Invasive Weeds of the



THE UNIVERSITY OF TENNESSEE 💆

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COVER PHOTO CREDITS



- 1. Wavyleaf basketgrass Geoffery Mason
- 2. Bamboo Shawn Askew
- 3. Giant hogweed Antonio DiTommaso
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- 9. Kudzu Shawn Askew

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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

<u>Tabs</u>: 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:

Infestation present	On bordering land	No concern
Uncontrolled	Treatment initiated	Controlled
Large infestation	Medium infestation	Small infestation

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

<u>Grid</u>: 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.

<u>Webpage</u>: 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.

 $\underline{http://hortweeds.tennessee.edu/webapp/weedguide/Default.aspx}$

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 all-ways 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-Pullina



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 moved before seeding, and perennials when moved 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. Cutstump 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 rootstock. 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 rootstock. If too much herbicide is applied, there is potential for run-off, which can damage surrounding desirable vegetation.

Hack and sauirt

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 1992



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.

Mulchina 1



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

Girdling

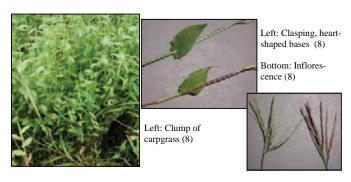


This method involves cutting the bark and cambium layer of a woody species in a continuous ring around the trunk or stem.

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.

Small carpgrass, Jointheadgrass Arthraxon hispidus



This summer annual grass has hairy-edged, ovate to lanceolate leaves that are 1 to 3 inches long. The leaves have a heart-shaped base that wraps around the stem. The finger-like spikelets appear in September through October. It is found in moist areas like ditches or wetlands. Small carpgrass can be mistaken for Japanese stiltgrass (*Microstegium* spp.); however, Japanese stiltgrass leaves do not have a heart-shaped base.



Use herbicides that are selective for grass and are approved for wetlands, such as fluazifop-p-butyl.

Where	Size	Treatment	Date

Giant reed



Left: Segmented stem (10)

Bottom: Inflorescence (9)

Right: Hairy-tufted base (11)





This perennial reed-like grass grows from 6.5 to 26 feet high. The stems are hollow and segmented, similar to bamboo, and can be up to 1.5 inches in diameter. The flower plume appears in late summer to early fall and can reach more than 3 feet in length. Leaves are large, smooth and 2 to 3.25 inches wide. The bases of the leaves are heart-shaped and can be hairy-tufted. The thick and fleshy root is up to 1.5 inches in diameter and forms a dense root mass.

Control Measures:



Burn after flowering.

Foliar applications of glyphosate at a rate of 65 to 81 oz ai/A can provide effective control when applied after flowering.

Where	Size	Treatment	Date

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









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.



Mowing brome species every 3 weeks will prevent seed production, but will not kill the existing grass. Hand-pulling on very small infestations can be effective.

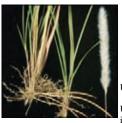
A combination of chemical control and burning is the most effective method. Applications of metribuzin at 0.43 to 1 lb ai/A or pronamide at 1lb ai/A in early spring before the perennial grasses emerge has provided some control. Burning should be conducted in May or June when plants are dry. Re-seeding or plugging of native grasses is necessary to prevent brome re-establishment. This process will have to be repeated for two to three years.

Preemergent applications of terbacil, metribuzin, trifluralin and pronamide may suppress downy brome when applied in conjunction with tillage.

Postemergence applications of the following should provide control of bromus species: sulfosulfuron at 1 oz ai/A sethoxydim at 4-8 oz ai/A glyphosate at 4-8 oz ai/A fluazifop-p-butyl at 0.5 oz ai/A imazapyr at 4.2 oz ai/A

Where	Size	Treatment	Date

Cogongrass Imperata cylindrica

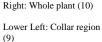




Up: Off-center midrib (7)

Upper Left: Roots, leaves, inflorescence (7)







This perennial, rhizomatic grass grows up to 6 feet tall. Leaf blades start from the ground, are stiff and have an off-center midrib. Blade edges are very sharp and finely serrated. The grass is a light green, turning a dark red in the fall. Long, soft, white plumes flower in the spring and late fall or winter, reaching 11 inches in length and 1.5 inches in width. Cogongrass can be confused with johnsongrass (*Sorghum halepense*), but johnsongrass has a more obvious white midrib and leaves 6 to 20 inches long, while cogongrass's leaves can grow 6 feet in length.

Control Methods:

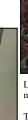


Combination of discing or mowing with an application of imazapyr 11.2 oz ai/A is the most effective treatment.

Where	Size	Treatment	Date

Japanese stiltgrass, Nepalese browntop

Microstegium vimineum







Left: Hairy ligule, swollen node, silver stripe (3)

Top: Decumbant growth habit. (3)

Right: Infestation (1)

This annual warm-season grass is low-growing with a decumbent habit. Leaves are arranged alternately, pointed at both ends, and have a silvery stripe of hairs down the center of the upper surface. The leaf midvein of the plant appears off-center. *Microstegium* spreads primarily by seeds, but also by stolon. Flower spikelets bloom in late summer to early fall. This plant can be confused with dayflower species (*Commelina* spp.), but dayflower has showy blue to purple flowers and a centered midvein.

Control Measures:



Mow just before seeds set; if mowed too early new plants will mature and set seed.

Apply a foliar application of 12 oz ai/A fluazifop-p-butyl.

Where	Size	Treatment	Date

Chinese silvergrass







Left to right: White midrib (10), Collar region (10), Whole plant (10), Inflorescence (10)

This perennial bunch grass can grow up to 12 feet in height. Individual grass blades grow from the base of the plant and reach about 6 feet tall, when they start drooping. Blades also have a distinctive white midrib. Flower stalks have leaf blades arranged alternately and are about 1 inch wide and 18 inches long. Flowers are arranged in a drooping fan that starts pink to red and matures to a silver color in late summer. This grass spreads by rhizomes. Individual clumps can reach upwards of 3 feet in diameter.

Control Measures:



Mow or graze repeatedly before flowering, but not in the fall, as it will promote new growth.

Apply a foliar application of 3 oz ai/A fluazifop-p-butyl or 16 oz ai/A glyphosate before seeds set.

Where	Size	Treatment	Date

Serrated tussock grass Nassella trichotoma







Bunch grass (39)

Short, white ligule (39)

Dark purple inflorescence (39)

This long-lived perennial bunch grass grows up to 3 feet tall with a 6- to 8-inch base. Leaf blades are very narrow (< 0.5 inch), tightly rolled and are very rough. The ligule is white, membranous and about 1/8 inch long with no hairs or splits. Dark purple flowers are produced in mid-summer and seedheads are formed in fall. In the fall, after many other grasses have turned tan or brown, tussock grass is still green with bleached white tips. Also, seedheads fall off as one piece, so any grass with seedheads visible in the spring cannot be tussock grass.

Control Measures:



Mow in summer, apply glyphosate at a rate of 16 oz ai/A glyphosate in the fall, then seed desirable species.

Where	Size	Treatment	Date

Kikuyugrass Pennisetum clandestinum





Left: Collar region (16)

Up: Stem (17)

Right: Inflorescence



This rhizatomous and stoloniferious grass can grow up to 2 feet tall, but is usually closer to 1 foot tall. Leaf blades are narrow and glabrous with finely serrated margins. Leaf sheathes (the lower part of the leaf that surrounds the stem) are a pale yellow and pubescent. The ligule is a dense row of hairs. The flower is the most distinctive feature, with three stamens on filaments up to 2 inches tall. This plant releases alleopathic chemicals, eliminating most plants around it.

Control Measures:



May spread viable plant parts to other areas.

To control this species, use a foliar application of fluazifop-p-butyl at 3 oz ai/A, quinclorac, or triclopyr. Repeat applications are often necessary for complete control.

Where	Size	Treatment	Date



Common reed *Phragmites australis*







Left to right: Stem, Infestation, Hairy ligule, Inflorescence (1)

This wetland grass can grow from 3 to 20 feet tall. Narrow (approximately 1 inch wide) leaves emerge from the stem in a manner similar to corn and grow 10 to 20 inches long. Flower heads produced throughout the summer are dense, feathery and grey to purple. This plant spreads primarily by large rhizomes that are found 6 inches deep, with roots produced at the nodes. Leaf and stem color are good ways to tell this species from the native reed species. Native reed leaves have a grayish cast, while the non-native has a yellowish cast. When the leaf blade is pulled away from the stem, the native reed has a shiny, smooth and reddish stem in the spring and summer, and the non-native is dull, ribbed and tan.

Control Measures:



Mowing will not help and extensive root systems will make hand-pulling or digging difficult.

Apply imazapyr at 8 oz ai/A or glyphosate at 48 to 80 oz ai/A to the upper foliage in early fall. Where desirable plants are present, inject or carefully drip 16 oz ai/A of glyphosate onto the stems. Burn dead plants the following spring to encourage growth of desirable plants.

Where	Size	Treatment	Date



This evergreen, woody, perennial grass grows from 3 to 15 feet tall. Leaves are elliptical with a pointed end. Stems are hollow, woody and often contain distorted nodes. Bamboo spreads primarily by rhizomes; however, sexual reproduction is also possible. Younger stems of native bamboos can be distinguished from invasive bamboos, as the native stems have a flat side (looks like the letter "D" when viewed in cross-section).

Control Measures:





Repeated mowing will exhaust the rhizomes over time.

If stand is not near desirable species, mow the bamboo stand, let it regrow to chest height then apply a foliar spray of glyphosate at 16 oz ai/A or imazapyr at 8 oz ai/A.

Where	Size	Treatment	Date

Johnsongrass Sorghum halepense







Left to right: Collar region (1), Young plant (1), Inflorescence (1)

This perennial grass can grow up to 8 feet tall. Leaves are broad (about 1 inch wide) and up to 2 feet long with a distinctive white midvein. Leaves sometimes have red spots and are folded in the stem. Stems are often pink or red near the base of the plant. Large purple panicles appear by mid-summer. This grass can be confused with many other native species. Eastern gammagrass (*Tripsacum dactyloides*) and switchgrass (*Panicum virgatum*) do not have a white midvein, while big bluestem (*Andropogon gerardii*) and indiangrass (*Sorghastrum nutans*) have no distinct midvein.

Control Measures:





Discing will replant root parts.

Many graminicides with active ingredients such as clethodim, sethoxydim and fluazifop-p-butyl have activity on johnsongrass when applied to foliage. Glyphosate also shows activity but it is nonselective and therefore may damage sensitive broadleaf plants.

Where	Size	Treatment	Date



Garlic mustard *Alliaria petiolata*





Left to right: Root (1), Whole plant (1), Basal rosette (2)

Immature plants have dark green basal rosettes with kidney-shaped leaves. Mature leaves are triangular and sharply toothed, decreasing in size the higher up they are on the stem. Small, white, four-petal flowers appear in clusters at the apex of the stem on second-year plant in mid-spring. A strong garlic odor is present when plants are crushed at all life stages. Basal rosettes can be confused with immature violets (*Viola* spp.), but crushing violets will not produce a strong garlic smell.

Control Measures:



Cut flowering stems at ground level before seed sets.

Apply metsulfuron at 0.5 oz ai/A, or imazapic at 0.95 to 1.4 oz ai/A to dormant rosettes in late fall or early spring. Late fall is a preferred timing, as most native species go dormant before garlic mustard.

Where	Size	Treatment	Date

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 fleshly 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.



Many systemic broadleaf herbicides such as 2,4-D, dicamba, aminopyralid or clopyralid are effective for control of musk and bull thistle. For Canada thistle, aminopyralid and clopyralid are the most effective treatments.

Thistle head weevils (*Rhynocyllus conicus*) can successfully control musk thistle.

Where	Size	Treatment	Date



Poison hemlock Conium maculatum







This biennial plant has a distinctive hollow stem with ribs and purple spots. It grows 3.3 to 10 feet and produces many white flowers on umbel-shaped heads. Leaves are finely divided. opposite, triangular in shape and have a foul odor when crushed. The root is long, white, fleshy and often undivided. Poison hemlock is similar to water hemlock (Cicuta maculata) and giant hogweed (Heracleum mantegazzianum), but the leaf veins in poison hemlock go to the tips of the teeth rather than the notches and the leaves of poison hemlock are not hairy. Also, this plant should not be confused with wild carrot (Dauca carota), as wild carrot has a single maroon flower in the center. In addition, poison hemlock flowers in the late spring, while wild carrot blooms in mid- to late summer. Also, wild carrot contains hairs and not the distinct purple spots found on the stems of poison hemlock.

Control Measures:



A foliar application of 2,4-D at 19.2 oz ai/A or dicamba at 16 oz ai/A will control this species.

Where	Size	Treatment	Date

Benghal dayflower Commelina benghalensis







Left to right: Seedling (31), Flower (30), Stem with red hairs (30)

This annual herb has alternate, lily-like leaves from 1 to 3 inches long and reddish hairs at the stem. Aboveground and underground flowers are produced. Aboveground flowers are small with showy blue to lilac petals from spring to fall. Underground flowers grow on rhizomes, are white and appear like swollen nodes. The plant grows in moist soil and has a sprawling habit. Bengal dayflower can be confused with other dayflower species, except only *C. benghalensis* has the presence of leaf hairs, a more lavender/lilac aboveground flower color and the production of underground flowers.

Control Measures:



This plant has shown a tolerance to glyphosate. Apply cafentrazone at 0.25 oz ai/A to the foliage.

Where	Size	Treatment	Date

Goatsrue Galega officinalis







Left to right: Flower (14), Whole plant (17), Leaves (14)

This perennial herbaceous legume has compound leaves with five to eight pairs of leaflets. Purple to white flowers appear in early summer and persist until frost. Goatsrue can grow up to 4 feet in height. This plant can be confused with crown vetch (*Coronilla varia*); however, goatsrue's flowers are in a spike form, while vetch flowers are in an umbel form.

Control Measures:



Mowing is ineffective as seeds can be produced on very short stems

Foliar application of dicamba at 8 to 12 oz ai/A, 2,4-D at 16 oz ai/A, or a combination of dicamba (8 oz ai/A) and 2,4-D (16 oz ai/A) in the summer during the bud stage and again in the fall for the next two years provides control of this species.

Where	Size	Treatment	Date

Giant Hogweed Heracleum mantegazzianum







Left to right: Flower (26), Seedling leaf (26), Whole plant (27)

The perennial herbaceous plant will cause severe skin irritation due to a photosensitizing compound (furanocoumarin) found in the plant sap. If skin comes in contact with the sap while sunlight is present, severe blistering will occur. Giant hogweed can grow up to 15 feet tall with small white flowers (early to mid-summer) in a large umbel. Stems are 2 to 4 inches in diameter with ridges, purple spots and hairs. Leaves have three deeply lobed leaflets, and the lower leaves can reach 5 feet in width. This species is similar to native cow parsnip (*Heracleum maximum*); however, cow parsnip is much smaller, reaching a maximum height of 6 feet.

Control Measures:





Wear proper personal protection equipment; cut roots at least 6 inches deep in the soil.

Apply a preemergence treatment of 32 to 128 oz ai/A dichlobenil or postemergence foliar treatment of 15.6 oz ai/A glyphosate, or 1 lb ai/A triclopyr for control of this species.

Where	Size	Treatment	Date

Korean clover and Japanese clover

Kummerowia spp.





Japanese clover: Left: Stem (19) Right: Flower (20)



Korean clover (*K. stipulacea*) is an upright, annual legume that reaches up to 2 feet tall. Its trifoliate leaves are 1/3 to an inch long, with hairs along the margin and mid-vein. Leaves of mature plants point towards the end of the branch, creating a cone. The bicolor purple to white flower blooms in mid- to late summer.

Japanese clover (*K. striata*) is a low-growing, spreading annual legume that grows to about 8 inches. The leaves are trifoliate and about ½ inch long. The mid-vein is very prominent with veins running perpendicular to it. It produces a purple to pink flower in mid-to late spring. These plants may be confused with lespedeza species (*Lespedeza* spp.), but lespedeza species are bushier and perennial.

Control Measures:



Apply metsulfuron at 0.3 to 0.6 oz ai/A, or dicamba at 8 to 16 oz ai/A to the plant foliage.

Where	Size	Treatment	Date

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.



Hand-pull when young, mowing will suppress growth but not eliminate this species.

Apply foliar applications of metsulfuron at 0.3 to 0.6 oz ai/A, or dicamba at 8 to 16 oz ai/A to the plant foliage.

Where	Size	Treatment	Date

Purple loosestrife

Lythrum salicaria



Flower (1)







Pointed

Infestation (1)

leaves (1)

caria square stem Second from right: L. alatum stem with wings (21)

Far right: L. sali-

This perennial plant can grow up to 8 feet high and 5 feet wide in wet soils and along stream banks. Leaves are narrow, pointed, opposite and have smooth edges. Stems are square, and one piece of rootstock may produce more than 50 stems. Flowers are pink to purple on long spikes in mid- to late summer. The root is a large taproot along with fibrous off-shoots. This plant can be distinguished from the native loosestrife (L. alatum), as native loosestrife has wings on

Control Measures:





its stems and one pink or purple flower at the leaf axils.



Mowing stimulates roots to resprout and spread.

Foliar application of 1 lb ai/A of triclopyr has been effective in controlling purple loosestrife. Glyphosate products registered for use in or near water have also been effective. Apply during budding or early flowering stages. Beetles (Galerucella spp.) have also provided biological control of this species.

Where	Size	Treatment	Date

Oriental ladysthumb, Asiatic smartweed Polygonum caespitosum



This herbaceous annual may grow up to 3 feet tall, but typically it remains prostrate. This plant prefers moist habitats like stream banks or ditches. Leaves are elliptical, measuring 1 to 3 inches long and ½ to 1 inch wide. Leaves have a dark green chevron on the upper surface that looks like a thumbprint. Stems are red with swollen nodes, often making the stem appear to zigzag. Tight clusters of pink flowers appear in mid-summer to fall. Oriental ladysthumb can be confused with other polygonum species like Japanese knotweed (*P. cuspidatum*); however, Japanese knotweed has white sprays of flowers and does not vine.

Control Measures:



Mow frequently to exhaust root and prevent seed production.

Foliar application of 27.2 oz ai/A glyphosate will provide control.

Where	Size	Treatment	Date



Membranous sheath (5)



Japanese knotweed





Zig-zag stem, flowers at nodes (1)

This herbaceous perennial grows up to 10 feet tall and has rhizomes up to 45 feet long. Leaves are ovate with a sharply pointed tip and are typically 2 to 5 inches wide and 2 to 6 inches long. Above each joint, membranous sheaths cover the stem. Zigzagging, hollow stems with swollen nodes start out as red then mature to brown. Sprays of green-white flowers emerge from each leaf node during the summer. Young plants may be confused with oriental ladyst-humb (*P. caespitosum*), but oriental ladysthumb has tight clusters of pink flowers, and often a dark green spot on the upper surface of the leaf.

Control Measures:



Hollow stem (2)

Mowing five times a year and hand pulling can provide effective control over a significantly long time period.

Apply 8 oz ai/A of glyphosate in the fall. Multiple years of treatment will be necessary for long-term control.

Where	Size	Treatment	Date

Crownvetch Securigera varia



Left to right: Flowers (10), Leaves and seeds (10), Mass planting

This herbaceous perennial has stems that grow up to 10 feet long, forming mounds up to 12 inches high. Alternate leaves are 2 to 6 inches long and have 15 to 25 leaflets with a single leaflet on the tip. Pink to purple 1 inch-wide flower clusters are produced in spring and continue blooming throughout the summer. Slender, long, green seed pods are produced in the fall and contain three to 12 seeds each. This plant may be confused with lespedeza species, but crownvetch leaves have considerably more leaflets than lespedeza.

Control Measures:



Mow repeatedly



Will poison horses





Late Spring

Apply 2.5 fl oz ai/A of aminopyralid to the foliage.

Size	Treatment	Date	

Tropical soda apple





Left to right: Flowers and spines (10), Spiny leaf veins (10)

This herbaceous perennial can reach up to 6 feet in height. Alternate, lobed leaves are up to 8 inches long and 6 inches wide, with spines along the main leaf veins and stem. Stems are hairy and have ½- to 1-inch long spines. Clustered flowers are typical, with five white petals and a pointed, yellow center. Flowers are produced throughout the growing season. Fruit is green and white mottled and 1 inch in diameter; maturing to a solid yellow.

Control Measures:



Hand-pull when young, but all parts must be removed for effective control. Due to the dangerous thorns, always wear thick gloves when pulling plants.

Mow plants before fruit forms then apply triclopyr at 44.5 oz ai/A on plant regrowth. Applying aminopyralid at 1.25 to 1.75 oz ai/A before flowering will reduce seed production potential.

Size	Treatment	Date	

Florida hedgenettle, rattlesnake weed Stachys floridana



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.



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

Where	Size	Treatment	Date

Puncturevine Tribulus terrestris



Left: Spiky seedhead (3)

Down: Flower and hairy leaves (3)



Spiny seed (3)

This prostrate summer annual can cover a radius of 8 feet in a growing season. Opposite leaves have three to seven pairs of leaflets. Leaflets are oblong, moderately to densely covered in silky hairs and about ½ to ½ inch long. Stems are green to red, usually prostrate, but become erect when shaded or in competition with neighboring plants. Single, small (½-inch diameter), bright yellow, five-petal flowers appear throughout the growing season. Fruits are produced in late summer and are round burrs about ½ inch in diameter with five parts. Each fruit part has two strong spines that can puncture bicycle tires.

Control Measures:



A preemergence application of chlorsulfuron at 1.5 oz ai/A or postemergence application of imazapyr at 3 oz ai/gal will provide control

Where	Size	Treatment	Date

Chocolate vine, fiveleaf akebia *Akebia quinata*



Left to right: New growth (2), Leaves (2), Fruit (2)

This vine has alternate palmately compound leaves containing five leaflets each and grows 20 to 40 feet in height. New leaves emerge with a burgundy color, turning blue-green when mature. Leaflets are oval with notched tips and entire margins. Flowers bloom in March and April and have three petals, are reddish to purple-brown and have a sweet, chocolate-like scent. The smooth leaf margins and five leaflets distinguish chocolate vine from other vines such as Virginia creeper (*Parthenocissus quinquefolia*) (toothed margin) and poison ivy (*Rhus radicans*) (three leaflets).

Control Measures:

A foliar application 2.8 lbs ai/A of triclopyr multiple times can provide control of chocolate vine.

Where	Size	Treatment	Date

Porcelainberry Ampelopsis brevipedunculata





Left: Fruit (2) Top: Leaves and flower (2)

This grape-like vine has bright green leaves that are deeply three- to five- lobed with toothed margins. Porcelainberry can climb 15 to 20 feet by tendrils that grow opposite of the leaves. It has small greenish-white flowers that bloom in mid-summer and produce distinctive fruits in the fall. The porcelain-looking fruits range from white to yellow to pastel shades of blue, green and purple. The vine can be confused with grape vine (*Vitis* spp.), but the fruits differ and the pith in the porcelainberry stems are white, while the grape stems have brown pith.

Control Measures:

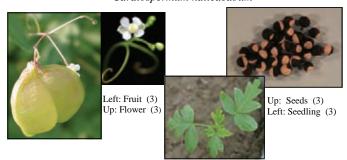


Hand-pulling may disturb nearby desirable species, as porcelainberry roots can merge with nearby roots.

Make a foliar application of 2 lbs ae/A of triclopyr for control of this species.

Where	Size	Treatment	Date

Balloon vine, Love-in-a-puff Cardiospermum halicacabum



This annual vine grows up to 10 feet a year and climbs with tendrils when support is present. The leaves are alternate and bipinnately compound with three pinnae and three leaflets. Leaf edges are coarsely serrate with smooth upper and lower surfaces. Small white flowers bloom from summer through fall. The fruit is a brown, papery capsule about 1 inch in diameter that contains three black seeds with heart-shaped scars.



Apply 2,4-D at 15 oz ai/A or bentazon at 12 oz ai/A for control of this species.

Where	Size	Treatment	Date

Bushkiller Cayratia japonica







Upper Left: Seedling (38) Lower Left: Leaf (38) Right: Flower (38)

This perennial vine has five leaflets per leaf, with the middle leaflet mounted on its own stem. The leaflets are ovate with dentate margins, with silvery-white coloration on their lower surface. It produces clusters of white, red and yellow flowers. It reproduces by creeping roots or rhizomes; no seed production has been reported in the U.S. to date. Bushkiller could be confused with Virginia creeper (*Parthenocissus quinquefolia*), as both plants have five leaflets, but the middle leaflet on Virginia creeper does not have its own stem.

Control Measures:



Foliar applications with sulfometuron at 4.64 oz ai/A plus metsulfuron at 1.26 oz ai/A at will provide control of this species.

Where	Size	Treatment	Date

Oriental bittersweet

Celastrus orbiculatus



Top Left: flower (2) Bottom Left: Fruit (2) Right: Leaf (1)





Oriental bittersweet is a deciduous vine that can climb more than 60 feet. The leaves are alternate, rounded and glossy with serrated edges reaching 2 to 5 inches in length. Small, inconspicuous flowers bloom in leaf axials in the spring. In the fall, three-sectioned yellow fruits split open to reveal bright red-orange seeds. In contrast, American bittersweet (*Celastrus scandens*) has more elliptical-shaped leaves, and the flowers and fruits only occur at the ends of the branches

Control Measures:



Apply 2,4-D at 14 to 56 oz ai/A or triclopyr to the foliage. Multiple applications may be required for total control of oriental bittersweet.

Where	Size	Treatment	Date

Field bindweed Convolvulus arvensis



Left to right: Flower (1), Twining stem (1), Young plant (1)

Field bindweed is a perennial vine with alternate arrow-shaped leaves. The leaf shape may vary greatly from one site to the next due to soil types and differing levels of nutrition. The flowers are white to pale pink funnels produced from summer until frost. This plant produces an extensive root system consisting of hardy rhizomes and very long fibrous roots. Field bindweed can be confused with hedge bindweed (*Convolvulus sepium*), but the leaves of hedge bindweed have squared bases and the plant produces larger flowers.

Control Measures:



Use a moldboard plow to expose roots, but do not use a disc.

Apply dicamba (8 to 16 oz ae/A) or 2,4-D (32 to 48 oz ae/A) postemergence in the fall, glyphosate (48 oz ae/A), metsulfuron (0.6 - 1.2 oz ai/A), or quinclorac (12 oz ai/A) are best applied during full bloom.

Bindweed mites (Aceria malherbae) can suppress field bindweed.

		• • •	
Where	Size	Treatment	Date

Pale Swallowwort

Cynanchum rossicum





Left to right: Flowers (2), Seedpods (2), Young growth (2)

This perennial vine can grow up to 6 feet long. The opposite leaves can grow up to 4 inches long and 3 inches wide and have a rounded base with a tapered, pointed end. Pale pink to red, five-petal flowers appear in clusters in late spring to summer. Long, slender seed pods about 3 inches long and a quarter inch wide are produced late summer. When mature, the pod produces brown seeds with white fringe to enable wind dispersal. Seeds are polyembrionic, which means they can produce more than one seedling per seed. Pale swallowwort can be confused with the native honeyvine (*Cynanchum leave*); however, honeyvine has leaves with a heart-shaped base and white flowers

Control Measures:



Foliar applications of glyphosate at 43 oz ai/A has been effective when applied after flowering. Cut-stem application, with 50% solution of glyphosate may also aid in the control of pale swallowwort.

0 31	-	*	
Where	Size	Treatment	Date

Cinnamon vine, Chinese yam Dioscorea oppositifolia

Leaves with immature bubils (1)

Bubils (1)

Bubils (1)

This herbaceous vine has heart-shaped leaves arranged alternately or in whorls of three. The leaves have seven to nine prominent veins starting from the base. New growth is a reddish-brown turning green with maturity; however, older leaves may have red veins and stems. The plant produces small white or green-white flowers that produce a cinnamon-like scent. Cinnamon vine reproduces either by bubil (small, round, brown aerial tuber) or by seeds held in a papery capsule. This plant may be confused with *Smilax* species (e.g., green briar), but cinnamon vine does not have thorns.

Control Measures:

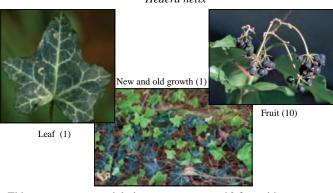


Mowing and clipping will aid in control, but it may take several growing seasons to achieve complete control.

Foliar applications of 72 oz ai/A of triclopyr or 64 oz ai/A of glyphosate post emergence have provided control of cinnamon vine.

Where	Size	Treatment	Date

English Ivy Hedera helix



This evergreen perennial vine can grow up to 90 feet with support. Leaves in the shade or on non-climbing stems have three to five lobes; however, leaves on climbing stems tend not to have any lobes. Both types of leaves have smooth edges and are dark green with white or pale green veins. Small, inconspicuous flowers appear in the fall on climbing stems that get enough sunlight.



A cut-stump application with 25 percent solution of triclopyr or 2 percent solution of glyphosate can provide control. These treatments may take multiple annual applications over multiple years to be effective. Use of adjuvants or soaps is recommended due to the waxy coating on the leaves.

Where	Size	Treatment	Date

Japanese honeysuckle Lonicera japonica







Left to right: Mature stem (1), Flowers (1), Young leaf (1), Whole plant (1)

This perennial vine has lobed leaves near the base of the stem and non-lobed leaves on the rest. Leaves can reach up to 3 inches in length, have no hairs and are egg-shaped. Japanese honeysuckle can grow upwards of 30 feet in height and will climb any available support structure. New growth appears pink to red, becoming woody as it matures. Its yellow-to-white flowers are produced in pairs in late spring to early summer. It can be distinguished from native vining honeysuckles such as coral honeysuckle (*L. sempervirens*) because Japanese honeysuckle's fruit is black, while native species have red to orange fruit. Also, native honeysuckles have fused leaves at the end of the stems, unlike Japanese honeysuckle.

Control Measures:





Root fragments will resprout.

Foliar applications of 2,4-D plus triclopyr in water has provided control of Japanese honeysuckle.

Where	Size	Treatment	Date

Kudzu Pueraria montana







Up: Seed pods (1) Left: Growth habit (1)

This fast-growing perennial vine can grow up to 1 foot a day, and 100 feet during the growing season. Frost kills the vegetation, but the long roots, which can reach 6 feet in length, can sprout back the following year. The trifoliate leaves are up to 1 foot wide and very hairy, with each leaflet containing no lobes or up to three lobes. Stems are also hairy, especially on the new growth. Long purple clusters of flowers appear in mid-summer, quickly followed by long, brown, pea-like seed pods containing 2 to 12 seeds. Seeds are rarely viable, so kudzu primarily spreads through vegetative reproduction.

Control Measures:

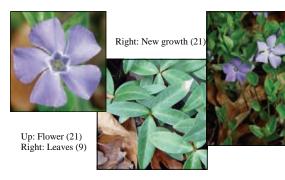


Goats and pigs will eat the roots.

Foliar application of clopyralid at 3.2 to 8 oz ai/A, metsulfuron at 1.8 to 2.4 oz ai/A, triclopyr at 44 oz ai/A or aminopyralid at 1.75 oz ai/A.

Where	Size	Treatment	Date

Vinca, Periwinkle



This trailing, evergreen vine can cover a 3-foot diameter area and grow 6 inches high. Its opposite leaves are shiny, dark green, elliptical and about 1 inch long. The showy pink to lavender flowers appear in masses in the spring and fall with sporadic blooms in the summer. Flowers are about 1 inch in diameter with five petals that get wider away from the center. It reproduces by rootlets at leaf nodes and underground runners. It can be confused with greater periwinkle (*Vinca major*), but greater periwinkle has larger leaves (more than 1.5 inches long) and flowers (1.5 inches wide).

Control Measures:



Poisonous to grazing animals.

Mow, cut or otherwise damage the plant then apply a systemic herbicide like glyphosate. Use of an appropriate adjuvant is critical for optimal control due to the thick cuticle of this species.

Where	Size	Treatment	Date

Chinese wisteria







Left to right: Leaf with branch (19), Flower (9), Fruits (22)

This woody vine can grow up to 65 feet in length. Alternate leaves are pinnately compound with each leaf up to 1 foot long. Leaves contain 13 to 19 elliptic leaflets with smooth margins that can grow 3 inches in length. Stems have white bark and twine their supports clock-wise. Showy, fragrant, pea-like, purple to blue flowers appear in late spring to early summer and are about 1 inch long, forming drooping spikes 8 to 20 inches long. Fruits are flat pods resembling pea-pods that are 4 to 6 inches long. This plant can be confused with native wisterias, but native wisterias do not have strong-smelling flowers and native species flower in mid- to late-summer.

Control Measures:







Foliar applications of clopyralid, triclopyr or glyphosate have provided control of this species.

Where	Size	Treatment	Date

Tree of Heaven Ailanthus altissima







Seedling (1)

Young seedlings are a cluster of leaves with various numbers of leaflets. Mature trees can be 80 to 100 feet tall and have alternate pinnately compound leaves with 11 to 41 leaflets each. Leaflets are lanceolate, acuminate and entire except for one to five basal teeth and produce a foul scent like burnt peanuts when crushed. Flowers are yellow-green and form a panicle in May-June, producing showy pink clusters of fruit. The entire margin and foul odor distinguish this plant from sumacs and other trees with compound leaves, like walnuts. *Note*: This plant produces an alleopathic compound (ailanthone) that prevents germination of other species in the surrounding soil.

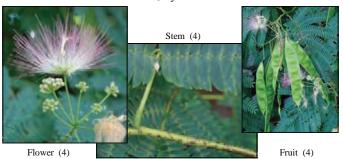
Control Measures:



Apply fosamine at 128 to 384 oz ai/A, dicamba at 32 oz ai/A, or metsulfuron at 0.6 to 1.2 oz ai/A to foliage while plants are young enough to avoid contacting non-target species.

Where	Size	Treatment	Date

Mimosa Albizia julibrissin



Mimosa has double compound leaves that give the 20- to 40-foot tree a ferny appearance. Each leaf has 10 to 25 pinnae and 40 to 60 leaflets per pinnae. In the summer the tree produces pink puffy flowers. Fruits are produced in the fall as tan seedpods. The tree often has multiple stems and a broad, spreading canopy. Seedlings can be confused with other double compound legumes, but mimosa does not have thorns or prickles like black locust (*Robinia pseudoacacia*) and is woody, unlike hemp sesbania (*Sesbania exaltata*).





Multiple applications will be required to manage resprouts.

Apply aminopyralid (1.75oz/A), clopyralid or triclopyr to foliage while plants are small enough to avoid spraying non-target species.

Where	Size	Treatment	Date

Japanese barberry Berberis thunbergii



Right: Flowers (8) Bottom right: Fruit (8) Bottom: Branch (10) Left: Spines (10)







This deciduous, low-growing shrub has leaves that range from ovate to obovate with smooth leaf margins. The leaves grow in clusters above spines and turn orange to red-purple in the fall. Young branches turn brown-red in winter. Small yellow flowers appear in May, and small bright red berries appear in mid-summer and remain throughout winter. American barberry's (*Berberis canadensis*) flower petals have a small notch at the tip, and common barberry (*Berberis vularis*) has spiny toothed leaves and flowers that form in more elongated clusters.

Control Measures:







Consistent mowing can be effective after large plants are removed.

A foliar application of MCPA at 48 oz ai/A can be sprayed in the fall while leaves are still present.

Where	Size	Treatment	Date

Paper mulberry Broussonetia papyrifera



Left: Velvety underside of leaf (10) Middle: Hairy twig (10) Upper right: Immature, mature fruit (33) Lower right: Flowers (10)



Paper mulberry is a deciduous tree that can grow up to 45 feet when mature. The twigs are hairy with a reddish-brown coloration, and the bark is tan. Leaves range from heart-shaped to having multiple lobes and all leaves have toothed edges. The lower surface of the leaf is velvety and the upper surface is rough and fuzzy. Leaves are arranged alternately and stems exude a milky sap when broken. The summer-maturing fruit is orange to reddish-purple and is about an inch in diameter. It is possible to confuse this plant with red mulberry (*Morus rubra*), but the upper surface of red mulberry's leaves are rough not fuzzy.

Control Measures:

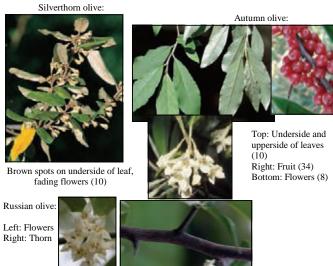




Apply a 15 to 25 percent solution of triclopyr for the hack and squirt method, and use a 50 percent of triclopyr solution for the cut stump method.

Where	Size	Treatment	Date

Silverthorn, Autumn, and Russian olive *Elaeagnus spp*.



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. umbellate*) 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.



Foliar applications of glyphosate or triclopyr have provided control of these species. Basal bark or cut stem treatments with glyphosate, imazapyr or triclopyr in a 10 to 50 percent solution may also be effective.

Where	Size	Treatment	Date

Winged Burning Bush

Euonymus alatus



Left to right: Berries (10), Branch (10), Fall color and winged branches (10)

This woody shrub gets its name from its brightly colored fall foliage and corky wings that run parallel along the stems. The leaves are elliptical with serrated edges and are arranged oppositely. The shrub produces small white-green flowers in the spring and small red to purple fruits in the late summer.

Control Measures:





Cut-stump treatments are most effective. Options include herbicide products that contain imazapyr or glyphosate.

Where	Size	Treatment	Date

Wintercreeper Euonymus fortunei











Left to right: Fruit (35), Leaves (10), Leaf buds and green stems (10), Bark (10)

This woody, evergreen, vining shrub has bright green, 1 to 2.5 inch long leaves containing silver-colored veins and finely toothed edges. Wintercreeper climbs trees and other supports, but if none are present this species will revert to a sprawling habit. Branches and stems have small brown or tan bumps. Small, inconspicuous, greenish-white clusters of flowers appear in mid-summer. Fruits. usually found on climbing stems in autumn, are red capsules that split to show orange-coated seeds. Wintercreeper can be confused with bittersweet (*Celastrus* spp.) or vinca (*Vinca* spp.) species; however, wintercreeper has opposite leaves, while bittersweet has alternate leaves with toothed edges. Vinca leaves have smooth edges.

Control Measures:

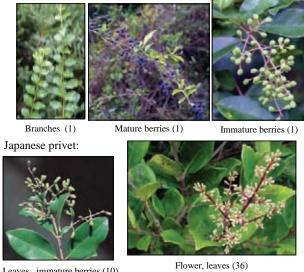


Foliar spray not recommended due to waxy coating on leaves. Use cut-stump treatments with glyphosate, triclopyr or 2,4-D.

Where	Size	Treatment	Date

Japanese Privet, Chinese Privet Ligustrum spp.

Chinese privet:



Leaves, immature berries (10)

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.







Morrow's Honeysuckle (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

Chinaberry, Umbrella tree

Melia azedarach



Left: Bi-pinnately compound leaves (10)

Right: Fruits (10)



This tree can grow up to 50 feet with a 2-foot trunk diameter. Leaves are bi-pinnately compound with leaflets that are between 1 and 3 inches long; the entire leaf can be up to 2 feet long. Leaflets have pointed ends, coarsely serrated margins and a blue-green cast. Showy hanging clusters of lavender flowers with five petals each are produced in the spring, and yellow to orange berries are produced in the fall. The berries persist into the winter months and often turn brown.

Control Measures:





Often requires repeat applications as roots will sucker.

Basal bark applications of 20 percent solution of triclopyr, or cutstump treatments with imazapyr, or triclopyr can control this species.

Where	Size	Treatment	Date

White mulberry



Top: White fruit (1)

Right: Mature and immature leaves on the same plant (1)





Mature and immature leaf (1)

This deciduous tree can grow upwards of 50 feet in height. Leaves range from irregularly lobed on younger trees to without lobes on older trees. Leaves are generally egg-shaped with toothed margins and are 2 to 4 inches long. The upper surface of the leaf is smooth and shiny, while the lower surface is smooth with hairs along the main veins. Leaf stems exude a white sap when broken. White to purple fruit similar to blackberries appears in early to mid-summer and can either be dry and tasteless or very sweet. This species can be confused with paper mulberry (*Broussonetia papyrifera*) and red mulberry (*Morus rubra*), except paper mulberry's fruits are round and orange to red, and red mulberry's leaves are rough and have no hairs.

Control Measures:





Untreated stumps will resprout.

Imazapyr at 8 oz ai/A, triclopyr in a 50 percent solution, or glyphosate in a 50 percent solution should be applied in cut-stump treatments.

Where	Size	Treatment	Date

Princesstree, Royal Paulownia, Empresstree Paulownia tomentosa

Up: Sapling left, new

growth right (1)

Left: Spotted stem (1)

Up: Hairy leaf surfaces (1)

This fast-growing deciduous tree can grow up to 50 feet tall and 2 feet in diameter. Leaves are similar in shape to the native catalpa species, but young princesstree leaves are fuzzy on both sides, while mature princesstree leaves are smooth on the upper surface and fuzzy on the lower surface. Catalpa leaves have sparse hairs on the upper surface and are rough underneath. Princesstree flowers are layender to blue, showy, up to 2 inches long, forming upright clusters reaching 12 inches in length. The woody, oval seedpods are formed in clusters and remain on the tree throughout the winter. In contrast, catalpa has thin, beanlike seedpods.

Control Measures:







Untreated rootstock will resprout.

Applications of triclopyr to the foliage has been effective in control of this species

or time species.			
Where	Size	Treatment	Date

White poplar *Populus alba*





Left: Lower leaf surface and twig white (12)

Right: Flowers

White poplar creates large colonies through sucker formation; these extensive colonies can shade out surrounding vegetation. This deciduous tree can reach heights of 80 feet with a trunk diameter of 3 feet. Leaves are cordate with toothed margins containing three to seven lobes. The leaves grow 2 to 6 inches long and 1 to 4 inches wide. When young, both sides of the leaf are covered in fine hairs, giving a silvery appearance; however, at maturity only the bottom surface is silver. New twig and bud growth is also covered in fine hairs. The bark of young white poplar is white, but older trees have rough, dark bark at the base.

Control Measures:







Burn multiple years for control of this species. This tree spreads by suckers, and one thicket of saplings may actually be part of one tree.

Applications of triclopyr to the foliage of young plants can provide control of White poplar.

Where	Size	Treatment	Date

Callery pear *Pyrus calleryana*







Left to Right: Growth habit (10), Flowers and leaves (10), Fruits (10)

This tree grows 30 to 50 feet tall and up to 30 feet wide. Leaves are alternate, simple, glossy green, with finely toothed margins. Showy clusters of white flowers appear in the spring before leafing out. Fruits are small brown balls that are produced in the late spring or summer. While landscaping cultivars (i.e., 'Bradford') are self-sterile (cannot reproduce with pollen from the same cultivar), there are many different cultivars planted close enough to one another to reproduce. Callery pear may be confused with apple species (*Malus* spp.), but apple trees have a more sprawling habit, while the pear is conically shaped.

Control Measures:







Foliar applications and cut-stump treatments with triclopyr have been effective in the control of callery pear.

		J 1	
Where	Size	Treatment	Date

European buckthorn, glossy buckthorn *Rhamnus frangula*





Left: Flowers (37)

Right: Branch with berries (5)

This shrub or small tree grows up to 18 feet tall. The alternately arranged leaves have veins that uniquely curve upwards. The upper surface is glossy and smooth, while the lower leaf surface contains sparse hairs with smooth margins. The tip of the leaf is rounded. Small clusters of four-petal yellow flowers appear at the leaf stems during the spring. Red fruit appear in the summer and turn black. Carolina buckthorn (*R. caroliniana*) is similar, but the leaves have toothed margins and have no hairs on either side.

Control Measures:



Apply 33.6 oz ai/A of fosamine or 80 oz ai/A of glyphosate to the foliage in the fall or apply a 20 percent glyphosate solution in a cut stump treatment.

Where	Size	Treatment	Date

Multiflora rose

Rosa multiflora



Left: Pinnately compound leaf (1)

Down: Arching canes (1



Right: Flower cluster (1)

Down: Black berries and spent flowers (1)





This sprawling shrub can grow up to 15 feet high and 13 feet wide. Leaves are pinnately compound with 5 to 11 leaflets per leaf, and the leaf stems are fringed. Leaflets are ½ to 1 inch long, oval and have toothed margins. Canes (or stems) are wide and have many curved, hard thorns. The canes grow 6 feet high before arching to the ground. Flowers are about 1 inch across, with five white petals forming a cluster in late spring. Small red fruits appear in clusters during late summer and persist through the winter. Plants reproduce by either seeds, stolons or tips of canes that root into the ground. Most other rose species do not have a fringed leaf stem.

Control Measures:







Thorns can puncture tires.

Apply metsulfuron at 0.2 oz ai/A or fosamine at 33.6 oz ai/A to the foliage in the fall. Triclopyr is also effective. Best results are achieved when foliar applications are made before extensive foliar feeding by Japanese beetle (Popilia japonica)

Where	Size	Treatment	Date

Wineberry, Wine raspberry Rubus phoenicolasius





Left: Trifoliate leaf (2) Right: Red hairs and spikes (2)

This deciduous shrub can grow up to 6 feet tall with arching canes up to 10 feet long. Leaves of this plant are alternate and contain three cordate leaflets with serrated margins. Leaf stems have fine red hairs and sometimes spikes. Stems are covered in fine red hairs and spines and the stems have the ability to root where the tip touches the ground. Non-showy flowers appear in late spring or early summer with four white petals, and the buds are also covered in fine red hairs. Fruit matures in the mid-summer to a red or dark orange. The fruit may also have hairs. This plant could be confused with other blackberries or raspberries, but neither exhibits the red hairs like wine wineberry.

Control Measures:





Applications of glyphosate or triclopyr have provided control of this species. Make applications to small plants to avoid spraying non-target species. Mow and then treat regrowth with the above herbicides to control larger infestations.

Where	Size	Treatment	Date

Japanese spiraea Spiraea japonica





Branch (10) Right: New and faded flowers (10)

Left:

This decidous shrub can grow to a height of 6 feet. The alternately arranged leaves are lanceolate, have serrated margins and have no hairs. Leaves can be up to 1.5 inches wide and 4.5 inches long. Stems have no hairs except new growth, which contains dense hairs. Flowers appear in early summer as wide, flat clusters of pink flowers. Japanese spirea can be confused with native spirea, but native spireas have no hairs on the branches or pink flowers.

Control Measures:



Mowing will only suppress growth, it will not eradicate the infestation.

Apply 8 oz ai/A of triclopyr to the foliage.

Where	Size	Treatment	Date

Chinese tallowtree, popcorn tree *Triadica sebifera*

Bottom: Flowers and leaves (6) Right: Growth habit (6)



This deciduous tree can reach heights of more than 50 feet tall. Leaves are simple, alternate, oval- or square-shaped, and have distinct yellow veins visible from either surface of the leaf. Leaves will grow 1 to 3 inches long and 1 to 2 inches wide. Bark is rough and often peels off vertically in thin strips. Flowers appear in late spring or early summer, are green-yellow and form a drooping spike up to 8 inches long. Fruits are three-sided capsules that are ½ to 1 inch long by 1 inch wide. Mature fruit turns black before the sides peel back, exposing three white seeds that are covered by a tallow-containing substance.

Control Measures:







Poisonous to cattle

Foliar applications of fosamine at 128 to 384 oz ai/A or imazapyr at 8 oz ai/A are effective when applied in the fall. Use a 5 percent solution of triclopyr for basal bark applications.

Size	Treatment	Date
	Size	Size Treatment

Japanese dodder Cuscuta japonica











This rapidly growing parasitic, annual plant can grow up to 6 inches a day and infects a wide array of plants from small ornamentals to entire mature trees. Japanese dodder does not infect monocot species such as grasses or lilies. The stem is a bright yellow-green to gold and is about the diameter of cooked spaghetti (0.1 inch). Flowers are cream-colored, bell-shaped, less than 1/8 inch long, and appear in late summer to fall. Leaves appear as tiny scales on the stem. Native species of dodder have thin, orange stems and do not generally infect large hosts such as woody shrubs or trees.

Control Measures:





As Japanese dodder attaches to the host plant with very fine rootlets, it is necessary to kill both the dodder and the host plant to prevent further infestation. Use a foliar spray of glyphosate to kill both the dodder and the host plant.

Where	Size	Treatment	Date

Broomrape Orobanche spp.







Flower examples (24)

New growth (25)

This parasitic plant grows from 4 to 12 inches tall and is either a single stem or a group of stems, each originating from the soil. The plant appears in early spring and flowers soon after. Stems are without chlorophyll and are tan or yellow. Snapdragon-like flowers are white to lavender, bilateral and appear in late winter to late spring. Broomrape attaches to the stem of host species (typically dicot crops) and siphons away water and nutrients.

Control Measures:



Clean all cultivating tools to prevent spread of this species.

Many herbicides show activity on this plant, but few are selective for its control. Once broomrape connects with a host plant, any systemic herbicides will transfer to both the broomrape and the host plant.

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 If you suspect you have found this weed, report to Measures: 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.

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%
fluazifop-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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- 21. Dan Tenaglia Missouriplants.com*
- 22. David J. Moorhead University of Georgia*
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- 25. Steve M. Brown University of Georgia*
- 26. Melissa Bravo The Pennsylvania State University
- 27. Antonio DiTommaso Cornell University
- 28. Phil Stahlman Kansas State University
- 29. Forest and Kim Starr www.hear.org*
- 30. Herb Pilcher USDA Agricultural Research Service*
- 31. Theodore Webster USDA Agricultural Research Service*
- 32. David G. Smith www.delawarewildflowers.org*
- 33. Amy Richard University of Florida*
- 34. Pennsylvania Department of Conservation and Natural Resources*
- 35. Keith Langdon National Park Service*
- 36. J.S. Peterson USDA-NRCS PLANTS Database*
- 37. John M. Randall The Nature Conservancy
- 38. Robert J. Richardson North Carolina State University
- 39. Jackie Miles Auckland Regional Council
- 40. Kim Camilli, Texas Forest Service*
- 41. Barry Rice, sarracenia.com*
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