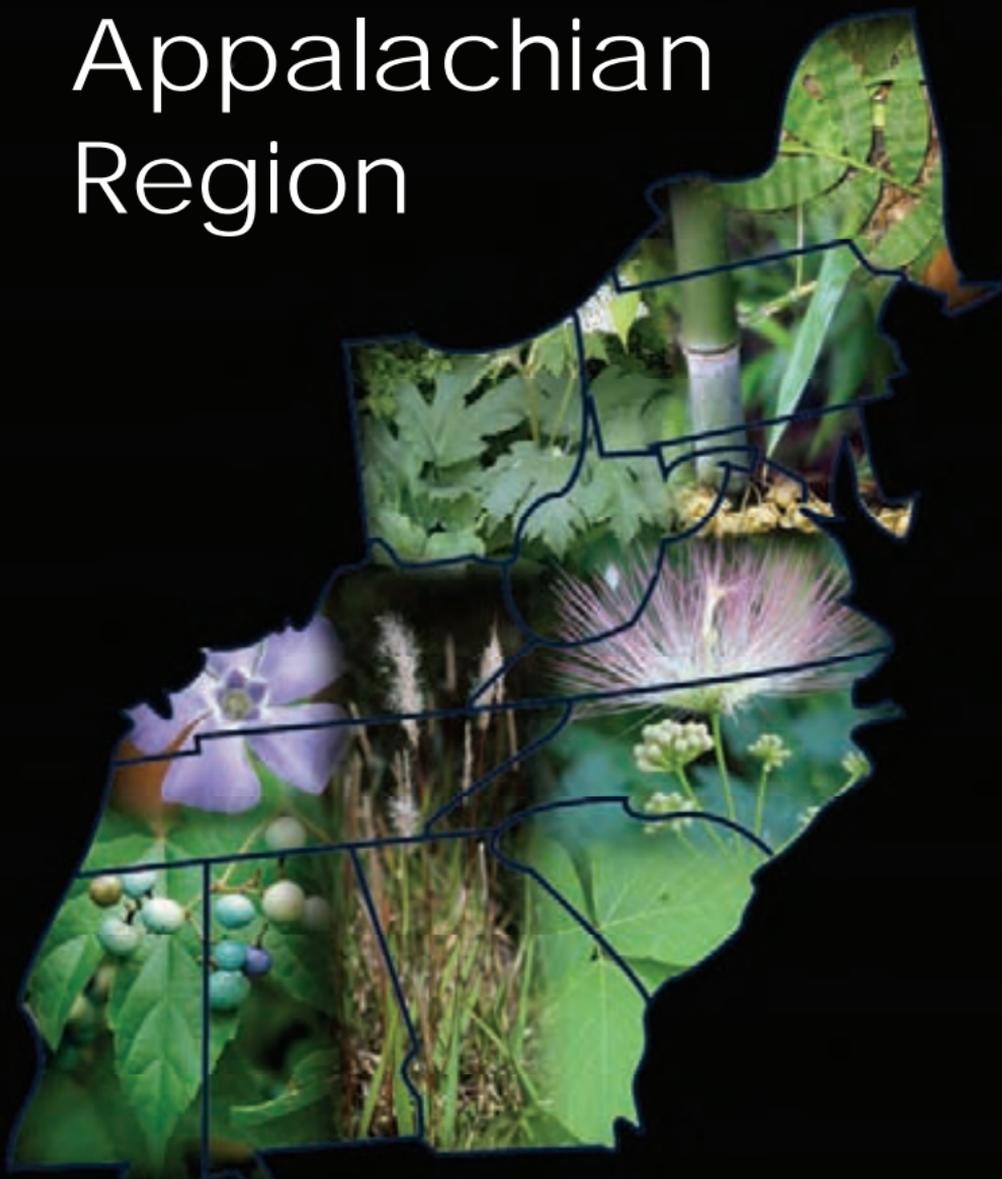


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UT Extension
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Invasive Weeds of the Appalachian Region



THE UNIVERSITY of TENNESSEE 
INSTITUTE of AGRICULTURE

i

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Numbers in parenthesis following photo captions refer to the numbered photographer list on the back cover.

HOW TO USE THIS GUIDE

Tabs: Blank tabs can be found at the top of each page. These can be customized with pen or marker to best suit your method of organization.

Examples:

		
<u>Infestation present</u>	<u>On bordering land</u>	<u>No concern</u>
<u>Uncontrolled</u>	<u>Treatment initiated</u>	<u>Controlled</u>
<u>Large infestation</u>	<u>Medium infestation</u>	<u>Small infestation</u>

Control Methods: Each mechanical control method is represented by an icon. These icons are defined in the IPM decision aid.

Grid: A grid is on every page to allow you to collect data while in the field. The headings represent what data we would like you to collect for the website, but most importantly the grid is a tool for you to keep records on invasive weed infestations in your area.

Webpage: The accompanying website has all the information in this guide, plus data entered by owners of this guide. It also provides timely information on new species of concern and new treatment methods as they are discovered.

<http://hortweeds.tennessee.edu/webapp/weedguide/Default.aspx>

This publication contains pesticide recommendations that are subject to change at any time. The recommendations in this publication are provided only as a guide. It is always the pesticide applicator's responsibility, by law, to read and follow all current label directions for the specific pesticide being used. The label always takes precedence over the recommendations found in this publication. Use of trade or brand names in this publication is for clarity and information; it does not imply approval of the product to the exclusion of others that may be of similar, suitable composition, nor does it guarantee or warrant the standard of the product. The author(s), the University of Tennessee Institute of Agriculture, University of Tennessee Extension, and North Carolina State University assume no liability resulting from the use of these recommendations.

IPM decision aid

Choose the options that apply to your situations and refer to the chart below to see our general integrated pest management (IPM) recommendations. Following the chart are descriptions of each of the control methods. These descriptions identify situations where those treatments are appropriate for use.

How large is the infestation?

- A) small (few plants/scattered)
- B) medium (1/4 to 5 acres)
- C) large (5 or more acres)

What type of land is the infestation in?

- a) wetland
- b) roadside/R. O. W.
- c) high-quality land/parkland
- d) grassland
- e) forest/woods

Type of invasive plant

- 1) annual
- 2) perennial
- 3) woody vine/tree

Lifestage

- i) dormant
- ii) seedling
- iii) pre-flower (woody= early season)
- iv) post-flower/setting seeds (woody = late season)

Size	Land type	Plant type	Life stage	Recommended Treatment
A,B,C	a,b,c,d,e	3	iv	Basal bark, cut-stump/cut-stem, hack and squirt
A	a,b,c,d,e	1,2	i,ii,iii,iv	Hand-pull
A,B,C	b,c,d,e	1	ii,iii,iv	Mowing
A,B,C	b,d	3	ii	Mowing
A,B,C	b,d	1,2	i, ii, iii	Discing
A,B,C	b,d	3	ii	Discing
A,B,C	b,d,e	1,2,3	ii, iii, iv	Grazing

Hand-Pulling



Hand-pulling is appropriate when plants are small and the soil is moist. Hand-pulling also includes the use of shovels, hoes, mattocks, etc. to help with removal. This method should be considered when working with a small infestation in sensitive areas where access to motorized equipment is limited, or desirable or rare species are intermixed with the invasive plant. Hand-pulling can greatly disturb the soil allowing other weed seeds to germinate and/or damaging roots of surrounding desirable species.

Mowing



Mowing is appropriate for herbaceous species and woody species with young/small stems. This method should be considered for any size infestation that allows access of motorized equipment. Mowing is most successful with annual species when mowed before seeding, and perennials when mowed both before seeding and repeatedly to exhaust the root stock. All vegetative material, especially when flowers or seeds are present, should be bagged and destroyed. Be careful not to move viable plant material to other areas as that can start a new infestation. Mowing may possibly damage desirable species in the area and compact the soil.

Discing/Cultivating



Discing is appropriate for herbaceous species and woody species with young/small stems. This method should be considered for any size infestation in situations where soil disturbance is acceptable and access is possible with motorized equipment. Discing works best with annual species and young woody species. Many perennial species propagate by root or stem parts, so discing would only serve to spread the species. Use caution in areas where the possibility of erosion is high.

Grazing



Grazing is only appropriate for an invasive species if a grazing animal finds that species palatable and that species is not poisonous to the animal. This method should be considered for any size infestation in grassland or stable woodland areas. Wetlands or high-quality parklands should not use this method due to soil compaction and potential waste run-off. If plants set seeds while being grazed, be aware that some seeds may persist through the digestive process and remain viable in manure. In addition, seeds may also be mixed with soil compacted in the grazing animal's hooves, allowing for further spread of the invasive species.

Cut-stump



cut-stem



This method involves removal of a woody species with a chain saw or other equipment and immediately treating the cut stump surface with a herbicide solution to prevent regrowth. Cut-stump or cut-stem treatments are appropriate for any woody or robust perennial species with a thick stem. This method should be considered when desirable species are intermixed with the invasive species in any environment. It is most successful later in the season when the plant is drawing nutrients to its root-stock. If desirable roots are tightly tangled with invasive roots, there is possibility for the desirable plants to be damaged.

Basal-Bark



This method involves applying a herbicide in a carrier of oil (i.e., diesel fuel, kerosene, etc.) along the bark of a woody species. Basal-bark treatments are appropriate for any woody species with stems under 6 inches in diameter. This method should be considered when desirable species are intermixed with the invasive species in any environment. It is most successful later in the season when the plant is drawing nutrients to its root-stock. If too much herbicide is applied, there is potential for run-off, which can damage surrounding desirable vegetation.

Hack and squirt



This method involves making cuts into the bark of a woody species with an axe or other implement and treating the exposed tissue with a herbicide treatment. Hack-and-squirt treatments are appropriate for any woody species with stems greater than 2 inches in diameter. This method should be considered when desirable species are intermixed with the invasive species in any environment, also when it is impractical to cut down existing invasive trees. It is most successful later in the season when the plant is drawing nutrients to its rootstock.

Other mechanical treatment methods

Prescribed burning



This method involves burning all plant life in a given area to kill and prevent growth of unwanted species. This should only be done in ecotypes that benefit from burning such as prairies or managed forest sites. Always check with your local authorities for proper permits and safety regulations.

Mulching



This method involves layering materials such as leaf litter, ground wood, plastic sheeting, or landscape fabric over unwanted species to prevent growth.

Girdling



This method involves cutting the bark and cambium layer of a woody species in a continuous ring around the trunk or stem.

Foliar spray

This method involves spraying a diluted herbicide solution onto the foliage of the plant species to be controlled. The label of each herbicide specifies the rates required for control of specific species. Herbicide labels will generally provide one or two types of application rates: either pounds, ounces, pints or quarts of product per acre or a percent solution. As the labels will not generally indicate over what area of ground the percent solution is to be applied, the amount of product per acre measurement is more accurate. When hand-spraying a herbicide, it is best to spray the foliage of the plant until it is completely wet, but before the herbicide starts dripping off of the surface.

Downy, Red, and Japanese brome *Bromus* spp.

Downy
brome:



Left to right: Collar region (13), Inflorescence (2), Young growth (2)

Red
brome:



Japanese
brome:



Left to right: Flowers (12), Inflorescence close-up (12)

Downy brome (Left) vs. Japanese brome (right) (28)

Downy brome (*B. tectorum*) is a summer annual grass that has narrow leaf blades covered by fine, soft, white hairs that can grow up to 18 inches tall. The ligule is irregularly toothed and stems are also covered with hairs. Flowers are a downy, drooping, panicle that turns purple from April to May. Seed spikelets have long, sharp bristles extending from each seed.

Japanese brome (*B. japonicas*) has longer hairs than downy brome, most notably on the underside of the leaf. It also has a shorter, less toothed ligule.

Seedheads of red brome (*B. rubens*) are upright, bottle brush-like tufts and have a purple cast.

Thistles

Carduus spp. and *Cirsium* spp.



Left to right: Canada thistle (2), Bull thistle (2), Musk thistle (1)

Musk Thistle (*Carduus nutans*) is a biennial with thick stems, a fleshy taproot and basal rosette. Leaves are alternate, smooth, dark green with a light green midrib. Leaves are deeply dissected, with each lobe having one to five spines. Flowers are spine-tipped bracts, deep purple and appear mid-spring to early summer. Plants give off a musky scent.

Canada Thistle (*Cirsium arvense*) is a rhizomatous perennial with lobed and spiny leaf margins. Leaves are smooth on the upper leaf surface, and can be smooth or hairy on the lower surface. The stem is mostly smooth, developing hairs at maturity. While the immature plant is a basal rosette, the mature plant does not exhibit one. Purple flowers appear during the summer, and the bracts have no spines.

Bull Thistle (*Cirsium vulgare*) is a biennial with a rosette in the first year. The upper leaf surfaces are incredibly spiny and the lower leaf surface is woolly. The stems are winged and spiny. Flowers appear in summer to early fall, with pink to purple flowers containing spiny bracts.

Sericea lespedeza, Bicolor lespedeza
Lespedeza cuneata, *Lespedeza bicolor*

Sericea lespedeza:

Right: Leaves (1)
 Left: Flower (3)



Bicolor lespedeza:

Left: Flower and stem (10)
 Right: Upper and lower leaf surface (10)



Sericea lespedeza grows from 1 to 5 feet in a bushy habit. Leaves are made up of three leaflets that are less than an inch long with sharp points and hairy lower surfaces. White to purple bilateral flowers appear in late summer in clusters or individually. The large 3- to 4-foot long taproot allows the plant to persist through drought.

Bicolor lespedeza is also bushy, but the 3- to 10-foot branches arch downward. Leaves are elliptical, with the lower surface a lighter color than the upper surface. Neither surface has any hairs. Flowers are dark pink and grow in spikes of five to 15 flowers on the ends of branches or upper leaf nodes. The plant has an extensive fibrous root system, making older plants very difficult to pull up.

Florida hedgenettle, rattlesnake weed
Stachys floridana



Left to right: Square stem (1),
Growth habit (1), Leaf (1)

This herbaceous perennial can grow up to 20 inches high. It is a winter weed, therefore leafing out in the fall then flowering and setting seeds in the spring. Leaves have an elongated triangular shape, arranged oppositely, have scalloped margins and are up to 3 inches long and up to 1 inch wide. Stems are green and four-sided. Pale lavender, bilateral flowers appear in the spring in whorls forming spikes at the end of stems. Roots are long, white, segmented tubers that resemble a rattlesnake's "rattle." This plant can be confused with purple deadnettle (*Lamium purpureum*) or catnip (*Nepeta cataria*), but neither of these plants have tubers.

Control

Measures:



Whole tubers must be removed for long-term control.

Apply dicamba at 2 oz ai/A postemergence for control of this weed.

Where	Size	Treatment	Date

Silverthorn, Autumn, and Russian olive

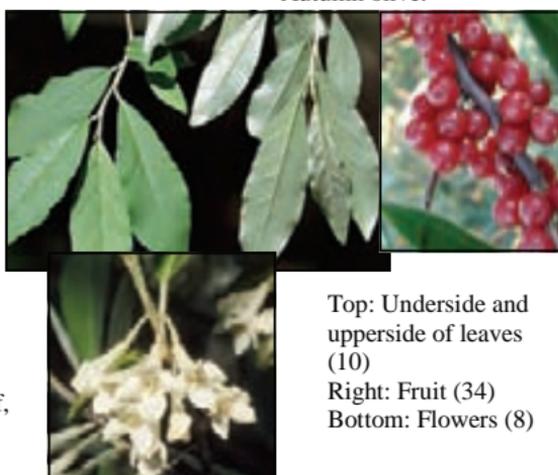
Elaeagnus spp.

Silverthorn olive:



Brown spots on underside of leaf, fading flowers (10)

Autumn olive:



Top: Underside and upper side of leaves (10)

Right: Fruit (34)

Bottom: Flowers (8)

Russian olive:

Left: Flowers
Right: Thorn

These woody shrubs are covered in alternately arranged, long, narrow silvery leaves. The shrubs can grow up to 30 feet tall and form a dense colony.

Autumn olive (*E. umbellata*) has deciduous, 1 inch-wide leaves with a silver coloration on the underside. It tends to be thornier than other *Elaeagnus* species. Clusters of long, fragrant, yellow flowers are produced in the spring with a juicy red fruit appearing in the summer.

Silverthorn (*E. pungens*) is a denser, evergreen shrub and has tall shoots emerging from the top of the plant. Leaves can be up to 2 inches wide and have many small brown spots on the underside of the leaf. White to brown flowers emerge in the late fall, with red berries appearing in the early spring.

Russian olive (*E. angustifolia*) has a dry, yellowish fruit with deciduous leaves ½ inch wide. It also tends to be thornier than other *Elaeagnus* species. Clusters of long, fragrant, yellow flowers are produced in the spring, with a dry, yellowing fruit appearing in the summer.

Japanese Privet, Chinese Privet

Ligustrum spp.

Chinese privet:



Branches (1)



Mature berries (1)



Immature berries (1)

Japanese privet:



Leaves, immature berries (10)



Flower, leaves (36)

These evergreen to semi-evergreen shrubs can grow up to 15 feet tall. Leaves are glossy with a smooth margin and have an opposite arrangement. Small plumes of white flowers appear in early summer at the end of branches; by fall dark blue berries are produced. This shrub grows in dense thickets, crowding out many other species growing in the area.

Japanese privet (*L. japonicum*) has tapering, sharp-tipped leaves that can reach 2 to 4 inches long and 1 to 1.8 inches wide. Leaves are dark green on the upper surface and have pale green veins on the lower surface.

Chinese privet (*L. sinense*) has smaller, thinner and more wavy leaves (1 to 2 inches long by ½ to 1 inch wide), and is usually shorter in height. Young branches and midveins on the underside of the leaf are densely pubescent.

Control
Measures:



Mowing will control the spread, but will not eradicate this species.

Apply imazapyr or hexazinone to the foliage or a cut-stump treatment with 2 to 4 oz ai/gal imazapyr to control this species. Apply imazapyr with caution due to the residual soil activity of this product.

Where	Size	Treatment	Date

Shrub Honeysuckles

Lonicera spp.

Amur honeysuckle (1)



Morrow's
Honeysuckle (1)



Up and Left:

Tartarian
honeysuckle,
note the differ-
ent colored
berries (1)

Shrub honeysuckles have a bush-like habit, opposite leaves and bloom in the spring. For information on Japanese honeysuckle vine, please see page 43.

Amur honeysuckle (*L. maackii*) can grow 20 feet tall with leaves that end in a long, tapered point. It produces pink to white flowers that fade to yellow. The fruit color is red.

Morrow's honeysuckle (*L. morrowii*) grows up to 10 feet and has grey-green, oblong leaves with hairs on the leaves' lower surface. The flowers are hairy and white, fading to yellow. The fruit color is red.

Tartarian honeysuckle (*L. tartarica*) is similar to Morrow's honeysuckle, but the leaves have no hairs. Also the fruit color can be red or yellow.

Native honeysuckles like grape honeysuckle (*L. prolifera*), yellow honeysuckle (*L. flava*), and red honeysuckle (*L. dioica*) can be distinguished by their blue or black berries.

Control
Measures:



Heavy mowing/cutting or grazing
by goats or deer for 3 to 5 years can
provide control of these species.

Foliar applications of imazapyr or glyphosate will provide control of these species.

Where	Size	Treatment	Date

Witchweed

Striga spp.



Left:
Witchweed growing on corn (14)



Right:
Whole plant (14)

This parasitic annual can grow up to 18 inches in height. Nearly opposite leaves are bright green, narrow, about an inch long, with smooth margins. Stems are sparsely covered in hairs and mature parts can have a square cross-section. Flowers are small (about ½ inch), bright red and appear in summer and continue throughout the growing season. Roots are white and succulent. This plant prospers by attaching its roots to a host plant's roots to siphon off nutrients. Witchweed generally parasitizes grass species but has been known to attach to dicots as well.

Control Measures: **If you suspect you have found this weed, report to APHIS immediately by calling (800) 206-WEED or (919) 513-4479.**

Where	Size	Treatment	Date

Listed below are the most common herbicides used for control of invasive species. Other effective products may be available that contain the same or similar active ingredients. Also listed below are formulas to help convert the active ingredient rates in the guide to the actual amount of product used. Please consult your local extension agent for herbicides recommended in your area.

Liquid formulations

$$\left(\frac{a/16}{b}\right) \times 128 = c$$

a = active ingredient rate (ex. **8** oz ai/A)
 b = product formulation (ex. **2.4** lbs/gal)
 c = amount of product in fluid ounces to apply per acre

Dry formulations

$$\left(\frac{d}{(e \div 100)}\right) \div 16 = f$$

d = recommended rate (ex. **4** oz ai/A)
 e = percent active ingredient (ex. **60%**)
 f = amount of product to use in ounces per acre

Common Name	Trade Name	Concentration
2,4-D	2,4-D Amine 4	3.8 lbs ai/gal or 39.30%
aminopyralid	Milestone	2.0 lbs ai/gal
cafentrazone	QuickSilver™ T&O Herbicide	21.3% or 1.9 lbs ai/gal
chlorsulfuron	Telar	75.00%
clopyralid	Transline	3.0 lbs ai/gal
dicamba	Banvel	4.0 lbs ai/gal
dichlobenil	Casoron 4G	4.00%
fluzafop-p-butyl	Fusilade	2.0 lbs ai/gal or 24.50%
fosamine	Krenite S Brush Control Agent	4.0 lbs ai/gal or 41.50%
glyphosate	Roundup Pro	4.0 lbs ai/gal
hexazinone	Velpar DF	75.00%
imazamox	Raptor Herbicide	1.0 lb ai/gal or 11.40%
imazapic	Plateau DG	70.00%
imazapyr	Arsenal AC	4.0 lbs ai/gal or 43.30%
imazethapyr	Pursuit Herbicide	2.0 lbs ai/gal or 21.60%
MCPA	MCPA Amine 4	3.7 lbs ai/gal or 39.90%
metribuzin	Sencor DF	75.00%
metsulfuron	Manor	60.00%
pronamide	Kerb 50-W (restricted use)	50.00%
quinclorac	Drive 75 DF Herbicide	75.00%
sethoxydim	Arrest	13.0% or 1.0 lbs/gal
sulfometuron	Oust XP	75%
tefluralin	Treflan E.C.	4.0 lbs ai/gal or 43.00%
terbacil	Sinbar Herbicide	80.00%
triclopyr	Remedy Ultra	5.5 lbs ai/gal or 60.45%

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