knotweed is a fast-growing, herbaceous perennial that grows 3 to 6 feet (1-2 meters) high and forms large, dense patches where it invades. The stout, hollow bamboo-like stems and the large (3 to 6 inches (7.5-15 cm) long), broadly ovate leaves are distinctive. Tiny white or greenish-white flowers develop in August and September and grow in numerous linear clusters that form a mass of white over the plant when in full flower. The plant is insect pollinated and seeds are wind dispersed. However, in the U.S. and European countries, seeds are not the primary means of reproduction. Dispersal and spread of Japanese knotweed is largely by rhizome (a thickened underground stem) growth and transport of rhizome fragments. Rhizomes may reach 45 to 50 feet (14-15 meters) in length.

Habitat: This plant occurs in a wide variety of habitats, many soil types, and a range of moisture conditions. It is most commonly found in areas with full sunlight and where the soil has been disturbed. It is often seen along river and stream banks where human disruption/flooding scour (natural process, not necessarily bad) or ice allows for its establishment. It is also seen near roadways and spreading from yards into open areas.

Threats: Japanese knotweed's early spring emergence and dense growth prevent other species from becoming established, which reduces species diversity and wildlife habitat. Large stretches of knotweed along rivers and streams in Vermont are substantially affecting many of the state's usually diverse riparian corridors.



Inset shows flowers

(Main illustration by Dott Emmett, courtesy of Blackwell Scientific, Inc.; inset illustration from "An Illustrated Flora of the Northern United States and Canada", 1913, Dover Publications)

Vermont Invasive Exotic Plant Fact Sheet

Japanese Knotweed

Smartweed Family (*Polygonaceae*)

Distribution: Japanese knotweed is a native of Japan. It was introduced as an ornamental into the United Kingdom in 1825 and into the United States in the late 1800s. The species has escaped from cultivation and has naturalized throughout eastern North America as far north as Nova Scotia and Newfoundland and as far south as North Carolina. It is also found in the coastal areas of Oregon and Washington and in much of the Midwest. Japanese knotweed is an invasive plant in Vermont, especially along river and stream banks.

Control: Choice of methods depends on size of the infestation. A small patch can be controlled by smothering the plants with black plastic topped with materials such as old corrugated tin or layers of cardboard and stones. This works best on places where the materials can be tended for two growing seasons, such as in a yard. In natural areas, small patches can be cut at least three times per growing season, and this should continue until the rhizomes dieback (can take up to five summers). Alternatively the stems can be cut in August when nutrients are being translocated to the rhizomes, and a solution containing 25% glyphosate should be dripped into the cut stem.

References:

- Brunelle, H. and B. Lapin. 1996. *Invasive Plant Information Sheet: Japanese knotweed*. The Nature Conservancy of Connecticut, Middletown, Connecticut.
- Gleason, Henry A. 1968. *The New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*. Hafner Publishing Co., Inc., New York.
- Sieger, Leslie. 1992. *Element Stewardship Abstract for Polygonum cuspidatum*. The Nature Conservancy, Arlington, Virginia.



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Vermont Invasive Exotic Plant Fact Sheet

European Frogbit *Hydrocharis morsus-ranae* L. Frogbit Family Vermont Class B Noxious Weed

Description: European frogbit is a floating-leaved aquatic plant that bears small white flowers. The plant has well-developed roots but is free-floating, not anchored in the sediment. Leaves are roundish and deeply notched at the base. Several plants may be connected together by runners. Reproduction by runners can be rapid over a single season. The plant also reproduces by seed and winter buds. The buds develop in the fall, separate from the plant and sink to the bottom where they overwinter, and then rise to the surface in the spring to form a new plant.

Habitat: European frogbit can be found in lakes, ponds, and rivers.

Threats: European frogbit is capable of producing dense mats of vegetation that completely cover the water surface. These dense mats may shade out native vegetation, thereby reducing plant diversity. Where plant beds are dense they may entangle themselves around motorboat propellers, and make swimming difficult.

Distribution: As its name implies, European frogbit is native to Europe. It was first found in the wild in North America in the Rideau Canal at Ottawa, Ontario. Since that time it has spread down the Ottawa and St. Lawrence Rivers. It has also been reported from Quebec near the mouth of the Richelieu River and in New York near Canton and Watertown. Populations in Vermont are located in Lake Champlain. At this time, the majority of the Vermont population of frogbit appears to be confined to the southern part of the lake and is not causing any problems. However, this species is reported to be a nuisance in southern Canada and northern New York due to its invasiveness.



Watson, L., and Dallwitz, M.J. 1998. (1992 onwards). *The Families of Flowering Plants: Descriptions, Illustrations, Identification, and Information Retrieval*. Version: 12th.

Control: Little information is available on the control of European frogbit. Based on the plant's habit, mechanical and hand removal would most likely be effective. It is not known whether biological or chemical controls are effective on European frogbit.

Vermont Invasive Exotic Plant Fact Sheet

European Frogbit

Frogs bit Family (*Hydrocharitaceae*)

References:

Countryman, W.D. 1978. *Nuisance Aquatic Plants of Lake Champlain*. Lake Champlain Basin Study.

Hellquist, C.B. *Aquatic Weed Species for Possible Legislation*. Department of Biology. North Adams State College, North Adams, MA.



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Vermont Invasive Exotic Plant Fact Sheet

Shrubby Honeysuckles

Tatarian honeysuckle (*Lonicera tatarica* L.) Morrow honeysuckle (*L. morrowii* A.Gray) Hybrid honeysuckle (*L. x bella* Zabel)
Amur honeysuckle (*L. mackii* Rupr. Maxim)

Honeysuckle Family

Vermont Class B Noxious Weed

Description: Shrubby honeysuckles are upright, coarse, deciduous shrubs that range from a few feet to 16 feet (5 meters) in height. The branches are widely spreading with the older ones being hollow. The opposite, simple leaves are oval to oblong in shape and range in length from 1 to 2.5 inches (2.5-6 cm). The tubular flowers are numerous and occur in pairs on slender stalks. The fruit is a many-seeded, red, orange, or yellow berry.

Tatarian honeysuckle has smooth, hairless leaves and pink or white flowers that do not turn yellow with age. Flower stalks are .5-1 inch (15-25 mm) and smooth.

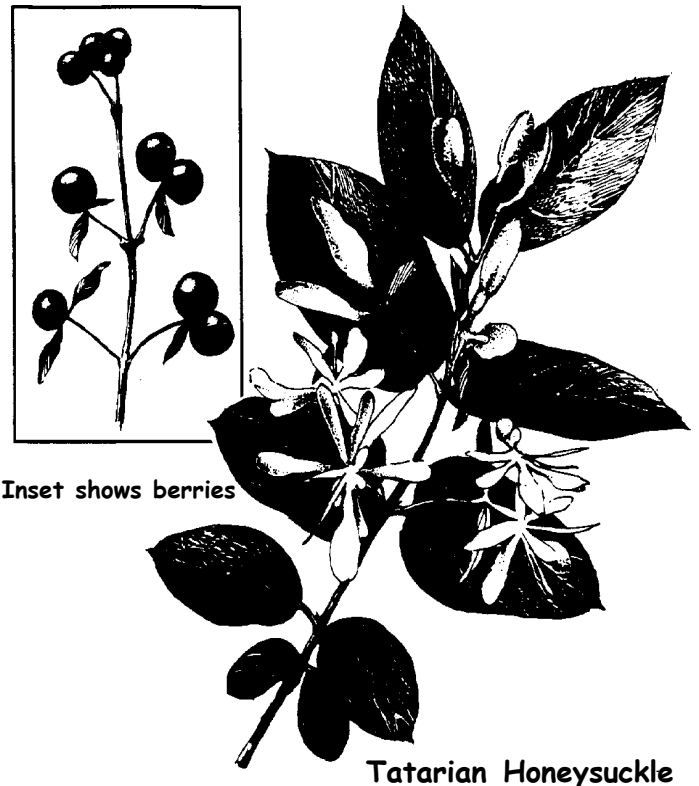
Morrow honeysuckle has downy leaves and white flowers that turn pale yellow as they age. Flower stalks are .2-.5 inches (5-15 mm) and densely hairy.

Bell honeysuckle is a hybrid between Tatarian and Morrow honeysuckles and thus has features intermediate between these 2 species.

Amur honeysuckle has dark green leaves that are hairy on the veins and white flowers that yellow with age.

Habitat: Shrubby honeysuckles occur most often in abandoned fields and pastures, hedge rows, and edges of forest and wetlands, but are also found in forest land, especially where soils are very limey. They are tolerant of varying soil moisture levels and moderate shade, but prefer open areas and achieve the greatest fruit production when in full sun.

Threats: Shrubby honeysuckles can rapidly invade and take over or become a common component of a site or natural community. They form a dense shrub layer that interferes with the life cycles of many native woody and herbaceous plants, including rare species. They can alter habitats or natural communities they invade by decreasing



Inset shows berries

Tatarian Honeysuckle

(Illustration by David [Randy] Kleinman, courtesy of the US Army Corps of Engineers.)

Threats continued: light availability. The fruit of shrubby honeysuckles is fed upon by many birds and possibly small mammals. The birds then spread the seed throughout the landscape, making control difficult.

Vermont Invasive Exotic Plant Fact Sheet

Shrubby Honeysuckles Honeysuckle Family (*Caprifoliaceae*)

Distribution: All of the exotic shrubby honeysuckles are highly invasive or have the potential to be so in the state. In Vermont, Tatarian honeysuckle, Morrow honeysuckle and Bell honeysuckle are, as a group, common in the Champlain Lowlands and sprading up the Connecticut Valley. The relative abundance of each species in these areas is not well known. Amur honeysuckle is less common than the other shrubby honeysuckles, and we are unaware of it's present distribution.

At least one or more of the species of shrubby honeysuckles are now naturalized (established and reproducing) throughout much of the northeastern U.S. While complete eradication will never be possible, control in certain areas is desirable. These invasive honeysuckles are native to Europe, eastern Asia and Japan. Tatarian honeysuckle was introduced to this continent in 1752. The other species arrived later, and introductions continue even today. As recently as the 1980s they were promoted for their wildlife values, ornamental use, and for soil stabilization.

Control: Care should be taken not to confuse the exotic shrubby honeysuckles with our native shrubs, especially fly honeysuckle (*Lonicera canadensis*) and snowberry (*Symphoricarpos albus*). Light infestation may be cleared by hand with a shovel or hoe provided the entire root is removed. Severe infestations have been controlled by repeated removal, burning or glyphosate herbicide applications. Cutting plants should be done in early spring and in late summer or early fall. Cutting of mature plants results in resprouting, but may temporarily reduce seed sources. Seedlings are easily pulled. If prescribed burning is appropriate for the area, it should be conducted during the growing season. Control methods must be repeated for a period of 3 to 5 years to inhibit growth of new shoots and eradicate target plants.

References:

- Anonymous. 1990. *Vegetation Management Manual*. Illinois Nature Preserves Commission.
Brunelle, H.J. 1996. *Invasive Plant Information Sheet: Bush Honeysuckles*. The Nature Conservancy of Connecticut, Middleton, Connecticut.
Converse, C.K. 1985. *Element Stewardship Abstract for Lonicera tatarica, L. morrowii, and L.x bella*. The Nature Conservancy. Unpublished document.
Williams, C. 1994. *Vegetation Management Guideline: Bush Honeysuckles*. Virginia Department of Conservation and Recreation and Virginia Plant Society.



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Vermont Invasive Exotic Plant Fact Sheet

Japanese Honeysuckle *Lonicera japonica* Thunb. Honeysuckle Family Vermont Class B Noxious Weed

Description: Japanese honeysuckle is a woody perennial trailing or twining vine. Its individual runners can grow more than 30 feet (9 meters) in length; it roots at the nodes of the pubescent runners. Leaves are simple, opposite and oval to oblong in shape. Occasionally, young leaves are lobed. Japanese honeysuckle's flowers are fragrant, two-lipped, 1 to 2 inches (2.5-5 cm) in length, and white, changing to yellow with age. Fruit is a many seeded, purple-black, pulpy berry. Japanese honeysuckle flowers from late May through the summer, and fruits from July through the fall. Late in the season, it continues photosynthesis after most associated native plants have become dormant, thus being one of the last plants to lose its leaves in the fall. Japanese honeysuckle (including the varieties) is easily distinguished from native honeysuckle vines by its upper leaves and by its berries. The uppermost pairs of leaves of Japanese honeysuckle are distinctly separate, while those of native honeysuckle vines are connate, or fused to form a single leaf through which the stem grows. Japanese honeysuckle has black berries, in contrast to the red to orange berries of native honeysuckle vines.

Habitat: Japanese honeysuckle is found in thickets, borders of woods and roadsides, and meadows. It occurs primarily in areas where natural or human disturbances have provided a light gap in the canopy. It can also be found in shaded areas, but most rapid growth occurs in areas exposed to sun.

Threat: Japanese honeysuckle invades by seeds (primarily), underground rhizomes, and aboveground runners. It spreads rapidly and outcompetes native vegetation due to wide seed dispersal, rapid growth rate, extended growing season, ability to capture resources both above- and below-ground, wide habitat adaptability, and lack of natural enemies. Once established, the vine may literally engulf small trees and

shrubs, which collapse under the weight, and



(Gleason, Henry A. 1952. *New Britton and Brown Illustrated Flora of the Northeastern United States and Adjacent Canada*, Hofner Press, New York. Vol. 3.)

Threat continued: few plants survive beneath the dense canopy. Japanese honeysuckle has an additional competitive edge as it grows during part or all of the winter, when many native species are dormant. This semi-evergreen character allows Japanese honeysuckle to photosynthesize at winter temperatures and light levels. The shade it casts during early spring may inhibit ephemeral herbs that complete their life cycle in the six weeks prior to deciduous tree leaf-out.

Distribution: In North America, Japanese honeysuckle is naturalized from Maine, Massachusetts, and New York, south to Texas and Florida and west to Missouri and Indiana. Japanese honeysuckle was introduced to North America from Japan in the 1800's as an ornamental shrub and vine. It has also been used for soil erosion control along railroads and highways. The berries of Japanese honeysuckle are a source of food for wildlife, thus

Vermont Invasive Exotic Plant Fact Sheet

Japanese Honeysuckle Honeysuckle Family (*Caprifoliaceae*)

Distribution continued: In North America, Japanese honeysuckle is naturalized from Maine, Massachusetts, and New York, south to Texas and Florida and west to Missouri and Indiana. Japanese honeysuckle was introduced to North America from Japan in the 1800s as an ornamental shrub and vine. It has also been used for soil erosion control along railroads and highways. The berries of Japanese honeysuckle are a source of food for wildlife, thus dispersing the seeds widely.

Control: Control methods for Japanese honeysuckle in areas of heavy and light infestations include mowing, grazing, prescribed burning, and the application of herbicides. Mowing and grazing reduces the spread of vegetative stems but does not completely remove the vegetation; instead, vigorous resprouting increases stem density. Small populations may be controlled by careful hand pulling, grubbing with a hoe or shovel, and removing trailing vines. Soil disturbance should be avoided in infested areas to minimize germination of seed in the seedbank. Cut material can take root and should therefore be removed from the site (not practical with most infestations).

The most effective treatment is a foliar application of glyphosate herbicide (trade names Roundup, Rodeo or Accord), applied after native vegetation is dormant and when temperatures are near and preferably above freezing. Applications within 2 days of the first killing frost are more effective than applications later in the winter. Care must be taken not to harm native species as the glyphosate herbicide is non-selective. Fire removes above-ground vegetation, and reduces new growth, but does not kill most Japanese honeysuckle roots, and surviving roots produce new sprouts that return to pre-burn levels of cover within a few years. Combining fire and herbicides may prove to be more effective than either method by itself if late autumn or winter burns are used to reduce Japanese honeysuckle biomass and all resprouts are then treated with a foliar application of glyphosate about a month after they emerge.

References:

Nuzzo, Victoria. 1997. *Element Stewardship Abstract for Japanese Honeysuckle*. The Nature Conservancy. <http://tncweeds.ucdavis.edu/esadocs/documnts/lonijap.rtf>

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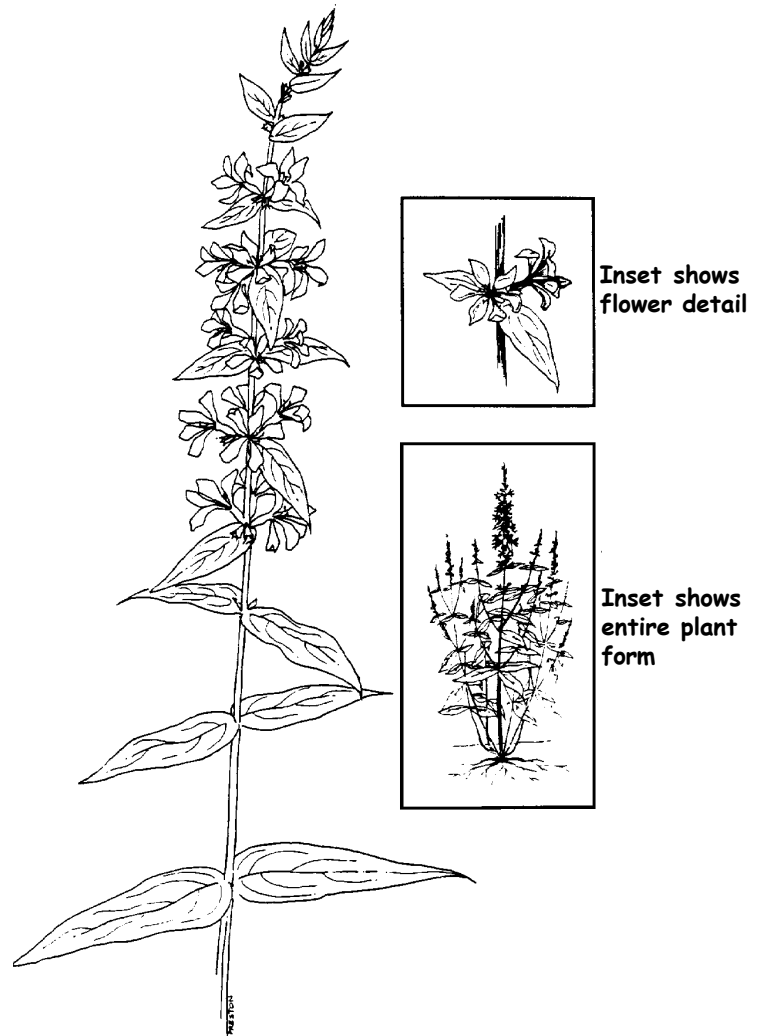
Vermont Invasive Exotic Plant Fact Sheet

Purple Loosestrife *Lythrum salicaria* L. Loosestrife Family Vermont Class B Noxious Weed

Description: Purple loosestrife is an erect, hardy perennial most easily identified by its showy magenta flowers that appear from July to September. Flowers are 5 to 6-petaled and are borne close to the stem on terminal spikes. Flowers from a mature plant can produce more than 2 million seeds annually. Purple loosestrife leaves are long and narrow. Opposite leaf arrangement is typical but leaves may also be found in whorls of 3 or 4, and sometimes are alternate on the stem. Stems are stiff, 4 to six-sided, and angular. Mature plants grow from 1.5 to 8 feet (.5-2 meters) tall. As many as 30 to 50 stems may arise from one root system, forming a large bushy cluster. Purple loosestrife spreads primarily from seed but also from the underground shoots and roots of established plants. Loosestrife's tiny flat seeds can live in soil and water for many years, and can be transported great distances by humans, animals, water, and wind.

Habitat: Purple loosestrife invades ditches, streams, rivers, lakes, wetlands, and other moist, shallow freshwater sites. It is tolerant of a wide variety of moisture and nutrient conditions as well as variations in climate. Plants are most successful on slightly acid or neutral soils. Purple loosestrife will especially take advantage of sites where there are human disturbances to the landscape, such as dredging, draining, or filling.

Threats: In spite of its spectacular beauty, purple loosestrife is a particularly troublesome plant. It quickly replaces native species such as cattails, grasses, sedges, and vulnerable rare plants. The impact of this plant on native wetland vegetation has been disastrous, with monotypic purple loosestrife stands virtually eliminating all other plants. It is not a desirable food or habitat for wildlife, provides poor spawning habitat, and may clog drainage ditches. Despite these impacts, purple loosestrife is still sold commercially as a landscape plant for perennial



(Illustration by Judy Preston - The Nature Conservancy of CT)

Threats continued: gardens in some states. More than 20 different cultivars have been developed, many of which are believed to be sterile. However, these plants become fertile when crossed with wild populations of purple loosestrife and therefore continue to promote its spread. Purple loosestrife is considered to be such a noxious weed that in many states, including Vermont, it is illegal to purchase and plant it.

Vermont Invasive Exotic Plant Fact Sheet

Purple Loosestrife

Loosestrife Family (*Lythraceae*)

Distribution: Purple loosestrife originates from the temperate regions of Europe and Asia where it is a minor component of wetland vegetation. It is believed to have been introduced to northeastern North America in the 1800s, probably because of seeds inadvertently transported in the ballast of ships. Because of purple loosestrife's popularity as a garden plant as well as a honey plant, intentional introduction has continued. Purple loosestrife currently occurs in nearly every state in the U.S. and all Canadian provinces. The heaviest infestations are in the northern half of the U.S. and in southern Canada. In Vermont, purple loosestrife covers thousands of acres and can be found in all counties.

Control: Control methods have included hand-pulling, cutting, burning, water level manipulation, and herbicide treatments. Most have been tried with varying degrees of success. Most of these methods will kill plants but not the large seed banks in the soil that allow rapid reestablishment. Current management efforts have focused on biological control agents, specifically four species of host specific, plant-eating insects from Europe. In Vermont, work has begun to evaluate the effects of two leaf-eating beetles (*Galerucella pusilla* and *G. californiensis*) on purple loosestrife and to investigate rearing of these insects for future purple loosestrife management.

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Vermont Invasive Exotic Plant Fact Sheet

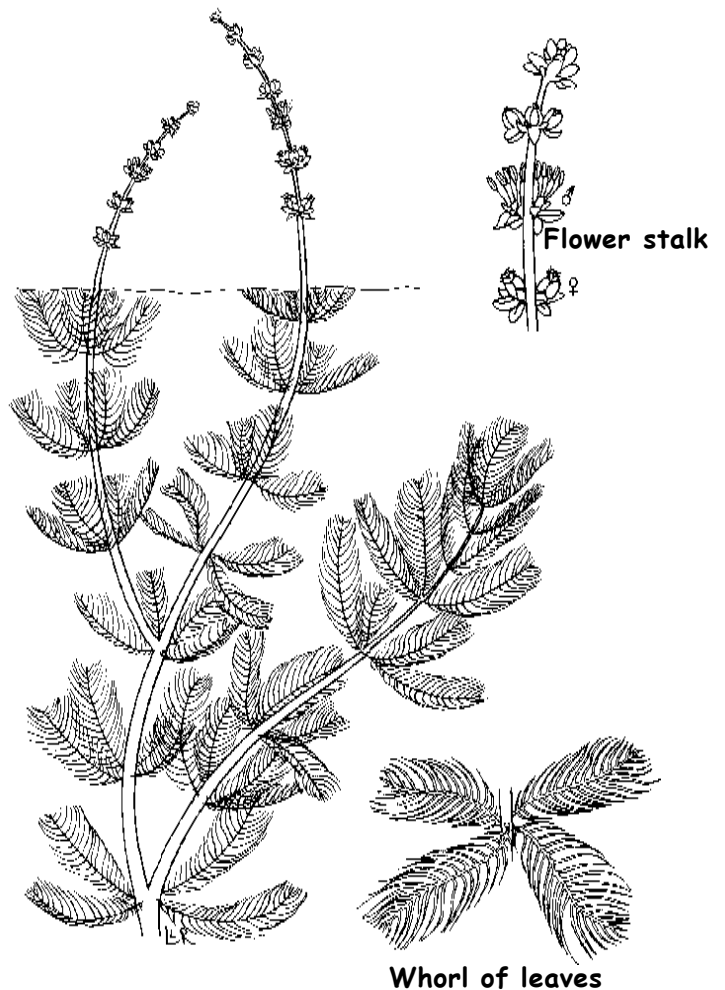
Eurasian Watermilfoil *Myriophyllum spicatum* L. Watermilfoil Family Vermont Class B Noxious Weed

Description: Eurasian watermilfoil is a submersed, perennial aquatic plant with leaves arranged in whorls of four around the stem. Each leaf is finely divided into many paired leaflets, giving the plant a delicate, feathery appearance. The plants are rooted in the bottom and usually branch heavily as they reach the water surface, forming a dense mat. The tops of Eurasian watermilfoil plants frequently have a reddish color. Erect flower spikes rise above the water surface. Flowers are small and are reddish in color. The spread of Eurasian watermilfoil can occur through seeds but is most frequently a result of vegetative fragmentation. Eurasian watermilfoil is similar in appearance to several species of native watermilfoils, but can be distinguished by having 11 or more leaflets on each side of the leaf midrib (natives have fewer leaflets).

Habitat: Eurasian watermilfoil can be found in lakes, ponds, reservoirs, rivers, canals, and drainage ditches. Eurasian watermilfoil grows along shallow shoreline areas as well as in deeper water, 25 feet (7.5 meters) deep or more. It is tolerant of a wide range of environmental conditions.

Threats: Eurasian watermilfoil is highly invasive and competes aggressively with native aquatic plant species, thereby reducing biodiversity. Dense milfoil infestations can severely impair swimming, boating, and fishing activities. When the plant grows in dense mats, water quality and fish abundance and distribution can also be affected.

Distribution: Eurasian watermilfoil is native to Europe and Asia. It was first introduced into North America in the mid 1940s. The first sighting of the plant was in a pond in Washington, D.C. Since then it has spread to at least 45 states and three Canadian provinces. The quick spread of Eurasian watermilfoil



(Aquatic plant line drawing is the copyright property of the University of Florida Center for Aquatic Plants (Gainesville). Used with permission.)

Distribution continued: across the country has been attributed mainly to boat traffic, where plant fragments have been transported accidentally from one site to another on motorboat propellers and trailers. The dumping of aquaria has also been the suspected source of some new populations. Eurasian watermilfoil infests over 57 lakes and several rivers throughout Vermont, including the Connecticut River.

Vermont Invasive Exotic Plant Fact Sheet

Eurasian Watermilfoil Watermilfoil Family (*Haloragaceae*)

Control: Eurasian watermilfoil is controlled through various mechanical, chemical, biological, and physical methods. Mechanical methods include harvesting, hydro-raking, diver-operated suction harvesting, and dredging. Some aquatic herbicides, such as fluridone, triclopyr, and 2,4-D can be effective. Biological methods include the use of the herbivorous Asian fish known as the grass carp and a milfoil-eating weevil (*Euhrychiopsis lecontei*) native to North America. **(Introduction of grass carp in Vermont is illegal because they consume other vegetation and create erosional and siltation problems.)** The use of the weevil is experimental at this time but it has shown promise. Other techniques used for milfoil control are overwinter drawdowns (lowering lake water levels to expose milfoil to drying and freezing), bottom barriers (mats anchored to the bottom that kill plants by blocking out sunlight), and hand-pulling.

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary of the Agency of Natural Resources.

References:

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Vermont Invasive Exotic Plant Fact Sheet

Yellow Floating Heart *Nymphoides peltata* (Gmel.) Britt. & Rendle. Gentian Family Vermont Class B Noxious Weed

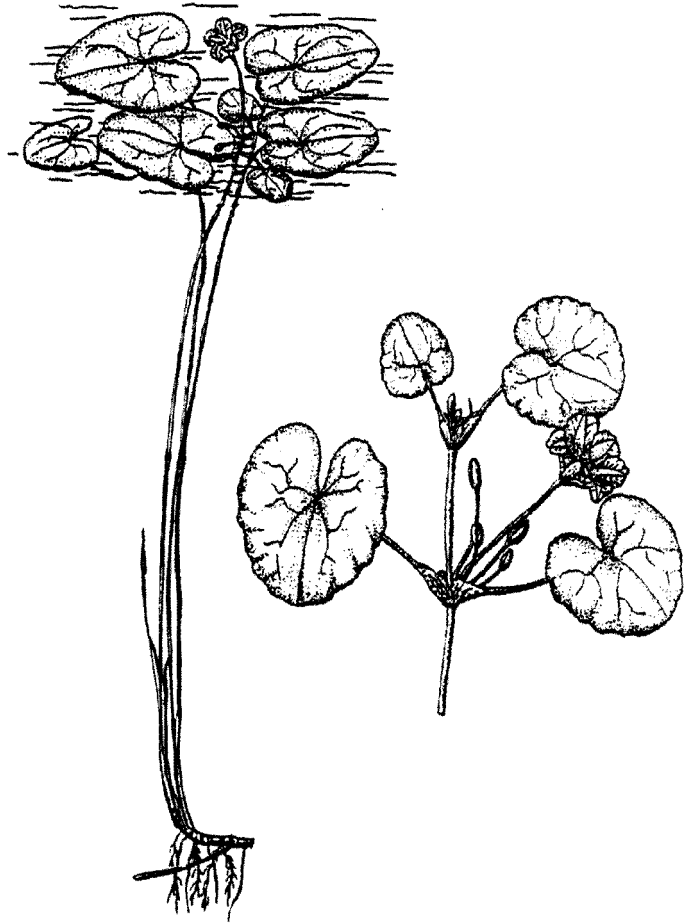
Description: Yellow floating heart is an aquatic plant with heart-shaped leaves and bright yellow flowers. The leaves rest on the water surface and can form a solid impenetrable mat.

Habitat: This plant is most commonly found in shallow quiet bays of lakes, ponds, and rivers.

Threats: Yellow floating heart can form dense colonies, creating extensive shaded areas that suppress the growth of native aquatic plants beneath the mat. Recreational activities such as boating and swimming may also be impeded.

Distribution: Yellow floating heart is native to Europe. Because of its attractive flower, it has been grown as a cultivated ornamental plant in water gardens in the U.S. since the late 1800s. It is now established in close to 20 states, appearing as far south and west as Louisiana and Washington. It was first discovered in Vermont in the 1950s and occurs in limited areas of the southern part of Lake Champlain.

Control: Little information is available on the control of yellow floating heart. Based on the plant's characteristics, mechanical and hand removal would most likely be effective. It is not known whether biological or chemical controls are effective on yellow floating heart.



(Illustration used with permission from :Crow, G.E. & C.B. Hellquist. In press. *Aquatic and wetlands plants of northeastern North America*. university of Wisconsin Press, Madison)

Vermont Invasive Exotic Plant Fact Sheet

Yellow Floating Heart Gentian Family (*Gentianaceae*)

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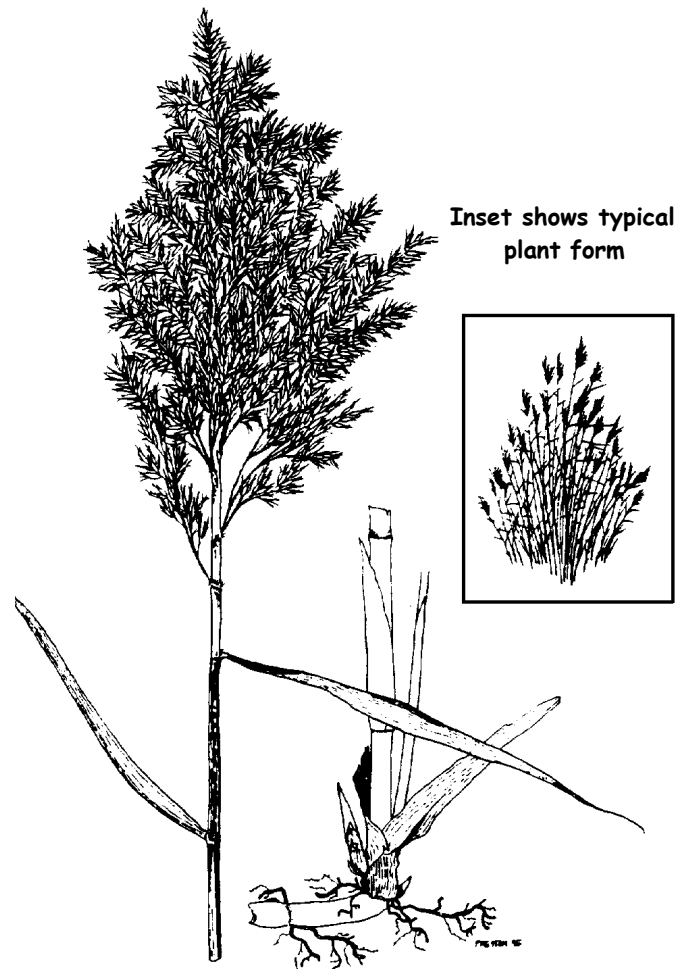
Giant or Common Reed *Phragmites australis* (Cav.) Trin. Grass Family Vermont Class B Noxious Weed

Description: *Phragmites* is an herbaceous, perennial grass that can grow up to 15 feet (4.5 meters) in height. It has stout stems, long leaves (up to 2 feet(.6 meters)), and large feathery plumes of flowers that change from a purple-brown color in July to tan or grey by late in the season. *Phragmites* may spread by seed, although a number of populations do not produce viable seeds. Stands of *Phragmites* are also established by the spread of underground rhizomes (a thickened underground stem).

Habitat: *Phragmites* thrives in sunny wetland habitats and prefers fresh or brackish water (tidal and nontidal marshes). Although it can tolerate salt water, growth is usually stunted. In Vermont, it is known to grow on lake shores and in marshes, bogs, fens, wet meadows, roadside ditches, spoil piles resulting from dredging, and even seepage areas on highway embankments. It grows in soils with a pH range of 3.7 to 9.0 and in saturated soils or those that are seasonally, regularly, or permanently inundated up to two feet. It cannot withstand strong wave action or running water because the vertical stems break easily. *Phragmites* especially takes advantage of situations where there are numerous human disturbances to the landscape. Examples include dredging, water pollution, alteration of the natural hydrological regime and increases in nutrients, soil salinity, or sedimentation.

Threats: *Phragmites* spreads rapidly by rhizomes in disturbed areas that have moist to wet soils. It will quickly dominate in these areas, displacing the natural, diverse community with a monoculture. A *Phragmites* rhizome can extend 30 feet (9 meters) in a year. Monocultures as large as 7,000 acres have been documented.

Distribution: *Phragmites* is found in temperate regions worldwide and can be found in every state of the United States.



(Illustration by Judy Preston - The Nature Conservancy of Connecticut)

Distribution continued: Paleoecological studies in Connecticut have found 3,000 year old fragments of *Phragmites*, providing evidence that it is a native plant in the Northeast. However, many scientists agree that the aggressive, invasive reed most commonly seen is a European strain imported in the early 1900s. This strain of *Phragmites* is widespread and very invasive in Vermont.

Vermont Invasive Exotic Plant Fact Sheet

Giant or Common Reed

Grass Family (*Gramineae/Poaceae*)

Control: Prior to specific removal techniques, it is essential to minimize land disturbances and other human alterations in the area of restoration so that the factors that favor the spread and establishment of *Phragmites* are no longer present. Healthy, stable, natural plant communities are the best defense against the invasion and spread of *Phragmites*.

A number of control methods have been tried on *Phragmites*. Cutting has worked to control it although it is important to cut at the right time and to do so for a number of years. The plants should be cut just before the end of July when most of the food reserves are in the aerial portion of the plant. Doing this for several years has contained and significantly reduced common reed stands in a number of sites in the northeast.

Glyphosate herbicide has been used on a number of reed stands along the East Coast. The chemical must be applied after the tasseling stage when the plant is supplying nutrients to the rhizome and will translocate the herbicide as well. Burning will not control stands unless there is a root burn, which is difficult to achieve because the rhizomes are often under soil, mud, or water. A prescribed burn done after a chemical treatment worked well at Brigantine National Wildlife Refuge in New Jersey and in Delaware. The chemicals killed 90 percent of the reed stand, and the burn removed *Phragmites* litter and exposed the seed bed for native plant re-establishment. Recent efforts using black plastic have also had some success. In any case, there is no easy solution for control of this aggressive species.

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References:

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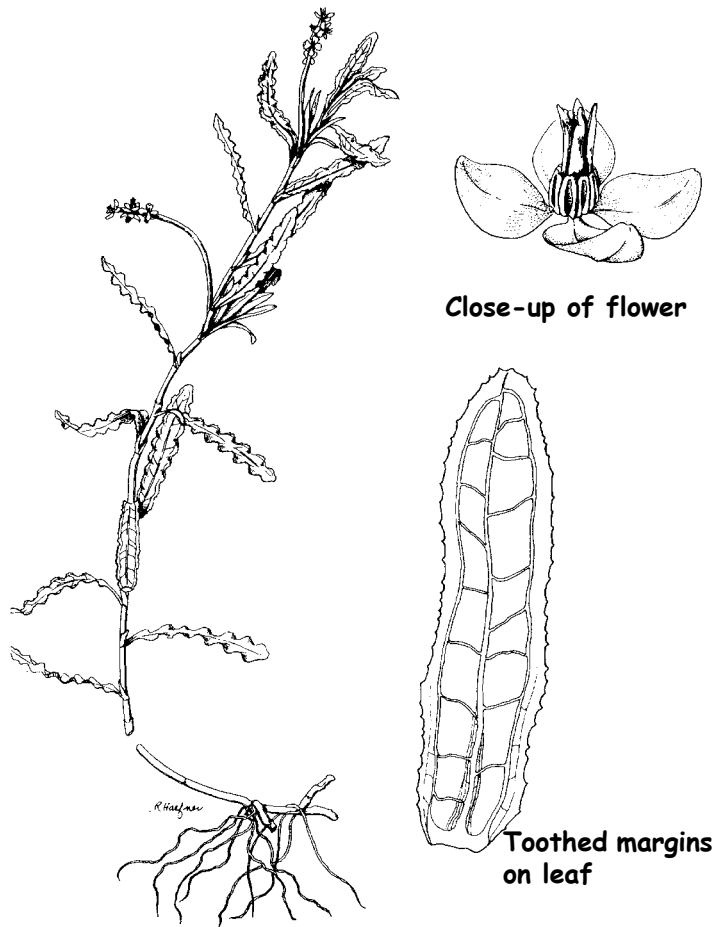
Curly Leaf Pondweed *Potamogeton crispus* L. Pondweed Family Vermont Class B Noxious Weed

Description: Curly leaf pondweed is a submersed, perennial aquatic plant easily identified by reddish-green, wavy leaves with finely toothed margins. The leaves are approximately one-half-inch (1-2cm) wide and 2 to 3 inches (5-7.5 cm) long. Stems are branched and somewhat flattened. Curly leaf pondweed spreads primarily by burr-like winter buds called "turions" which are hard and prickly. One plant may produce hundreds of turions, which are then dropped to the sediment to germinate the following year. Curly leaf pondweed flowers are small, somewhat inconspicuous, and arranged in a dense spike on a curved, one to 2 inch (5 cm) stalk. Seeds mature in June but play a small role in plant reproduction and spread. Plants begin to die back by mid-July.

Habitat: Curly leaf pondweed is found in freshwater lakes, ponds, rivers and streams, and in slightly brackish waters. It is tolerant of low light, very low water temperatures, and is a species of alkaline or nutrient-rich waters. Curly leaf pondweed gets a head start on native aquatic species in the spring and early summer when conditions are unfavorable to most native aquatic species. Curly leaf pondweed will invade shallow as well as deep water areas of 12 feet or more.

Threats: Curly leaf pondweed can grow in dense beds which outcompete native aquatic plants, reducing plant diversity. The dense surface mats may also interfere with water-based recreational activities.

Distribution: Native to Eurasia, Africa and Australia, curly leaf pondweed has spread aggressively since being introduced to North America in the mid-1800s. It can now be found in 48 states and has become invasive in many areas. In Vermont, it has been identified in Lake Champlain and at least 13 inland lakes.



(Conservation Commission of the State of Missouri. 1990. *Water Plants for Missouri Ponds*. Reprinted with permission.)

Vermont Invasive Exotic Plant Fact Sheet

Curly Leaf Pondweed

Pondweed Family (*Potamogetonaceae*)

Control: In areas where curly leaf pondweed growth is causing problems, mechanical removal and herbicides have been employed with varying degrees of success. In Vermont, there are no programs at this time that focus on removal of curly leaf pondweed.

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Vermont Invasive Exotic Plant Fact Sheet

Common Buckthorn and Glossy Buckthorn

Rhamnus cathartica and *Rhamnus frangula*

Buckthorn Family

Vermont Class B Noxious Weed

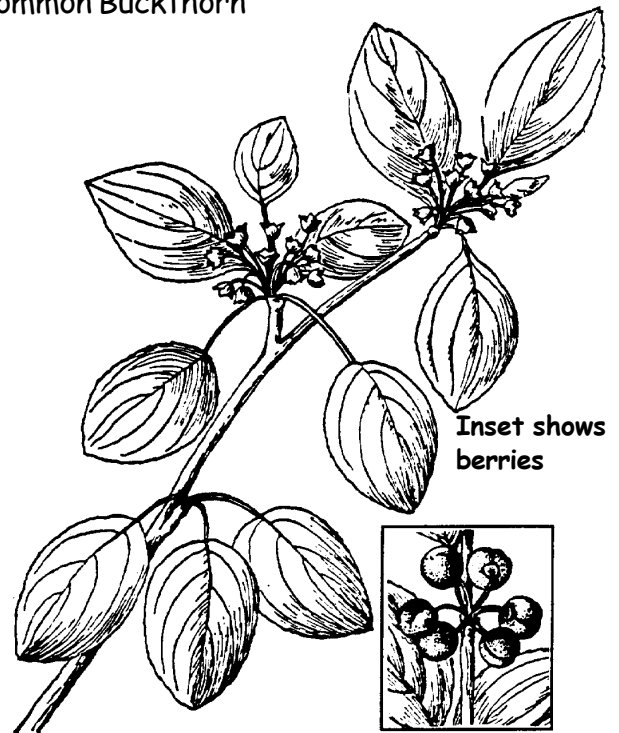
Description: Common buckthorn is a deciduous shrub or small tree that reaches up to 20 feet (6 meters) high. It has smooth, dull green, minutely toothed, oblong leaves, about 1 to 2.5 inches (2.5-6 cm) long, that are opposite or nearly so on the stem. The leaves have three or four pairs of veins which curve upward toward the tip. Fragrant flowers with 4 greenish-yellow petals, are borne in umbrella-shaped clusters (umbels) among the leaves. The fruit is small, round, and black and contains 3 to 4 seeds. The bark is grey-black, and the twigs have prominent raised patches (lenticels) and may be tipped with sharp thorns. Common buckthorn leaves persist on the plant well into fall as does much of the fruit.

Glossy buckthorn can reach up to 23 feet (7 meters) high. It has thin, alternate, glossy leaves, 1 to 3 inches (2.5-7.5 cm) long, which are oblong to elliptical, have more than 5 pairs of veins, and have smooth or wavy margins. Leaves are smooth on the top surface but slightly hairy below. The flowers, yellowish-green with 5 petals, are borne in umbels. The fruit, red when immature and black when ripe, contains 2 to 3 seeds and falls off the plant after ripening. The brown-green bark has elongated lenticels. Leaves persist late into fall.

Habitat: Common buckthorn occurs in a variety of habitats, including pastures, exposed rocky sites, the understory of open oak, beech, and ash woods, woodland borders and wet areas. It prefers neutral or alkaline soils. It does not grow as well in dense shade.

Glossy buckthorn (sometimes called European buckthorn) prefers wetter, less shaded habitats and more acidic soils than common buckthorn. It can invade similar habitats, but more commonly invades wet areas similar to its native habitat, such as wet prairies, sedge meadows, marshes, calcareous fens, sphagnum bogs and tamarack swamps.

Common Buckthorn



Glossy Buckthorn



(Illustrations courtesy of the New York Botanical Garden, from the "New Britton and Brown Illustrated Flora of the United States and Adjacent Canada".)

Vermont Invasive Exotic Plant Fact Sheet

Common Buckthorn and Glossy Buckthorn Buckthorn Family (*Rhamnaceae*)

Threats: Common and glossy buckthorn readily invade natural areas, establishing dense, even-aged thickets which crowd or shade out native plants. Both buckthorns produce fruits that are readily eaten, and thus spread by wildlife.

Distribution: Common and glossy buckthorn are native to Eurasia. In North America, common buckthorn has naturalized from Nova Scotia to Saskatchewan, south to Missouri and east to Virginia. Glossy buckthorn has naturalized from Nova Scotia to Manitoba, south to Minnesota, Illinois, New Jersey and Tennessee. In Vermont both exotic buckthorns are widespread in the Champlain Valley, the Taconic Foothills, and in the Connecticut River Valley. They are spreading into the Vermont Piedmont region and up the Winooski, Lamoille and Connecticut river valleys. Care should be taken not to confuse the 2 exotic buckthorns with our native alder-leaved buckthorn, a low shrub of alkaline wetlands.

Control: Buckthorns can be controlled by a number of methods. However, repeated treatments are needed as buckthorns are able to resprout. The removal of adult plants may enable new seeds to sprout by increasing light availability. Seedlings and small plants can be pulled up. Repeated cutting or mowing will reduce plant strength and eventually kill the plant. Mowing can also be used to prevent seedlings from becoming established in open areas. Girdling stems along with clipping resprouted growth is effective, as it slowly starves the trees to death with minimal disruption to soils and sensitive wetlands. Combining herbicide use with cutting can also be effective. Stems should be cut after leaf out and again in fall. Repeated burning will remove the above ground portion of the plant, but the below ground part will resprout. In some cases, fire can encourage buckthorn infestation.

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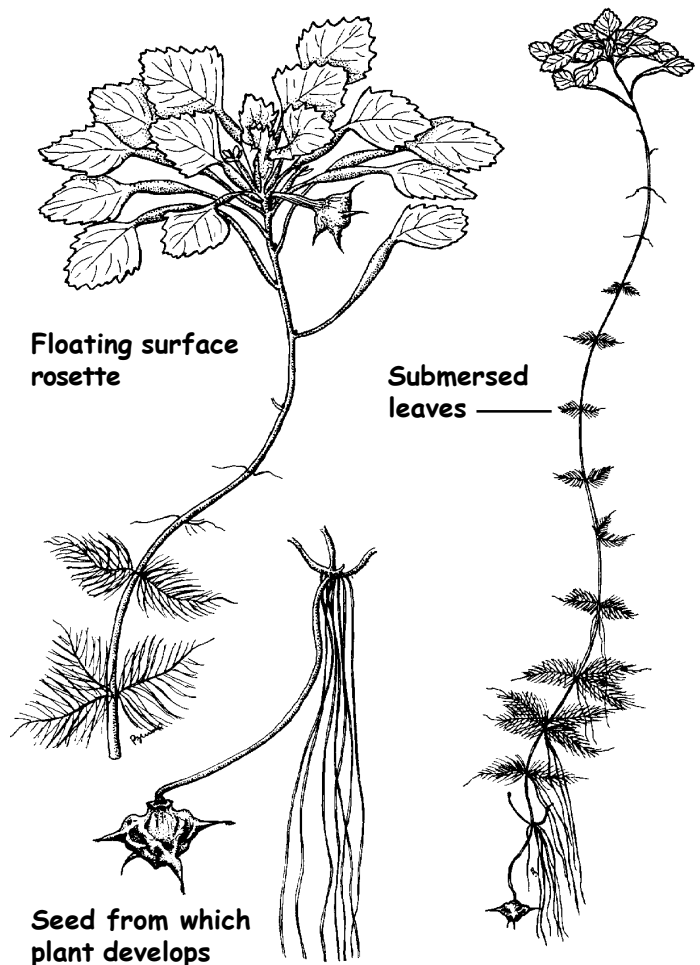
Vermont Invasive Exotic Plant Fact Sheet

Water Chestnut *Trapa natans* L. Water-nut Family Vermont Class B Noxious Weed

Description: Water chestnut is a rooted, annual aquatic plant with both floating and submersed leaves. Floating leaves are triangular with toothed margins and have an inflated spongy leaf stem. Floating leaves form a rosette on the water's surface that may grow to a foot in diameter. Submersed leaves are whorled around the stem, and are feather-like; each leaf is divided into smaller leaflets. Plant stems are long and cord-like, attaining lengths of up to 16 feet (5 meters). Flowers are small, inconspicuous, and white and form in the axils of the surfacing leaves in July. The fruit of the water chestnut is a woody, nutlike seed with 4 sharp, barbed spines. Mature rosettes may produce as many as 10 to 15 seeds. Once mature, these seeds drop from the plant and fall to the sediment. Seeds may remain viable in the sediment for 5 or more years; viability of up to 12 years has been reported. A true annual, water chestnut overwinters entirely by seed.

Habitat: Water chestnut grows in freshwater lakes and ponds, and slow-moving streams and rivers. It prefers calm, shallow, nutrient-rich waters.

Threats: Dense water chestnut growth can be impenetrable and can easily choke out the water bodies which it invades. It can outcompete native vegetation, reduce oxygen levels which may increase the potential for fish kills, and provides little value to waterfowl. Dense infestations of water chestnut make swimming, boating, and other recreational activities nearly impossible. Its sharp spiny fruits wash ashore and can be hazardous, inflicting painful wounds to those who step on them.



(Crow and Hellquist 1983. *Aquatic Plants of New England Series: Trapa natans*, Illustration by Pam Bruns)

Vermont Invasive Exotic Plant Fact Sheet

Water Chestnut

Water-nut Family (*Trapaceae*)

Distribution: Water chestnut's native range is Europe, Asia, and Africa. First introduced into the northeastern United States in the late 1800s, water chestnut currently infests waterbodies in Vermont, New York, and Massachusetts, as well as Canada. Maryland and Virginia used to have populations of water chestnut but management activities were successful in eradicating the plant. In Vermont, water chestnut was first reported in southern Lake Champlain in the 1940s. Hundreds of acres of southern Lake Champlain are infested; the northernmost population in the lake is found in Converse Bay in Charlotte. Populations have also been found in several Lake Champlain tributaries and a handful of other waterbodies in the Lake Champlain Basin.

Control: Because water chestnut is an annual plant, effective control can be achieved if seed formation is prevented. Herbicides and mechanical removal methods have been used. Mechanical harvesting, cutting, and handpulling are the methods currently being used in Vermont to manage this species.

* No person may use pesticides, biological controls, bottom barriers, structural controls or powered mechanical devices in waters of the state to control nuisance aquatic vegetation, insects or other aquatic life including lamprey unless that person has been issued a permit by the secretary of the Agency of Natural Resources.

References:

- Countryman, W.D. 1978. *Nuisance Aquatic Plants in Lake Champlain*. Aquatec, Inc.
Florida Department of Natural Resources. 1990. *Florida Prohibited Aquatic Plants*.
Madsen, John D. 1990. *Waterchestnut (Trapa natans L.) Research in Watervliet Reservoir - 1989 Report*. Rensselaer Fresh Water Institute. FWI Report #90-8.



For more information about Vermont's invasive exotic plant species or if you would like to know how you can help, please contact:

The Nature Conservancy of Vermont, 27 State Street, Montpelier, VT 05602
Tel: 802-229-4425

Vermont Department of Environmental Conservation, 103 S. Main St., Bldg. 10 North, Waterbury, VT 05671-0408 Tel. 802-241-3777

Vermont Department of Fish and Wildlife, 103 S. Main St., Bldg. 10 South, Waterbury, VT 05671-0501 Tel. 802-241-3715

Vermont Department of Forests, Parks and Recreation, 103 S. Main St., Bldg. 10 South, Waterbury, VT 05671-0601 Tel. 802-241-3678



