

# Autumn Olive

(*Elaeagnus umbellata*)

Best Management Practices in Ontario





# Foreword

These Best Management Practices (BMPs) provide guidance for managing invasive autumn olive (*Elaeagnus umbellata*) in Ontario. Funding and leadership for the production of this document was provided by Environment and Climate Change Canada, Canadian Wildlife Service - Ontario (CWS - ON). The BMPs were developed by the Ontario Invasive Plant Council (OIPC) and its partners to facilitate the invasive plant control initiatives of individuals and organizations concerned with the protection of biodiversity, agricultural lands, infrastructure, crops and natural lands.

The intent of this document is to relay specific information relating to invasive plant control practices that have been advised by leading professionals across Ontario. This document contains the most up-to-date, effective and environmentally safe research and knowledge available at the time of publication and complies with current provincial and federal legislation regarding pesticide usage, habitat disturbance and species at risk protection. It is subject to change as legislation is updated or new research findings emerge and is not intended to provide legal advice. The timing suggested will differ throughout Ontario and should be tailored to your region. Interested parties are advised to refer to the applicable legislation to address specific circumstances. Check the website of the Ontario Invasive Plant Council ([www.ontarioinvasiveplants.ca](http://www.ontarioinvasiveplants.ca)) for updates.

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For more information on invasive plants in Ontario, please visit the following websites:

[www.ontario.ca/invasivespecies](http://www.ontario.ca/invasivespecies), [www.ontarioinvasiveplants.ca](http://www.ontarioinvasiveplants.ca), [www.invadingspecies.com](http://www.invadingspecies.com) or [www.invasivespeciescentre.ca](http://www.invasivespeciescentre.ca)

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Autumn olive.

Photo courtesy of Chris Evans  
University of Illinois-Bugwood.org.





Autumn olive is widely sold for gardening and landscaping.

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

## Introduction

Autumn olive (*Elaeagnus umbellata*), also known as Japanese silverberry, is a deciduous perennial shrub native to temperate and tropical Asia that was introduced into the United States in the early 1800s from Japan. Autumn olive has become a problem outside of its native range due to the fact that it is a prolific seed producer and is capable of rapid growth in a wide variety of environments, including environments poor in nutrients. It often forms dense thickets that shade out native species and increases the nitrogen content of the soil.

Autumn olive was planted throughout North America for a variety of purposes and was promoted in the 1960s and 1970s as a beneficial wildlife species. It was widely used in wildlife management areas in the eastern U.S. to provide food and cover for birds and animals. It has also been sold commercially for gardens, roadsides and landscaping. Because of its tolerance of low soil pH and ability to fix nitrogen, it has been used for mine and soil reclamation. It has also been planted for use as a windbreak and as a beneficial companion plant to enhance black walnut productivity.

This document was developed to help guide the effective and consistent management of this invasive shrub across Ontario.



# Description

## Size and Shape:

Autumn olive is a medium to large shrub growing up to 6 m tall and 9 m wide. Its crown is rounded with dense branches.



Autumn olive can grow up to 6 m tall and 9 m wide.  
Photo courtesy of Chris Evans, University of Illinois, Bugwood.org.

## Leaves:

The leaves are alternate, simple, elliptic to lanceolate with undulate (wavy) and entire (without teeth) margins. They are bright green to grayish-green above, and distinctively silvery/scaly below, with short petioles. Leaves are variable in size, typically ranging from 2.5 to 10 cm in length and 1 to 4 cm in width. Leaves typically appear in late April or early May.



Leaves are alternate and simple with smooth margins.  
Photo courtesy of Credit Valley Conservation.

## Branches and Bark:

Young twigs are silvery with orange or brownish scales, giving them a speckled appearance. As the plant ages the bark becomes light gray to gray-brown and fibrous. Each shrub is typically multi-stemmed, containing long (2.5 to 5 cm) thorns on spur branches.



Mature stems are light gray to gray-brown in colour.  
Photo courtesy of Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.



## Flowers:

Autumn olive has fragrant cream or light-yellow tubular flowers, each typically 4 to 10 mm long and 7 mm in diameter. Each flower has four petals and four stamens. The flowers are arranged in clusters of 1 to 10 in the leaf axils. They bloom from May to June and are pollinated by insects.



Each cream to light-yellow flower has four petals. The flowers are arranged in clusters situated in the leaf axils.

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

## Fruit:

The small (3 to 9 mm long), rounded, single-seeded, juicy drupes grow on short stalks (pedicels). They appear silvery with brown scales when young, ripening to a rich pink or red speckled colour. Ripening takes place in September through October.



The fleshy, berry-like fruit is a rich pink or red with silver flecks when ripe.

Photo courtesy of Pennsylvania Department of Conservation and Natural Resources - Forestry, Bugwood.org.

## Seeds:

Its seeds are yellow and approximately 3 to 9 mm long.



Brown seeds are 3-9 mm long.






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

## Roots:

Autumn olive forms root nodules induced by symbiosis with actinomycete bacteria in the soil, which promotes nitrogen fixation.

# Lookalikes

**Table 1:** The main identification features of autumn olive in comparison to four species that may appear similar (lookalikes).

	<b>Autumn Olive</b> <i>(Elaeagnus umbellata)</i>	<b>Russian Olive</b> <i>(Elaeagnus angustifolia)</i>	<b>Silverberry</b> <i>(Elaeagnus commutata)</i>	<b>Canada Buffaloberry</b> <i>(Shepherdia canadensis)</i>	<b>Northern Bush Honeysuckle</b> <i>(Diervilla lonicera)</i>
	 <p>Photo courtesy of Nancy Loewenstein, Auburn University, Bugwood.org.</p>	 <p>Photo courtesy of Credit Valley Conservation.</p>	 <p>Photo courtesy of Anneli Salo [CC BY-SA 3.0 (<a href="https://creativecommons.org/licenses/by-sa/3.0/">https://creativecommons.org/licenses/by-sa/3.0/</a>)], via Wikimedia Commons.</p>	 <p>Photo courtesy of Rob Routledge, Sault College, Bugwood.org.</p>	 <p>Photo courtesy of Rob Routledge, Sault College, Bugwood.org.</p>
<b>Native Range and Habitat</b>	<ul style="list-style-type: none"> <li>• Native to Asia</li> <li>• Moderately shade tolerant; variety of soil types</li> <li>• Open woods, forest edges, roadsides, sand dunes, abandoned fields, gravel pits, disturbed sites</li> </ul>	<ul style="list-style-type: none"> <li>• Native to southeastern Europe and Asia</li> <li>• Tolerant of dry to moist soils, low nutrients, high salinity, shade and extreme temperatures</li> <li>• Riparian areas, lakeshores, old fields, forest edges, gaps, sandy floodplains</li> </ul>	<ul style="list-style-type: none"> <li>• Native to northern North American including Ontario</li> <li>• Tolerant of sun or partial shade, moist to dry areas, salt and drought</li> <li>• Clay or sandy fields, prairies, shorelines</li> </ul>	<ul style="list-style-type: none"> <li>• Native to North America including Ontario</li> <li>• Tolerant of sun and partial shade, moist to dry soils, clay sand, loam and drought</li> <li>• Calciphile</li> <li>• Shorelines, thickets, woodland openings</li> </ul>	<ul style="list-style-type: none"> <li>• Native to central and eastern North America including Ontario</li> <li>• Sun, partial to full shade; dry soils</li> <li>• Dry woodlands, rocky or sandy areas</li> </ul>
<b>Typical Size and Form</b>	<ul style="list-style-type: none"> <li>• Typically 3-5 m up to 6 m</li> <li>• Many-branched shrub</li> <li>• Twigs have brown and orange scales when young, light brown without scales when mature</li> <li>• Spike-like terminal thorns</li> </ul>	<ul style="list-style-type: none"> <li>• Taller than autumn olive, typically 3-9 m</li> <li>• Single or multi-stemmed tree</li> <li>• Twigs silvery and scaly when young and light brown with no scales when mature</li> <li>• Spike-like terminal thorns</li> </ul>	<ul style="list-style-type: none"> <li>• Similar in height or smaller than autumn olive, typically 0.5-5 m</li> <li>• Twigs golden brown</li> <li>• No thorns</li> </ul>	<ul style="list-style-type: none"> <li>• Shorter than autumn olive, typically 1-3 m, up to 4 m</li> <li>• Erect, spreading stems</li> <li>• No thorns</li> </ul>	<ul style="list-style-type: none"> <li>• Much smaller than autumn olive, typically 30-120 cm</li> <li>• Densely branched shrub</li> <li>• Twigs are greenish-brown, gray to light reddish-brown when mature</li> <li>• No thorns</li> </ul>

**Autumn Olive**  
(*Elaeagnus umbellata*)



Photo courtesy of Nancy Loewenstein, Auburn University, Bugwood.org.

**Russian Olive**  
(*Elaeagnus angustifolia*)



Photo courtesy of Credit Valley Conservation.

**Silverberry**  
(*Elaeagnus commutata*)



Photo courtesy of Anneli Salo [CC BY-SA 3.0 (<https://creativecommons.org/licenses/by-sa/3.0/>)], via Wikimedia Commons.

**Canada Buffaloberry**  
(*Shepherdia canadensis*)



Photo courtesy of Rob Routledge, Sault College, Bugwood.org.

**Northern Bush Honeysuckle**  
(*Diervilla lonicera*)



Photo courtesy of Rob Routledge, Sault College, Bugwood.org.

**Leaves**

- Alternate
- Elliptical to oval
- Green above, silvery scaly with small golden-brown spots below
- Undulate (wavy) and entire- margined

- Alternate
- Longer, narrower leaves than autumn olive
- Silvery-gray above and below
- Smooth margins

- Alternate
- Lance-elliptic, often wavy
- Green throughout the growing season
- Densely covered in silvery-white scales both sides, rusty brown scales beneath

- Opposite
- Oval to narrowly egg-shaped
- Slightly silvery on both sides
- Thick, leathery green above, grey-green and covered in silver hairs and rust-colored dots below
- Smooth margins

- Opposite
- Egg-shaped (ovate), tapering
- Green and smooth above, paler below
- Serrated

**Flowers**

- Clusters of 1-10, each with 4 petals
- Cream-light yellow, tubular
- Bloom May-June in leaf axils

- Clusters of flowers, each with 4 petals
- Silvery-white to yellow
- Bloom late spring in leaf axils

- 1-4 funnel-shaped flowers
- Yellow
- Bloom June to July in leaf axils

- Clusters of 1 or more funnel/disk-shaped flowers with no petals
- Below leaf joints
- Small, yellowish-green or yellow-brown
- Bloom April-May

- Yellow, orange, purple, red usually grow in pairs
- Petals united
- Bloom June to July in axils or at ends of spreading branches

**Fruit**

- Small, berry-like drupes
- Rounded with silvery surface flecks, pink to red when ripe
- Ripen September to October
- Fleshy

- Larger than autumn olive, looks like small olives
- Yellow or reddish-brown with dense silvery scales
- Mature Aug-Oct and stay all winter
- Dry and mealy

- Oval drupe, each containing a single seed
- Silvery to yellowish
- Covered in silvery scales when young
- Summer to fall
- Dry and mealy

- Small, oval berry-like drupes
- Red to amber, translucent
- Each has one stony seed
- July to fall
- Fleshy

- Small brown capsule of dry seeds produced in summer



# Biology and Life Cycle

Autumn olive reproduces primarily by seed but can reproduce through root-crown sprouting and suckering. Height ranges from 1.5 to 6 m but 3-5 m is typical. Autumn olive grows very quickly, reaching sexual maturity as early as three years of age, after which it bears fruit annually. The shrub typically has a productive lifespan of up to 40 years.

Early in the spring, autumn olive produces leaves which are retained until late fall. Flowering buds appear in the leaf axils soon after the leaves expand (e.g. May) and bloom from May to June. Autumn olive is dioecious - male and female flowers are usually on different plants - but occasionally male flowers will grow on female plants and vice versa. The flowers are open-pollinated, often by a variety of insects.

The juicy, round, berry-like fruits of autumn olive are ripe by September or October and remain on the plant well into the winter months. Mature trees typically produce up to 14 kg of fruit/year, containing up to 66,000 seeds, though trees producing up to 36 kg of fruit/year (with up to 200,000 seeds) have been reported. While autumn olive is most productive in full sun, it can still survive and produce some seed in moderate shade.

The fruits are eaten by a variety of birds and mammals, which disperse the seeds widely. The seeds benefit from a period of cold treatment but even without it, germination rates of >70% have been documented. With cold treatment, germination rates can exceed 90%. Because the seed germinates so rapidly, autumn olive does not typically persist for more than a few years in the seed bank, though many plants typically occur nearby and provide an ongoing seed source for repeated invasions. On average, seeds are viable for three years.

As mentioned above, autumn olive can also reproduce asexually, through root-crown sprouting and suckering. It sprouts most vigorously from the root crown after it has been damaged (e.g. following cutting, mowing or fire). There is some evidence that the branches of autumn olive are also capable of sprouting roots.

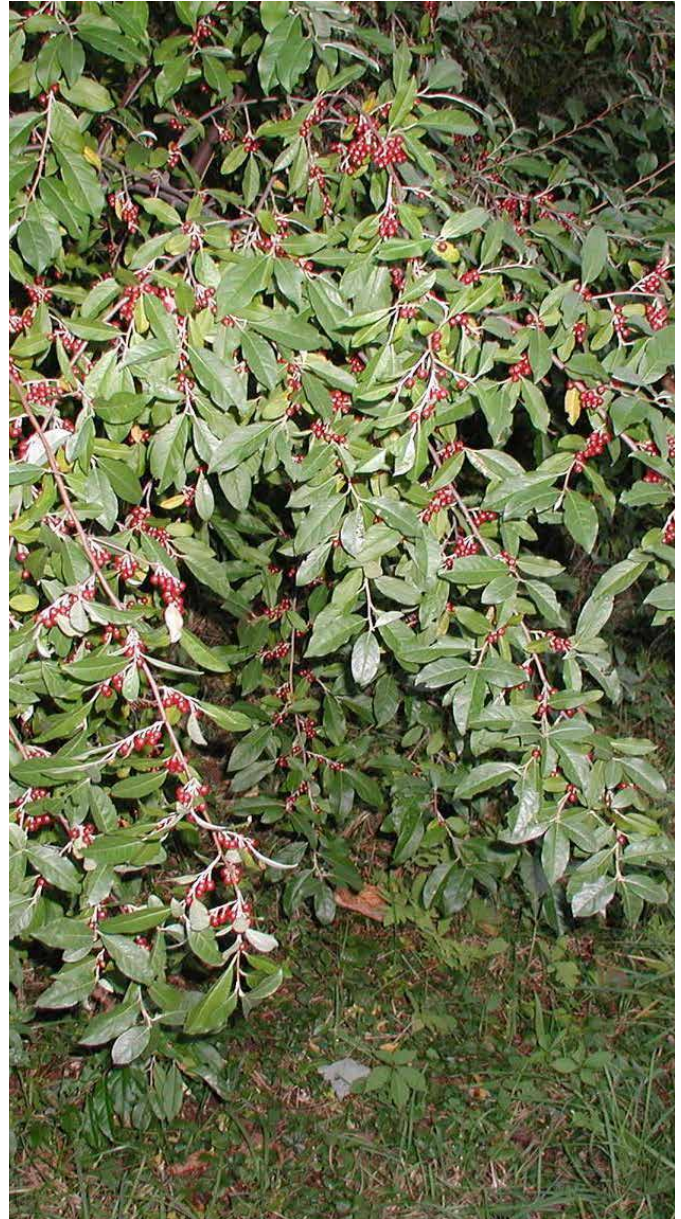


Photo courtesy of Leslie J. Mehrhoff, University of Connecticut, Bugwood.org.



# Range and Habitat

Autumn olive is native to eastern Asia (including Afghanistan, China, Korea, Taiwan and Japan) as well as tropical Asia (including Bhutan, India, Nepal and Pakistan). It is found in many habitats across North America, including open woods, forest edges, roadsides, sand dunes, abandoned fields and gravel pits, pastures, railroad and utility rights-of-way, vacant lots, yards and gardens. It is probably most prolific on disturbed sites and is best adapted to early-successional habitats. It is a non-leguminous nitrogen fixer.

Autumn olive grows best on deep, moderate to well-drained soils that are moderately acidic to moderately alkaline, but it can grow in a variety of soils (nutrient-poor, sandy, loamy, some clay, coarse-textured soils) and in soils with a pH as low as 4.0. It is intolerant of wet soils. Being a nitrogen fixer, it can tolerate nitrogen-poor soils. It is moderately shade tolerant, but rarely found in dense forests. It is also drought tolerant but does not do as well in very dry or shallow soils.



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

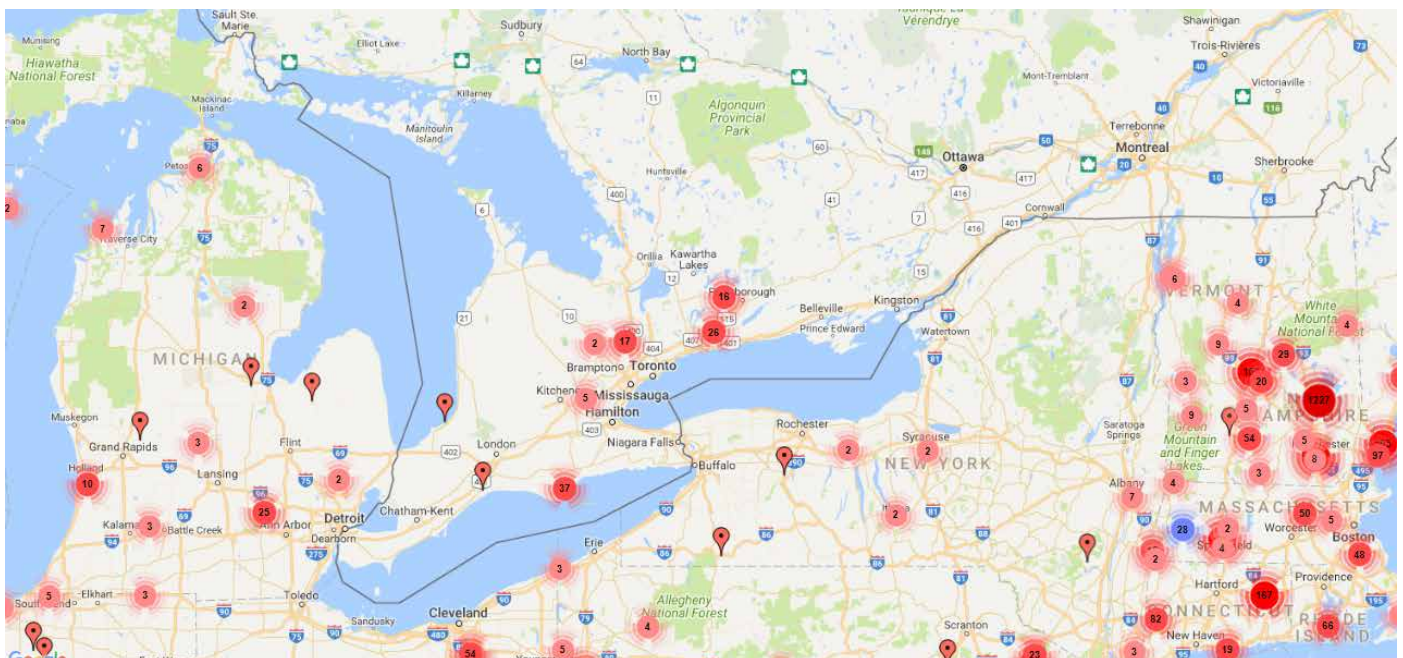


# Pathways of Spread and Distribution in Ontario

Autumn olive was first introduced to the U.S. in the early 1800s from Japan. Before its invasive abilities became known, it was widely planted throughout North America for a variety of purposes including food and cover for birds and animals, as an ornamental in gardens and for beautification of roadsides, as a windbreak, as a companion plant to enhance black walnut productivity, for soil stabilization and erosion control and as shelterbelts. Because of its tolerance of low soil pH and its nitrogen fixing ability, it has been used for mine and soil reclamation.

Its main mode of dispersal is through the variety of wildlife that eat its abundant fruit. Disperser species include birds such as northern cardinals, sparrows, ruffed grouse, ring-necked pheasants and wild turkeys, as well as mammals such as raccoons, skunks, opossums and black bears. Fruit can persist on the branches late into the winter.

In North America, autumn olive is found in most U.S. states and in Ontario, Quebec, New Brunswick, Newfoundland and Nova Scotia. In Ontario, escaped autumn olive is most common in southwestern Ontario but has been reported in eastern Ontario, as well. It is most common in dry to mesic sandy, forested and open or sparsely shaded habitats, and found most frequently in: deciduous and mixed forests dominated by black oak (*Quercus velutina*), white oak (*Q. alba*), eastern white pine (*Pinus strobus*), and red maple (*Acer rubrum*); eastern red-cedar (*Juniperus virginiana*) glades; prairie/savanna relicts dominated by Indian grass (*Sorghastrum nutans*); coniferous plantations; seasonally wet, "open floodplain thickets"; gravelly till in northern white-cedar (*Thuja occidentalis*) floodplain slope woodland; raised sandy knolls in open to sparsely shaded graminoid fens; and low sand dunes in eastern cottonwood (*Populus deltoides*) savanna. It is common on roadsides, field edges and hedgerows.



Distribution map showing the locations of formally reported autumn olive. Single red dots represent one record. Red dots with numbers indicates the number of records reported in the area.

Autumn olive distribution map courtesy of EDDMapS ([www.eddmaps.org/ontario](http://www.eddmaps.org/ontario)). The map point data is based on records contained in the Invasive Species Database, compiled as of January 2018 from various sources on a voluntary basis. This map is illustrative only. Please do not rely on this map as a definitive distribution as it is subject to change based on additional confirmed invasive species sites. This map may contain cartographic errors or omissions.





Autumn olive outcompetes native plants for light, space and nutrients.

Photo courtesy of Stanislaw Chris Evans, University of Illinois, Bugwood.org.

## Impacts

Autumn olive is a prolific seed producer. This, combined with its hardiness, resilience, rapid growth rate, widespread seed dispersal and ability to colonize a wide variety of soil and moisture conditions as well as poor quality environments, contributes to its spread and invasiveness. It has been designated a noxious weed in some northeastern U.S. states and has been identified as a severe threat or highly invasive species in many others.

## Ecological

Autumn olive outcompetes native plants for light, space and nutrients, displacing them and forming dense, monoculture thickets with plant concentrations of up to 125,000/ha. This reduces species richness and diversity and poses a demonstrable threat to the integrity of the native plant communities in the areas it invades. Autumn olive may pose a particular threat to prairies, savannas and open woods and can alter ecosystem fire regimes, as fuels do not accumulate beneath it. It is also a high concern in communities adapted to infertile soils, where the nitrogen fixed by autumn olive can promote the growth and spread of weedy species at the expense of the low-nutrient tolerant natives. In Ontario, natural communities of sandy, infertile habitats throughout the Great Lakes region are already impacted by other pressures and the added stress of a highly invasive species invading the areas is of great concern. In addition, where autumn olive dominates shorelines and stream banks it can result in an increase in stream water nitrate concentrations. There is also evidence that suggests autumn olive releases allelopathic chemicals which may impact native species growing nearby.



Wherever autumn olive establishes, it reduces plant species richness and diversity. This is especially concerning for all species of conservation concern (e.g. listed in the *Species at Risk Act* (SARA) as being endangered, threatened or of special concern in Canada). Many of these may be impacted by this reduction in biodiversity. The following are species at risk for which autumn olive is named as a specific threat in Ontario in either their federal Recovery Strategy (for species listed as Threatened or Endangered) or the Management Plan (for species listed as Special Concern). More information can be found at the *Species at Risk Act* (SARA) Registry ([www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1](http://www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1)).

**Table 2:** Species listed under the federal *Species of Risk Act* for which autumn olive is named as a threat in Ontario.

Species at Risk	Status	Habitat / Details	Primary Threat(s) from Autumn Olive
<b>Colicroot</b> ( <i>Aletris farinosa</i> )	<ul style="list-style-type: none"> <li>Threatened</li> </ul>	<ul style="list-style-type: none"> <li>Herbaceous perennial in the Nartheciaceae</li> <li>Restricted to four geographic regions in southwestern Ontario: City of Windsor-Town of LaSalle; Walpole Island; near Eagle (Municipality of West Elgin); Turkey Point (Haldimand-Norfolk County)</li> <li>Grows in open, sunny, moist, sandy or mucky ground, prairies, abandoned fields, roadsides and forest edges</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Slender Bush-clover</b> ( <i>Lespedeza virginica</i> )	<ul style="list-style-type: none"> <li>Endangered</li> </ul>	<ul style="list-style-type: none"> <li>Flowering plant in the pea family (Fabaceae)</li> <li>In Ontario, found only in Essex County</li> <li>Dry, sandy soil in tallgrass prairies</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Climbing Prairie Rose</b> ( <i>Rosa setigera</i> )	<ul style="list-style-type: none"> <li>Special Concern</li> </ul>	<ul style="list-style-type: none"> <li>Perennial vine-like shrub in the rose family (Rosaceae)</li> <li>In Ontario, found in open habitats of the Carolinian Zone, predominately southwestern Ontario</li> <li>Typically found in open habitats with moist heavy clay to clay-loam soils such as old fields, abandoned agricultural land, as well as prairie remnants and shrub thickets</li> <li>Depends on areas being kept open by periodic fire or other disturbances</li> </ul>	<ul style="list-style-type: none"> <li>Habitat loss due to invasion/competition</li> </ul>
<b>Virginia Goat's-rue</b> ( <i>Tephrosia virginiana</i> )	<ul style="list-style-type: none"> <li>Endangered</li> </ul>	<ul style="list-style-type: none"> <li>Member of the pea family (Fabaceae)</li> <li>Found only in southwestern Ontario where it is believed to be restricted to two sites on the Norfolk Sand Plain near Turkey Point on Lake Erie's north shore</li> <li>Limited to acidic sand deposits in remnant black oak savanna and open black oak woodland</li> <li>Prefers open, sunny areas with sandy soil, such as prairies, open oak and pine forests on sandy ridges, and sand dunes, roadsides and abandoned fields</li> </ul>	<ul style="list-style-type: none"> <li>Habitat alteration due to invasion/competition in areas where open sandy habitat was previously maintained by natural fire regime</li> </ul>

# Legislation

Many plant species and control methods are regulated under federal and/or provincial legislation. Regulations regarding chemical, mechanical and biological control of autumn olive at the time of writing are also summarized in this document. **Please note that this is for clarity only and not legal advice.**

Land/vegetation managers are responsible for ensuring that their project complies with all relevant legislation. If protected species or habitats are present, an assessment of the potential effects of the control project could be required. For activities that may affect species listed in the *Endangered Species Act* (ESA), species listed on Schedule 1 of SARA and for activities which contravene SARA's general or critical habitat prohibitions, permits may be required. Depending on the species and its location, applications should be directed to the appropriate authorities. See details below. Consult with your local Ministry of Natural Resources and Forestry (MNRF) district office early in your control plans for advice (<https://www.ontario.ca/page/ministry-natural-resources-and-forestry-regional-and-district-offices>).

Not all of the legislation below currently applies to any one project but legislation is always changing and may become relevant after publication of this document. Always refer to the most current legislation.

## Federal

### **Plant Protection Act and Plant Protection Regulations**

Under the *Plant Protection Act* and Plant Protection Regulations, the Canadian Food Inspection Agency (CFIA) is responsible for protecting plant resources in Canada by preventing the importation of new plant pests and limiting the movement and spread of pests within Canada. Invasive plants that are regulated under the *Plant Protection Act* are included in the list of [Pests Regulated by Canada](#).

At the time of publication, autumn olive was not listed under the *Plant Protection Act* as a Pest Regulated by Canada.

### **Weed Seeds Order**

The Weed Seeds Order (WSO), 2016 is a ministerial order made under the *Seeds Act* which lists invasive plants regulated under the *Seeds Act*. Under this Order the CFIA restricts the presence of weed species in commercially sold seeds in an effort to prevent the introduction and spread of new weeds.

At the time of publication, autumn olive was not listed under the Weed Seeds Order.

### **Pest Control Products Act**

The management of pesticides is the joint responsibility of the federal and provincial governments. Under the *Pest Control Products Act*, (PCPA) Health Canada's Pest Management Regulatory Agency (PMRA) registers pesticides for use in Canada with an approved label after conducting a stringent, science-based evaluation that ensures any risks are acceptable. The pesticide label is a legal document that prescribes how the pesticide may be used; pesticides must be applied in accordance with all label directions. Ensure you have the most current label and are aware of any re-evaluation decision: visit the Pest Management Regulatory Agency's product label search site at <http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>.



## **Fisheries Act**

The *Fisheries Act*, administered by Fisheries and Oceans Canada (DFO) and Environment and Climate Change Canada (ECCC), applies to both plant and pesticide use as it specifies that it is an offence to (for example):

- harmfully alter, disrupt, or destroy fish habitat, including streamside vegetation.
- move or introduce aquatic organisms (including plants) to new habitats.
- damage fish habitat or put harmful substances such as pesticides into water frequented by fish, including pesticide drift.

To find out if you need a permit under the *Fisheries Act*, consult <http://www.dfo-mpo.gc.ca/pnw-pppe/index-eng.html>.

## **Species at Risk Act**

ECCC also enforces the *Species at Risk Act* (SARA), whose purpose is “to prevent wildlife species in Canada from disappearing, to provide for the recovery of wildlife species that are extirpated (no longer exist in the wild in Canada), endangered, or threatened as a result of human activity, and to manage species of special concern to prevent them from becoming endangered or threatened”. Permits may be required by those persons conducting activities (e.g. invasive plant management) that may affect species at risk. For more information on species at risk, critical habitat or permits, consult the SARA Public Registry (<http://www.sararegistry.gc.ca/default.asp?lang=en&n=24F7211B-1>).

## **Migratory Birds Convention Act**

The *Migratory Birds Convention Act* (MBCA) administered by ECCC, provides for the protection of migratory birds through the Migratory Birds Regulations and the Migratory Birds Sanctuary Regulations. For birds protected under the MBCA (<http://www.ec.gc.ca/nature/default.asp?lang=En&n=496E2702-1>), it is not permitted to kill a bird and/or disturb or destroy its nest or eggs anywhere they are found in Canada except under the authority of a permit issued under the Migratory Birds Regulations. Information on general nesting periods is available to minimize the risk to breeding birds (<https://www.ec.gc.ca/paom-itmb/default.asp?lang=En&n=4F39A78F-1>). However, operating outside nesting periods is not a guarantee that birds will not be killed or disturbed; therefore, it is the individual’s responsibility to ensure they do not contravene the Act. To find out if you need a permit under the *Migratory Birds Convention Act*, visit: <https://www.ec.gc.ca/nature/default.asp?lang=En&n=2D16D723-1>.

## Provincial

### **Weed Control Act**

The *Weed Control Act* is administered by the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) and enforced provincially. The intent of the *Weed Control Act* is to reduce negative impacts of noxious weeds on agriculture and horticulture, to reduce plant diseases by eliminating plant disease hosts such as European buckthorn and to reduce health hazards to livestock caused by poisonous plants.

A noxious weed includes a plant that has been listed in the schedule of noxious weeds found in regulation 1096 made under the *Weed Control Act*. This list is commonly referred to as the “Noxious Weed List”.

In general, a species designated as a noxious weed under the *Weed Control Act* has one or more of the following characteristics:

- Difficult to manage on agricultural land once established and will reduce the yield and quality of the crop being grown;
- Negatively affects the health and well-being of livestock; or
- Poses a risk to the health and well-being of agricultural workers.

In Ontario, 25 weeds are designated as noxious under the *Weed Control Act*. Municipalities are responsible for appointing one or more weed inspectors at their discretion. The weed inspector is responsible for responding to calls made to the municipal clerk with regards to a noxious weed that has been reported on someone’s property. The weed inspector can order the landowner to destroy the weed within seven days.

At the time of publication, autumn olive was not listed on the *Weed Control Act*’s Noxious Weeds list. The noxious weeds list can be found here: [http://www.omafra.gov.on.ca/english/crops/facts/noxious\\_weeds.htm](http://www.omafra.gov.on.ca/english/crops/facts/noxious_weeds.htm).

### **Invasive Species Act**

Under the *Invasive Species Act*, there are rules to prevent and control the spread of invasive species. At the time of publication, autumn olive was not listed under this Act. For more information on which species are, visit: <https://www.ontario.ca/page/stop-spread-invasive-species>.

### **Pesticides Act**

A federally registered pesticide must also be classified by the Ministry of the Environment and Climate Change (MOECC) under the *Pesticides Act* before it can be sold, stored or used in Ontario. The provincial classification of federally registered pesticides can be found at [www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action](http://www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action). Pesticides must also only be used for purposes allowed under Ontario’s Cosmetic Pesticides Ban. The Ontario’s Cosmetic Pesticides Ban specifies exceptions for the use of certain pesticides (Class 9), including the use of pesticides related to protecting public works including roads, buildings and structures, and provided certain conditions are met. For example, an exemption for a Class 9 active ingredient may apply if a plant interferes with the essential maintenance of a public works.



## **Endangered Species Act**

The Ministry of Natural Resources and Forestry (MNR) enforces the *Endangered Species Act*, whose purpose is to provide protection for species classified by the province as endangered or threatened, as well as to provide habitat protection for species classified by the province as endangered or threatened. Permits are required by those persons conducting activities that may affect species at risk, such as invasive plant management. To find out which species are at risk in Ontario or for information on obtaining a permit, consult [www.ontario.ca/environment-and-energy/species-risk-ontario-list](http://www.ontario.ca/environment-and-energy/species-risk-ontario-list).

## **Conservation Authorities Act**

Ontario's Conservation Authorities were formed under the *Conservation Authorities Act* to ensure conservation, restoration and responsible management of water, land and natural habitat through programs that balance human, environmental and economic needs. They provide approval for projects that are close to or affecting bodies of water, or above the high water mark, but not for projects that are directly in water, or below the high water mark\*.

\*The high water mark is the level where a body of water reaches its highest point in the season. Sometimes, an impression of the high water mark is left on the landscape, such as a line on rocks.

Consult your local conservation authority here: <http://conservationontario.ca/> to determine if you need a permit to undertake your project.

## **Municipal**

Under the *Building Code Act*, municipalities are able to pass bylaws to address the presence of invasive plants. Municipalities can enact bylaws to control plants (for example, when there is a risk of negative impact to human health and safety).

Municipalities are also responsible for enforcing the *Weed Control Act* to reduce the infestation of noxious weeds that negatively impact on agricultural and horticultural lands. Municipalities can designate additional plants not listed on the Ontario Noxious Weed list as noxious within their own jurisdiction.

Check with your local municipality to determine if there are further restrictions around autumn olive in your community.



Photo courtesy of Chris Evans, University of Illinois, Bugwood.org.

# Best Management Practices

## Management Considerations

Preventing the spread of and controlling autumn olive before it becomes locally established will reduce its impacts on biodiversity, the economy and society.

It is important to use a control plan that incorporates integrated pest management (IPM) principles. This means using existing knowledge about the pest species and its surrounding environment to prevent and fight infestations and may require more than one type of control measure to be successful.

Once autumn olive has been confirmed at a location, a control plan can be developed based on infestation size, site accessibility, potential for spread and the risk of environmental, economic or social impacts. Site-specific conditions such as native plant diversity, wildlife usage and water table fluctuations should also be considered when developing control plans. A detailed inventory of each site is strongly recommended before starting control efforts to help ensure proper methods and timing are used to minimize negative impacts to surrounding wildlife and native plant species.

## Mapping

If you are unsure if you have autumn olive on your land, examine the area and map any infestations. For large land managers, such as conservation authorities or municipalities, hiring an appropriately qualified summer student or recruiting volunteers (who are appropriately qualified) can assist with this. For an individual landowner with a smaller property, mapping is more manageable on your own. If you know you have autumn olive in one area of your property, ensure you map the rest of your property to identify other infestations, to prevent them from spreading.

Because autumn olive leafs out early and retains its leaves late in fall, it is often easiest to locate for mapping or control efforts in early spring or late fall when the leaves of native vegetation are absent or have changed color.

For detailed information on mapping techniques the Landowners Guide for Managing and Controlling Invasive Plants in Ontario here: <http://www.ontarioinvasiveplants.ca/resources/technical-documents>.

To see what might already in your area, visit EDDMapS Ontario here: <http://www.eddmaps.org/ontario/>



## Landscape Level Management

If autumn olive has become widely established, a more detailed management strategy should be undertaken. A detailed management strategy should consider, where possible, a landscape level management approach. This means engaging surrounding landowners and managers in your management strategy. Focusing on individual, local challenges, without looking at the broader landscape, can lead to intense labour and increased management costs and does not always have a strategic impact across larger areas. A strategic and integrated landscape level approach to management, conservation and planning serves to bring partners, landowners and land managers together to work toward common and shared goals that consider both site-level needs and wider landscape considerations. This approach makes it easier to efficiently use and balance resources, coordinate activities and accomplish shared strategic management goals.

Effective management and control requires several treatments and a combination of control measures. It's not always realistic, especially for large infestations, to try and eliminate the infestation all at once. Determine the desired (native) plant community, and the land use objective, and then develop an appropriate IPM strategy.

## Setting Priorities

Determining what your highest priority locations for control are prior to management will help to determine your best course of action. Therefore, when developing a management strategy, it's important to take into account the following considerations to help inform control decisions:

1. If you have limited resources, try to remove the outlying populations (isolated plants or satellite populations) first, to prevent further spread.
2. If you have more resources, working into larger, "core" populations of autumn olive is an important step which can reduce the quantity of seed dispersing into uninfested areas. In many cases, resource limitations may prohibit immediate removal of entire core populations. Under these circumstances, core areas should be prioritized and addressed strategically.
3. Concentrate on high-priority areas or areas where the plant is going to cause the most problems in terms of spread, such as the most productive or sensitive part of an ecosystem, along a creek, near species at risk, a favourite natural area, or the side of a trail where people may come into contact with the plants.
4. Protect federally, provincially and regionally rare species and communities by removing invasive plants and ensuring rare species are not negatively impacted by control efforts.
5. Review the different control options and costs with considerations to surrounding water, habitat, time of year and type of land use i.e. high-traffic recreational areas, agriculture.
6. Ensure all landowners have been identified and consulted before control takes place.
7. Consider dedicating a certain time each year to control efforts and make it a joint effort with neighbouring landowners/land managers.
8. Begin to assess whether regeneration or restoration is appropriate, and if seeding or planting of native plants is needed to help jump-start natural succession and increase biodiversity in the area (see page 18 for more information).
9. Follow-up monitoring is crucial in order to remove seedlings that may sprout after initial control efforts and to monitor regeneration of native species, in order to ensure other invasive species have not invaded.

## Prioritizing within a Control Area

(This section is modified from *The Landowners Guide to Managing and Controlling Invasive Plants*, published by Credit Valley Conservation).

1. Focus on large blocks of un-invaded areas and keep them free of invaders.
2. Control small, younger, outlier (satellite) populations first.
3. Remove outlying plants.
4. Reverse the invasion, expand the un-invaded area outward.

This flow chart can help land managers choose where to first focus control efforts if controlling satellite populations due to limited resources:

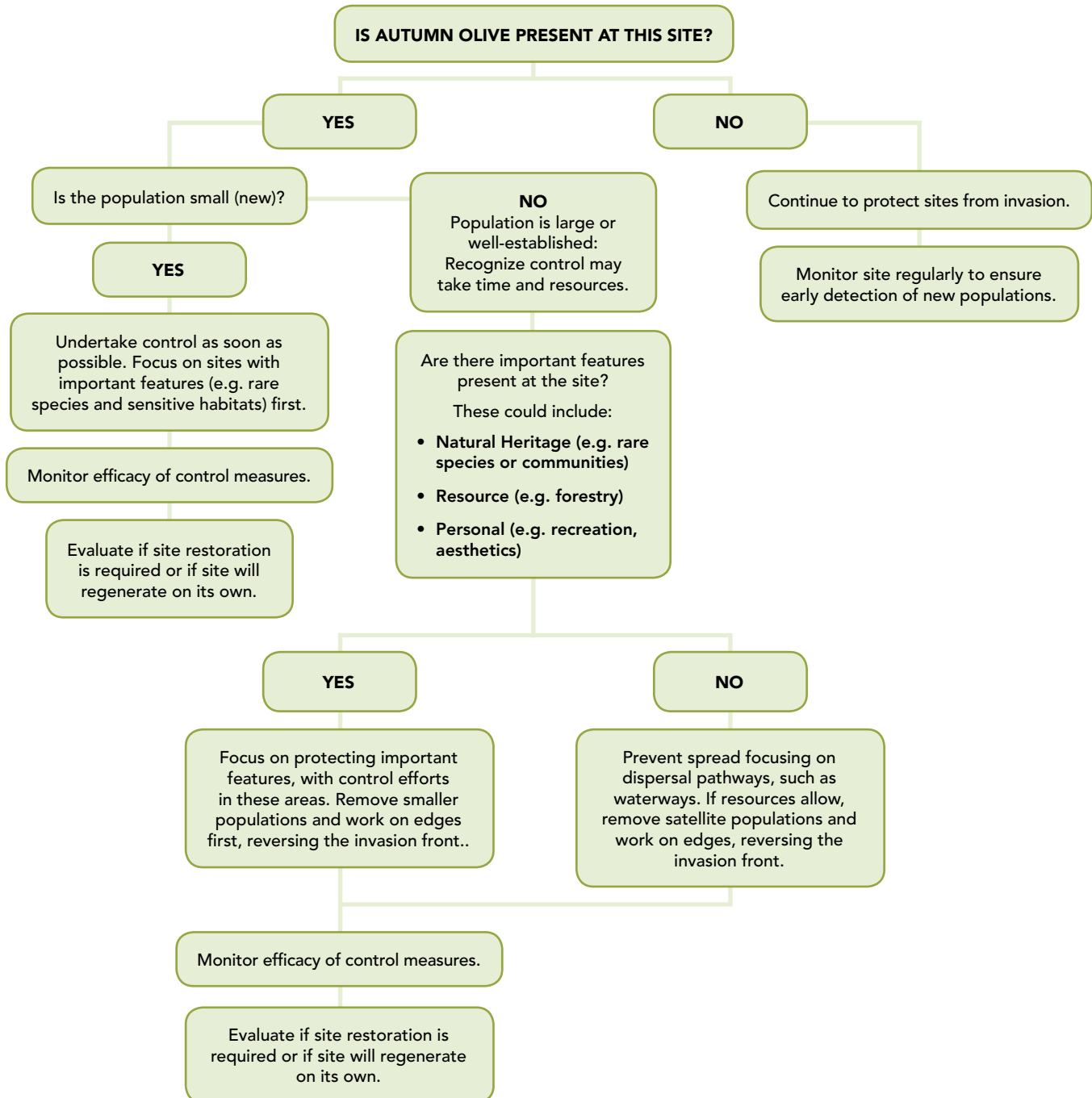


Figure 1: How to prioritize autumn olive sites for effective control.



## Long-term Management and Monitoring

Because of the persistent and aggressive nature of autumn olive and its ability to recolonize so quickly, a long-term management and monitoring plan is imperative to achieve control success. A long-term management and monitoring plan should be created prior to control implementation. Monitoring will provide data to determine the effectiveness of the initial control treatments and enables assessment of the initial control measures used as well as the types of follow-up treatments that are necessary. Long-term management is important because after removal, there are still other factors to consider including the seed bank left by autumn olive, other autumn olive populations that might be nearby and other invasive plant seed banks. One of the most important factors to consider is which native plant species will return to the control area after control has been conducted.

Monitoring could be as simple as taking photos or performing a visual inspection, or more complex and include extensive surveys. In general, annual treatment is imperative and should focus on selectively removing isolated populations as they appear. Spot treatment will assist in allowing for native plant regeneration. For more information on monitoring see the *Landowners Guide for Managing and Controlling Invasive Plants in Ontario* here: <http://ontarioinvasiveplants.ca/resources/technical-documents>

## After Management: Assessing Regeneration vs. Restoration

**Consider the following factors:**

1. **Level of disturbance at the site:** What is the level of disturbance at the site? Was it a heavily invaded site (e.g. a lot of disturbance was caused during control measures)? Will it continue to be disturbed (e.g. through beach use or trail use/management)?
2. **Invasive species biology:** What is the biology of the invasive species removed and is there a seed bank to consider (e.g. although autumn olive seed banks may not be long-lived there may be other invasive species seed banks to consider)?
3. **Re-invasion risk:** Are there invasive species nearby which could re-invade the site from nearby trails, watercourses or other pathways of introduction?
4. **Existing native vegetation:** What native vegetation is left? How long before it regenerates by itself? Does it need help? Species with specific habitat requirements or reproductive strategies resulting in low fecundity, such as species at risk, may require re-introduction. The majority of plant species should be able to recover naturally, especially if healthy populations exist adjacent to the controlled area.

If you answered yes to most of the questions above, it is most likely that the site will be re-invaded before it has a chance to regenerate on its own or the plant will continue to invade and be present among the native species, resulting in annual control. Restoration will be needed to reduce the risk of re-invasion. See page 27 for restoration methods.

# Control Measures

**Caution:** Burning, mowing or cutting autumn olive may result in vigorous re-sprouting. When applying manual control, the entire root must be removed to prevent re-sprouting. Because of the thorns, it is recommended that protective clothing, including gloves, is worn when applying any kind of control.

Autumn olive, once established, is almost impossible to eradicate completely. Frequent monitoring and repeated treatments will be needed to achieve successful management. It is therefore important to prevent seed production and dispersal both within the managed site and outside it, as nearby plants provide a seed source for repeated invasion.

If using non-selective method of control, make sure to go through the infested area first to flag SAR plants or important non-target species in order to avoid damaging them during control efforts. If there may be nesting or breeding bird populations within the control site, control during nesting/breeding season (typically May to August) should be avoided.

## Mechanical

Mechanical control methods such as pulling/digging or mulching are particularly useful where volunteers are available. These methods are time consuming and labour intensive in larger, established infestations, but may effectively supplement the use of herbicide.



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



## Pulling and Digging:

<b>Infestation Size:</b>	Small (<300 m <sup>2</sup> ) or scattered infestations of seedlings, small plants and stems up to 9 cm in diameter.
<b>Goal:</b>	Eradication.
<b>Timing (season):</b>	Can be performed any time of the year, preferably after a rain when soil is moist and pliable. Seedlings are easiest to identify in early spring because autumn olive produces leaves earlier than most native shrubs.
<b>Treatment Frequency:</b>	Once or as needed. May be repeated for several seasons until the seed bank is depleted.
<b>Best Practices:</b>	Seedlings and very young plants can be hand-pulled. Plants up to approximately 9 cm in diameter can be removed using a weed pulling tool, fork or winch. The entire root crown must be removed in order to prevent re-sprouting. Hand digging larger plants can be done but roots must be cut off below the root crown as the tree may re-sprout from any roots that are left in the soil. Disturbed soil will result from these techniques and should be tamped down or covered in a thick layer of mulch (if appropriate for the type of habitat) to minimize exposing new autumn olive seeds. Wear gloves and protective clothing.
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act.</i>
<b>Advantages:</b>	Inexpensive, simple, effective and selective. Removes whole plant. Opportunity for community engagement through removal event. Can be done in remote locations or in sensitive habitats.
<b>Disadvantages:</b>	Labour intensive. Entire root must be removed or plant will regrow. Creates soil disturbances which may stimulate seed germination or allow other invasive species the chance to move in. Thorn hazard.
<b>Ideal For:</b>	Landowners with restricted access to chemical control or who have small, recent infestations requiring immediate control. Sensitive ecosystems for which non-selective control methods are not ideal.



Seedlings and very young plants can be hand-pulled but the entire root must be removed to prevent re-sprouting.

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

## Mechanical Mulching:

<b>Infestation Size:</b>	Small to large infestations and thickets of impenetrable shrubs.
<b>Goal:</b>	Used to slow or reduce spread and halt seed production. Regular mulching will deplete plant energy (carbohydrate) reserves and may eventually kill it.
<b>Timing (season):</b>	Winter or early spring, preferably before leaf-out.
<b>Treatment Frequency:</b>	Annually over several years.
<b>Best Practices:</b>	Use a mulching head on a skid steer or similar equipment and follow with foliar treatment of suckering stems. Use together with basal bark treatment for what cannot be reached with mulcher.
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act.</i>
<b>Advantages:</b>	Effective. Relatively inexpensive.
<b>Disadvantages:</b>	Non-selective. Takes a long time until plants are exhausted. Creates multiple stems.
<b>Ideal For:</b>	Landowners with restricted access to chemical control and for large infestations of impenetrable shrubs. Also ideal for large areas you want to open up for restoration or for recreation i.e. walking trails.



(BEFORE) Autumn olive and multiflora rose thicket before using mulching as a control method.

Photo courtesy of Eric Giles.



(AFTER) Autumn olive and multiflora rose thicket after mulching.

Photo courtesy of Eric Giles.



### Cutting/Mowing:

Cutting or mowing autumn olive stimulates re-sprouting in mature plants unless the cut surfaces are treated with herbicide. Mowing may be helpful in maintaining open areas by preventing the establishment of seedlings but is not recommended as a control option alone. Repeated cutting or mowing will result in a thicker stem base and denser branches.

### Girdling:

Not recommended, as it is hard to achieve adequate girdle with multi-stemmed shrubs.

### Prescribed burning:

Prescribed burning is not recommended as burning will cause autumn olive to re-sprout vigorously.

## Biological

Biological control is the use of a herbivore, predator, disease or other natural enemy to reduce established populations of invasive species. Most invasive species have few natural enemies in their new habitats. Biological control aims to re-establish relationships between an invasive species and its natural enemies by selecting highly host-specific natural enemies from the country of origin and moving them to the country where the invasive species is a problem. This is only done after extensive host-range testing in the country of origin or quarantine, to ensure that the potential biocontrol agent is host-specific to the targeted invasive species. This method has been used successfully for invasive plants in North America, including purple loosestrife (*Lythrum salicaria*), leafy spurge (*Euphorbia esula*) and St John's wort (*Hypericum perforatum*). Biological control agent selection, testing, and initial release is coordinated by agencies of the federal government.

No biological control is available for autumn olive except for grazing. Goats, sheep and deer will eat autumn olive readily however, effective control requires heavy and repeated grazing in spring and early summer over multiple years. This often results in overgrazing of grasses and desirable species, as well as a risk of soil erosion and compaction.

## Chemical

The management of pesticides is a joint responsibility of the federal and provincial governments. Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) by Health Canada's Pest Management Regulatory Agency (PMRA) and be classified under the provincial *Pesticides Act* by the Ministry of the Environment and Climate Change (MOECC).

It is important that pesticides are applied in accordance with all label directions. The pesticide label is a **legal document** and prescribes how the pesticide can be legally and safely used. Ensure you have the most current label and are aware of any re-evaluation decisions.

For an up-to-date list of pesticides labelled for autumn olive plant control and to access the most current label, visit the Pest Management Regulatory Agency's product label search site at <http://pr-rp.hc-sc.gc.ca/lr-re/index-eng.php>. To determine if a federally registered pesticide is also classified for use in Ontario, visit: <https://www.lrcsde.lrc.gov.on.ca/PCDWeb/home.action>

In addition to being used in accordance with label directions, pesticides must also only be used for purposes allowed under Ontario's Cosmetic Pesticides Ban.

The province's Cosmetic Pesticides Ban contains exceptions for the use of pesticides (class 9), including the use of pesticides related to agriculture, forestry and the protection of natural resources (provided certain conditions are met) which may allow chemical control of autumn olive on your property (see below).

Furthermore, non-domestic (i.e. commercial, restricted etc.) herbicides can only be purchased, stored and applied by appropriately licensed exterminators.

For more information on pesticides and all aspects of weed control, The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA)'s Publication 75, Guide to Weed Control 2014-2015 can be found at: <http://www.omafra.gov.on.ca/english/crops/pub75/pub75toc.htm>.

### Exceptions to the Ontario Pesticides Ban

The following is a list of exceptions to the Ontario Pesticides Ban. For details on each exception, refer to the Ontario Governments document "Technical Guidance: Pesticides Act and Ontario Regulation 63/09 Municipalities". This document provides information to the municipalities industry about Ontario's cosmetic pesticides ban. <https://www.ontario.ca/page/technical-guidance-pesticides-act-and-ontario-regulation-6309-municipalities>

#### Are you protecting a Natural Resource?

The "natural resources" exception exists for the use of prohibited pesticides to manage, protect, establish or restore a natural resource. In order to qualify for this exception your project must meet the criteria specified in Section 33 of Ontario Regulation 63/09, including the use of pesticides in accordance with Integrated Pest Management (IPM) principles outlined in this BMP guide. You will need to contact the MNRF ([www.ontario.ca](http://www.ontario.ca)) to obtain a written letter of opinion from the MNRF Regional or Branch Director.

#### Are you a farmer?

The agriculture exception allows a farmer to use Class 9 pesticides for the purposes of the agricultural operation that he or she owns or operates. This exception may apply to the control of autumn olive if it impacts their agricultural or horticultural operation. Agricultural operations

include agriculture, aquaculture and horticulture activities. Examples include:

- growing, producing or raising farm animals
- production of crops, including greenhouse crops, maple syrup, mushrooms, nursery stock, tobacco, trees and turf grass, and any additional agricultural crops prescribed under the *Nutrient Management Act, 2002*
- activities that are part of an agricultural operation such as maintenance of a shelterbelt for the purposes of the agricultural operation
- the production of wood from a farm woodlot, if at least one of the activities described earlier is carried out on the property where the farm woodlot is located

Some activities are not included in the definition of an "agricultural operation".

#### Are you involved in Forestry?

A forest is defined as a treed area of land that is one hectare in size or larger. Class 9 pesticides may be used in a forest for the purposes of harvesting, renewing, maintaining or establishing a forest, protecting forest resources derived from a forest and accessing a forest for these purposes under the forestry exception. The control of autumn olive may fall under the forestry exception; a Forestry Class Land Exterminator licence would be required to use commercial pesticides in a forest.

#### Herbicide Application and Autumn Olive

Systemic herbicides are often more effective during the late summer and early fall months, when downward flow of plant compounds from the leaves helps facilitate the transport of herbicides to the roots. However, some herbicides may be more effective in the spring.

There are a variety of techniques for applying herbicides but the most effective method is the cut stump method.



## Cut Stump (most effective):

<b>Infestation Size:</b>	Any infestation size of plants with medium to large stems (>2 cm diameter).
<b>Goal:</b>	Eradication.
<b>Timing (season):</b>	Late in the growing season (August to October) or during the dormant season. Not during bird nesting season. Not effective during spring/sap flow.
<b>Treatment Frequency:</b>	As needed.
<b>Best Practices:</b>	Cut stem as close to the ground as possible and paint or spray herbicide to the entire cambium layer of the cut stump immediately (within minutes). For cut stump applications, triclopyr, glyphosate or picloram are recommended.
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act, Pesticides Act.</i>
<b>Advantages:</b>	Selective. Less soil disturbance and quicker than pulling out all the roots. Kills whole plants.
<b>Disadvantages:</b>	Does not always eliminate suckering. May need to be repeated multiple times. May need exemptions from MOECC.
<b>Ideal For:</b>	Sensitive habitats or in restoration sites. Areas where standing dead brush is undesirable.

## Basal Bark Treatment:

<b>Infestation Size:</b>	Younger stems with thin bark, typically plants of 2 to 15 cm in diameter. Low to medium density.
<b>Goal:</b>	Eradication or control.
<b>Timing (season):</b>	Any time of year. Not during bird nesting season (May-August). Dry conditions. It should not be used when snow or water prevent herbicide from being applied at the ground level or when stems are saturated.
<b>Treatment Frequency:</b>	As needed.
<b>Best Practices:</b>	Triclopyr mixed with bark oil is recommended. Triclopyr can be applied from January to fall colouration (not to be used in extremely hot temperatures). Apply chemical all the way around the stem in a 30 to 60 cm high strip starting at the root collar. Can use hatchet to cut into the basal bark if plant has just a few large stems.
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act, Pesticides Act.</i>
<b>Advantages:</b>	Selective. Less soil disturbance and quicker than pulling out all the roots. Kills whole plants. Less labour intensive than pulling.
<b>Disadvantages:</b>	May need to be repeated multiple times. May need exemptions from MOECC. In populations with many branches, typically 10 to 20% of stems are missed, resulting in a plant that may be more difficult to treat the following growing season. Does not always eliminate suckering.
<b>Ideal For:</b>	Sensitive habitats or in restoration sites.

## Foliar Application:

<b>Infestation Size:</b>	Dense patches and for suckers or seedlings smaller than 2.5 m tall.
<b>Goal:</b>	Eradication.
<b>Timing (season):</b>	Do not apply during bird nesting season. Must be applied when leaves have fully opened, preferably before shrubs become seed bearing, although some herbicide labels recommend use July to mid-September. See label for details.
<b>Treatment Frequency:</b>	Re-apply as needed; generally annual application over at least 2 years is needed for large plants because of the size of the root system.
<b>Best Practices:</b>	In general, foliar applications of herbicides are most effective early in the growing season, as they often require growing leaves for effectiveness. Metsulfuron is ideal for grassland plantings but may affect non-target trees, as the herbicide can be taken up by the roots of non-target woody species. 2,4-D is safer for non-target grasses than metsulfuron, but is also not recommended in tree plantings. Foliar application of glyphosate is less effective than metsulfuron, but is safer for foliar applications in tree plantings. Since a variety of animals and birds consume autumn olive berries, herbicide should not be applied if berries are present. One hundred percent coverage of foliage should be achieved.
<b>Regulatory Considerations:</b>	<i>Species at Risk Act, Migratory Birds Convention Act, Endangered Species Act, Invasive Species Act, Conservation Authorities Act, Pesticides Act.</i>
<b>Advantages:</b>	Less soil disturbance and quicker than pulling out all the roots. Kills plants whole. Effective on seed bank emergence.
<b>Disadvantages:</b>	Risk to non-target, native species. May need to be repeated multiple times. May need exemptions from MOECC. Height restrictive. May not prevent suckering. Less targeted than basal bark or cut stump applications resulting in more non-target impacts.
<b>Ideal For:</b>	Landowners who have access to chemical control.



Photo courtesy of Eric Giles.



# Disposal of Plant Material

## Burn or let decompose in localized piles:

Creating small, localized piles of cut plant material (without dragging material over uninvaded areas) will help contain re-sprouts to one small area rather than spreading out the cut material. Burning is also an option.

## Do not backyard compost:

Home composters do not reach the necessary temperature to kill viable parts (seeds and roots) of the plant.

## Municipal compost:

Parts of invasive plants capable of reproducing (seeds and roots) should only be composted if the material is taken to a large-scale municipal composting facility where temperatures in the compost pile reach high enough to kill the living material. Composting operations that demonstrate strict adherence to pathogen kill processes and maintain optimal moisture conditions may provide sufficient conditions to destroy most seeds or rhizomes of invasive plants. Ontario composting facilities are required to routinely monitor the compost process and meet strict, provincially regulated time-temperature parameters for pathogen kill.

## Municipal disposal:

Call ahead to your local municipality about disposal availability for invasive plant material. If your local municipality accepts invasive plant material in the local landfill, carefully place reproductive plant material in black plastic garbage bags. Seal the bags tightly and leave in direct sunlight for one to three weeks, to kill any living plant material. Check the bags to make sure the plant material has died and deposit in the landfill.



Viable plant parts, such as fruit and seeds, should not be backyard composted.

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

# Types of Restoration

## During Control

### Mulching:

Covering sites with mulch immediately after invasive species control (i.e. manual or chemical control) may aid in the recovery of native species and prevent immediate re-colonization by other invaders. Mulching reduces light availability, allowing more shade-tolerant native plant species to germinate and colonize the gaps left by autumn olive removal. This will also limit the germination from the seed bank.

### Seeding:

Seeding an area with other plant species immediately after management activities may be useful to prevent the establishment of new invasive species. This can give desirable native species the chance to establish themselves. See "stand conversion" for more information.

## After Control

### Planting:

If there are invasive plants nearby or in the seed bank which may colonize the control area, planting larger native species stock (potted etc.) will help them outcompete invasive seedlings. It may however be better to monitor and remove invasive species over several seasons before investing in restoration planting. Wait until all management is completed before doing a large stock re-planting, especially if you find it difficult to distinguish between newly planted native species and invasive seedlings.

When completing planting at control sites, consider light availability (have any trees recently been removed which have opened up an area?). These environmental changes should be taken into account when choosing plant species for restoration, as they will affect the growing and soil conditions. Also, additional management activities may disturb the newly planted materials, so it is best to postpone planting until all invasive plant control is complete.



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



# Preventing the Spread

Early detection is the most effective tool for controlling the spread of autumn olive and everyone can help. Follow these tips:

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## Report it.

If you think you see autumn olive take a picture, record the location and report it using the tools listed below.

## Watch for it.

Learn what autumn olive looks like and then monitor hedges, property boundaries, riparian areas, fence lines and trails. Early detection of invasive plants can make it easier and less expensive to remove or control them.

## Stay on trails.

Avoid traveling off-trail and in areas known to have autumn olive or other invasive species.

## Stop the spread.

Inspect, clean and remove mud, seeds and plant parts from clothing, pets (and horses), vehicles (including bicycles, trucks, ATVs, etc.), and equipment such as mowers and tools. Clean vehicles and equipment in an area away from natural areas where plant seeds or parts aren't likely to spread (e.g. wash vehicles in a driveway or at a car wash) before travelling to a new area.

## Keep it natural.

Try to avoid disturbing soil and never remove native plants from natural areas. This leaves the soil bare and vulnerable to invasive species.

## Use native species

Try to use local native species in your garden. Don't plant autumn olive and if you have removed it, replant with native species. Encourage your local garden centre to sell non-invasive or native plants. [The Grow Me Instead guides list alternatives to plant instead of invasive species.](#)

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# Tracking the Spread (Outreach, Monitoring, Mapping)

Several reporting tools have been developed to assist the public and resource professionals to report autumn olive sightings, track the spread, detect it early, and respond to it quickly. These include:

- 1) EDDMapS: an online reporting tool where users can view existing sightings of autumn olive and other invasive species in Ontario, and document their sightings. This tool, at [www.eddmaps.org/ontario](http://www.eddmaps.org/ontario), is free to use.
- 2) Toll-free Invading Species Hotline: a telephone number (1-800-563-7711) which individuals can use to report sightings verbally.
- 3) Invading Species Website: an online reporting tool ([www.invadingspecies.com](http://www.invadingspecies.com)).

If you think you have autumn olive on your property or if you see it in your community, please report it. You will be asked to send in photos of the leaf, stem and trunks for identification.



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



# Best Management Practices Documents Series

Autumn Olive Best Management Practices in Ontario  
Black Locust Best Management Practices in Ontario  
European Black Alder Best Management Practices in Ontario  
Garlic Mustard Best Management Practices in Ontario  
Giant Hogweed Best Management Practices in Ontario  
Invasive Common (European) Buckthorn Best Management Practices in Ontario  
Invasive Dog-strangling Vine Best Management Practices in Ontario  
Invasive Honeysuckles Best Management Practices in Ontario  
Invasive Reed Canary Grass Best Management Practices in Ontario  
Japanese Knotweed Best Management Practices in Ontario  
Multiflora Rose Best Management Practices in Ontario  
Phragmites (Common Reed) Best Management Practices (EN, FR)  
Phragmites (Common Reed) Best Management Practices for Ontario Roadways  
Purple Loosestrife Best Management Practices in Ontario  
Scots Pine Best Management Practices in Ontario  
Spotted Knapweed Best Management Practices in Ontario  
White Sweet Clover Best Management Practices in Ontario  
Wild Parsnip Best Management Practices in Ontario

## Additional Publications from the Ontario Invasive Plant Council

Invasive Plant Technical Bulletin Series  
A Landowner's Guide to Managing and Controlling Invasive Plants in Ontario  
A Quick Reference Guide to Invasive Plant Species  
Clean Equipment Protocol for Industry  
Creating an Invasive Plant Management Strategy: A Framework for Ontario Municipalities  
Grow Me Instead! Beautiful Non-Invasive Plants for Your Garden, a Guide for Southern Ontario (EN, FR)  
Grow Me Instead! Beautiful Non-Invasive Plants for Your Garden, a guide for Northern Ontario  
Landowners Guide to Controlling Invasive Woodland Plants  
Invasive Phragmites Site Prioritization Tool

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