Michigan Department of Natural Resources
Michigan Natural Features Inventory
2/2012

Autumn olive

Elaeagnus umbellata

Autumn olive is native to Asia and was introduced into the US in the 1830s. It was commonly planted for wildlife food and cover until its invasive traits became apparent. It produces abundant fruits that are widely distributed by birds and mammals. Like many non-native shrubs, it leafs out early and retains its leaves late in fall, shading out desirable native species and reducing species diversity. It is able to germinate and survive in shade as well as sun.

Autumn olive has root nodules that fix atmospheric nitrogen. As a result, it has the potential to degrade native plant communities that are adapted to low nutrient levels such as barrens and prairies. The resulting increase in nitrogen can promote the growth and spread of weedy species at the expense of low-nutrient adapted natives. In addition, it can increase stream water nitrate concentrations when it comprises a large portion of the stream bank vegetation.

Autumn olive does not appear to suffer significantly from herbivory by deer. In one study, it grew as tall outside of exclosures as it did within, while natives growing in the same places were much smaller when browsed by deer.


Suzan Campbell, MNFI

Identification

Habit:
Autumn olive is a deciduous shrub or small tree growing up to 6 m (20 ft) in height and 9 m (30 ft) in width. Its form is rounded, with dense branches.

Leaves:
Autumn olive's leaves are alternate and oval, with finely pointed tips. Their margins are wavy but do not have teeth. They are bright green above, and a distinctive silvery-scaly below. Leaves range from 5 to 10 cm (2-4 in) in length. They leaf out in mid-March.


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

Bark/Stems:


Robert Vidéki, Doronicum Kft., Bugwood.org

Autumn olive's young twigs are silvery with brownish scales giving them a speckled appearance. Thorns on young branches may be several inches long. With age, the bark becomes light gray to gray-brown.

Flowers:


Suzan Campbell, MNFI

Autumn olive has fragrant cream or light yellow flowers. They are tubular with four petals and stamens, and are arranged in clusters of 1 to 8. They bloom from April to June and are pollinated by insects.

Fruits/Seeds:
Autumn olive's abundant fruits are silvery with brown scales when young and ripen to a speckled red in September and October. Fruits are eaten by a variety of birds and mammals, which disperse the seeds widely.


Suzan Campbell, MNFI

Habitat:
Autumn olive is moderately shade tolerant and occurs on a variety of soil types. It spreads rapidly in old fields and is also found in open woods, along forest edges, roadsides, sand dunes, and other disturbed areas. It poses a particular threat to prairies, savannas and open woods, particularly where fire is infrequent or has been completely suppressed.

Similar species

Russian olive

The related Russian olive *(E. angustifolia)* is also a non-native invasive species. It is taller and is usually a single or multi-stemmed tree. It has longer, narrower leaves that are silvery on top as well as on the underside.

Buffaloberry

Buffaloberry (*Shepherdia canadensis*) is also related to autumn olive but is native to Michigan. It has opposite leaves, rather than alternate, and it does not grow as tall. Typically, it ranges from 1-4 m (3-13 ft) tall while autumn olive can grow twice as tall.

Bush honeysuckles

A number of non-native invasive honeysuckles have red berries also. They have opposite leaves, rather than alternate and they do not have tiny glistening scales on their leaves or twigs.

Quick check

Autumn olive will ALWAYS have:

- Alternate leaves
- Tiny glistening scales on the twigs, fruit and undersides of leaves.

Reproduction/Dispersal

Autumn olive reproduces primarily by seed. It also sprouts vigorously from the root crown following cutting or fire.

Autumn olive is polygamodioecious; male and female flowers are usually on different shrubs but occasionally male flowers will grow on female plants and vice versa. The flowers are insect pollinated.

Seeds are dispersed by a variety of animals including songbirds such as thrushes, cardinals, cedar waxwings, evening grosbeaks, sparrows, bobwhite, ruffed grouse, ring-necked pheasants, wild turkeys, and mallards. Mammals including raccoons, skunks, opossums, and even black bears will eat it also. Since the fruit persists late into winter, it offers a source of nutrients when little else is available. At the same time, however, this results in wide distribution of its seed.

Plants mature rapidly and may bear fruit at 3 years of age. Mature trees may produce up to 30 lbs of fruit a year, yielding up to 66,000 seeds. The seed benefits from a period of cold treatment but even without it, germination rates of over 70 percent have been documented. With cold treatment, germination rates exceed 90 percent.

Because the seed germinates so rapidly, autumn olive does not persist in the seedbank. Typically, however, many plants occur nearby, outside of the managed area, and provide an ongoing seed source for repeated invasions.

While autumn olive is most productive in full sun, it can still survive and produce some seed in moderate shade. It can spread into open forest when there are source populations nearby.

Planning a control program

Resources for invasive species control invariably fall short of the actual need, so it is important to prioritize sites for treatment and plan carefully. Assessing the scope of the problem is a critical first step:

- Map known populations.
- Does it occur in high quality habitat or on important recreational, hunting or fishing lands?
- Does it occur adjacent to high value lands?
- Is there a pool of volunteers available to assist with control? Or will efforts rely on paid staff or contractors?

Given this information, develop a strategy for control:

1. Prioritize high value sites for treatment, including lower value surrounding lands with source populations of autumn olive.
2. Choose appropriate control methods, given site conditions and available resources.
3. If using herbicide, be sure to read the product label before finalizing plans. Is there potential for harm to non-target species? Have you made adequate provisions to minimize damage?
4. Do these control methods require any permits (i.e. herbicide application in wetlands, prescribed burning)?
5. Prevent further spread; focus on mature plants, particularly those in full sun with abundant fruit.
6. Eradicate smaller satellite populations.
7. Treat larger infestations of lower value as resources permit if success is likely—don't waste scarce resources where there is little chance of success.
8. Monitor to ensure desired results are being achieved; adapt management to improve success.

Best survey period

Because autumn olive leafs out early and retains its leaves late in fall in much of the state, 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. It is very distinctive, however, and can be distinguished in summer by its silvery leaf undersides and year-round by its speckled twigs.

Documenting occurrences

In order to track the spread of an invasive species on a landscape scale, it is important to report populations where they occur. The Midwest Invasive Species Information Network (MISIN) has an easy-to-use interactive online mapping system. It accepts reports of invasive species' locations from users who have completed a simple, online training module for the species being reported. It also offers the potential for batch uploading of occurrence data for any invasive species.

Herbaria also provide a valuable and authoritative record of plant distribution. The University of Michigan Herbarium's database can be searched online for county records of occurrence, for example. When autumn olive is first encountered in a county where it had not been known previously, specimens should be submitted to the Herbarium to document its presence. Check the "Online Resources" section for links to both of these resources.

Control

Autumn olive can be more difficult to control than many invasive shrubs and is almost impossible to eradicate completely from a region once it has become well-established. A primary goal in controlling this species is to prevent seed production and dispersal both within the managed site and outside it, as nearby plants provide a seed source for repeated invasion. A variety of techniques including both mechanical and chemical controls may be most effective and should be tailored to the specific conditions on the site. It is critical to monitor the site to ensure that cut stumps do not resprout. Where abundant seed sources are present nearby, monitoring may be required indefinitely.

Mechanical control

In the very earliest stages of invasion, when only seedlings and young plants are present, mechanical controls such as pulling and repeated cutting may be adequate to control or eradicate autumn olive. Mechanical control methods are particularly useful where volunteers are available. These methods are impractical in larger, established infestations, but may effectively supplement the use of herbicide.

Hand-pulling/Digging

Autumn olive seedlings can be hand-pulled easily, particularly when the soil is moist and the population is small. Pull steadily and slowly to minimize soil disturbance and tamp down the soil afterwards. Tools such as the Weed Wrench® or Root Talon® provide additional leverage, facilitating the removal of somewhat larger plants up to a diameter of 9 cm (3.5 in). Hand digging larger plants is less effective as they will resprout from any roots that are left in the soil.

On low-quality sites, large shrubs can be pulled out with a chain and gouged out with the bucket of a tractor. This creates a lot of ground disturbance, however and should not be used on higher quality sites. Often there is some resprouting, but with the large plants removed, follow-up treatment is facilitated or mowing can begin.

Cutting/Mowing

Cutting or mowing autumn olive stimulates resprouting 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.

Grazing

Goats and sheep will eat autumn olive readily. Goats are particularly effective; they will debark the shrubs, they don't mind thorns and they can stand on their hind legs to defoliate branches up to a height of 5 feet.

Effective control requires repeated heavy defoliation in spring and early summer; although goats can clear brush in a single season, multiple years are needed to actually kill the shrubs. Grazing should be managed to prevent overgrazing of grasses and forbs, which would lead to soil erosion and reduced diversity.

Chemical control

For large, well-established infestations, effective control of autumn olive requires the use of herbicide. Factors that should be considered when selecting an herbicide for use on a particular site include proximity to water or wetlands, presence or absence of desirable native vegetation, potential for erosion and the effectiveness of the herbicide under consideration on autumn olive. Because autumn olive leafs out early and remains green much later than many native species, spring or fall treatment may minimize damage to desirable plants.

General considerations

Anyone who applies herbicides as part of their employment must become a certified pesticide applicator. In addition, certification is required for the use of some herbicides under any circumstances. The exam is administered by the Michigan Department of Agriculture and Rural Development and a link to their website is included in the "Online Resources" section.

A permit from the Michigan Department of Environmental Quality is usually required to apply herbicide where standing water is present—in wetlands, along streams, rivers

or lakes, or over open water. A permit is also required for herbicide use below the ordinary high water mark along the Great Lakes or Lake St. Clair shoreline, whether or not standing water is present. A link to their website is included in the "Online Resources" section.

A number of adjuvants or additives may be used with herbicides to improve their performance including mixing agents, surfactants, penetrating oils and dyes . Some are included in premixed products while others must be added. Adjuvants do not work with all products; consult the product label to determine which adjuvants may be used with a specific herbicide formulation.

Dyes are useful in keeping track of which plants have been treated and making spills on clothing or equipment apparent. Some premixed herbicide include them or they can be added to others. Clothing dyes such as Rit® can be added to water soluble herbicides, while other products require oil-based dyes. Consult the product label for instructions.

Crop Data Management Systems, Inc. (CDMS) maintains a database of agro-chemicals that includes herbicide labels for specific products. Herbicide labels contain information on application methods and rates, specific weather conditions, equipment types, nozzles etc. to provide the desired coverage and minimize the potential for volatilization or drift. They also contain critical information about the potential for damage to valuable non-target species. A link to the CDMS website is included in the "Online Resources" section.

Read the entire pesticide label before use. Follow all directions on the label.

Herbicide specifics

Glyphosate (e.g., Roundup®, Rodeo®, Accord®) can provide moderate control of autumn olive both as a foliar spray and for cut surface treatments, but it may require more follow-up and re-treatment than other herbicides discussed here.

It should not be used for cut surface treatments in spring while leaves are emerging and sap is flowing upward, as it is not effective at this time. It is not selective and will kill desirable non-target species, in some cases leading to increased erosion on site.

Triclopyr provides effective control of broad-leaved plants but does not kill grasses or some conifers. It is available in both amine (e.g., Garlon 3A®) and ester (e.g., Garlon 4 Ultra®) formulations. The amine formulation can be safely used in wetlands.

Triclopyr can be used as a foliar spray once autumn olive is fully leafed out in spring until just before it changes color in fall. The ester formulation should be used with a vegetable oil based multi-purpose adjuvant (e.g. SprayTech® Oil) and the amine formulation should be used with a wetland-approved non-ionic surfactant (e.g., Cygnet Plus®). Triclopyr can also be used in conjunction with cut surface treatments; cut-stump, girdling and frilling. Treatments may be applied throughout the year including when snow is present, however control may be reduced in early spring when the sap is beginning to flow or during summer drought.

Ester formulations are particularly effective for root or stem-sprouting species such as autumn olive because the triclopyr persists in the plant until it dies. The ester formulation should be used with a penetrating oil (e.g., AX-IT®), which improves effectiveness and increases the amount of time after cutting in which treatment can occur. Penetrating oil also facilitates absorption in basal bark treatment.

In non-target plants, triclopyr residues in the soils can damage non-target species via root uptake. Use caution in high-quality forests.

In sensitive areas, the amine form may be used for cut-surface treatments but must be painted onto the cut surface immediately. It can also be used for drill and fill techniques.

Foliar application

Foliar application of herbicide can be useful on sites with extensive autumn olive populations and few desirable natives. Herbicide should be applied after spring sap flow to actively growing plants, although during periods of drought or other stress, it may not be effective. It can be applied to the foliage with squirt bottles, backpack sprayers or boom-mounted sprayers.

The product label for the specific herbicide being used provides essential information on coverage; how much of the foliage should be treated how wet it should be. Herbicide labels also contain information on specific weather conditions, application modes, equipment types, nozzles etc. to provide the desired coverage and minimize the potential for volatilization or drift.

The herbicide applicator is responsible for managing drift and damage to non-target vegetation. Wind speeds between 3 and 10 miles per hour are best for foliar herbicide spraying. At higher wind speeds, herbicide may be blown onto adjacent vegetation or water bodies.

At lower wind speeds, temperature inversions can occur, restricting vertical air movement. Under these conditions, small suspended droplets of herbicide can persist in a concentrated cloud and be blown off-target by variable gusts of wind. Ground fog indicates the presence of a temperature inversion, but if no fog is present, smoke movement on the ground can also reveal inversions. Smoke that layers and remains trapped in a cloud at a low level indicates an inversion, while smoke that rises and dissipates indicates good air mixing.

In hot, dry weather, herbicide can evaporate rapidly. Setting equipment to produce large droplets can help compensate for this. In general, follow all directions on the label of the specific herbicide being used, in order to prevent damage to non-target vegetation or water bodies.

Cut-stump

Cut-stump treatment may be used in any season except during heavy spring sap flow, when sap is flowing upwards. Ideally, it should occur before fruit is produced that season.

Cut-stump treatment is useful for species like autumn olive that normally resprout after cutting. After the stems have been cut, they are painted with concentrated herbicide, using a squirt bottle or wicking applicator. Small stems can be cut several inches above the ground so that both the sides and the cut surface may be treated. On large stems, cuts should be made as close to the ground as possible and only the cambium—the thin layer where active growth occurs, just inside the bark—should be treated. When using glyphosate or the amine formulation of triclopyr, cut surfaces must be treated immediately or the herbicide will be ineffective.

Product labels list what adjuvants may be used to increase effectiveness of the herbicide; penetrating oils only work with ester formulations, for example. Similarly, dyes, which are useful in keeping track of which stems have been treated, may be water or oil-based and should be selected to work with a specific herbicide formulation.

Treated plants should be monitored for several years as they may still resprout. New stems may be treated with a foliar spray, or cut and retreated.

Basal bark

Basal bark treatment can be used on stems that are less than six inches in diameter at any time except during heavy sap flow in spring. It should not be used when snow or water prevent herbicide from being applied at the ground level or when stems are saturated. It it is most useful during the dormant season. Typically, ester formulations of herbicide are used with penetrating oils.

In basal bark treatment, concentrated herbicide is applied to a band of bark around autumn olive stems extending up 18 inches from the ground. Basal bark treatment is most effective on younger stems with thin bark.

Prescribed burning

In fire-adapted communities, a prescribed burn may enhance control of autumn olive, but should be considered as part of an integrated management plan for the site.

General considerations

A permit is required before implementing a prescribed burn. The Michigan Department of Natural Resources (DNR) is responsible for issuing burn permits in the Upper Peninsula and Northern Lower Peninsula unless a municipality wishes to do so. Municipalities located in the Southern Lower Peninsula issue burn permits under authority of the state law. A link to the DNR local fire contacts web page is included in the "Online Resources" section. In the Southern Lower Peninsula, contact the local Fire Marshall for permits and more information. Some municipalities require insurance coverage before a permit is issued, to cover the cost of damages if the fire should escape.

Before initiating a program of prescribed burning, a written burn plan establishing the criteria necessary for starting, controlling, and extinguishing a burn is required. The burn plan includes details such as specific weather conditions, locations of control lines, ignition pattern, equipment and personnel needed, contingency plans, and important phone numbers. The burn plan is essentially the "prescription" for how to conduct the burn safely while accomplishing the management objectives.

If other invasive species that are stimulated by burning are present on the site, planning should incorporate additional control methods to eradicate them.

Prescribed burning specifics

Prescribed burning alone will not control autumn olive as it resprouts vigorously in response to fire. In fire-adapted communities, prescribed burning can be a useful tool for controlling large autumn olive shrubs. If there is enough fuel to top kill or partially top kill the autumn olive, subsequent burns (1-3 additional) will ignite the dead stems. This generates enough heat on the stump to kill the shrub. It is less effective on smaller shrubs, however.

Prescribed burning is also beneficial when used in conjunction with chemical treatment. When it is used first, to top kill shrubs, resprouts can be sprayed with herbicide. Alternatively, following treatment with herbicide, any resprouts will be injured or killed by burning. Prescribed burning can also kill autumn olive seedlings when adequate fuel is present.

If left untreated, autumn olive can alter fire ecology as fuels do not accumulate beneath it.

Biological control

No biological controls have been reported for autumn olive except for grazing by sheep and goats, which was reported under grazing.

Disposal of plant parts

When seedlings or young shrubs are pulled, they should be disposed of in a manner that will ensure that their roots will dry out completely. In addition, if fruit is present, it should be burned or bagged and placed in a landfill. Where this is not possible, any resulting seedlings will require monitoring and control.

Although landscape waste cannot generally be disposed of in land fills, Michigan law permits the disposal of invasive species plant parts. See the "Online resources" section for a link to the relevant legislation.

Online resources:

CDMS - herbicide labels:
http://www.cdms.net/LabelsMsds/LMDefault.aspx?t=

Fire Effects Information System, *Eleagnus umbellata*
http://www.fs.fed.us/database/feis/plants/shrub/elaumb/all.html

Invasive.org, Autumn olive
http://www.invasive.org/browse/subinfo.cfm?sub=3021

Invasipedia at BugwoodWiki, *Eleagnus umbellata*
http://wiki.bugwood.org/Elaeagnus_umbellata

Invasive Plant Atlas of New England, Autumn olive
http://www.eddmaps.org/ipane/ipanespecies/shrubs/Elaeagnus_umbellata.htm

Midwest Invasive Species Information Network, Autumn Olive
http://www.misin.msu.edu/facts/detail.php?id=6

The Michigan Department of Agriculture and Rural Development—Pesticide Certification
www.michigan.gov/pestexam

The Michigan Department of Environmental Quality—Aquatic Nuisance Control
www.michigan.gov/deqinlandlakes
http://www.michigan.gov/deq/0,4561,7-135-3313_3681_3710---,00.html

Michigan Department of Natural Resources—Local DNR Fire Manager contact list
http://www.michigan.gov/dnr/0,4570,7-153-30301_30505_44539-159248--,00.html

Michigan's Invasive Species Legislation
Natural Resources and Environmental Protection Act 451 of 1994, Section 324.4130
http://legislature.mi.gov/doc.aspx?mcl-324-41301

Michigan Legislation—landscape waste, disposal of invasive species plant parts
Natural Resources and Environmental Protection Act 451 of 1994, Section 324.11521, 2 (d)
http://legislature.mi.gov/doc.aspx?mcl-324-11521

The Nature Conservancy's Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas
http://www.invasive.org/gist/handbook.html

The Nature Conservancy's Weed Control Methods Handbook: Tools and Techniques for Use in Natural Areas
http://www.invasive.org/gist/handbook.html

University of Michigan Herbarium - Michigan Flora Online
http://michiganflora.net/

Quick reference—Autumn olive

This chart has been provided as a convenience, to summarize the pros and cons of each herbicide and to present details on adjuvants, concentrations, etc. that do not fit into the discussion in the preceding sections. Although every attempt has been made to ensure accuracy, the product labels for the listed herbicides are the ultimate authority for their usage. Where there are conflicts, always follow the label directions. Techniques are listed in order of general preference by MDNR Wildlife Division staff but not all are suitable for wetlands or sensitive sites. Site conditions vary—choose a method that is best suited to conditions on the site being treated..

Anyone using herbicides in the course of their employment is required to be a certified pesticide applicator. Treatment in wetlands or over open water requires a permit from the Michigan Department of Environmental Quality.

These chemicals are available in a variety of formulations and concentrations. Concentration is listed below as a percentage of the active ingredient (AI) to facilitate use of different products. Always follow all directions on the product label including mixing instructions, timing, rate, leaf coverage and the use of personal protective equipment.

	Herbicide	% A.I.	Adjuvant	Timing	Pros	Cons
Basal Bark	**Triclopyr ester** (e.g., Garlon 4 Ultra®)	27%	Use a penetrating oil (e.g., AX-IT®), unless it is already included in product, e.g. Michigan blend.	Use any time of year, including winter months EXCEPT during heavy spring sap flow OR when snow or water prevent application at ground level OR when stems are saturated.	Relatively selective herbicide and technique. More effective than glyphosate on this species.	Not approved for use in wetlands.
Foliar Spray	**Triclopyr ester** (e.g., Garlon 4 Ultra®)	2-3%	Use a non-ionic surfactant (e.g., Cygnet Plus®).	Spring, before most natives emerge.	More effective than glyphosate on this species. Broad-leaf specific—will not harm sedges and grasses.	Not approved for use in wetlands.
Foliar Spray	**Triclopyr amine** (e.g., Garlon 3A®)	2-3%	Use a non-ionic surfactant (e.g., Cygnet Plus®).	Spring, before most natives emerge.	Safe for use in wetlands. More effective than glyphosate on this species. Broad-leaf specific—will not harm sedges and grasses.	
Cut-stump	**Triclopyr ester** (e.g., Garlon 4 Ultra®)	27%	Use a penetrating oil (e.g., AX-IT®), unless it is already included in product, e.g. Michigan blend.	Use any time EXCEPT during spring sap flow.	Relatively selective herbicide and technique. More effective than glyphosate on this species.	Not approved for use in wetlands.
Cut-stump	**Glyphosate** (e.g., Roundup®, Rodeo®, Accord®)	27%	Different products have different formulations—follow directions on the label.	Use after spring sap flow, while plant is actively growing.	Some products approved for use in wetlands. Less toxic than many alternatives.	Cuts must be treated IMMEDIATELY. When adjacent shrubs share roots, plants that were not treated may be injured.
Foliar Spray	**Glyphosate** (e.g., Roundup®, Rodeo®, Accord®)	2-3%	Some products already contain a surfactant—if not, add one (e.g. Cygnet Plus®, Nu-Film IR®).	Spring, before most natives emerge.	Relatively inexpensive Some products approved for use in wetlands.	Non-selective!!!! Use only on young plants—may resprout. Ineffective on mature plants.
Injection	**Triclopyr amine** (e.g., Garlon 3A®, Renovate®)	27%		Use any time EXCEPT during spring sap flow. Inject 1 ml into cambium at 3-4 inch intervals around trunk at convenient height.	Extremely selective herbicide and technique. Safe for use in wetlands, sensitive areas.	Somewhat labor intensive.