

# INVASIVE SPECIES HANDBOOK

## A GUIDE TO INVASIVE PLANTS IN THE TUG HILL REGION

Photo: Tom Heutte, USDA Forest Service, Bugwood.org





Lake Ontario

Interstate Route 81

Black River

Lowville

Pulaski

Salmon River Reservoir



Rome

Oneida Lake

# TUG HILL REGION COVER TYPES

## Legend

- Tug Hill plateau
- Tug Hill core forest
- Open Water
- Developed
- Barren Land
- Forest
- Shrub/Scrub
- Grassland and Herbaceous
- Agriculture
- Wetlands

# SPECIES QUICK FINDER



## GRASSES

- 9** Common Reed Grass
- 11** Japanese Stiltgrass
- 13** Reed Canarygrass
- 15** Yellow Iris



## FORBS

- 17** Garlic Mustard
- 19** Giant Hogweed
- 21** Himalayan Balsam
- 23** Japanese Knotweed
- 25** Periwinkle
- 27** Purple Loosestrife
- 29** Swallow-Wort



## WOODY PLANTS

- 31** Autumn Olive
- 33** Black Locust
- 35** Common Buckthorn
- 37** Honeysuckle
- 39** Japanese Barberry

# INVASIVE SPECIES HANDBOOK

## A GUIDE TO INVASIVE PLANTS IN THE TUG HILL REGION

Copyright 2009

by The Nature Conservancy

First Edition, 2009

Published by The Nature Conservancy  
Central & Western New York Chapter  
1048 University Avenue  
Rochester, New York 14607

# CONTENTS

Tug Hill Region.....	ii
Species Quick Finder.....	iii
Contents.....	v
Acknowledgements.....	vi
What is an Invasive Species?.....	1
General Management Strategies.....	3
Species Accounts.....	7-39
Glossary.....	40
Resources.....	41

# ACKNOWLEDGEMENTS

This project was a collaboration between The Nature Conservancy and St. Lawrence-Eastern Lake Ontario Partnership for Regional Invasive Species Management (SLELO PRISM). It was made possible through a grant from the National Fish and Wildlife Foundation, funded by the Environmental Protection Agency, as well as funding from the New York State Department of Environmental Conservation via the Environmental Protection Fund.

Special thanks to Lisa Geinke and Adam Bunger who did the hard work of identifying invasive plants on Tug Hill during the summer of 2008. They also did research for earlier versions of this guidebook and contributed many of the photos. Linda Garrett, Carol Hutchinson, and Bob Keller of the Tug Hill Tomorrow Land Trust helped with invasive plant identification during a preliminary survey in the summer of 2007.

Unattributed photos were taken by Adam Bunger, Lisa Geinke, Michelle Peach, John Randall, and Mandy Tu of The Nature Conservancy. We would also like to thank the following people for making their photographs available for this guide: Barry Rice/sarracenia.com; Chuck Barger, University of Georgia; and John D. Byrd, Mississippi State University; Steve Dewey, Utah State University; Donna R.

Ellis, University of Connecticut; Terry English, USDA APHIS PPQ; Chris Evans, to River CWMA; Linda Haugen, USDA Forest Service; Tom Heutte, USDA Forest Service; Daniel Herms, The Ohio State University; Steve Hurst, USDA NRCS PLANTS database; Leslie J. Mehrhoff, University of Connecticut; Jack Ranney, University of Tennessee; Jan Samanek, State Phytosanitary Administration, Michael Shephard, USDA Forest Service; Jil Swearingen, USDI National Park Service; Dan Tenaglia, Missouriplants.com; Barbara Tokarska-Guzik, University of Silesia; Linda Wilson, University of Idaho associated with Bugwood.org.

Booklet design and pre-press by Robert McNamara and Erin Zehr.

To provide comments or request additional copies, contact:

The Nature Conservancy  
269 Ouderkirk Rd.  
Pulaski, NY 13142  
315-387-3600



# WHAT IS AN INVASIVE SPECIES?

An invasive species is a non-native plant, animal, or other organism (e.g., microbe) that has the ability to invade natural areas and proliferate. They will often dominate an ecosystem to the detriment, and sometimes the exclusion, of native species. As a result, invasive species are likely to cause economic or environmental problems in addition to harming human, animal, or plant health. Invasive species are able to do this because the natural conditions, predators, parasites and other organisms that keep them under control in their native range do not exist in the new environment where they have been introduced.

Human activities, such as trade, travel and tourism, have increased substantially. This in turn has increased the speed and volume of species movement to unprecedented levels. Invasive species are often unintended hitchhikers on cargo and other trade conveyances. Still more species are deliberately introduced as pets, ornamental plants and food, or for recreation, pest control or other purposes.

Not all non-native species are invasive. Most experts agree that about 1/3 of the plants currently found in New York are non-native, but only a small fraction, perhaps 10 – 15%, cause enough damage to be considered invasive. The plants presented in this guidebook are aggressive invasive species that threaten the diversity of plants and animals as well as the quality of life in the Tug Hill region.

**Invasive Plant Threats.** On a global basis, invasive species are second only to habitat destruction as the greatest threat to native plants, animals and natural communities, such as forests, wetlands, streams, and ponds. In fact, experts estimate that invasive species have contributed to the population decline of 42% of threatened and endangered species in the U.S. Many invasives also pose threats to agricultural areas, urban parks, yards, and roadsides. Some invasive species, such as West Nile virus, hydrilla, zebra mussel, and emerald ash borer, prey upon, displace or otherwise harm native species. Others compete directly with native species for nutrients, sunlight and space. Invasive species can also alter ecosystem processes, transport disease, interfere with crop production, and cause disease in animals or humans. Invasive plants are often less valuable to animals for food and shelter, so they can reduce wildlife populations.





Invasive species are a leading source of environmental and economic damage across New York State. Recent estimates conclude that invasive species cost the U.S. at least **\$137 billion per year**. In addition to reducing the diversity of native plants and animals, plants included in this guide have the potential to impact forest regeneration, agriculture, and recreation in the Tug Hill region. Garlic mustard, for example, has been shown to reduce the viability of tree seedlings by exuding a toxic chemical into the soil. Japanese knotweed grows in dense patches along streams, which can alter stream habitat conditions and make fishing access difficult if not impossible. Contact with giant hogweed can have serious health consequences.

Despite the problems caused by the plants described in this guidebook, Tug Hill is still relatively free of invasive species. Early detection and rapid response to invasive species can prevent significant impacts to natural communities and human activities, which is why it is so important to raise awareness and begin control efforts now.

New York State is being proactive about invasive species identification and control and has established Partnerships for Regional Invasives Species Management (PRISMs) throughout the state. The creation of these public-private partnerships is dramatically enhancing efforts to prevent and control the spread of invasive species. A New York State Invasive Species Task Force Report states: “By looking more at prevention, early detection, and rapid response as priorities for these funds, future invasive species problems and costs can be more effectively contained and minimized.”

# GENERAL MANAGEMENT STRATEGIES

While eradication of invasive plants may be desirable, it is not always feasible as a management goal. Controlling existing populations to prevent their spread and quickly treating new infestations is usually the most practical goal.

For most invasive plants there are a variety of effective control measures. In this guidebook we describe alternative control methods that have been used successfully elsewhere; the most suitable one for your situation will depend on the invasive plant, the size of the invasion, surrounding environmental conditions, and the management objectives for the area in question. We have divided the control options into three categories: mechanical, biological, and chemical. In some instances several control methods may be combined. Regardless of the control method, repeated treatment for many years is often required to deplete the seed bank.

Removal of invasive plants often results in disturbance of the soil or large areas of bare soil where native vegetation has been displaced. In many cases it will be necessary to replant the area with native species. When seeding is completed it may be useful to plant a short-lived cover crop such as annual rye or oats to compete with the weedy species and control erosion as the native seedlings are becoming established.

## MECHANICAL CONTROL

Mechanical methods include prescribed burning, pulling, mowing, cutting, and other techniques that physically remove all or part of the plants. It is important to minimize soil disturbance as much as possible when using mechanical control because disturbance encourages invasive plant establishment. In general, mechanical control is most feasible for small invasions because of the intensive effort required. Depending on the species, it may be necessary to remove all plant material from the site and dispose of it by burning or burying very deeply to prevent roots or stems from re-sprouting.

Mechanical control can be done by hand or using common tools such as shovels, loppers, mowers, and saws. Weed wrenches are specialized tools designed specifically for pulling plants and are especially useful for trees and shrubs.



## BIOLOGICAL CONTROL

In biological control, a plant's natural enemies, usually insects or diseases, are imported and released to control the invasive species. Before biological control agents are approved for use in the U.S. they must go through years of testing to ensure they attack only the invasive plant and do not have a negative effect on other plants or animals. At the time of writing, purple loosestrife is the only species in this guidebook for which biological control has been approved. A list of biological control suppliers is available at <http://www.cdpr.ca.gov/docs/pestmgt/ipminov/bensuppl.htm>.

## CHEMICAL CONTROL

Chemical control may be appropriate when the infestation is large or when there are no other effective control methods known. Herbicides are most often either sprayed, brushed or wicked on the foliage, basal bark or cut stumps or stems of target plants.

Regardless of which technique you use you should follow these guidelines:

- **Always carefully read and follow all label instructions. It is against the law to do otherwise.**
- **Use the safest effective herbicide at the safest time.**
- **Use appropriate personal protective equipment while working with herbicides.**
- **Always apply herbicide by working away from areas already treated.**
- **Do not over-apply chemical to the point of run-off from leaves, stems or stumps to minimize the effect on non-target plants and animals.**
- **Do not spray in windy conditions.**
- **Warn others by placing herbicide warning signs around the perimeter of the treated area.**

The Nature Conservancy does not endorse any particular herbicide or manufacturer, and therefore trade names are generally not used in the control recommendations. To obtain toxicology information on pesticides including trade names, toxicity ratings, reproductive and carcinogenic effects, impact on other organisms, and persistence in the environment, check the web site: <http://pmep.cce.cornell.edu/profiles/extoxnet/index.html>. Many herbicides are readily available in garden stores.

**In foliar treatments,** herbicides are applied to green leaves with a hand sprayer, sponge applicator, or wick. Herbicide should be applied uniformly, ensuring that all the leaves are thoroughly wetted but not dripping to avoid contact with non-target species. Spray applications will usually involve mixing a surfactant/dispersal agent with the herbicide; be sure to follow label directions. If label recommendations allow, colorants or marker dyes may be added to assist in proper herbicide application.

**In cut-stump or cut-stem treatments,** herbicide is applied to freshly cut trunks or stems with a hand held sprayer, brush, sponge applicator or contact solution bottle. Herbicide should be applied as soon as possible after cutting. For woody plants, only the cambium layer just inside the bark needs to be treated, not the entire stump. Trees and shrubs should generally be cut at the end of the growing season so that chemicals will be actively absorbed into the stump, although many species may be treated in the winter. Winter application is best done with temperatures above freezing to maximize translocation.

**In basal bark treatments,** herbicide is applied in a ring around an uncut trunk or stem. In general, it should be applied in a 6 – 18 in. band around the entire trunk approximately 6 – 12 in. from the base of the plant. Often the herbicide is mixed with horticultural oil to increase penetration through the bark, but follow label instructions. The effectiveness of this treatment may not be consistent on trees larger than 5 – 6 in. in diameter at chest height.



6





# COMMON REED GRASS

*Phragmites australis*

## DESCRIPTION

**Appearance:** Herbaceous perennial grass reaching heights of 15 ft., usually growing in dense stands. **Leaves:** Dark green/gray long (7.5 – 16 in.), stiff leaves. **Flowers:** Large plumes of purplish brown flowers appear in July and turn tan-gray late in the season. **Stem:** Rigid, tan, ribbed stems grow very densely together. **Roots:** Dense mat of rhizomes.

## THREATS/DAMAGE

This highly aggressive plant thrives in wetlands and disturbed and degraded soils. It often becomes established and spreads along roadsides and drainage ditches. It can tolerate a wide range of environmental conditions. Common reed grass typically forms dense, single species stands that exclude other wetland vegetation and alter community structure. This change can cause a decrease in wildlife abundance, including waterfowl and many marsh nesting birds. Common reed grass can also increase the potential for winter fires when above ground portions of the plant dry out and die.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Cutting:** Cutting should be done near the end of July, when the season's food reserves in the leaves can be removed, thus reducing the plant's vigor. All cut portions of the plants must be removed and disposed of properly.

**Burning:** While prescribed fire is not effective at controlling common reed grass, it can be used to remove leaf litter and the large amount of dead material following cutting and/or chemical treatments.

### CHEMICAL

#### Materials Application

**Foliar treatment:** For effective control, glyphosate approved for use near aquatic habitats should be applied when at least 95% of the plants are tasseling because that is when the plant is supplying nutrients to the roots. Care should be taken because even though it may be approved for use near aquatic habitats, glyphosate is non-selective. Both foliar and cut/stem applications have been successful.



Photo: Joseph McCauley, U.S. Fish and Wildlife Service, Bugwood.org



# JAPANESE STILTGRASS

*Microstegium vimineum, Andropogon vimineus*

## DESCRIPTION

**Appearance:** Annual weak stemmed, reclining grass up to 3 ft. high.

**Stem:** Hairless nodes on stems. By fall stems turn red. **Leaves:** Pale green ¼ - 3/8 in. wide and 1 1/8 – 3 3/16 in. long leaves have a pale shiny midrib on the upper surface. Mid-vein is slightly offset from center with a line of silvery hairs running down it. **Flowers:** Inflorescence up to 2 3/4 in. long blooms in late summer/early fall, typically with awn. **Fruit:** Ellipsoid grain 1/8 in. long matures in late fall and is dispersed by water and animals.

Note: Virginia cutgrass (*Leersia virginica*) a native perennial grass, looks similar to Japanese stiltgrass, but it does not have a shiny midrib or an awn on the fruits, and it has a hairy ring around the stem nodes.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Hand pulling is very effective and often the preferred control method, but it can be time consuming and labor intensive. Pulling should be completed before seed production in August – September. Annual weeding is necessary to deplete the seed bank.

**Cutting:** Cutting can be effective to clear large patches of stiltgrass just prior to seed production in August - September.

## THREATS/DAMAGE

Stiltgrass is shade tolerant and prefers closed canopy forests, especially riparian areas, but can also be found in sunny areas or disturbed areas, such as roadsides, forest borders, and fields. Dense single species stands can become quickly established, preventing native species from establishing. Stiltgrass may alter soil conditions to its benefit and the detriment of native species by increasing pH and nitrogen levels. Large invasions of stiltgrass can have negative impacts on ground nesting birds. In addition, stiltgrass may provide habitat for rats that prey on native bobwhite quail. Individual plants can produce up to 1,000 seeds, which remain viable in the soil up to 5 years.

## CHEMICAL

### Materials Application

**Foliar treatment:** Herbicide applications can be effective at controlling large patches of stiltgrass when applied during late summer. The greatest success has been found with imazameth, but varying degrees of success have also been achieved with fluazifop-p, glyphosate, and sethoxydim.



Photo: Chris Evans, River to River CWMA, Bugwood.org



Photo: James H. Miller, USDA Forest Service, Bugwood.org



Photo: Chuck Barger, University of Georgia, Bugwood.org



Photo: Leslie J. Mehrhoff, University of Connecticut, Bugwood.org



Photo: Ted Bolner, Southern Weed Science Society, Bugwood.org

# REED CANARYGRASS

*Phalaris arundinacea*

## DESCRIPTION

**Appearance:** Robust, cool season, sod-forming perennial grass that can grow more than 6 ft. high. **Leaves:** Long flat leaf blades up to 1 1/2 ft. long and 1/10 – 4/5 in. wide. **Flowers:** Flowers arranged in dense, branched panicles that can exceed 2 - 8 in. in length bloom in June – July. Most contain three florets. **Fruit:** Fruits are lanceolate, 1/4 in. and pale. **Roots:** Sod forming.

## THREATS/DAMAGE

Reed canarygrass often invades fertile wetlands, moist fields, drainage ditches and many other moist areas. Human disturbance and alteration of water levels encourage reed canarygrass growth. It can become established at new sites by seed but then often spreads vegetatively creating dense stands and heavy thatch layers that suppress other vegetation and may displace wildlife. In some cases reed canarygrass is suspected of promoting silt deposition thereby narrowing waterways and irrigation canals.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Only effective for small patches.

**Cutting:** Repeated cutting, up to 5 times per growing season, can effectively control reed canarygrass.

**Note:** A combination of approaches may be the best way to control reed canarygrass. Competitive crop management or interspersed planting of native species has also been effective and control methods should try to implement some form of native grass and forb plantings.

### CHEMICAL

#### Materials Application

**Foliar treatment:** Several herbicides have been tested and proven effective for controlling reed canarygrass. The most effective include glyphosate and fluazifop butyl. The best time to apply herbicides is in spring when they are actively growing, but success has also been achieved with fall herbicide applications.





Photo: Richard Old, XID Services, Inc., Bugwood.org

Photo: Richard Old, XID Services, Inc., Bugwood.org



# YELLOW IRIS

*Iris pseudacorus*

## DESCRIPTION

**Appearance:** Large, 3 - 4 ft. tall, clumping perennial herb. **Leaves:** Broad, stiff, lance shaped leaves, 20-40 in. long by 4 - 12 in. wide, have raised midribs, and are arranged with sheathing and overlapping leaves. **Flowers:** Yellow flowers bloom from April to June. **Fruit:** At maturity seed pods are a glossy green measuring 1.5 - 3 in. in length. **Seeds:** Pitted, pale brown, disc shaped seeds are  $\frac{3}{4}$  - 2 in. in diameter.

## THREATS/DAMAGE

Yellow iris can form dense colonies in low freshwater wetlands, lake and pond shorelines, and in floodplain riparian areas. In natural areas, these colonies can invade and dominate a variety of vegetation types, displacing native plant and animal diversity. Yellow iris is tolerant of salt, drought and poor water quality, making it a good competitor in disturbed wetlands. It provides less nutrients to wildlife than native species, such as water arum, that it can displace.

## CONTROL/MANAGEMENT

*Caution should be used when handling this plant, as it can cause skin irritation.*

## MANUAL

### Methods

**Pulling:** Only effective for small patches. Care must be used because soil disturbance can promote the germination of new plants and small root fragments can resprout.

**Cutting:** Effective if repeated annually until plant eventually dies and seed bank is exhausted.

## CHEMICAL

### Materials Application

Herbicides can effectively control yellow iris. Because of its growth in and near water, aquatic approved herbicides must be used. Yellow iris can be controlled by a foliar spray of herbicide or applying herbicide to freshly cut stems. Glyphosate products, applied in a 25% solution using a dripless wick/wiper applicator or applied in a 5-8% solution if sprayed, have been effective.





Photo: Todd Pfeiffer, Klamath County Weed Control, Bugwood.org



Photo: Steve Hurst, USDA NRCS PLANTS Database, Bugwood.org



Photo: Nancy Loewenstein, Auburn University, Bugwood.org





# GARLIC MUSTARD

*Alliaria petiolata*

## DESCRIPTION

**Appearance:** Biennial herb from 1-3 ft. in height that completes its life cycle over two years. **Stem:** Usually smooth (sometimes with sparse hairs) and unbranched. They can grow from 1/2 - 3 1/2 ft. tall. One plant usually produces 1-2 stems (sometimes more). **Leaves:** Lower leaves are kidney shaped with palmate venation, 3/4 - 4 3/4 in. long, arranged in a basal rosette that forms the first year and persists through winter. Upper leaves are alternate, triangular, and toothed. **Flowers:** In the second year numerous white 1/4 in., 4-petaled flowers bloom in late April – June. Most flowers are in a cluster at the top of the stalk but some may occur in leaf axils. **Fruit:** Dark brown to black seeds, enclosed in 1 1/2 - 2 3/4 in. capsules, are dispersed in late summer. **Note:** Crushed leaves and stems have a garlic-like odor.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Pulling can be conducted throughout the growing season but is best completed before plants set seed. It is important to remove the roots as well as the stem to prevent re-sprouting. Pulling should be avoided in sensitive areas where soil disturbance can lead to more invasions by garlic mustard or other species.

**Cutting:** Cutting is a less destructive method of control than pulling but is effective only when the flower stalk is elongating.

## THREATS/DAMAGE

Garlic mustard occurs in a wide range of moist to dry habitats including roadsides, floodplains, and forest edges and interiors. It is also common in areas disturbed by human activities. Garlic mustard is one of the few non-native herbaceous plants that invades and dominates the understory of forested areas in North America. It displaces many native spring wildflowers that occur in the same habitat, and some evidence suggests that it exudes a chemical from its roots that prevents tree seedlings from becoming established.

## CHEMICAL

### Materials Application

**Foliar treatment:** Glyphosate produces a high degree of control but also kills native plants, especially grasses, so it is most suitable for use in forest communities that have few semi-evergreen herbaceous or grass species. Bentazon produces nearly equal control, with much lower impact on grasses, and little or no impact on native herbs. It appears suitable for use in many forest communities.



Photo: Daniel Herms, The Ohio State University, Bugwood.org



Photo: Jill M. Swearingen, USDI National Park Service, Bugwood.org



Photo: Chris Evans, River to River CWMA, Bugwood.org



Photo: Chris Evans, River to River CWMA, Bugwood.org



Photo: Chris Evans, River to River CWMA, Bugwood.org



# GIANT HOGWEED

*Heracleum mantegazzianum*

## DESCRIPTION

**Appearance:** Biennial or perennial herb that stands 7-16 ft. tall. **Stem:** Often purple-mottled, up to 4 in. in diameter, hollow and ridged. **Leaves:** Alternate, three-parted and pinnate leaves are up to 10 ft. long with fine hairs underneath. Upper leaves become gradually smaller. **Flowers:** 50-150 small, white flowers appear on a compound umbel up to 5 ft. in diameter between June and August. Most plants flower in the third or fourth year. **Fruit:** Elliptic, ridged and winged fruits, 3/8 – 5/8 in. in length are shed from elongate stalks in August – October.

## THREATS/DAMAGE

Giant hogweed has two major impacts: ecological and human health. It suppresses growth of native plants, which has a negative impact on the animals that depend on them. In addition, direct skin contact with giant hogweed induces extreme photosensitivity, which can lead to severe, slow to heal burns and scarring. Costs are incurred for both medical treatment and efforts to keep the plant under control. Over 100,000 seeds per plant are dispersed annually by water, wind, or humans.

**CONTROL/MANAGEMENT** *Extreme caution should be used when handling this plant, as it can cause severe skin irritation.*

## MANUAL

### Methods

**Pulling:** Plants may be dug-out, but care should be taken to remove most of the root to prevent resprouting. Although this is the most common type of control, it can be difficult and unpleasant. Always wear protective clothing and avoid getting the sap on your skin.

**Mowing:** Mowing does not kill the plant and causes resprouting, but it might be successful if done consistently and persistently enough to starve the roots.

## CHEMICAL

### Materials Application

**Foliar treatment:** Glyphosate is considered the most effective herbicide and should be used in spring and early summer when plants are less than three ft. tall. A follow-up application in mid-summer may be necessary. Use caution around desirable species since it is nonselective.



Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Donna R. Ellis, University of Connecticut, Bugwood.org



Photo: Terry English, USDA APHIS PPO, Bugwood.org

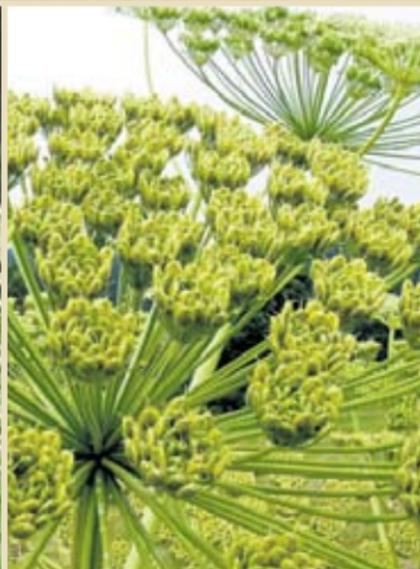


Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Donna R. Ellis, University of Connecticut, Bugwood.org

# HIMALAYAN BALSAM

(Ornamental Jewelweed)

*Impatiens glandulifera*

## DESCRIPTION

**Appearance:** Succulent annual that can be 3 - 10 ft. tall. **Stem:** Purple-tinged and hollow. **Leaves:** Simple, serrate, elliptical, 6 in. long leaves are opposite or whorled. **Flowers:** White, pink, or purple, irregular, solitary flowers appear on side stalks from June-October. **Fruit:** Five chambered capsules that, when mature, explode when touched.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** It can be easily pulled in early summer prior to seed formation, but the seeds remain viable for two years, so follow up control is recommended. **Note:** When pulling near streams and wetlands use barriers to prevent sediment and vegetation debris from entering the water system.

**Mowing/Cutting:** Mowing is very effective in early summer prior to seed formation and will reduce the risk of disturbance and erosion compared to hand-pulling, but mowed or cut plants may re-sprout later in the season. Plants should be cut as close as possible to ground level.

## THREATS/DAMAGE

Himalayan balsam occurs in areas with high soil moisture, such as riparian areas. It is unusually tall for an annual and has a fast growth rate and the ability to reseed aggressively (each plant can produce about 800 seeds), which enables it to out-compete native vegetation. Its replacement of perennial vegetation on river banks may lead to increased soil erosion. The seeds can be widely dispersed by moving water, which is not uncommon given the plant's preference for moist areas.

## CHEMICAL

### Materials Application

**Foliar treatment:** All herbicide treatment should occur before flowering and be repeated a second year to control late-germinating plants. Glyphosate may effectively control Himalayan balsam, but treatment needs to be combined with effective re-vegetation of the site. Selective broadleaf herbicides, such as 2,4-D or triclopyr, would be most effective when it is growing in a grassy area or with other monocots.



Photo: Barbara Tokarska-Guzik, University of Silesia, Bugwood.org



Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Michael Shephard, USDA Forest Service, Bugwood.org



Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Tom Heutte, USDA Forest Service, Bugwood.org



# JAPANESE KNOTWEED

*Polygonum cuspidatum*

## DESCRIPTION

**Appearance:** Perennial plant that reaches 10 ft. or taller. **Stem:** Round, sometimes ridged, often mottled. **Leaves:** Simple and alternate leaves are 3-6 in. long and 2-5 in. wide, with abruptly pointed tips. **Flowers:** Thousands of greenish-white flowers 1/8 in. wide appear in mid-to late summer. **Fruit:** ¼ -3/8 in. fruits have 3 wings that are easily dispersed by wind and water.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

Mechanical control methods such as cutting, mowing and pulling can be effective over a long time scale, but they need to be done consistently. It is most effective for small or environmentally sensitive areas where herbicides cannot be used. Because even a small piece of stem will regrow wherever it touches the soil, all plant material must be removed from the site and properly disposed of to prevent re-establishment or spread to other sites.

## THREATS/DAMAGE

Japanese knotweed is an aggressive invader in riparian areas, but it can also be found in other disturbed areas, such as roadsides. It spreads quickly and forms dense thickets that exclude native plants and alter the ecosystem. It also interferes with human activities, such as fishing, because it is too dense to walk through easily. All of the dead stems and leaves can create a fire hazard during the dormant season. It is particularly problematic in riparian areas because it can survive floods and rapidly colonize scoured shores and islands.

### CHEMICAL

#### Materials Application

**Cut stem treatment:** In early fall, stems should be cut about 2 in. above the ground and followed immediately by application of glyphosate or triclopyr to the cut stem. This treatment is best when Japanese knotweed is growing mixed with or near other species.

**Foliar treatment:** A foliar application of glyphosate can be used to control large populations, but multiple treatments may be required. It is most effective to spray in late summer or early fall after cutting the stems in late spring or early summer. **Note:** Care must be taken when using chemical treatment near water courses.



Photo: Tom Heutte, USDA Forest Service, Bugwood.org



Photo: Jack Ranney, University of Tennessee, Bugwood.org



Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Jan Samanek, State Phytosanitary Administration, Bugwood.org



Photo: Tom Heutte, USDA Forest Service, Bugwood.org

# PERIWINKLE

*Vinca minor*

## DESCRIPTION

**Appearance:** Evergreen to semi-evergreen trailing vine that reaches up to 6 3/5 ft. in length and 6 in. in height. **Stem:** Slender, somewhat woody, and green in color. **Leaves:** Opposite, glossy leaves are approximately 1 in. long and narrowly elliptical in shape. Some varieties have variegated leaf colors. **Flowers:** Violet to blue (possibly white) 1 in. wide flowers with 5 petals bloom in spring.

## THREATS/DAMAGE

Periwinkle invades open to shady forests, often around former plantings at old home sites. It grows vigorously, forming a dense single species evergreen mat that displaces and excludes most other plants, including native wildflowers. It spreads by vegetative means only, so it is more often introduced to new locations by planting.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling and Mowing:** It can be removed by digging, raising the runners with a rake, and mowing the plants. All of the plant parts, including roots, must be removed.

**Cutting:** Cutting is ineffective unless paired with herbicide treatment.

### CHEMICAL

#### Materials Application

**Foliar treatment:** Glyphosate treatment following spring cutting can be used to control regrowth.





Photo: Chris Evans, River to River CWMA, Bugwood.org



Photo: Chris Evans, River to River CWMA, Bugwood.org



Photo: Dan Tenaglia, Missouriplants.com, Bugwood.org



Photo: Steve Hurst, USDA NRCS PLANTS Database, Bugwood.org



# PURPLE LOOSESTRIFE

*Lythrum salicaria*

## DESCRIPTION

**Appearance:** Erect perennial herb, usually less than 4 ft. tall. **Stem:** Square woody stem usually covered by downy hair. **Leaves:** Lance-shaped and rounded to heart-shaped at the base without stalks. Leaves are arranged in pairs or whorls around the stem. **Flowers:** Numerous magenta or purple colored flowers with 5-7 petals grow on spikes throughout much of the summer. **Fruit/Seed:** Capsules that are enclosed in the hairy sepals.

## THREATS/DAMAGE

Purple loosestrife is capable of invading a variety of wetland habitats including marshes, river and stream banks, pond edges, lakes, road side ditches, and reservoirs. It prefers moist soil with neutral to slightly acidic pH. Once established, however, purple loosestrife can exist in a wide range of soil types. Disturbed areas are more prone to invasion because exposed soil is ideal for germination. It can quickly form dense stands that displace native vegetation.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling/Cutting:** Infestations less than 100 plants can be controlled by pulling or cutting just before the plants begin flowering to avoid spreading seed. When pulling, all root fragments should be removed and plants should be properly disposed of.

### CHEMICAL

#### Materials Application

**Foliar treatment:** Spot treatment with glyphosate is effective on older plants. It is most effective when applied as plants are preparing for dormancy, but mid-summer and late season treatments may be needed to reduce seed production.

### BIOLOGICAL

Biological controls are needed for long-term control of larger populations. Four insects have been approved by the USDA as biological control agents for purple loosestrife: a root-mining weevil (*Hylobius transversovittatus*), two leaf-feeding beetles (*Galerucella californiensis* and *Galerucella pusilla*), and a leaf eating weevil (*Nanophyes marmoratus*).





Photo: Linda Haugen, USDA Forest Service, Bugwood.org



Photo: Steve Dewey, Utah State University, Bugwood.org



Photo: Linda Wilson, University of Idaho, Bugwood.org



Photo: Linda Wilson, University of Idaho, Bugwood.org



Photo: John D. Byrd, Mississippi State University, Bugwood.org



## SWALLOW-WORT, BLACK AND PALE

*Cynanchum nigrum* (black) & *Cynanchum rossicum* (pale)

### DESCRIPTION

**Appearance:** Herbaceous perennial vines in the milkweed family that reach 2-6 ft. in height. **Stem:** Unbranched, twining. **Leaves:** Opposite, oval to wedge-shaped, leaves 2 ½-4 ½ in. long and 2-2 ¾ in. wide with pointed tips are glossy and medium-green in color. In summer, the leaves become a warm yellow color. **Flowers:** Small, fleshy, pink to maroon flowers with 5 petals are borne in loose clusters and are visible in late May-mid July. **Fruit:** Smooth, slender, pointed, light-green pods are frequently borne in pairs. They are abundant during July/August and, like milkweed, open in late summer, disseminating large numbers of downy seeds.

### CONTROL/MANAGEMENT

#### MANUAL

##### Methods

**Pulling:** The complete root must be dug out, ideally before the seeds ripen. Plants bearing seeds should be burned or bagged and disposed of in a landfill.

**Cutting/Mowing:** Mowing will not eradicate swallow-wort, but it can be used to prevent seeds from appearing or maturing. Cutting is most effective at preventing a mature seed crop if done in early to mid-July when there are small, immature pods on the plants.

### THREATS/DAMAGE

Swallow-wort is a very aggressive invader of Christmas tree plantations, perennial crops, pastures, roadsides, disturbed areas, and natural areas. It is drought tolerant and will thrive in a wide range of soil, moisture and light conditions, but it does not grow in wet areas. The wind dispersed seeds are produced in large numbers and can travel a great distance. Swallow-wort can interfere with forest regeneration and change the microbial composition of the soil. It is toxic, so deer and other grazers will not eat it. Since it is a member of the milkweed family, monarch butterflies will lay their eggs on pale swallow-wort, but the larvae do not survive.

#### CHEMICAL

##### Materials Application

**Foliar treatment:** Triclopyr and glyphosate have been found to be effective in controlling swallow-wort when applied after plants flower. Earlier application is ineffective because there is not enough exposed leaf surface to deliver a killing dose to the roots.





SWALLOW-WORT

# AUTUMN OLIVE

*Elaeagnus umbellata*

## DESCRIPTION

**Appearance:** Deciduous perennial shrub up to 20 ft. in height. **Bark/ Stem:** Smooth and gray. Young stems have a dense covering of silvery to rusty scales. Branches are thorny and scaly. **Leaves:** Oblong, 1-2 in. long, alternate, gray-green on top with silvery scales on back. Edges are untoothed but wavy. **Flowers:** Clusters of 5-10 bell-shaped, light yellow, fragrant flowers appear along twigs in late spring. **Fruit:** Round, juicy, pink to red, larger than ¼ in. berries dotted with metallic scales appears in fall.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Seedlings and sprouts can be hand pulled when soil is moist enough to allow removal of the entire root system.

**Cutting:** Repeated cutting is ineffective without herbicide application.

## THREATS/DAMAGE

Autumn olive occurs primarily in disturbed areas such as forest edges, open woods, successional fields, pastures, and roadsides, but it is widely disseminated by birds and can adapt to many sites. It spreads rapidly and creates dense shade. It threatens native ecosystems by out-competing and displacing native plant species, creating dense shade, and interfering with natural plant succession and nutrient cycling.

### CHEMICAL

#### Materials Application

**Cut-stump treatment:** Cut the main stem then immediately apply glyphosate in late summer/early fall (most effective) or winter (less effective).

**Basal bark spray treatment:** A thin line of triclopyr (undiluted or with diesel formulation) applied around the entire stem 6-12 in. above the ground is effective.

**Foliar treatment:** Application of dicamba or 2,4-d during the summer is most effective, though they can be used anytime during the growing season. Glyphosate is also effective but not recommended because it is non-specific.





Photo: Chris Evans, River to River CWMA, bugwood.org



Photo: Chris Evans, River to River CWMA, Bugwood.org



# BLACK LOCUST

*Robinia pseudoacacia* L.

## DESCRIPTION

**Appearance:** Fast growing tree up to 75 ft. in height with an open crown. **Bark/Stem:** Black and deeply furrowed with flat-topped ridges on mature trees; smooth and green on saplings. **Leaves:** Alternate, pinnately compound with 7-21 elliptic, untoothed leaflets on each side of a common stalk and one leaflet at the tip. **Thorns:** A pair of short, sharp thorns sit at the base of each leaf where it is attached to the twig. Seedlings and root sprouts have long thorns. **Flowers:** Fragrant, drooping white flowers arranged in elongated clusters appear in late May and June. **Fruit:** 2-4 in. long, smooth seed pods mature in September but persist through winter.

## THREATS/DAMAGE

Black locust primarily invades disturbed habitats, degraded woods, thickets and old fields. It has been extensively planted for its nitrogen-fixing qualities and its hard wood, but it reproduces vigorously by root suckering and stump sprouting and forms a common connecting root system that allows it to create single species stands and crowd out native vegetation. Dense clones of black locust create shaded “islands” with little ground vegetation.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Cutting:** Cutting at any time will result in resprouting unless followed by herbicide application.

**Mowing:** Mowing is only temporarily effective because of black locust’s ability to resprout and spread vegetatively.

### CHEMICAL

#### Materials Application

**Cut-stump Treatment:** Cut stem near the base and immediately treat with glyphosate (mid-June through August) or triclopyr (anytime).

**Basal Bark Treatment:** Uncut stems can be treated all the way around with triclopyr.

**Foliar Treatment:** Glyphosate and clopyralid can be effective when used in single species stands.





**BLACK LOCUST**

**33**

# COMMON BUCKTHORN

*Rhamnus cathartica*

## DESCRIPTION

**Appearance:** Small trees 20-25 ft. tall and up to 10 in. in diameter with spreading, loosely-branched crowns. **Bark/Stem:** Grey to brown bark with elongate silvery projections (lenticels). Buckthorns often have multiple stems. Cut branches expose yellow sapwood and orange heartwood. **Twigs:** Closely-spaced leaf scars give a warty appearance. Twigs often end in stout thorns. **Leaves:** Small, dark glossy, ovate to elliptic, usually alternate, leaves with small teeth and a pointed tip appear early in spring and stay green late into fall. **Flowers:** Inconspicuous flowers appear in May or June clustered in the axils of the leaves. **Fruit:** Clusters of black fruit ¼ in. long ripen in August and September.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Plants less than  $\frac{2}{5}$  in. in diameter can be hand pulled when the soil is moist. Plants up to  $1\frac{1}{2}$  in. in diameter should be dug.

**Cutting:** Cutting any time will cause resprouting unless followed by herbicide application.

## THREATS/DAMAGE

Common buckthorn aggressively invades maple forests and riparian woods but it can also be found in hedge rows, pastures, and abandoned fields. Plants leaf out early and retain leaves late into the fall creating dense shade, which has a particularly destructive effect on native herbaceous and low shrub communities. It may prevent the establishment of tree seedlings and completely shade out native wildflowers. Seeds have a laxative effect on birds who disperse them, which has a negative health effect.

## CHEMICAL

### Materials Application

**Cut-stump treatment:** Cut stems near soil in fall or winter and immediately treat the vascular tissue just inside the bark with glyphosate or triclopyr (water or oil dilution).

**Basal bark spray treatment:** Triclopyr (oil dilution) or 2,4-D can be applied to uncut stems but may not kill large trees. Treat one side for stems less than 2 in.; otherwise treat full stem.

**Foliar treatment:** Spray in the fall with glyphosate when native plants are leafless but buckthorn is not and temperatures will remain above freezing for a few days. Fosamine (water dilution) can also be applied in the fall. It will not kill all plants, but mortality will be apparent the next growing season.





Photo: The Nature Conservancy



# HONEYSUCKLE

*Lonicera tatarica*, *Lonicera morrowii*, *Lonicera x bella*

## DESCRIPTION

**Appearance:** Upright, dense, deciduous shrub generally 5-12 ft. in height. **Bark/Stem:** Shrubs usually have multiple stems. Older stems have grey shaggy bark and are often hollow. **Leaves:** Opposite, 1½ in. long, oval or oblong shaped and untoothed. They vary in color and texture from smooth, hairless and bluish-green to downy. **Flowers:** Pairs of fragrant tubular flowers bloom in the leaf axils in May and June. They range in color from white to red but are most often pink. **Fruit:** Red, yellow or orange berries that are situated in pairs in the leaf axils ripen in early summer.

Note: Native honeysuckles are all woody, vine-like, twining species that are easy to distinguish from the exotic, invasive shrubs.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Small plants can be pulled by hand in early spring when soil is moist. Larger plants can be pulled if the roots are loosened with a shovel. Pulling should be avoided in sensitive areas where soil disturbance can lead to more invasions.

**Cutting:** Cut plants several times a year until root stores are depleted. Honeysuckle will resprout vigorously, so repeated cutting or herbicide application is essential.

**Burning:** Prescribed burning in the spring will kill seedlings and top kill mature shrubs.

## THREATS/DAMAGE

Most natural communities are susceptible to invasion by honeysuckle, but woodlands are particularly vulnerable, especially if they are already disturbed. Honeysuckle thrives in sunny upland sites, including forest edges, roadsides, pastures, and abandoned fields but can also be found in wetlands and lakeshores. Honeysuckle leafs out early in spring, and eventually it may entirely replace native plants in an area by shading and depleting the soil of moisture and nutrients. Seeds are readily dispersed by birds, but the fruits are carbohydrate-rich and do not provide high enough fat content for long flights, causing a negative health effect on birds.

### CHEMICAL

#### Materials Application

**Cut-stump treatment:** Cut stems at the base and immediately treat with glyphosate in fall or with triclopyr (formulated for oil dilution) any time of year (triclopyr formulated for water dilution is ineffective).

**Basal bark spray treatment:** Apply triclopyr (formulated for oil dilution) around the entire stem base.

**Foliar treatment:** Spray seedlings or shrubs with glyphosate in early spring or late fall when native plants do not have leaves.





Photo: Chuck Barger, University of Georgia, Bugwood.org



# HONEYSUCKLE



# JAPANESE BARBERRY

*Berberis thunbergii*

## DESCRIPTION

**Appearance:** Small, compact, deciduous spiny shrub, usually 3-6 ft. tall with slightly curving branches. **Bark/Stem:** The bark is brown but the inner wood is yellow. **Leaves:** Clusters of rounded, untoothed leaves 1-2 in. long grow close to the branches. They appear early in the spring and turn reddish in the fall. **Spines:** A single, sharp spine grows off the stem beneath each leaf cluster. Small leaves are found in the axils. **Flowers:** Yellow flowers, 1/3 in. across and single or in clusters of 2-4, bloom in late May. **Fruit:** Bright red, egg-shaped berries 1/3 in. long, in clusters or alone, mature in August and stay on the shrub through winter. **Roots:** Yellow.

## CONTROL/MANAGEMENT

### MANUAL

#### Methods

**Pulling:** Plants may be pulled or dug in the spring when they are easy to identify. This is more effective for controlling small infestations. Roots are shallow but tough, so a hoe, weed wrench or mattock should be used to uproot the bush and all connected roots. Heavy gloves should be worn for protection from the shrub's spines.

**Burning:** Prescribed fire effectively kills the plant and prevents future establishment.

**Mowing:** Although mowing is not effective for removing large, well established plants, regular mowing will control resprouts after initial removal by other means.

## THREATS/DAMAGE

Japanese barberry prefers well-drained soils and partial sunlight, but it can also survive on wet, calcareous sites and under the shade of a forest canopy. It is most common along woodland edges, roadsides, fences, old fields, and in open woodlands. Japanese barberry spreads vegetatively through horizontal lower branches that root freely, and, once established, it quickly forms dense stands in woodlands, forests, and meadows that shade out native plants. The dense stands and sharp spines can make woodlands difficult to walk through. Seeds are dispersed by birds and rabbits.

## CHEMICAL

### Materials Application

**Cut-stump treatment:** Cut near the soil and immediately treat with glyphosate or triclopyr. It is most effective in the fall, when sap is running toward the roots, and least effective in spring, when sap is running away from the roots.

**Basal bark spray treatment:** Apply triclopyr around the base of an uncut stem.

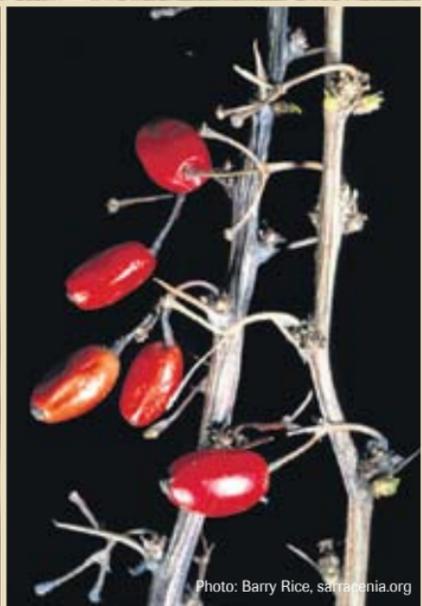


Photo: Barry Rice, sacraenia.org



# JAPANESE BARBERRY

# GLOSSARY

- **Alternate**—Leaves occur singly on the stem, branch, or twig, with each leaf on the opposite side from the ones above and below it.
- **Awn**—A bristle-shaped appendage found on grass flowers.
- **Axil**—The space between where a leaf or branch attaches to the stem and the stem itself.
- **Basal bark treatment**—A control method where herbicide is applied in a ring around an uncut trunk or stem.
- **Biennial**—A plant that lives for two years, usually flowering and fruiting in the second year.
- **Compound leaves**—Leaves with two or more leaflets attached to a single stalk. Black locust is an example.
- **Crown**—The branches, twigs and leaves that form the top of a tree.
- **Cut-stump treatment**—A control method where herbicide is applied to freshly cut trunks or stems with a hand held sprayer, brush, sponge applicator or contact solution bottle.
- **Elliptic**—Narrow at the ends and broad in the middle.
- **Foliar spray**—A control method where herbicides are applied to green leaves with a hand sprayer, sponge applicator, or wick.
- **Heartwood**—The harder wood found in the center of a trunk or branch.
- **Herbaceous**—Any plant that does not have a woody stem, therefore not a tree or shrub.
- **Inflorescence**—A cluster of flowers growing from a single stalk.
- **Lance shaped**—Narrow at the tip, widest below the middle, and either tapering to a point or rounded at the other end.
- **Leaflet**—The individual blades that make up a compound leaf.
- **Midrib**—The central vein or “rib” in a leaf.
- **Nodes**—The point where a leaf, twig or branch attaches to the stem
- **Opposite**—Leaves are found in pairs on either side of the stem, branch, or twig.
- **Ovate**—Egg-shaped, with the broader end at the base
- **Palmate venation**—A pattern of leaf veins where all main veins originate from a central point at the base of the leaf and radiate out towards the edges like fingers on a hand.
- **Panicles**—Loose, irregular clusters of flowers with pedicels (like small stems) that originate from the same place.
- **Perennial**—A plant that lives for many years.
- **Pinnate**—Leaflets in a compound leaf that are attached on either side of a stalk.
- **Root suckering**—New stems grow from old roots, either as the roots grow away from the original stem or when the old stem has been cut.
- **Runners**—Branches that grow along the ground and put out roots where they touch the soil.
- **Sapwood**—The most recently produced wood in a stem or branch that grows in a ring closest to the bark.
- **Sepals**—The modified leaves that grow at the base of a flower.
- **Sheathing**—Enclosed by a tubular envelope, often where a grass leaf attaches to the stem.
- **Simple**—Leaves that are not compound.
- **Tasselling**—Another word for flowering that refers specifically to grasses.
- **Toothed**—The edge of the leaf is divided into small segments or teeth
- **Tubular**—With the base of the petals joined to form a tube.
- **Untoothed**—The edge of the leaf is smooth with no breaks.
- **Variegated**—Marked, striped, or blotched with some color in addition to the plant’s overall color.
- **Whorled**—Multiple leaves are found in a circle around the stem, branch or twig.

# RESOURCES

## SLELO PRISM

Tug Hill is a part of the St. Lawrence-Eastern Lake Ontario (SLELO) Partnership for Regional Invasive Species Management (PRISM), a collaborative effort between a large and diverse group of partners throughout the region to protect the natural and cultural integrity of aquatic and terrestrial areas from invasive species. The SLELO PRISM will be coordinating invasive species efforts in the area and is a good point of contact for questions or information about invasive species in Tug Hill. You can access information about SLELO on-line at [http://nyis.info/PRISM/SLELO/SLELO\\_Brochure.pdf](http://nyis.info/PRISM/SLELO/SLELO_Brochure.pdf) or by calling The Nature Conservancy or the Jefferson County CCE numbers listed below.

## Other Invasive Species Resources

- The New York Invasive Species Clearinghouse – <http://nyis.info>
- Center for Invasive Species and Ecosystem Health – <http://www.invasive.org>
- NYS Department of Environmental Conservation - <http://www.dec.ny.gov/animals/265.html>
- Invasive Plant Council of NYS - <http://www.ipcnys.org/>
- *iMapInvasives* - <http://www.imapinvasives.org/>
- For more information or to report a sighting of invasive species contact Cornell Cooperative Extension or The Nature Conservancy

Jefferson County: **315-788-8450**

Lewis County: **315-376-5270**

Oneida County: **315-736-3394**

Oswego County: **315-963-7286**

St. Lawrence County: **315-379-9192**

The Nature Conservancy: **315-387-3600**



## **USES OF THE BOOK**

**This guidebook highlights the invasive plants that are already most abundant on Tug Hill as well as several species that are currently rare but pose the greatest threat to human or natural communities if they are not detected early and controlled before becoming widespread. In addition to helping you identify these plants by providing information about where they grow and what they look like, the guide explains why they are a threat and offers suggestions for eradicating or controlling them if and when you do find them. This guidebook is not a comprehensive list of all invasive plants that are currently found on Tug Hill.**

## **ABOUT THE NATURE CONSERVANCY**

**The Nature Conservancy is the leading conservation organization working around the world to protect ecologically important lands and waters for nature and people. We are a science-based organization that works collaboratively to pursue non-confrontational, pragmatic solutions to conservation challenges. Our Northern New York office is based in Pulaski, New York.**

## **INVASIVE SPECIES**

**An invasive species is a non-native plant, animal, or other organism (e.g., microbe) that has the ability to invade natural areas and proliferate. They will often dominate an ecosystem to the detriment, and sometimes the exclusion, of native species. As a result, invasive species are likely to cause economic or environmental problems in addition to harming human, animal, or plant health. This guidebook focuses on invasive plants in the Tug Hill region of New York.**