

Prescriptions for Specific Nonnative Invasive Plants

The following are herbicide prescription summaries for prevalent invasive plants, detailing mainly selective application treatments. These prescriptions have been assembled from published research results, unpublished trials, State reports, weed council manuals, magazines, and Web sites. In general, very few species-specific experiments have been reported that compare a full array of treatments for nonnative invasive plant species. But until further specific understanding is gained, we must proceed with current knowledge and technology to combat this invasion. Herbicides are mentioned in order by effectiveness when comparative information is available or alphabetically when such information is lacking. Remember to follow the label-specified maximum herbicide amounts that are permissible for an acre of land when using selective application treatments.

Nonnative Trees

Nonnative tree species hinder reforestation and management of right-of-ways and natural areas as well as dramatically altering habitats. Some occur as scattered trees while others form dense stands. Most spread by prolific seed production and abundant root sprouts. They can be eliminated with herbicides by stem injection, cut-treat, and soil spots, with basal and foliar sprays for seedlings and saplings. Following stem control, total elimination requires surveillance and treatment of root sprouts and plant germinants that originate from the soil seed bank.



Tree-of-Heaven, *Ailanthus*

Tree-of-heaven or ailanthus (*Ailanthus altissima*) is a deciduous tree to 80 feet (25 m) tall with long pinnately compound leaves, gray slightly fissured bark, and large terminal clusters of greenish flowers in early summer.

Flowers and other parts of the plant have a strong odor.

Viable seed are produced by 2- to 3-year-old plants. Immature appearing seeds are capable of germination. Root sprouts may appear after the main stem is deadened, and root segments left in soil after pulling treatments will sprout. Tree-of-heaven sprouts have been found to have 10 to 14 feet (3 to 4 m) of first year height growth, while seedlings can grow 3 to 6 feet (1 to 2 m) in the first year. This vigorous growth can continue for 4 or more years.

*Nontarget plants may be killed or injured by root uptake.

U Transline controls a narrow spectrum of plant species.

Recommended control procedures:

Large trees. Make stem injections and then apply Garlon 3A, Pathway*, Pathfinder II, or Arsenal AC* in dilutions and cut spacings specified on the herbicide label (midsummer best, late winter somewhat less effective). For felled trees, apply these herbicides to stem and stump tops immediately after cutting.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix), Krenite S as a 30-percent solution (3 quarts per 3-gallon mix), or Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix).



Silktree, *Mimosa*

Silktree or mimosa (*Albizia julibrissin*) is a small legume tree to 10 to 50 feet (3 to 15 m) tall that reproduces by abundant seeds and root sprouts. It has feathery deciduous leaves, smooth light-brown bark, and showy pink blossoms that yield dangling flat pods. Seedpods float and seed remain viable for many years.

Recommended control procedures:

Large trees. Make stem injections using Arsenal AC* or Garlon 3A in dilutions as specified on the herbicide label (anytime except March and April). For felled trees, apply these herbicides to stem and stump tops immediately after cutting.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

Resprouts and seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant:

- July to OctoberóGarlon 3A, Garlon 4, or glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix)
- July to SeptemberóTransline^U as a 0.2- to 0.4-percent solution (1 to 2 ounces per 3-gallon mix)



Princesstree, Paulownia

Princesstree or paulownia (*Paulownia tomentosa*) is a deciduous tree to 60 feet (18 m) tall with large heart-shaped leaves that are fuzzy hairy on both sides and pecan-like nuts in clusters (containing many tiny winged seeds) following showy pale-violet flowers in early spring. Stump sprouts and root sprouts may eventually emerge after main stems are deadened.

Recommended control procedures:

Large trees. Make stem injections using Arsenal AC* or a glyphosate herbicide in dilutions and cut spacings specified on the herbicide label (anytime except March and April). For felled trees, apply these herbicides to stem and stump tops immediately after cutting.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

Resprouts and seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix); a glyphosate herbicide, Garlon 3A, or Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix).



Chinaberrytree

Chinaberrytree (*Melia azedarach*) is a deciduous tree growing to about 50 feet (15 m) tall. It has lacy, many-divided leaves that are dark green and blue flowers in spring that yield round yellow fruit that persist during winter. Stump sprouts and root sprouts may eventually emerge after main stems are deadened.

Recommended control procedures:

Trees. Make stem injections using Arsenal AC*, Pathway*, Pathfinder II, or Garlon 3A in dilutions and cut spacings specified on the herbicide label (anytime except March and April). For felled trees, apply these herbicides to stem and stump tops immediately after cutting.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

*Nontarget plants may be killed or injured by root uptake.

Sprouts and seedlings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Garlon 3A or Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix); Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix).



Tallotree, Popcorn tree

Tallotree or popcorn tree (*Triadica sebifera*, formerly *Sapium sebiferum*) is a deciduous tree growing to 60 feet (18 m) tall that has heart-shaped leaves turning scarlet in fall, long drooping flowers in spring, and bundles of white waxy popcorn-like seeds in fall and winter. Three-year-old plants can produce viable seed and small seedlings can be easily hand pulled. Burning results in abundant seedlings.

Recommended control procedures:

Large trees. Make stem injections using Arsenal AC*, Garlon 3A, or Pathfinder II in dilutions and cut spacings specified on the herbicide label (anytime except March and April). For felled trees, apply the herbicides to stem and stump tops immediately after cutting (at least a 10-percent solution for Garlon 3A). Ortho Brush-B-Gone (triclopyr) and Enforcer Brush Killer (triclopyr) are effective for treating cut stumps and readily available to homeowners in retail garden stores. For treatment of extensive infestations in forest situations, apply Velpar L* to the soil surface within 3 feet of the stem (one squirt of spot gun per 1-inch stem diameter) or in a grid pattern at spacings specified on the herbicide label.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix), Krenite S as a 30-percent solution (3 quarts per 3-gallon mix), or Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix).



Russian Olive

Russian olive (*Elaeagnus angustifolia*) is a small thorny tree to 35 feet (10 m) tall that has microscopic silvery scales covering leaves, twigs, and fruits. Leaves are long and narrow with entire margins. Bark is fissured and reddish brown. Olive-like fruit are yellow and appear in late summer to fall.

Recommended control procedures:

Trees. Make stem injections using Arsenal AC* or Garlon 3A in dilutions and cut spacings specified on the herbicide label (anytime except March and April). For felled trees, apply the herbicides to stem and stump tops immediately after cutting.

Saplings. Apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.

Seedlings and saplings. Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Arsenal AC* as a 1-percent solution in water (4 ounces per 3-gallon mix); a glyphosate herbicide, Garlon 3A, or Garlon 4 as a 2-percent solution in water (8 ounces per 3-gallon mix) for directed spray treatments that have limited or no soil activity.

Nonnative Shrubs

Nonnative shrubs often occur with nonnative tree species and present similar problems. Herbicide control options are similar to trees, with the exception that foliar sprays can be used more often and are more effective. All are shade tolerant with bird-dispersed seeds resulting in scattered plants under existing forest canopies (except nonnative roses), which requires additional surveillance within the interior of forest stands.



Silverthorn, Thorny Olive

Silverthorn or thorny olive (*Elaeagnus pungens*) is an evergreen, densely bushy shrub 3 to 25 feet (1 to 8 m) in height. It has long limber projecting shoots, scattered thorny, dense alternate leaves silver scaly in spring on both top and bottom becoming dark green above and silvery beneath by midsummer. Oblong fruit red and brown scaly appear in spring.

Recommended control procedures:

- Thoroughly wet all leaves with Arsenal AC* or Vanquish* as a 1-percent solution in water (4 ounces per 3-gallon mix) with a surfactant (April to October).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts

per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).



Autumn Olive

Autumn olive (*Elaeagnus umbellata*) is a tardily deciduous bushy leafy shrub, 3 to 20 feet (1 to 6 m) in height, with scattered thorny branches. It has alternate leaves green above and silvery scaly beneath, with many red berries in fall having silvery scales.

Recommended control procedures:

- Thoroughly wet all leaves with Arsenal AC* or Vanquish* as a 1-percent solution in water (4 ounces per 3-gallon mix) with a surfactant (April to October).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).



Winged Burning Bush

Winged burning bush (*Euonymus alata*) is a deciduous, wing-stemmed, bushy shrub to 12 feet (4 m) in height, multiple stemmed and much branched, canopy broad and leafy. It has small and obovate opposite leaves, green turning bright scarlet to purplish red in fall, along stems with four corky wings. Many orange fruit appear as stemmed pairs in leaf axils and turning purple in fall.

Recommended control procedures:

- Thoroughly wet all leaves with Arsenal AC* or Vanquish* as a 1-percent solution in water (4 ounces per 3-gallon mix) with a surfactant (April to October).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts

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per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).



Chinese Privet, European Privet

Chinese privet (*Ligustrum sinense*) and European privet (*L. vulgare*) are difficult to distinguish except at flowering, both are evergreen to semievergreen. Both are thicket-forming shrubs to 30 feet (9 m) in height that are soft woody, multiple stemmed with long leafy branches and opposite leaves less than 2 inches long. Showy clusters of small white flowers in spring yield clusters of small ovoid, dark-purple berries during fall and winter.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (August to December): a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix) or Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray. Or, cut large stems and immediately treat the stumps with Arsenal AC* or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stumps and cut stems with Garlon 3A or a glyphosate herbicide as a 20-percent solution in water (2.5 quarts per 3-gallon mix) with a surfactant.



Japanese Privet, Glossy Privet

Japanese privet (*Ligustrum japonicum*) and glossy privet (*L. lucidum*) are evergreen to 35 feet (10 m) in height, with upward spreading canopies. They have thick leathery opposite leaves 2 to 4 inches (5 to 10 cm) long, and hairless leaves and stems. Clusters of small showy white flowers in spring yield small rounded green to purple fruit.

* Nontarget plants may be killed or injured by root uptake.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: August through September—Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix) or Garlon 4 as a 3-percent solution (12 ounces per 3-gallon mix); March to June—a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with Arsenal AC* or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stumps and cut stems with a glyphosate herbicide or Garlon 3A as a 20-percent solution in water (2.5 quarts per 3-gallon mix) with a surfactant.



Bush Honeysuckles

Amur honeysuckle (*Lonicera maackii*), Morrow's honeysuckle (*L. morrowii*), Tatarian honeysuckle (*L. tatarica*), and sweet-breath-of-spring (*L. fragrantissima*) are all tardily deciduous, upright, arching-branched shrubs. Amur is to 30 feet (9 m) in height and spindly in forests, Morrow's is to 6.5 feet (2 m) in height, and Tatarian and sweet-breath-of-spring are to 10 feet (3 m) in height. All are much branched and arching in openings, multiple stemmed, with dark-green oval-to-oblong distinctly opposite leaves 0.8 to 2.4 inches (2 to 6 cm) long. Fragrant showy tubular white-to-pink or yellow paired flowers appear from May to June. Abundant paired berries are red to orange during winter. Seeds are long-lived in the soil.

Recommended control procedures:

- Thoroughly wet all leaves with glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix) with a surfactant (August to October). Or, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.
- For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).



Sacred Bamboo, *Nandina*

Sacred bamboo or nandina (*Nandina domestica*) is an evergreen erect shrub to 8 feet (2.5 m) in height, with multiple bushy stems resembling bamboo, glossy pinnately to bipinnately compound green or reddish leaves. Early summer terminal clusters of tiny white-to-pinkish flowers yield dangling clusters of red berries in fall and winter.

Recommended control procedures:

- Thoroughly wet all leaves with glyphosate herbicide as a 1-percent solution in water (4 ounces per 3-gallon mix) with a surfactant (August to October). Or, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray.
- For stems too tall for foliar sprays, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).
- Collect and destroy fruit.



Nonnative Roses

Multiflora rose (*Rosa multiflora*), Macartney rose (*R. bracteata*), Cherokee rose (*R. laevigata*), and other nonnative roses are all evergreen except multiflora and are all erect, arching, or trailing shrubs to 10 feet (3 m) in height or long, clump forming. They have pinnately compound leaves with three to nine leaflets, frequent recurved or straight thorns. Clustered or single white-to-pink flowers in early summer yield red rose hips in fall to winter.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: April to June (at or near the time of flowering) Escort* at 1 ounce per acre in water (0.2 dry ounces per 3-gallon mix); August to October Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix) or Escort* at 1 ounce per acre in water (0.2 dry ounces per 3-gallon mix); May to October repeated applications of a glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix), a less effective treatment that has no soil activity to damage surrounding plants.

*Nontarget plants may be killed or injured by root uptake.

- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to young bark as a basal spray (January to February or May to October). Or, cut large stems and immediately treat the stumps with one of the following herbicides in water with a surfactant: Arsenal AC* as a 10-percent solution (1 quart per 3-gallon mix) or a glyphosate herbicide as a 20-percent solution (2.5 quarts per 3-gallon mix).

Nonnative Vines

Nonnative vines are some of the most troublesome invaders because they often form the densest infestations, making herbicide applications difficult. Many of these vines overtop even mature forests and often form mixed-species infestations with nonnative trees and shrubs. Specific herbicides can be effective on certain vines while not controlling, but actually releasing any underlying nonnative trees and shrubs. In these situations, select the best herbicide or herbicide mixture for controlling all the nonnative species in a mixed-species infestation. Vine control is always difficult because foliar active herbicides must move through lengthy vines to kill large unseen woody roots and tubers. Thus, herbicides that have both soil and foliar activity are often the most effective. Only the lower foliage within sprayer reach needs to be treated with a herbicide having both foliar and soil activity. With all herbicides, spray foliage of climbing stems as high as possible and if not controlled, then cut vines before retreatment.



Oriental Bittersweet

Oriental bittersweet (*Celastrus orbiculatus*) is an attractive but very invasive deciduous, twining, and climbing woody vine to 60 feet (20 m) with drooping branches in tree crowns, forming thicket and arbor infestations. It has alternate elliptic-to-rounded leaves 1.2 to 5 inches (3 to 12 cm) long. Its axillary dangling clusters of inconspicuous yellowish flowers yield green spherical fruit that split to reveal three-parted showy scarlet fleshy covered seeds, which remain through winter at most leaf axils.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Garlon 4, Garlon 3A, or a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix).
- For stems too tall for foliar sprays, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts

per 3-gallon mix) with a penetrant (check with herbicide distributor) to the lower 16 inches of stems. Or, cut large stems and immediately treat the cut surfaces with one of the following herbicides in water with a surfactant: Garlon 4 or a glyphosate herbicide as a 25-percent solution (32 ounces per 1-gallon mix).



Climbing Yams

Air yam (*Dioscorea bulbifera*), Chinese yam or cinnamon vine (*D. oppositifolia*, formerly *D. batatas*), and water yam (*D. alata*) are herbaceous, high climbing vines to 65 feet (20 m) that cover shrubs and trees in infestations. They have twining and sprawling stems with long-petioled smooth heart-shaped leaves and dangling potato-like tubers (bulbils) that appear at leaf axils and drop to form new plants. Aerial tubers spread down slope by gravity and by water. All species also have large underground tubers that make control difficult.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October): Garlon 3A or Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix). Sometimes the air yams take up the herbicide; otherwise, they must be collected and destroyed (not composted).
- Cut climbing plants just above the soil surface and immediately treat the freshly cut stem with undiluted Garlon 3A (safe to surrounding plants).



Winter Creeper, Climbing Euonymus

Winter creeper or climbing euonymus (*Euonymus fortunei*) is an evergreen shrub to 3 feet (1 m) in height and woody trailing vine to 40 to 70 feet (12 to 22 m) that forms a dense ground cover and climbs by clinging aerial roots along the stem. It has leaves that are opposite, thick, and dark green or green-white variegated on green stems. Pinkish-to-red capsules split open in fall to expose orange fleshy covered seeds.

Recommended control procedures:

- Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant (July to October for successive years): Tordon 101*^â as a 3-percent solution (12 ounces per 3-gallon mix) or Tordon K*^â as a 2-percent solution (8 ounces per 3-gallon mix).

*Nontarget plants may be killed or injured by root uptake.

^âWhen using Tordon herbicides, rainfall must occur within 6 days after application for needed soil activation. Tordon herbicides are Restricted Use Pesticides.

- Or, repeatedly apply Garlon 4 or a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) in water with a surfactant, a less effective treatment that has no soil activity to damage surrounding plants.
- Cut all vertical climbing stems to prevent fruiting and spread by birds.



English Ivy

English ivy (*Hedera helix*) is an evergreen vine climbing to 90 feet (28 m) that forms dense ground cover and climbs by aerial roots. It has thick dark-green leaves with whitish veins when juvenile that are heart-shaped with three to five pointed lobes, later becoming broadly lanceolate, and terminal flower clusters in summer that yield dark-purple berries in winter and spring.

Recommended control procedures:

- Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant (July to October for successive years): Garlon 3A or Garlon 4 as a 3- to 5-percent solution (12 to 20 ounces per 3-gallon mix) or a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix). Use a string trimmer to reduce growth layers and injure leaves for improved herbicide uptake. Cut large vines and apply these herbicides to cut surfaces.
- Or, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to large vines being careful to avoid the bark of the host tree.



Japanese Honeysuckle

Japanese honeysuckle (*Lonicera japonica*) is a semievergreen to evergreen woody vine, high climbing and trailing to 80 feet (24 m), branching and often forming arbors in forest canopies and/or ground cover under canopies. It has opposite leaves and long woody rhizomes that sprout frequently and make control difficult.

Recommended control procedures:

- Apply Escort* with a surfactant to foliage June to August either by broadcast spraying 2 ounces per acre in water (0.6 dry ounces per 3-gallon mix) or by spot spraying 2 to 4 ounces per acre in water (0.6 to 1.2 dry ounces per 3-gallon mix).
- Or, treat foliage with one of the following herbicides in water with a surfactant (July to October or during warm days in early winter) keeping

spray away from desirable plants: a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) or Garlon 3A or Garlon 4 as a 3- to 5-percent solution (12 to 20 ounces per 3-gallon mix).

■ Or, cut large vines just above the soil surface and immediately treat the freshly cut stem with a glyphosate herbicide or Garlon 3A as a 20-percent solution (2.5 quarts per 3-gallon sprayer) in water with a surfactant July to October (safe to surrounding plants).

■ Prescribed burning in spring will reduce dense ground mats and sever climbing vines for more effective herbicide treatments to resprouting vines.



Kudzu

Kudzu (*Pueraria montana*) is a deciduous twining, trailing, mat-forming, woody leguminous vine 35 to 100 feet (10 to 30 m) with lobed three-leaflet leaves. Large root crowns that increase in size with age are difficult to control. Prescribed burning in spring can clear debris, sever climbing vines, and reveal hazards before summer applications.

Recommended control procedures:

■ Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant: July to October for successive years when regrowth appearsóTordon 101*^á as a 3-percent solution (12 ounces per 3-gallon mix) or Tordon K*^á as a 2-percent solution (8 ounces per 3-gallon mix), either by broadcast or spot sprayóspraying climbing vines as high as possible. July to September for successive yearsóEscort* at 3 to 4 ounces per acre in water (0.8 to 1.2 dry ounces per 3-gallon mix)óor when safety to surrounding vegetation is desired, Transline^Ü as a 0.5-percent solution in water (2 ounces per 3-gallon mix); spray climbing vines as high as possible or cut vines that are not controlled after herbicide treatment.

■ For partial control, repeatedly apply Garlon 4 or a glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix) with a surfactant during the growing season. Cut large vines and immediately apply these herbicides to the cut surfaces. Or, apply Garlon 4 as a 20-percent solution in commercially available basal oil, diesel fuel, or kerosene (2.5 quarts per 3-gallon mix) with a penetrant (check with herbicide distributor) to large vines as a basal spray (January to April), which controls vines less than 2 inches in diameter.

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ÜTransline controls a narrow spectrum of plant species.

áWhen using Tordon herbicides, rainfall must occur within 6 days after application for needed soil activation. Tordon herbicides are Restricted Use Pesticides.



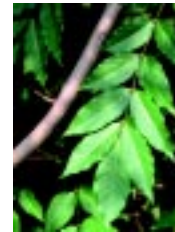
Vincas, Periwinkles

Common periwinkle (*Vinca minor*) and bigleaf periwinkle (*V. major*) are evergreen to semievergreen (leaves always present) somewhat-woody, trailing or scrambling vines to 3 feet (1 m) long and upright to 1 foot (30 cm) that form dense ground cover. They have opposite lanceolate-to-heart-shaped leaves and five-petaled pinwheel-shaped violet single flowers. Viable seed appear to be produced only rarely.

Recommended control procedures:

■ Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant (July to October for successive years): Tordon 101*^á as a 3-percent solution (12 ounces per 3-gallon mix), Tordon K*^á as a 2-percent solution (8 ounces per 3-gallon mix), or Garlon 4 as a 4-percent solution (15 ounces per 3-gallon mix).

■ Or, during the growing season, repeatedly apply Garlon 4 or a glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix) with a surfactant. In winter, herbicide treatments should be limited to warm days.



Chinese Wisteria, Japanese Wisteria

Chinese wisteria (*Wisteria sinensis*) and Japanese wisteria (*W. floribunda*) are deciduous high climbing, twining, or trailing leguminous woody vines to 70 feet (20 m) with long pinnately compound leaves and showy spring flowers. Chinese and Japanese wisterias are difficult to distinguish due to possible hybridization.

Recommended control procedures:

Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant:

■ July to October for successive years when regrowth appearsóTordon 101*^á as a 3-percent solution (12 ounces per 3-gallon mix), Tordon K*^á as a 2-percent solution (8 ounces per 3-gallon mix), or Garlon 4 as a 4-percent solution (15 ounces per 3-gallon mix)

■ July to September for successive years when regrowth appearsó Transline*^Ü as a 0.5-percent solution in water (2 ounces per 3-gallon mix) when safety to surrounding vegetation is desired

■ September to October with repeated applicationsóa glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix)

Nonnative Grasses

Nonnative grasses continue to spread and increasingly reside along highway right-of-ways and thus gain access to adjoining lands. Most nonnative invasive grasses are highly flammable, increasing fire intensities, subjecting firefighters to increased risk, and spreading even faster after wildfire or a prescribed burn. Nonnative grasses have become one of the most insidious problems in the field of wildlife management on pasture and prairie lands, because they have little wildlife value and leave no room for native plants. Repeated applications of herbicides are required for control.



Giant Reed

Giant reed (*Arundo donax*) is a giant leafy reed grass to 20 feet (6 m) in height that forms thickets in distinct clumps. It has cornlike gray-green and hairless leaves jutting from stems and drooping at the ends. Erect plumelike terminal panicles of flowers and seed heads appear in late summer and persist through winter. Seed are not viable.

Recommended control procedures:

Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (September or October with multiple applications to regrowth):

- A glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix)
- Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix)
- A combination of the two herbicides



Tall Fescue

Tall fescue (*Lolium arundinaceum*, formerly *Festuca arundinacea* and *F. elatior*) is an erect, tufted cool-season perennial grass, 2 to 4 feet (60 to 120 cm) in height. It has whitish-eared areas where leaf blades connect to the stem, and the stem has swollen nodes. Dark-green seedstalks and leaves appear in late winter, usually flowering in spring (infrequently in late summer). This grass is dormant in midsummer. Most tall fescue is infected with a fungus that can reduce weight gains and lower reproductive rates in livestock, while adversely affecting the nutrition of songbirds and Canada geese. Tall fescue monocultures are generally poor habitat for wildlife.

*Nontarget plants may be killed or injured by root uptake.

Recommended control procedures:

- On forest lands, apply a glyphosate herbicide as a 0.5-percent solution in water (2 quarts per 10 gallons mix per acre), or Arsenal AC* as a 1-percent solution (25 ounces per 20 gallons mix per acre) in spring.
- On noncroplands, apply 10 to 12 dry ounces of Plateau per 20 gallons mix per acre (consult the label for additives) in spring. Mixing Plateau with a glyphosate herbicide or Arsenal AC* will improve control but may damage associated native plants. Vantage (sethoxydim), Poast (sethoxydim), Assure (quizalofop), and Select (clethodim) may be useful on pastures, but they are usually more costly than a glyphosate mix with Plateau or Arsenal AC*.
- Early spring burning if repeated inhibits fescue and encourages native warm-season grasses.



Cogongrass

Cogongrass (*Imperata cylindrica*) is an aggressive, colony-forming dense erect perennial grass 1 to 5 feet (30 to 150 cm) in height. It has tufts of long leaves, yellow-green blades (each with an off-center midvein and finely saw-toothed margins), and silver-plumed flowers and seeds in spring, arising from sharp-tipped branching rhizomes. Older infestations will be more difficult to control.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (September or October with multiple applications to regrowth): Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix), a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix), or combination of the two herbicides.
- Repeat before flowering in spring to suppress seed production and again in successive years for eradication.



Nepalese Browntop

Nepalese browntop (*Microstegium vimineum*) is a sprawling, dense, mat-forming annual grass, 0.5 to 3 feet (15 to 90 cm) long with stems growing to 1 to 3 feet (30 to 89 cm) in height, often bending over and rooting at nodes to form extensive infestations. It has alternate, lanceolate leaf blades to 4 inches (10 cm) long with off-center veins and thin seed heads in late summer and fall.

Recommended control procedures:

- Apply a glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix) with a surfactant in late summer. Or, apply Vantage (see label) for situations that require more selective control and less impact on associated plants.
- Repeat treatments for several years to control abundant germinating seeds. Mowing or pulling just before seed set in September will prevent seed buildup.

**Chinese Silvergrass**

Chinese silvergrass (*Miscanthus sinensis*) is a tall, densely tufted, perennial grass, upright to arching, 5 to 10 feet (1.5 to 3 m) in height. It has long, slender, and upright-to-arching leaves with whitish upper midveins and many loosely plumed panicles turning silvery to pinkish in fall.

Recommended control procedures:

Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (September or October with multiple applications to regrowth):

- Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix)
- A glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix)
- A combination of the two herbicides

**Bamboos**

Golden bamboo (*Phyllostachys aurea*) and other nonnative bamboos (*Phyllostachys* spp. and *Bambusa* spp.) are perennial infestation-forming grasslike plants 16 to 40 feet (5 to 12 m) in height. They have jointed cane stems and bushy tops of lanceolate leaves in fan clusters on grasslike stems, often golden green.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (September or October with multiple applications to regrowth): Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix), a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix), or combination of the two herbicides.

- Cut just above ground level and treat stems immediately with a double-strength batch of the same herbicides or herbicide mixture.

Nonnative Ferns

Japanese climbing fern is presently the only nonnative invasive fern in the temperate parts of the South.

**Japanese Climbing Fern**

Japanese climbing fern (*Lygodium japonicum*) is a climbing and twining, perennial viney fern to 90 feet (30 m), often forming mats of shrub- and tree-covering infestations. It has lacy finely divided leaves along green-to-orange-to-black wiry vines.

Recommended control procedures:

Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to October):

- Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix)
- Garlon 3A, Garlon 4, or a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix)
- Escort* at 1 to 2 ounces per acre in water (0.3 to 0.6 dry ounces per 3-gallon mix)

Nonnative Forbs and Subshrubs

Forbs are broadleaf herbaceous plants and subshrubs are short semi-woody plants. Control treatments are usually by foliar sprays of herbicides.

**Garlic Mustard**

Garlic mustard (*Alliaria petiolata*) is an upright biennial forb in small-to-extensive colonies under forest canopies, characterized by a faint-to-strong garlic odor from all parts of the plant when crushed (odor fading as fall approaches). It has basal rosettes of broadly arrow-point shaped leaves with wavy margins in the first year (remaining green during winter), a 2- to 4-foot (60- to 120-cm) flower stalk and terminal clusters of flowers with four white petals in the second year, and eventually dead plants with long slender seed pods after June of the second year. Stand density varies yearly depending on germination

*Nontarget plants may be killed or injured by root uptake.

requirements of seeds in the soil seed bank, with a single crop germinating over a 2- to 4-year period.

Recommended control procedures:

- To control two generations, thoroughly wet all leaves with a glyphosate herbicide as a 2-percent solution in water (8 ounces per 3-gallon mix) during flowering (April through June). Include a surfactant unless plants are near surface waters.
- In locations where herbicides cannot be used, pull plants before seed formation. Repeated annual prescribed burns in fall or early spring will control this plant, while flaming individual plants with propane torches has also shown preliminary success.



Shrubby Lespedeza, Chinese Lespedeza

Shrubby lespedeza (*Lespedeza bicolor*) and Chinese lespedeza (*L. cuneata*) are perennials, with three-leaflet leaves, that remain standing dormant most of the winter and form dense stands that prevent forest regeneration and land access. Shrubby lespedeza is a much-branched legume up to 10 feet (3 m) in height with small purple-pink pealike flowers, and single-seeded pods. Chinese lespedeza is not really a shrub, but a semiwoody ascending-to-upright leguminous forb to 6 feet (2 m) in height with many leaves feathered along erect slender whitish stems that often branch in the upper half and tiny cream-colored



flowers in leaf axils during summer. Seed of both are long lived in the soil seed bank and require long-term monitoring after control treatments. Prescribed burning can promote spread of the infestation margins.

Recommended control procedures:

- Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (July to September): Garlon 4 as a 2-percent solution (8 ounces per 3-gallon mix), Escort* at three-fourths of an ounce per acre (0.2 dry ounces per 3-gallon mix), Transline^U as a 0.2-percent solution (1 ounce per 3-gallon mix), a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix), or Velpar L* as a 2-percent solution (8 ounces per 3-gallon mix).
- Mowing 1 to 3 months before herbicide applications can assist control.

*Nontarget plants may be killed or injured by root uptake.

^UTransline controls a narrow spectrum of plant species.



Tropical Soda Apple

Tropical soda apple (*Solanum viarum*) is an upright, thorny perennial sub-shrub or shrub, 3 to 6 feet (1 to 2 m) in height, characterized by remaining green year-round in most southern locations and by a sweet smell that is attractive to livestock and wildlife. It has oak-shaped

leaves, clusters of tiny white flowers, and golf-ball size fruit that are mottled green white turning to yellow in late summer to fall. Report infestations to county agents for treatment under a federally sponsored eradication program.

Recommended control procedures for isolated sightings:

- Thoroughly wet leaves and stems with one of the following herbicides in water with a surfactant at times of flowering before fruit appear: Garlon 4 (or Remedy in pastures) or Arsenal AC* as a 2-percent solution (8 ounces per 3-gallon mix); a glyphosate herbicide as a 3-percent solution in water (12 ounces per 3-gallon mix).
- Collect and destroy fruit to prevent reestablishment.
- If mowing is used to stop fruit production, delay herbicide applications until 50 to 60 days to ensure adequate regrowth.

Pesticide Precautionary Statement

Pesticides used improperly can be injurious to humans, animals, and plants. Follow the directions and heed all precautions on the labels

Store pesticides in the original containers under lock and key out of reach of children and animals and away from food and feed.

Apply pesticides so that they do not endanger humans, livestock, crops, beneficial insects, fish and wildlife. Do not apply pesticides when there is danger of drift, when honeybees or other pollinating insects are visiting plants, or in ways that may contaminate or leave illegal residues.

Avoid prolonged inhalation of pesticide sprays or dust; wear protective clothing and equipment if specified on the container.

If your hands become contaminated with a pesticide, do not eat or drink until you have washed them. In case a pesticide is swallowed or gets in the eyes, follow the first aid treatment given on the label, and get prompt medical attention. If a pesticide is spilled on your skin or clothing, remove clothing immediately and wash thoroughly.

Do not clean spray equipment or dump excess spray material near ponds, streams, or wells. Because it is difficult to remove all traces of herbicides from equipment, do not use the same equipment for insecticides or fungicides that you use for herbicides.

Dispose of empty pesticide containers promptly and in accordance with all applicable Federal, State, and local laws.

NOTE: Some States have restrictions on the use of certain pesticides. Check your State and local regulations. Also, because registrations of pesticides are under constant review by the U.S. Environmental Protection Agency, consult your State forestry agency, county agricultural agent or State extension specialist to be sure the intended use is still registered.

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